

**NASHVILLE MUNICIPAL UTILITIES  
TOWN OF NASHVILLE, INDIANA**

**STANDARD SPECIFICATIONS & DETAILS**

**ADOPTED: March 15, 2024**

**NASHVILLE MUNICIPAL UTILITIES OFFICE:  
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### 1.01 **Introduction**

The following Chapters provide a description of acceptable materials, installation and testing for the construction of gravity sanitary sewers, manholes, forcemains, water distribution piping, water pump stations, sanitary lift stations, and their appurtenances within the Town of Nashville and the **Nashville Municipal Utilities (NMU)** service area. Use of other materials, installation practices and testing not specified herein will be allowed only with the prior written approval and authorization from **Nashville Municipal Utilities**. The Standard Specifications and Details may be revised by **Nashville Municipal Utilities** without notice.

### 1.02 **Conformance to Nashville Municipal Utilities Master Plan**

To ensure the continued development of an integrated and comprehensive water/sanitary sewer system, all new and extended facilities shall conform to the **Nashville Municipal Utilities** Master Plan(s) in sizing and general location. Information provided by the Developer and Design Engineer will be used to verify the conformity of the proposed project to the Master Plan. **Nashville Municipal Utilities** will then provide the Developer and Design Engineer with the required facility size for their use in design.

### 1.03 **Requirements for Acceptance into Nashville Municipal Utilities System**

The following requirements shall be met prior to **Nashville Municipal Utilities** accepting infrastructure into its System:

1. Infrastructure shall be constructed in accordance with the approved plans and specifications.
2. The infrastructure shall pass all testing described in the approved specifications and be witnessed by **Nashville Municipal Utilities**.
3. The Developer shall tender donation of title and ownership of the system to **Nashville Municipal Utilities**.
4. The Contractor shall present to **Nashville Municipal Utilities** a three (3) year

maintenance bond to protect the Nashville Municipal Utilities against imperfections of the system. The bond shall be for 20% of the total system installation cost.

5. Record Drawings shall be provided to **Nashville Municipal Utilities** once construction is complete.
6. The Developer shall enter into an agreement with **Nashville Municipal Utilities** per Indiana Regulatory Commission (IURC) main extension rules.

#### **1.04 Property / Easement Requirements**

##### **A. Sanitary Sewer Easement Requirements**

Easements shall be exclusive Sanitary Sewer Easements and shall be dedicated and recorded solely for the benefit of the **Nashville Municipal Utilities**. No building, structure, tree, landscaping or other obstruction shall be allowed to be placed, erected, maintained, or allowed to be within the easement.

Exclusive sanitary sewer easements shall not overlap other easements.

Easement boundaries shall be shown on the plans, referenced in the specifications, and shown on the plats as “Sanitary Sewer Easement” in lieu of “Utility Easement.” Common utility easements are prohibited for sanitary sewer facilities.

##### **1. Minimum Requirements**

- a. Sanitary Sewers Less than Twenty-Four inches in diameter (24”):

<b>Depth of Sewer</b>	<b>Minimum Width (feet)</b>
Up to and including 10 feet	20
Greater than 10 feet; up to and including 20 feet	30
Greater than 20 feet	40

All sanitary sewers shall be centered in the easement. For those sanitary sewers constructed in the public right-of-way, the easement shall extend the distance outside the right-of-way necessary to provide the required easement width.

In residential development, as approved by **Nashville Municipal Utilities** on a case-by-case basis, if the sewer is located outside, but within five (5) feet of the right-of-way, has 10 feet or less cover, and is fifteen (15) inches or less in diameter, then the easement may only be required to be ten (10) feet wide.

b. Sanitary Sewers Twenty-Four Inches (24”) and Larger:

The easement width will be determined on a case-by-case basis by **Nashville Municipal Utilities**, but shall not be less than a minimum of thirty (30) feet in width.

**B. Lift Station Property Requirements**

The minimum property requirements for lift stations are included in the attached Standard Details. The property requirements for lift stations may, at the discretion of **Nashville Municipal Utilities**, be modified on a case-by-case basis.

**C. Water System Requirements**

Nashville Municipal Utilities shall prepare the easement document and the Developer or Design Engineer shall provide the easement exhibits (with legal description and drawing) and last deed of record. The easement description and exhibits shall be prepared by a licensed Professional Land Surveyor registered in the State of Indiana.

The Developer or Design Engineer shall submit drawings as prepared by the Surveyor with the easement submittal. A digital layout of the tract of land shall be provided which delineates the proposed easement in addition to the last deed of record. The easement shall be laid out in compliance with the **Nashville Municipal Utilities** GIS system referencing the Indiana East State Plane Coordinate system. Additionally, the easement shall be laid out using North American Datum of 1983 (NAD83) for horizontal control and be measured in US Survey Foot Feed (not international Foot).

1. Minimum Requirements

a. Adjacent to a platted public right-of-way (ROW):

A minimum twenty foot (20’) wide utility easement directly adjacent to the right-of-way is required. The easement shall be adjacent to the right-of-way in order to allow the Utility access for future maintenance and repair of the facilities installed within the easement.



b. Adjacent to a Private Street:

A minimum thirty foot (30') wide utility easement directly adjacent to a permanent feature for example, the edge of pavement, back of curb, or sidewalk is required. An access easement shall also be provided for the Private Street.

c. Undeveloped Areas:

In areas where no private or platted streets exist, the easement shall be a thirty (30) foot wide non-exclusive easement. Provisions must allow **Nashville Municipal Utilities** access for future maintenance and repair of the facilities installed within the easement.

d. Special Areas:

Site conditions or facility requirements may require a departure from the standard easement requirements. **Nashville Municipal Utilities** shall notify the applicant if this is applicable.

## Chapter 2 - Sanitary Sewer Materials

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### 2.01 Introduction

The following Chapter provides a description of materials acceptable for the construction of gravity sanitary sewers, force mains, manholes, gravity storm sewers, lift stations, and their appurtenances within the Town of Nashville and **Nashville Municipal Utilities** service area. Use of other materials not specified herein will be allowed only with the written approval and authorization from **Nashville Municipal Utilities** Executive Director.

### 2.02 Gravity Sanitary Sewer Materials

#### A. General

1. **Nashville Municipal Utilities** currently allows the use of the following pipe materials meeting or exceeding the minimum requirements/specifications set forth herein for the construction of gravity sanitary sewers:
  - Polyvinyl Chloride Pipe (PVC)
  - Ductile Iron Pipe (DIP)
2. Polyvinyl Chloride Pipe (PVC) may be used in the following locations:
  - a. All gravity sanitary sewer shall be Polyvinyl Chloride Pipe (PVC), unless otherwise noted or approved.
3. Each length of pipe shall be marked per the requirements of the respective ASTM standard. Upon request, the Contractor at his own expense shall furnish **Nashville Municipal Utilities** with copies of all material tests required by applicable ASTM standards.

#### B. Polyvinyl Chloride (PVC) Pipe and Fittings

1. Pipe: PVC Pipe shall be installed where indicated on the Contract Drawings
2. Pipe shall be Green in color.
3. Fittings: PVC Fittings shall only be installed on sanitary service laterals and new sewer mains for service lateral wye fittings, as required.
4. Pipe must be delivered to job site by means which will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical. Pipe shall not be stored outside where subject to sunlight.

5. Jointing of PVC pipe shall be by a natural rubber ring inserted into the belled end of the pipe or double hub joints. Solvent weld joints are not acceptable.
6. The PVC pipe manufacturer shall provide special fittings, acceptable to **Nashville Municipal Utilities** to make watertight connections to manholes.
7. Pipe manufacturer shall furnish notarized certificate of compliance with applicable specifications.
8. The cleaning and assembly of pipe and fittings shall be in accordance with the manufacturer's recommendation.
9. Small Diameter Gravity Sewer Application (15" and Smaller):
  - a. PVC gravity sewer shall be polyvinyl chloride plastic pipe, SDR-35 pipe. PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for ductile-iron fittings. All PVC pipe shall conform to the latest revisions of the following:
    - i. ASTM D3034 Standard Dimension Ratio (SDR) 35.
  - b. Pipe shall meet the extra strength minimum of SDR-35 (PS 46) for depths 15 ft. or less and SDR-26 (PS 115) for depths greater than 15 ft. Gasketed fittings shall conform to the same specifications and be supplied with the pipe.
10. Large Diameter Gravity Sewer Application (Greater than 15"):
  - a. Large diameter PVC pipe used for gravity sewer applications shall meet or exceed all performance requirements of the previous paragraph, except ASTM F679 shall be referenced instead of ASTM D3034.
  - b. All large diameter gravity sewer pipe (greater than 15") shall be ASTM F679, PS-46 (depth of cover less than 15 feet) or PS-115 (depth of cover 15 feet or greater).
11. All pipe and fittings shall be inspected at the factory and on the job site. Testing of PVC pipe and fittings shall be accomplished in conformance with the latest revision of ASTM D3034, ASTM D2444, ASTM D2412, and ASTM D2152. The manufacturer shall submit five (5) copies of certification of test for each lot of material represented by shipment to the job site.
12. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform in color as commercially practical. PVC pipe shall have a ring painted around spigot ends in such a manner as to allow field checking of setting depth of pipe in the socket.
13. Joints for polyvinyl chloride (PVC) mains shall be integral bell and spigot type joints with rubber-o-ring gasket. The cleaning and assembling of the pipe joints shall be in

accordance with manufacturer's recommendations.

14. PVC Gravity Lateral Service Connection Piping (6" minimum).

- a. PVC gravity lateral service connection pipe (6") shall be ASTM-3034, SDR 35 solid wall PVC pipe. All fittings shall be heavy wall, SDR-26.
- b. New sanitary sewers shall have PVC wye fittings for service laterals installed.
- a. For laterals with no existing stub out connection, use Inserta-Tee or approved equal when tapping into an existing sewer main.
- b. The repair of laterals shall utilize the "Shear Guard" by Onset Pipe Products or approved equal. Fernco Repair fittings will not be acceptable.

**C. Non-Detectable Underground Utility Identification Tape**

1. Underground non-detectable utility warning tape shall be pigmented polyolefin film with a printed message on one side used to protect, identify, and locate underground utility lines.
2. Tape shall have minimum thickness of 4 mils and minimum width of 3 inches and maximum width of 6 inches. The material and ink shall be chemically inert and shall not degrade when exposed to acids, alkalis, and other destructive substances commonly found in soil. Ink used to print the material is permanent and cannot be removed by normal handling or upon burial.
3. The tape shall be color coded and imprinted with the message as follows:

Type of Utility	Color Code	Message
Sewer	Green	Caution Sewer Line Buried Below

4. Underground identification tape shall be "Terra Tape Standard" as manufactured by Reef Industries, Inc., or equal.

**2.03 Forcemain Materials**

**A. General**

1. **Nashville Municipal Utilities** allows the use of the following pipe materials meeting or exceeding the minimum requirements set forth herein, for the construction of sanitary sewer forcemains.
  - Polyvinyl Chloride Pipe (PVC)
  - Ductile Iron Pipe (DIP)
  - High Density Polyethylene Pipe (HDPE)

2. Polyvinyl Chloride Pipe (PVC) may be used in the following locations:
  - a. All sanitary forcemain pipe shall be Polyvinyl Chloride Pipe (PVC), unless otherwise noted or approved.
3. Ductile Iron Pipe (DIP) may be used in the following locations:
  - a. The lift station wetwell and valve vault interior. Refer to Chapter 9 - Sanitary Sewer Lift Stations for requirements.
  - b. The lift station site.
4. High Density Polyethylene Pipe (HDPE) may be used in the following locations:
  - a. Small diameter forcemain applications for grinder pumps.
  - b. Horizontal directional drill (HDD) locations as approved by **Nashville Municipal Utilities**.

#### **A. Polyvinyl Chloride (PVC) Pressure Pipe and Fittings**

1. Pipe:
  - a. Pipe shall be Green in Color.
  - b. 4" through 12" Diameter – shall conform to one of the following:
    - i. PVC plastic IPS pipe shall conform to ASTM D2241, Pressure Class 200 (SDR 21). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform to the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.
    - ii. PVC plastic DIPS pipe shall conform to ANSI/AWWA C-900, Pressure Class 235 (DR 18). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform to the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.
  - c. 16" through 30" Diameter – shall conform to the following:
    - i. PVC plastic pipe shall conform to ANSI/AWWA C-900, Pressure Class 235 (DR 18). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform to the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe
    - ii. Pipe shall be Green in color.
2. Joints:
  - a. Joints for PVC mains shall be integral bell and spigot type joints with rubber- o-ring gasket. The cleaning and assembling of the pipe joints shall be in accordance with manufacturer's recommendations. Joints shall conform to ASTM D3139.
  - b. Joints shall be restrained as required in the Restrained Joint Tables for PVC pipe

included in the Standard Details.

3. Fittings:
  - a. Fittings shall be ductile iron and conform to specifications noted herein under Ductile Iron Pipe (DIP) and Fittings.
  - b. All fittings shall be restrained using mechanical restraints.

**B. Ductile Iron Pipe (DIP) and Fittings**

1. Ductile iron pipe shall conform to the current requirements of AWWA C151, Pressure Class 350 (16" pipe and smaller) or Pressure Class 250 (18" pipe and larger), with push-on joints and shall be restrained per EBAA Iron Restrained Joint Calculator or approved equal. To ensure uniformity of installation and appearance, all system piping components shall be the products of one manufacturer.
2. The interior of the pipe shall be double cement-mortar lined with bituminous seal coat in accordance with the current requirements of AWWA C104. Thickness of the lining shall be set forth in the aforementioned specification. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.
3. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA specifications.
4. Fittings shall be ductile iron and rated for a minimum working pressure of 350 psi (4" through 24") or 250 psi (30" and larger) in accordance with the current requirements of AWWA C110 shown therein. Fittings shall have mechanical joints meeting the current requirements of AWWA C111. Fittings shall have interior cement-mortar lining as specified for the pipe. Compact ductile iron fittings meeting the current requirements of AWWA C153 will also be acceptable. Provide notarized certificate of compliance to the AWWA specifications.
5. Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell, with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts. All bolts and nuts shall be high strength, heat treated ASTM A36 or A-307 carbon steel as a minimum requirement. After field installation, all steel surfaces shall have one coat of Sherwin-Williams Targuard; or equal, coal tar epoxy coating applied before backfill. Nuts and bolts shall meet the requirements of AWWA C111.
6. All Exposed Pipe Shall be flanged joints.
  - a. Provide pipe flanges and accessories conforming to AWWA A21.15
    - i. Provide flat faced flanges.
    - ii. Provide 1/8-inch thick, full faced gaskets designed for exposure to liquid

- within pipe.
- b. After field installation, all steel surfaces shall be coated per specifications herein.
- 7. Gasket material for standard wastewater service up to 150°F shall be SBR (Styrene-Butadiene Rubber).
  - 8. Provide AWWA C110 mechanical joint plugs and locked or restrained pipe joints where indicated on Drawings. Fittings under structures shall be mechanical joint with retainer glands. Retainer glands shall be of the “wedge action” design, where tightening the screws causes the wedge to lock onto the pipe.
  - 9. All underground ductile iron pipes shall be encased with polyethylene film in tube form conforming to AWWA C105 (latest edition).
    - a. Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight (8) mils.
    - b. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial compound to mitigate antibiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.
    - c. The polyethylene film shall have the following characteristics:
      - i. Impact Resistance: 600 grams per ASTM D1709 Method B
      - ii. Propagation Tear Resistance: 2,550 grams force per ASTM D1922
      - iii. Thickness: 0.008 inches minimum (8 mil)
    - d. Polyethylene encasement shall be installed per ANSI/AWWA C105 Modified Method A.
    - e. Polyethylene encasement shall be V-Bio as manufactured by DIPRA.
  - 10. The cleaning and assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

**C. High Density Polyethylene (HDPE) Pipe and Fittings**

- 1. High density polyethylene pipe shall be manufactured by the following:
  - a. Manufactured by JM Eagle,
  - b. “DriscoPlex” as manufactured by Chevron Phillips,
  - c. or Approved equal.

2. Pipe shall be black in color with a green striping.
3. All forcemain HDPE pipe shall be iron pipe size (IPS). All HDPE pipe for sewer forcemain applications shall be DR 11 (200 psi WPR). Pipe shall be upsized one (1) standard pipe diameter to match internal pipe diameter as close to the connecting pipe as possible.
4. HDPE pipe and fittings shall be made of polyethylene resins having a cell classified in ASTM D 3350 as 445574C/E, having specific base resin densities of at least 0.941 g/cc minimum and 0.955 g/cc maximum respectively; and having melt index less than 0.15 grams/10 min. The pipe shall be designed for a normal internal working pressure and earth cover over top of the pipe to suit the conditions of proposed use.
5. Pipe made from these resins must have a long-term strength rating of 1,600 psi or more.
6. The polyethylene resin shall contain antioxidants and shall be stabilized with carbon black against ultra-violet degradation to provide protection during processing and subsequent weather exposure.
7. The polyethylene resin compound shall have a resistance to environmental stress cracking as determined by the procedure detailed in ASTM D 1693, Condition B with sample preparation by procedure C of not less than 200 hours.
8. Each length of pipe shall be marked, at no more than 10 foot intervals, with the following information:
  - a. Nominal Pipe Size
  - b. Type Plastic Material – PE4710 Pipe Pressure Rating
  - c. Manufacturer's Name, Trademark and Code
9. All pipe shall be made from virgin material. No rework compound. Pipe shall be homogenous throughout, and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.
10. Fittings for the polyethylene pipeline shall be Ductile Iron Fittings per requirements noted above.
11. Fittings for bends 22-1/2° or greater shall be provided as shown on the Drawings. For alignment changes of less than 20° deflection, the pipe may be laid in curves with a radius of 100 feet or greater.
12. All run-of-the-pipe fittings shall be fusion welded into the pipeline.



13. Tee branches shall be of the size shown on the Drawings and shall be furnished with flanged ends per ANSI B-16.1. All fittings shall be factory made.
14. Fittings shall be capable of withstanding the same pressure and loading conditions specified for the pipe.
15. Pipe Jointing:
  - a. Pipe to be joined by leak proof, thermal, butt fusion joints. All fusion must be done by personnel trained by the pipe supplier using tools approved by the pipe supplier.
  - b. The fusion machine shall have hydraulic pressure control for fusing two (2) pipe ends together; it shall include pressure fusion indicating gauges to correctly monitor fusion pressures. The machines shall be equipped with a McElroy Datalogger to record fusion pressure and temperature. The machines shall be equipped with an electric or gasoline engine powered facing unit to trim irregularities from the pipe ends. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature. All datalogger information shall be submitted electronically to **Nashville Municipal Utilities**.
  - c. Joint strength must be equal to that of adjacent pipe as demonstrated by tensile test. In addition, results of tensile impact testing of joint should indicate a ductile rather than a brittle fracture. External appearance of fusion bead should be smooth without significant juncture groove.

## **E. Couplings and Adapters**

1. Couplings and Adaptors:
  - a. Couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal.
  - b. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed.
  - c. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure

- of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.
- d. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.
  - e. Flexible couplings and flanged adapters shall be as manufactured by Dresser, per the following, unless otherwise specified and/or noted on the Drawings:
    - i. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe:
      - Style 138 by Dresser
    - ii. Transition couplings for joining pipe of different outside diameters:
      - Style 162 by Dresser (4"-12")
      - Style 62 by Dresser (2"-24")
    - iii. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment:
      - Style 127 by Dresser cast (3"-12")
      - Style 128 by Dresser steel (3"-48" C.I. Pipe)
      - Style 128 by Dresser steel (2"-96" Steel pipe)

#### **F. Non-Detectable Underground Utility Identification Tape**

1. Underground non-detectable utility warning tape shall be pigmented polyolefin film with a printed message on one side used to protect, identify, and locate underground utility lines.
2. Tape shall have minimum thickness of 4 mils and minimum width of 3 inches and maximum width of 6 inches. The material and ink shall be chemically inert and shall not degrade when exposed to acids, alkalis, and other destructive substances commonly found in soil. Ink used to print the material is permanent and cannot be removed by normal handling or upon burial.
3. The tape shall be color coded and imprinted with the message as follows:

Type of Utility	Color Code	Message
Sewer	Green	Caution Sewer Line Buried Below

4. Underground identification tape shall be “Terra Tape Standard” as manufactured by Reef Industries, Inc., or equal.

## **G. Location/Tracer Wire**

1. Open Cut Excavation:
  - a. Direct burial tracer wire shall be #10-AWG solid, copper-clad steel core (2,032 lb. average tensile break load) with 45 mil high density polyethylene “GREEN” color insulating jacket complying with ASTM D1248, 30-volt rating. The wire shall be continuous with no fabricated or field construction connections interrupting the wires continuity from end to end. Wire insulation shall be highly resistant to acids, alkalis, and other destructive substances commonly found in soil.
  - b. Tracer wire shall be 1030 HS as manufactured by Copperhead Industries LLC; or approved equal.
2. Horizontal Directional Drilling:
  - a. Directional drilling tracer wire shall be #10-AWG solid, copper-clad steel core (2,032 lb. average tensile break load) with 45 mil high density polyethylene “GREEN” color insulating jacket complying with ASTM D1248, 30-volt rating. The wire shall be continuous with no fabricated or field construction connections interrupting the wires continuity from end to end. Wire insulation shall be highly resistant to acids, alkalis, and other destructive substances commonly found in soil.
  - b. Two (2) wires shall be installed for all horizontal directional drill locations.
  - c. Tracer wire shall be 1045 EHS SoloShot as manufactured by Copperhead Industries LLC; or approved equal.
3. Open Cut Excavation Tracer Wire Splice Kit:
  - a. Open cut excavation splice kit shall be DryConn Direct Bury Lug Aqua Model #90220 as manufactured by King Innovation; or approved equal.
4. Tracer Wire Terminating Box:
  - a. Tracer wire terminating box shall be located along the sewage forcemain at the lift station valve vault conc. apron face. Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements. Lid material shall be of cast iron or ductile iron and shall be flush with the ground. Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B-253. Brass screw running through brass wire harness and lid will be used as connection for locator transmitter hook-up. Brass wire harness shall be used to secure tracer wire leads to brass screw enabling locator equipment hook-up. Petrolatum wax tape incorporated with magnetized tracer box to encapsulate tracer wire leads and brass wire harness. Petrolatum wax tape must be formed around brass wire harness connection after tracer wire leads are connected to prevent oxidation of wire ends. To ensure proper long term locatability and signal strength, the petrolatum wax tape must be utilized to prevent oxidation. Access Box shall be designed for operational access to underground

tracer wire systems and shall include an anti-sink/pull-out restraint flange.

- b. Tracer wire terminating box shall be “Snake Pit Roadway Box” as manufactured by Copperhead Industries, Inc.; or equal.
5. Grounding Rod:
- a. Grounding rod for tracer wire shall be Model “ANO-12” as manufactured by Copperhead Industries LLC; or approved equal.

## **H. Utility Marker**

1. Tracer Wire Marker Posts:
- a. Pipeline marker posts with terminal connections to receive tracer wire shall be located along the sewage forcemain route. Marker posts shall be constructed of superior grade ABS plastic material, 3.5” outside diameter, 7 feet total height (with min. 4 feet above grade), with lid. Lettering shall be clearly printed on the marker post indicating: **“Nashville Municipal Utilities”** and **“Buried Sewage Forcemain”** and **“Emergency Contact: 812-988-5526”**. Marker post shall be Model PMP-7CE with Lid C2 as manufactured by Handley Industries, Inc., or approved equal.
2. Utility Markers:
- a. Utility marker shall be a single piece marker shall be constructed of a durable, UV resistant, continuous glass fiber and resin reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40 deg. F to +140 deg. F. Marker shall be a constant flat “T” cross sectional design of 0.125” minimum thickness with reinforcing support ribs incorporate longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration and furnished with a fastened metal anchor barb for permanent anchoring into soil.
  - b. Each marker shall be permanently identified with the manufacturer’s name and month/year of fabrication. A black line shall be stamped horizontally across the front of the marker near the bottom to indicate proper burial depth. Marker shall have a minimum width of 3.75 inches and overall length of 72 inches.
  - c. Each marker shall be green color throughout with a vinyl, non-reflective green background decal located at the top end of the marker with white vertical lettering **“CAUTION SEWAGE FORCEMAIN”**. Decal shall be outdoor quality, UV resistant, with embedding graphics under a protective weather and fade resistant laminate cover.
  - d. Utility marker shall be model “CRM3-072-07” as manufactured by Carsonite Composites; or approved equal.

## **2.04 Sanitary Sewer Manhole Materials**

### **A. General**

1. Sanitary sewer manholes shall be installed at the end of each line segment; at all changes in grade, size, materials, and/or alignment; at all intersections; and at distances not greater than 400 feet. Cleanouts shall not be substituted for manholes.
2. In unpaved/grassy areas manholes shall be designed and installed such that they extend a minimum of three (3) inches above finished grade to prevent water ponding. Positive drainage away from the manhole shall be provided. Manholes shall not to be buried.

### **B. Pre-cast Concrete Manhole**

1. Circular manholes of the form and dimensions shown on the Drawings shall be constructed of ASTM C 478 precast reinforced concrete manhole sections erected on 4,000-psi concrete foundation. Precast concrete manhole bottom sections may be substituted for "cast-in-place" foundations subject to **Nashville Municipal Utilities** review. The excavation shall be kept free of water while the manhole is being constructed and the manhole shall not be backfilled until inspected by the Engineer.
2. Standard manholes shall be 4' -0" inside diameter and greater than six (6) feet in depth, measured from the top of the cover frame to the invert of the outlet and shall be of eccentric cone top construction as shown on the Drawings. Shallow manholes of five (5) feet or less in depth, measured from the top of the cover frame to the invert of the outlet and shall be of flat top construction. Refer to Standard Details for required manhole diameter for sanitary sewer pipe diameter.
3. Concrete Manhole Sections: Precast concrete manhole sections (risers and grade rings) shall conform to ASTM C478.
4. Precast Concrete Eccentric Cones: Precast concrete eccentric cones shall be of the size and shape shown on the Drawings and shall conform to ASTM C478.
5. Precast Manhole Section Joints:
  - a. Precast manhole section joints shall be jointed with ASTM C443 rubber o-ring gasket PLUS flexible butyl resin concrete sealant (rope) conforming to ASTM C 990. All internal manhole joints shall be grouted with non-shrink grout. All external manhole joints shall be wrapped with polyolefin backed exterior joint wrap; model CS-212 as manufactured by ConSeal, or approved equal. Manhole section joints shall be watertight. These requirements apply to all joints, including

manhole risers and grade rings.

6. When making joints with mastic compound prime and seal all joints with primer supplied with the joint compound. Manhole section joints shall be watertight. These requirements apply to all joints, including manhole risers, cones, and grade rings.
7. Manhole Inverts: Manhole inverts shall be formed with 3,000 psi concrete. Inverts shall be constructed as shown on the Contract Drawings and shall form a smooth finish. The inverts shall be constructed on site after both inlet and outlet pipes are installed. With review and approval by **Nashville Municipal Utilities**, the bench and trough may be precast as part of the base unit. Invert channel shall be smooth with a semi-circular bottom and vertical sides extending up to the height of the pipe crown. Changes of flow direction within manholes shall be made by a smooth curve having as large a radius as possible. The manhole bench shall be smooth and slope towards the channel not less than ½ inch per foot.
8. Manhole Steps: Steps shall be included in the structures.
9. Where indicated on the Drawings or in the Specifications, Traffic Weight Manhole frames and covers shall be provided. These shall weigh a minimum of 325 pounds.
10. Non-Traffic Weight: Manhole frame and cover weight to be minimum of 250 pounds.
11. Standard Manhole Frame and Covers:

Standard manhole castings shall consist of cast iron frames conforming to ASTM A48 Class 30 or better with a minimum clear opening of twenty-four (24) inches. Casting shall have a minimum of four (4) equally spaced bolt holes for the purpose of anchoring the casting to the manhole cone or grade ring.

Manhole covers must set neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. Covers shall have sufficient corrugations to prevent slipperiness and be marked in 2" large letters, "SANITARY SEWER". The covers shall have two concealed pick holes. Covers on sanitary sewer manholes shall not be perforated.

Acceptable manufacturer is EJ (Model 1045) or Neenah (Model R-1556).

12. Bolt Down Watertight Manhole Frame and Covers:

Bolt down watertight manhole covers shall be required for manholes installed within the floodplain and floodway.

Watertight manhole covers shall consist of cast iron frames conforming to ASTM A48 Class 30 or better with a minimum clear opening of twenty-four (24) inches. Casting shall have a minimum of four (4) equally spaced bolt holes for the purpose of anchoring the casting to the manhole cone or grade ring. Covers shall have machined bearing surfaces, continuous gasket seal preinstalled into slots with dovetail design and shall be of the “*Self-Sealing*” type as manufactured by EJ/East Jordan (Model 1040) or Neenah (Model R-1916-F). Watertight manhole covers shall have sufficient corrugations to prevent slipperiness and be marked in large letters “SANITARY SEWER”.

13. Pipe Connections into Manholes: To connect a sanitary sewer to a manhole, either a flexible boot KOR-N-SEAL 1 or 2 flexible connector, cast-in-place Dura-Seal gasket, “A”-Lock gaskets or approved equal shall be used. Connections to an existing manhole shall be flexible boot KOR-N-Seal or approved equal.
14. All flexible connectors shall conform to ASTM C-923, and shall be resistant to ozone, weather elements, chemicals including acids and alkalis, animal and vegetable fats, oils and petroleum products.
15. The stainless steel elements of the connector shall be totally non-magnetic Series 305 stainless steel. The stainless steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds.
16. Forcemain Discharge Manholes: The forcemain shall connect to the manhole as close to the invert as possible and shall be directed to flow directly into the manhole effluent pipe. On a case-by-case basis, **Nashville Municipal Utilities** shall require the forcemain discharge manhole, as well as the two proceeding manholes downstream of the discharge manhole to be coated with an epoxy liner system. The liner system shall be Mainstay, or **Nashville Municipal Utilities** approved equal.
17. Precast Concrete Manhole Base Sections: Precast concrete manhole base sections shall be "monolithic", consisting of base slab and base riser section.
18. Drop Connections into Manholes: Where indicated on the Drawings, drop connections into manholes shall be installed. Drop connections shall be cast-in-place or precast, and shall conform to the requirements shown on the Details
19. Buoyancy Calculations:
  - a. Buoyancy calculations shall be provided for all manholes. All manholes shall include a minimum factor of safety of 2.0 included in calculations and shall have a base extension of 6” minimum.

#### **C. Compression Couplings**

1. When joining different types of pipe together or new pipe to existing pipe, the Contractor shall use Shear Guard by Onset Pipe Products, or approved equal; that are resistant to corrosion by soil and sewage and that will provide a permanent watertight joint. The compression coupling shall meet the physical test and joint-leak requirements specified in ASTM C-594. The bands for attaching pipes shall be stainless steel conforming to ASTM C-594. Each coupling shall bear the manufacturer's name and an indication of its size.

## **2.05 Sanitary Sewer Valves and Gates**

### **A. Plug Valves (Forcemains Only)**

1. All plug valves shall be eccentric plug valves unless otherwise specified.
2. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-64, grooved ends per AWWA C606-87. Screwed ends shall be to the NPT standard.
3. Valve bodies shall be flushing body type and made of ASTM A126 Class B cast iron. Valves shall be furnished with a 1/8" welded overlay seat of not less than 95% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.
4. Plugs shall be made of ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.
5. Valves shall have replaceable sleeve type bearings and grit seals at the upper and lower journals.
6. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.
7. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.



8. Buried valves shall be manually operated with 2-inch square operating nuts in vertical position for use in a valve box unless otherwise indicated on the plans. Buried valves shall have extension stems that bring the 2-inch square operating nut to within 2 feet of finished grade. Each buried valve shall be supplied with a tee wrench that allows the valve to be operated with the tee handle at waist height. All valves 6- inch and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft shall be stainless steel and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts, washers and appurtenances shall be stainless steel.
9. Valves and gear actuators for buried or submerged service shall have seals for all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, washers and appurtenances shall be stainless steel.
10. Cylinder actuators shall be equipped with a 2-inch operating nut to allow manual valve operation in case of supply failure.
11. Valves shall provide drip tight shutoff up to the full pressure rating. Valves shall be provided with adjustable limit stops and rotate 90 degrees from fully opened to fully closed.
12. Valves shall have rectangular port openings for throttling service, and shall open to 100% of the corresponding pipe diameter.
13. All buried service plug valves shall have mechanical joint ends and have all exterior surfaces factory coated and two coats of coal tar epoxy field applied.
14. All valves and actuators shall be as manufactured by DEZURIK (Style PEF), or approved equal.

**B. Plug Valves (Submerged Forcemains Only)**

1. Submerged plug valves shall comply with Specifications of Chapter 2, Section 2.05, Paragraph A except plug valves shall be suited for submerged service in sewage and shall have a bonnet with stainless steel extension stem, hardware and fasteners. Bonnet shall extend to extent indicated on the plans.

### **C. Swing Check Valves**

1. Check valves shall be ductile iron body and domed access cover per ASTM A536 Grade 65-45-12, and flexible internal disc, rated for 150 psi working pressure. Flanges shall be faced and drilled in accordance with ANSI B16.1, Class 125 Standard. Valve shall be designed, manufactured, tested and certified to AWWA C508.
2. Valve body shall have a full-flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for installation of a backflow actuator without special tools or removing the valve from the pipeline.
3. The top access port shall be full size, allowing for removal of the disc without removing the valve from the pipeline. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content.
4. The disc shall be of one-piece construction, precision molded Buna-N, with an integral o-ring type sealing surface, and contain steel and nylon reinforcement in the hinge. Non-slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action.
5. A screw-type backflow actuator shall be provided for field installation to allow opening of the valve during no-flow conditions. Buna-N seals shall be used to seal the stainless steel stem in a bronze bushing. The backflow device shall be of the rising stem type to indicate position and furnished with a T-handle for ease of operation.
6. Swing check valves shall be base bid as manufactured by Val-Matic (Swing-Flex Series #500), or approved equal.

### **D. Sewage Combination Air/Vacuum Release Valves Manholes**

1. Sewage Combination Air Valves and Boxes shall be installed at the high points of the force main and at various locations as shown on the Contract Drawings. Sewage Combination Air Valve shall be installed as shown on Standard Detail Drawing in the Appendices.
2. Air valves shall be automatic float operated valves designed to exhaust air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs. The valve shall also release accumulated air from a piping system while the system is in operation and under pressure.

3. The valve seat shall provide complete shut off to the full valve pressure rating.
4. Valves shall incorporate a full port orifice, a seal plug assembly, and an upper and lower float to provide a rolling resilient seal.
5. The seal shall be a one-piece design and include a large orifice and a small orifice and each shall open or close as needed to allow release or intake of air as the demand on the system regulates.
6. Valve shall be designed to intake or discharge a minimum of 100 SCFM of air with a 3.5-psi differential pressure.
7. Materials: Valve cover, lower float, stem, washer, spring, nuts and bolts: 316 Stainless Steel.
8. Upper float: Foamed polypropylene. O-rings: Buna-N.
9. Seal plug assembly and base and body: 316 Stainless Steel.
10. All Sewage Combination Air Valves on the force main shall be ARI model no. D-025 as manufactured by A.R.I. Flow Control Accessories, Kfar Charuv, Israel, or approved equal.
11. Sizes shall be based on the pipeline diameter as noted herein:

Pipe Diameter	3" – 8"	10" – 16"	18" – 20"	24" – 48"
Air Valve Size	2"	3"	4"	6"

12. The Sewage Combination Air Valve Access Manhole shall be a 4-foot diameter precast manhole barrel section and shall be set on a concrete footer supported with crushed stone. The cover and frame shall be cast iron, with a 24-inch clear opening as indicated for Sanitary Manhole hereinbefore. Care shall be taken to ensure that manhole barrel does not rest on top of pipe.
13. Contractor to install pipe at sufficient depth to accommodate Valve height so that top of manhole is at existing ground level.
14. A stainless steel pipe nipple (if needed for NPT connection) and isolation ¼ turn full port stainless steel ball valve of diameter equal to the air valve size indicated above shall be furnished and installed between the valve and main connection.

**E. Valve Boxes – Buried Valves (Except Sewage Combination Air/Vacuum Release Valves)**

1. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "SEWER". Valve boxes for valves larger than 8 inches shall be three-piece. Valve boxes shall be accurately centered over valve operating nut with centering device, and backfill thoroughly tamped about them. Valve boxes shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be grade in any paving, walk or road surface, and 2 inches above finish grade in grass plots, fields, woods or other open terrain with positive drainage away from box. Valve box centering device shall be Box-Seat as manufactured by QWP, Box Lok as manufactured by Trumbull, or approved equal. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry, Bingham & Taylor, or approved equal.
2. Contractor shall furnish one (1) 6-foot T-handle operating wrenches for underground valves. Nut operator extensions for all valves buried deeper than 3 feet shall be provided with stem extensions sufficient to raise operator nut to within 3 feet of finished grade.
3. Valve boxes shall have extension stems, where necessary when operating nut is raised to be within 3 feet of the existing grade.

**F. Elastomeric ("Duckbill") Check Valve (Wetwell Only – Valve Vault Drain Line)**

1. Elastomeric "Duckbill" check valves shall be all rubber of the flow-operated type, with slip-on end and stainless steel backup ring connection.
2. The port area shall contour down to a duckbill, allowing passage of flow in one direction while preventing reverse flow. The valve shall be one-piece rubber construction with nylon reinforcement of material suitable for the intended service.
3. When line pressure inside valve exceeds the backpressure outside the valve by a certain amount, the line pressure forces the bills of the valve open, allowing flow to pass. When backpressure exceeds the line pressure by the same amount, the bill of the valve is forced closed. Upon request by the Engineer, flow test data shall be made available for review from an accredited hydraulics laboratory to confirm pressure drop data.
4. The valve shall open on 1/2" level of flow and shall be able to withstand 10' of submergence without damage.
5. Elastomeric check valves shall be Series TF-2 as manufactured by the Red Valve Co.,

Inc.; Cla-Val Series DBO; or equal.

**G. Stainless Steel Slide Gate (Wetwell Only)**

1. Gates and operators shall be supplied with all the necessary parts and accessories indicated on the Drawings, specified or otherwise required for a complete, properly operating installation, and shall be the latest standard product of a manufacturer regularly engaged in the production of fabricated gates. Except as modified or supplemented herein, all gates and operators shall conform to the applicable requirements of AWWA C561, latest edition.
2. Sluice gates shall be ASTM A240 Type 304L stainless steel, non self-contained of the rising stem configuration, wall thimble mounted. All gate components shall be designed to safely withstand the maximum seating and unseating heads based on the Drawings. Sluice gates shall be substantially watertight under design head conditions. Leakage shall not exceed 0.05 gpm per foot of seating perimeter. Under the unseating head, the leakage for heads of 20 feet or less shall not exceed 0.1 gpm per foot. For unseating heads greater than 20 feet, the allowable leakage shall not exceed the rate per foot of perimeter specified by the following equation:

Maximum allowable leakage: Gallons per minute per foot of perimeter =  
$$0.10 + [0.0025 \times (\text{unseating head in feet} - 20)]$$

The gate's sealing system shall have been tested through a cycle test in an abrasive environment and should show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration. Certification of this testing shall be provided to **Nashville Municipal Utilities** upon request.

3. Frames shall be ASTM A-240 Type 304L stainless steel, constructed of structural members or formed plate welded to a rigid one piece frame with mounting flange and rectangular opening as indicated on the Drawings. The guide slot shall be made of UHMWPE (ultra-high molecular weight polyethylene).
4. The slide shall be ASTM A-240 Type 304L stainless steel, constructed of flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.
5. Guides shall be made of UHMWPE per ASTM D-4020 and shall be of such length as to retain and support at least two-thirds (2/3) of the vertical height of the slide in the fully open position. Side and top seals shall be made of UHMWPE of the self-adjusting type. A continuous compression cord or J-bulb type of Nitrile ASTM D-2000 or EPDM shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the

slide and allow the water to flow only in the opened part of the gate. The bottom seal shall be made of resilient neoprene ASTM D-2000, set into the bottom member of the frame and shall form a flush-bottom.

6. The operating stem shall be ASTM A-276 Type 316 stainless steel designed to transmit in compression at least two (2) times the rated output of the operating manual mechanism with a 40 lbs. effort on the crank. The stem shall have a slenderness ratio (L/r) less than 200. The threaded portion of the stem shall have machined cut or rolled threads of the Acme type. For stems in more than one piece and with a diameter of 1¾ inches and larger, the different sections shall be joined together by solid bronze couplings. Stems with a diameter smaller than 1¾ inches shall be pinned to an extension tube. The couplings shall be grooved and keyed and shall be of greater strength than the stem.
7. Stem guides shall be fabricated from ASTM A-240 Type 304L stainless steel. The guide shall be equipped with an UHMWPE bushing. Guides shall be adjustable and spaced in accordance with the manufacturer's recommendation. The L/r ratio shall not be greater than 200. Rising stem gates shall be provided with a clear polycarbonate stem cover. The stem cover shall have a cap and condensation vents and a clear mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.
8. For new and existing concrete structures, sluice gates shall be mounted directly on the concrete vertical surface in front of a flush pipe of size and type as shown on the Drawings. Wall thimbles are not necessary for new concrete structures provided the sluice gate concrete mounting surface is square and plumb within sluice gate manufacturer's minimum tolerances. A permanent EPDM gasket of uniform thickness shall be provided between the sluice gate frame and concrete surface.
9. Fasteners: All anchor bolts for guides and gates and all bolts and studs for connecting gates to adjacent flanges or thimbles shall be Type 304 stainless steel and shall be furnished by the gate manufacturer.
10. Operators:
  - i. Manual operation shall be by crank-operated floorstand of the type specified herein and shown on the Drawings and provided by the gate manufacturer. All bearings and gears shall be totally enclosed in a weather-tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40 lbs. on the crank, and shall be able to withstand, without damage, an effort of 80 lbs. The crank shall be removable and fitted with a corrosion-resistant rotating handle. The maximum crank radius shall be 15 inches.

- ii. Floorstand pedestals shall be ASTM A-126 cast iron Class B designed to position the input shaft approximately 36" above the operating floor. An arrow with the word "Open" shall be permanently attached or cast on the floorstand, indicating the direction of rotation to open the gate. Finish painting of cast iron components shall be in accordance with Chapter 8.
11. Stainless steel sluice gates shall be Series 20 as manufactured by Rodney Hunt-Fontaine; Model GH-46 as manufactured by Golden Harvest, Inc.; or approved equal.

## **2.06 Grinder Pump Station**

### **A. Manufacturer**

1. Grinder pump stations shall be manufactured by Hydromatic; or approved equal.

### **B. General Requirements**

1. Simplex Grinder Pump Station shall be Hydromatic Model TL-Pro Simplex Fiberglass Low Pressure Sewer System Complete Grinder Package.
2. Simplex Grinder pump shall be Hydromatic model HV200 series, unless otherwise approved to meet location conditions.
3. Duplex Grinder Pump Station shall be Hydromatic Model TL-Pro Duplex Fiberglass Low Pressure Sewer System Complete Grinder Package.
4. Grinder Pump Station shall have concrete anti-flotation base installed per manufacturer's recommendations.
5. Grinder Pump Station shall have remote mounted control panel per manufacturer's recommendations.

### **C. Grinder Pump Station Connection To The Pressure Service Line**

1. The 1.5 inch NPT female stainless steel discharge flange shall be connected to a 1.5 inch diameter, 8-inch long, Type 316 stainless steel male NPT threaded end by plain end HDPE pipe.
2. Transition shall be Model 862 by Poly-Cam or approved equal.

### **D. Check Valves**

1. Service line shall have check valve in grinder station and check valve prior to discharge into manhole or other approved discharge location.
2. Discharge into forcemain shall be approved on a case by case basis.

**E. Service Line**

1. Service line shall be HDPE material and shall meet requirements for Forcemain Materials as listed herein.



## Chapter 3 - Water Materials

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### 3.01 Introduction

The following Chapter provides a description of materials acceptable for the construction of water distribution piping and their appurtenances within the Town of Nashville and **Nashville Municipal Utilities** service area. Use of other materials not specified herein will be allowed only with the written approval and authorization from the NASHVILLE MUNICIPAL UTILITIES Executive Director.

### 3.02 Water Distribution Piping Materials

#### A. General

1. **Nashville Municipal Utilities** allows the use of the following pipe materials meeting or exceeding the minimum requirements set forth herein, for the construction of water mains.
  - Ductile Iron Pipe (DI) – Standard, unless otherwise approved
  - Polyvinyl Chloride Pipe (PVC)
  - High Density Polyethylene Pipe (HDPE)
2. Standard pipe sizes are 4", 6", 8", 12", 16", 20", and 24" diameter. The pipe sizes to be used throughout the proposed development shall be established by the Developer and confirmed by **Nashville Municipal Utilities** after comparing to its Master Plan.
3. Ductile Iron Pipe shall be used in the following locations:
  - a. All water main shall be Ductile Iron (DI) Pipe, unless otherwise noted or approved.
  - b. Water Service Lines (4" and Larger).
4. Polyvinyl Chloride Pipe (PVC) may be used in the following locations:
  - a. Only on a case-by-case basis as approved by **Nashville Municipal Utilities**.
5. Small Diameter (1" through 2") High Density Polyethylene Pipe (HDPE) may be used in the following locations:
  - a. Water Service Lines (1" through 2").
6. Large Diameter (4" and Larger) High Density Polyethylene Pipe (HDPE) may be used in the following locations:
  - a. Horizontal directional drill (HDD) locations as approved by **Nashville Municipal Utilities**.

## **B. Ductile Iron Pipe and Fittings (4-inch Diameter and Larger)**

1. Pipe: Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51, latest revision, Pressure Class 350, with push-on joints unless otherwise noted on Drawings.
2. The interior of the pipe shall be double cement-mortar lined with bituminous seal coat in accordance with ANSI/AWWA C104/A21.4, latest revision. Thickness of the lining shall be set forth in the aforementioned specification unless otherwise directed by the Engineer. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.
3. Each length of pipe shall be marked, at no more than 10 foot intervals, with the following information:
  - a. Nominal Pipe Size
  - b. Material – “DI” or “DUCTILE”
  - c. Manufacturer’s Name, Trademark and Code
4. Joints and Fittings: Fittings shall be Pressure Class 350 ductile iron and have restrained push-on joints in accordance with ANSI/AWWA C110/A21.10, latest revision with the exception of the manufacturer's proprietary design dimensions. Fittings shall have interior cement-mortar lining as specified hereinbefore for the pipe.
5. The use of restrained joints utilizing a friction type connection shall not be accepted. Joints for ductile iron pipe and fittings, as described hereinbefore, shall be rubber-gasket joints and be in accordance with ANSI/AWWA C111/A21.11, latest revision.
6. Joints shall have the same pressure rating as the pipe or fitting of which they are a part. Joints shall be installed per the manufacturer’s recommendations.
7. All pipe joints and fittings shall be restrained for lengths indicated in the Standard Details. Pipe joints and fittings at ends left for future connections shall be restrained per lengths indicated. Concrete thrust blocking for pipe restraint shall not be used. Restraints shall have same pressure rating as the pipe.
8. Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.
9. All ductile iron pipe and fittings shall be fabricated by the same pipe manufacturer.
10. Where spigot end of restrained joint pipe connects with valves or other items that have mechanical-joint ends, connection shall be made with a restrained mechanical-joint

gland. Restrained mechanical-joint connection shall be manufactured by EBAA Iron, Inc., or approved equal.

11. Restrained joint pipe may be used and shall be FLEX-RING Restrained Joint by American Ductile Iron Pipe, TR FLEX Restrained Joint by U.S. Pipe, SUPER-LOCK Restrained Joint by Clow Water Systems, SNAP-LOCK Restrained Joint by Griffin Pipe, or approved equal.
12. All underground ductile iron pipes shall be encased with polyethylene film in tube form conforming to AWWA C105 (latest edition).
  - a. Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight (8) mils.
  - b. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial compound to mitigate antibiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.
  - c. The polyethylene film shall have the following characteristics:
    - i. Impact Resistance: 600 grams per ASTM D1709 Method B
    - ii. Propagation Tear Resistance: 2,550 grams force per ASTM D1922
    - iii. Thickness: 0.008 inches minimum (8 mil)
  - d. Polyethylene encasement shall be installed per ANSI/AWWA C105 Modified Method A.
  - e. Polyethylene encasement shall be V-Bio as manufactured by DIPRA.

### **C. Polyvinyl Chloride (PVC) Pipe**

1. Pipe: 4-inch through 30-inch - PVC plastic pipe shall conform to ANSI/AWWA C-900, Class 235 (DR 18). PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.
2. Pipe shall be Blue in Color.
3. Each length of pipe shall be marked, at no more than 10 foot intervals, with the

following information:

- a. Nominal Pipe Size
  - b. Type Plastic Material – AWWA C900
  - c. Manufacturer's Name, Trademark and Code
  - d. and the National Sanitation Foundation NSF 14 Seal of Approval for drinking water.
4. The basis of acceptance of PVC plastic water main pipe will be a written, notarized certification, accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested and inspected in accordance with the designated standard specifications. These certifications shall be obtained from the manufacturer and delivered to **Nashville Municipal Utilities** representative on the project site. A sufficient number of tests and certifications shall be made so as to be representative of the complete project. Copies of the test results shall be kept on file by the manufacturer and shall be available for review by **Nashville Municipal Utilities** upon request.
  5. Pipe shall be visually inspected on the project site for proper markings which shall include manufacturer's name or trademark, nominal pipe size, pressure rating for water at 73.4 degrees F., plastic pipe material designation code (e.g. PVC 1120), dimension ratio, AWWA or ASTM designation and pressure class with which the pipe complies, and the National Sanitation Foundation NSF 14 Seal of Approval for drinking water.
  6. Fittings: Fittings shall be pressure class 350 ductile iron and have mechanical-joints or push-on joints in accordance with ANSI/AWWA C110/A21.10, latest revision, and shall conform to the details and dimensions shown therein. Fittings shall have interior cement-mortar lining as specified hereinbefore for the pipe. Compact ductile iron fittings meeting the requirements of ANSI/AWWA C153/A21.53, latest revision, will also be acceptable.

**D. Small Diameter (1" through 2") High Density Polyethylene (HDPE) Pipe and Fittings**

1. Pipe: High density polyethylene pipe shall be by one of the following:
  - Manufactured by JM Eagle,
  - Manufactured by Charter Plastics,
  - "DriscoPlex" as manufactured by Chevron Phillips,
  - or Approved Equal.
2. Pipe shall meet the requirements of AWWA C901 (latest revision), ASTM D2239 and be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4.

3. The resin material shall meet the requirements of ASTM D3350 with a minimum cell classification of PE 445574 CC 2 or 3.
4. All water service line diameter sizes shall be Standard Inside Dimension Ratio (SIDR). All HDPE pipe for water service line applications shall be SIDR 7 (250 psi WPR).
5. Pipe shall be blue in color.
6. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
7. Pipe made from these resins must have a long-term strength rating of 1,600 psi or more.
8. The polyethylene resin shall contain antioxidants and shall be stabilized with carbon black against ultra-violet degradation to provide protection during processing and subsequent weather exposure.
9. The polyethylene resin compound shall have a resistance to environmental stress cracking as determined by the procedure detailed in ASTM D 1693, Condition B with sample preparation by procedure C of not less than 200 hours.
10. Fittings: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy is to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
11. Electrofusion Fittings shall be PE4710 HDPE, Cell Classification of 445574C as determined by ASTM D3350 and be the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.
12. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 4710 HDPE, Cell Classification of 445574C as determined by ASTM D3350 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.
13. The pipe shall be designed for a normal internal working pressure and earth cover over

top of the pipe to suit the conditions of proposed use.

14. Each length of pipe shall be marked, at no more than 10 foot intervals, with the following information:
  - Nominal Pipe Size
  - Type Plastic Material – PE4710
  - Pipe Pressure Rating
  - Manufacturer's Name, Trademark and Code
  - and the National Sanitation Foundation NSF 14 Seal of Approval for drinking water.
15. All pipe shall be made from virgin material. No rework compound.
16. Pipe shall be homogenous throughout, and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.
17. Fittings for the polyethylene pipeline shall be Ductile Iron Fittings per requirements noted above.
18. Bends 22-1/2° or greater shall have a fitting installed.
19. For alignment changes of less than 20° deflection, the pipe may be laid in curves with a radius of 100 feet or greater.
20. All run-of-the-pipe fittings shall be fusion welded into the pipeline. Tee branches shall not be allowed. All fittings shall be factory made.
21. Fittings shall be capable of withstanding the same pressure and loading conditions specified for the pipe.
22. Pipe Jointing:
  - a. Small Diameter HDPE Water Service Lines shall be one continuous length of pipe from the water main to the meter pit, unless otherwise approved.
  - b. Pipe jointing shall only be permitted on a case-by-case basis as approved by **Nashville Municipal Utilities** for Small Diameter HDPE water service lines. If allowed, pipe shall be joined by leakproof, thermal, butt fusion joints. All fusion must be done by personnel trained by the pipe supplier using tools approved by the pipe supplier.
  - c. The fusion machine shall have hydraulic pressure control for fusing two (2) pipe ends together; it shall include pressure fusion indicating gauges to correctly monitor fusion pressures. The machines shall be equipped with a McElroy

Datalogger to record fusion pressure and temperature. The machines shall be equipped with an electric or gasoline engine powered facing unit to trim irregularities from the pipe ends. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature. All datalogger information shall be submitted electronically to **Nashville Municipal Utilities**.

- d. Joint strength must be equal to that of adjacent pipe as demonstrated by tensile test. In addition, results of tensile impact testing of joint should indicate a ductile rather than a brittle fracture. External appearance of fusion bead should be smooth without significant juncture groove.
- e. Threaded or solvent cement joints and connections are not permitted.

**E. Large Diameter (4” and larger) High Density Polyethylene (HDPE) Pipe and Fittings**

- 1. Pipe: High density polyethylene pipe shall be by one of the following:
  - Manufactured by JM Eagle,
  - “DriscoPlex” as manufactured by Chevron Phillips,
  - or Approved Equal.
- 2. Pipe shall meet the requirements of AWWA C906 (latest revision) and be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4.
- 3. The resin material shall meet the requirements of ASTM D3350 with a minimum cell classification of PE 445574C/E. Pipes having an outside diameter of 4” and larger shall have a manufacturing standard of ASTM F-714.
- 4. All large diameter water main HDPE pipe shall be ductile iron pipe size (DIPS). All HDPE pipe for water main applications shall be DR 9 (250 psi WPR). Pipe shall be upsized one (1) standard pipe diameter to match internal pipe diameter as close to the connecting pipe as possible.
- 5. Pipe shall be black in color with blue striping.
- 6. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
- 7. Pipe made from these resins must have a long-term strength rating of 1,600 psi or more.

8. The polyethylene resin shall contain antioxidants and shall be stabilized with carbon black against ultra-violet degradation to provide protection during processing and subsequent weather exposure.
9. The polyethylene resin compound shall have a resistance to environmental stress cracking as determined by the procedure detailed in ASTM D 1693, Condition B with sample preparation by procedure C of not less than 200 hours.
10. Fittings: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy Datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
11. Electrofusion Fittings shall be PE3408/4710 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02 and be the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.
12. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.
13. The pipe shall be designed for a normal internal working pressure and earth cover over top of the pipe to suit the conditions of proposed use.
14. Each length of pipe shall be marked, at no more than 10 foot intervals, with the following information:
  - Nominal Pipe Size
  - Type Plastic Material – PE4710
  - Pipe Pressure Rating
  - Manufacturer's Name, Trademark and Code
  - and the National Sanitation Foundation NSF 14 Seal of Approval for drinking water.
15. All pipe shall be made from virgin material. No rework compound.
16. Pipe shall be homogenous throughout, and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.



17. Fittings for the polyethylene pipe line shall be molded or fabricated from the same material as specified hereinbefore for the high density polyethylene pipe.
18. Bends 22-1/2° or greater shall have a fitting installed.
19. For alignment changes of less than 20° deflection, the pipe may be laid in curves with a radius of 100 feet or greater.
20. All run-of-the-pipe fittings shall be fusion welded into the pipeline. Tee branches shall not be allowed. All fittings shall be factory made.
21. Fittings shall be capable of withstanding the same pressure and loading conditions specified for the pipe.
22. Pipe Jointing:
  - a. Pipe to be joined by leakproof, thermal, butt fusion joints. All fusion must be done by personnel trained by the pipe supplier using tools approved by the pipe supplier.
  - b. The fusion machine shall have hydraulic pressure control for fusing two (2) pipe ends together; it shall include pressure fusion indicating gauges to correctly monitor fusion pressures. The machines shall be equipped with a McElroy Datalogger to record fusion pressure and temperature. The machines shall be equipped with an electric or gasoline engine powered facing unit to trim irregularities from the pipe ends. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature. All datalogger information shall be submitted electronically to **Nashville Municipal Utilities**.
  - c. Joint strength must be equal to that of adjacent pipe as demonstrated by tensile test. In addition, results of tensile impact testing of joint should indicate a ductile rather than a brittle fracture. External appearance of fusion bead should be smooth without significant juncture groove.
  - d. Threaded or solvent cement joints and connections are not permitted.

#### **F. Couplings and Adapters**

1. Couplings and Adapters:
  - a. Couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and

tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal.

- b. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed.
- c. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.
- d. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.
- e. Flexible couplings and flanged adapters shall be as manufactured by Dresser, per the following, unless otherwise specified and/or noted on the Drawings:
  - i. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe:
    - Style 138 by Dresser
  - ii. Transition couplings for joining pipe of different outside diameters:
    - Style 162 by Dresser (4"-12")
    - Style 62 by Dresser (2"-24")
  - iii. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment:
    - Style 127 by Dresser cast (3"-12")
    - Style 128 by Dresser steel (3"-48" C.I. Pipe)
    - Style 128 by Dresser steel (2"-96" steel pipe)

#### **G. Non-Detectable Underground Utility Identification Tape**

5. Underground non-detectable utility warning tape shall be pigmented polyolefin film with a printed message on one side used to protect, identify, and locate underground utility lines.
6. Tape shall have minimum thickness of 4 mils and minimum width of 3 inches and maximum width of 6 inches. The material and ink shall be chemically inert and shall not degrade when exposed to acids, alkalis, and other destructive substances commonly found in soil. Ink used to print the material is permanent and cannot be removed by normal handling or upon burial.
7. The tape shall be color coded and imprinted with the message as follows:

Type of Utility	Color Code	Message
Sewer	Green	Caution Sewer Line Buried Below

8. Underground identification tape shall be “Terra Tape Standard” as manufactured by Reef Industries, Inc., or equal.

#### **H. Location/Tracer Wire**

1. Open Cut Excavation:
  - a. Direct burial tracer wire shall be #10-AWG solid, copper-clad steel core (684 lb. average tensile break load) with 30 mil high density polyethylene “GREEN” color insulating jacket complying with ASTM D1248, 30-volt rating. The wire shall be continuous with no fabricated or field construction connections interrupting the wires continuity from end to end. Wire insulation shall be highly resistant to acids, alkalis, and other destructive substances commonly found in soil.
  - b. Tracer wire shall be 1030 HS as manufactured by Copperhead Industries LLC; or approved equal.
2. Horizontal Directional Drilling:
  - a. Directional drilling tracer wire shall be #10-AWG solid, copper-clad steel core (2,032 lb. average tensile break load) with 45 mil high density polyethylene “GREEN” color insulating jacket complying with ASTM D1248, 30-volt rating. The wire shall be continuous with no fabricated or field construction connections interrupting the wires continuity from end to end. Wire insulation shall be highly resistant to acids, alkalis, and other destructive substances commonly found in soil.
  - b. Two (2) wires shall be installed for all horizontal directional drill locations.
  - c. Tracer wire shall be 1045 EHS SoloShot as manufactured by Copperhead Industries LLC; or approved equal.
3. Open Cut Excavation Tracer Wire Splice Kit:
  - a. Open cut excavation splice kit shall be DryConn Direct Bury Lug Aqua Model #90220 as manufactured by King Innovation; or approved equal.

4. Tracer Wire Terminating Box:
  - a. Tracer wire terminating box shall be located along the water main at the large water service vault outside face. Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements. Lid material shall be of cast iron or ductile iron and shall be flush with the ground. Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B-253. Brass screw running through brass wire harness and lid will be used as connection for locator transmitter hook-up. Brass wire harness shall be used to secure tracer wire leads to brass screw enabling locator equipment hook-up. Petrolatum wax tape incorporated with magnetized tracer box to encapsulate tracer wire leads and brass wire harness. Petrolatum wax tape must be formed around brass wire harness connection after tracer wire leads are connected to prevent oxidation of wire ends. To ensure proper long term locatability and signal strength, the petrolatum wax tape must be utilized to prevent oxidation. Access Box shall be designed for operational access to underground tracer wire systems and shall include an anti-sink/pull-out restraint flange.
  - b. Tracer wire terminating box shall be “Snake Pit Roadway Box” as manufactured by Copperhead Industries, Inc.; or equal.
5. Grounding Rod:
  - b. Grounding rod for tracer wire shall be Model “ANO-12” as manufactured by Copperhead Industries LLC; or approved equal.

## **I. Utility Marker**

1. Tracer Wire Marker Posts:
  - a. Pipeline marker posts with terminal connections to receive tracer wire shall be located along the sewage forcemain route. Marker posts shall be constructed of superior grade ABS plastic material, 3.5” outside diameter, 7 feet total height (with min. 4 feet above grade), with lid. Lettering shall be clearly printed on the marker post indicating: “**Nashville Municipal Utilities**” and “Buried Sewage Forcemain” and “Emergency Contact: 812-988-5526”. Marker post shall be Model PMP-7CE with Lid C2 as manufactured by Handley Industries, Inc., or approved equal.
2. Utility Markers:
  - a. Utility marker shall be a single piece marker shall be constructed of a durable, UV resistant, continuous glass fiber and resin reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40 deg. F to +140 deg. F. Marker shall be a constant flat “T” cross sectional design of 0.125” minimum thickness with reinforcing support ribs incorporate longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration and furnished with a fastened metal anchor barb for permanent

anchoring into soil.

- b. Each marker shall be permanently identified with the manufacturer's name and month/year of fabrication. A black line shall be stamped horizontally across the front of the marker near the bottom to indicate proper burial depth. Marker shall have a minimum width of 3.75 inches and overall length of 72 inches.
- c. Each marker shall be green color throughout with a vinyl, non-reflective green background decal located at the top end of the marker with white vertical lettering "CAUTION SEWAGE FORCEMAIN". Decal shall be outdoor quality, UV resistant, with embedding graphics under a protective weather and fade resistant laminate cover.
- d. Utility marker shall be model "CRM3-072-07" as manufactured by Carsonite Composites; or approved equal.

**J. 1" through 2" Water Service Components**

Description	Manufacturer	Model Number	Stock Number
1" Corp. Stop	Ford Meter Box Co.	F600-4	0501
1" Corp. Ell 90° Bend	Ford Meter Box Co.	L02-44	0505
1" Corp. Ell 45° Bend	Ford Meter Box Co.	LA02-44	0503
1" Yoke Bar	Ford Meter Box Co.	Y504	0529
1" Yoke Ell	Ford Meter Box Co.	L92-44	0519
Meter Pit – 1" and 1-1/4" Service	Fratco (or Equal)	20" Notched	1111
Meter Pit Lid – 1" and 1-1/4" Service	Ford Meter Box Co.	X-3	1120
2" Service Saddle	Ford Meter Box Co.	F202-979-CC7	
2" Corp. Stop	Ford Meter Box Co.	FB1600-7	
Meter Setter	Ford Meter Box Co.	VBB77-15B-11-77	
2" Male Fittings	Ford	C84-77	

Meter Pit – 1-1/2” and 2” Service	Fracto (or Equal)	36” Notched	
Meter Pit Monitor Ring – 1-1/2” and 2” Service	Ford Meter Box Co.	FL-36	
Meter Pit Ring & Lid – 1-1/2” and 2” Service	Ford Meter Box Co.	No. 10	

1. Corporation stops, of the size required, shall be tapped directly into the water main for Ductile Iron Pipe (Standard) or by the use of a tapping saddle for PVC pipe (PVC pipe is only acceptable if requested/approved by **Nashville Municipal Utilities** on a case-by-case basis).
2. Corporation stops shall have AWWA C800-66 C.S. threaded inlet. Outlets shall be suitable for the type of service piping furnished and laid, and the Contractor shall verify compatibility with service piping as required before ordering stops.
3. Fittings shall be brass.

**K. Meter Pit (1” through 2” Water Service Lines)**

1. Meter pits shall adhere to **Nashville Municipal Utilities** Standard Details.

**L. Meter Vault (4” and Large Water Service Lines)**

1. Refer to **Nashville Municipal Utilities** Standard Details.
2. Meter Vaults are owned by the Property Owner. Property Owner is required to exercise and maintain valves in vault.

**3.03 Water Valves**

**A. General**

1. **Nashville Municipal Utilities** currently allows the use of the following valves meeting or exceeding the minimum requirements/specifications set forth herein.

**B. Gate Valves**

1. All gate valves shall be furnished with mechanical joint end connections, unless

otherwise shown on the Drawings or specified hereinafter. Plastic pipe “stub-joint” ends on valves for PVC water mains will not be accepted. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working pressure case on the body of the valve.

2. Gate valves (4” though 12”) shall be resilient seated manufactured to meet or exceed the requirements of AWWA C515. Valves shall have a clear, unobstructed water way when fully opened shall be at least as large as the pipe inside diameter for which it is intended.
3. All internal and external surfaces shall be coated with a fusion bonded epoxy to a minimum thickness of eight mils. Said coating shall be non-toxic, impart no taste to water and shall conform to AWWA C550 of latest revision. Said coating shall be applied to assembly such that all exposed areas, including end connection bolt holes, body-to-bonnet bolt holes, etc., shall be coated with epoxy. All nuts and bolts shall be stainless steel.
4. Valves shall be provided with two O-ring stem seals located above the thrust collar. The two rings shall be replaceable with the valve fully open and subject to full rated working pressure. The area between the O-ring shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. One anti-friction washer shall be located below and one anti-friction washer above the thrust collar.
5. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either seat direction, and shall consist of a cast iron gate with a resilient urethane rubber seat completely encapsulated to the gate.
6. Further, it shall be designed such that no sliding of rubber on the seating surfaces is required to compress the rubber. It shall also be designed such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate.
7. All 4” through 12” valves shall be seat tested at the rated working pressure of 350 psi and shall test at 700 psi in accordance with AWWA C515. All valves shall be satisfactory for applications involving valve operation after long periods of inactivity.
8. Gate valves set with valve boxes shall be provided with two inch square operating nut and shall be opened by turning to the left (counterclockwise). Each gate valve shall be installed in a vertical position with a valve box. Contractor must use extension stems, if necessary, to raise operator nut within 3 ft. of final grade. A “Posi-Cap” high-strength plastic valve box aligner shall be installed within the valve box, centered

about the extension stem and located under the operating nut. All gate valves shall be encased in polyethylene film.

9. Gate valves shall be Model Series 2361 resilient wedge gate valves as manufactured by Mueller Company; American-Darling Series 2500-1; M&H Series 7000; or approved equal.

### **C. Tapping Sleeves and Valves**

#### **1. Tapping Sleeves:**

- a. Tapping sleeves shall be all stainless steel for connections to existing water lines with ANSI 125# outlet stainless steel flange, suitable for maximum working pressures of 250 psi (4"–12" sizes) and shall be JCM 432 by JCM Industries, H-304 by Mueller Company, SST III by Romac Industries; or approved equal.
- b. Coordinate with **Nashville Municipal Utilities** for connections to water mains larger than 12".

#### **2. Tapping Valves:**

- a. 4" through 12": Tapping valves shall be resilient wedge gate valve conforming to AWWA C515 standard (4" to 12" size), with ductile iron body, fully bronze mounted, non-rising stem and have a maximum working pressure of 250 psi and static test pressure of 500 psi. Tapping valves shall have one end flanged with alignment lip to attach to tapping sleeve and other end mechanical joint type complying with AWWA C111 standard.
3. Tapping valve shall be installed in a vertical position with a roadway type valve box and shall be provided with a 2-inch square operating nut and shall be opened by turning to the left (counterclockwise). Contractor shall use extension stems, if necessary, to raise operator nut within 3 feet of final grade.
4. Tapping valves for sizes 4" through 12" shall be Mueller A-2361, American-Darling Series 2500-1, M&H Series 7000; or approved equal.
5. All existing water mains to be tapped under this Contract shall be exposed in order to verify line sizes prior to ordering tapping sleeves and valves.
6. All tapping valves must be sized to match the water main being extended. All tapping sleeves and valves shall be encased in polyethylene film.

### **D. Insertion Valves**

1. General: The sleeve shall be fabricated to assure a 360° seal around the pipe under working pressures up to 200 psi. It shall be designed to accommodate the equipment



and fixtures necessary to drill and ream the pipe and install the insertion valve without any interruption in water distribution service.

2. The valve assembly, when installed in the sleeve, shall perform as a water control device with an effective shutoff of the flow of water. The valve shall be installed in the open position, under water pressure without any interruption of water service. The valve shall give a full unobstructed full flow waterway after installation.
3. Materials: The sleeve shall be made of ASTM A-36 steel, epoxy coated to 10 - 12 mils.
4. Flange: A special flange shall be used in the installation of equipment and insertion valve.
5. Neck: The neck shall be manufactured to precision tolerances to assure proper alignment, support, and sealing of the insertion valve.
6. Lugs: Lugs on the sleeve are to be configured to properly align the sleeve halves during installation, provide a bolting surface and assure a 360° seal. The lugs are to be designed to prevent excessive stress on the pipe.
7. Bolts and Nuts: High strength low alloy steel bolts and nuts meeting AWWA Standard C-111 shall be furnished. Type 304 stainless steel bolts with SDC nuts are optional.
8. Gaskets: All gaskets shall be made of Styrene Butadiene Rubber (SBR) compounded for potable water service in accordance with ASTM D2000 3 BA715. The gaskets shall provide a positive 360° seal on the pipe and assure a tight, durable and resilient seal at the pipe sleeve – valve insert junction.
9. Coating: The sleeve shall be lined and coated with fusion bonded epoxy meeting the requirements of AWWA-C213.
10. Armors: Heavy gauge type 304 stainless steel armor plates shall be used to bridge the gap between the sleeve halves.
11. Insert: The insert shall consist of a ductile iron casting coated with SBR rubber compounded for water service with a durometer of 60 Shore A. The insert shall seal on the inside diameter of the sleeve and the lower half of the water main.
12. Valve Stem: The stem and nut assembly shall be in accordance with AWWA C-500-80, Section 3.12.
13. Manufacturer: Insertion valve, equipment, and sleeves shall be as manufactured by Romac Industries, Seattle, WA, or equal

## **E. Butterfly Valves**

1. Butterfly valves are only permitted on water mains 16-inch in diameter and larger.
2. All butterfly valves shall be of the tight closing, rubber seat type with Buna-N rubber seats, which are recess mounted and securely fastened to the valve body or to the valve disc. Seating surfaces shall be stainless steel. Valves shall be rated for 150 psi pressure (Class 150B) and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full structural, hydrostatic and leakage test requirements of the application class of AWWA C504. Valves shall have mechanical joint ends and mechanical joint accessories meeting the requirements of ANSI/AWWA C111/A21.11.
3. Valve bodies shall be constructed of cast iron ASTM A126, Class B and shall have integrally cast mechanical joint ends. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with AWWA C504. Valve shafts shall be constructed of 18-8 stainless steel or of approved construction.
4. Disc shall be constructed of any material described in AWWA C504, Section 3.4. All disc seating edges shall be smooth and polished. Valve shafts shall be a one piece unit extending full size through the valve disc and bearings or a two piece unit (stub-shaft type). Disc mounted seats shall be mechanically retained; body mounted seats shall be bonded to the valve body. Bonded-in seats must be simultaneously molded in, vulcanized and bonded to the body and the seat. Bearings shall be corrosion resistant and self-lubricating.
5. Operator shall be the traveling 2-inch nut type, AWWA C504, Class 150. All operators shall be fully gasketed and grease packed and designed to withstand submersion in water to 10 psi. Valve shall open with a counterclockwise rotation of the operator, and operation shall closely resemble conventional distribution valve practice and shall minimize water hammer. Operator shall be equipped for buried service.
6. All surfaces of the valve shall be clean, dry and free from grease before painting. An epoxy coating conforming to AWWA C550 shall be factory applied to the interior ferrous surfaces of the valve except for finished or seating surfaces. Exterior surfaces shall be shop painted with two (2) coats of Fed. Spec. TT-V-51F Asphalt Varnish.
7. Butterfly valves installed in the ground shall have the operator nut in a vertical position for use in a roadway type valve box. There shall be a maximum 36" depth to valve

operator nut. Contractor must use extension stems, if necessary, to raise operator nut within 36" of the final grade. A "Posi-Cap" high-strength plastic valve box aligner shall be installed within the valve box, centered about the extension stem and located under the operating nut. All butterfly valves shall be encased in polyethylene film as specified in Section 02505.

8. Butterfly valves shall be as manufactured by Dezurik; or approved equal.

#### **F. Air Release Valves and Boxes**

1. Air release valves are only permitted on water mains 16-inch in diameter and larger.
2. Air release valves and boxes shall be installed at locations to be determined in the field by the Engineer. Air release valve stems shall be connected to the main by a corporation stop and a tapping saddle. An isolation ball valve shall be furnished and installed between the air release valve and corporation stop. Valves shall be suitable for average working water pressure of 200 psi. Valves shall be equipped with cast iron body and cove, stainless steel float, Buna-N seat and bronze linkage.
3. Air release valves installed on water mains shall have a 1-inch inlet. All air release valves shall be APCO No. 200-A (with 5/32 inch orifice) as manufactured by Valve and Primer Corporation Schaumburg, Illinois or equal.
4. Air release valves shall be installed at the high point of the water main and shall be connected on the main by a corporation stop with a female I.P.S. threaded outlet. The inlet pipe to the valve shall be ASTM B 43 extra strong seamless red brass pipe with I.P.S. male threaded ends.
5. The air release valve box shall be a standard meter pit and cover with pipe cut-outs as shown in the standard details.

#### **G. Valve Boxes – Buried Valves (Except Air Release Valves) 4" Diameter and Large**

1. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "WATER". Valve boxes for valves larger than 8 inches shall be three-piece. Valve boxes shall be accurately centered over valve operating nut with centering device, and backfill thoroughly tamped about them. Valve boxes shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be grade in any paving, walk or road surface, and 2 inches above finish grade in grass plots, fields, woods or other open terrain with positive drainage away from box. Valve box centering device shall be Box-Seat as manufactured by QWP, Box Lok as

manufactured by Trumbull, or approved equal. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry, Bingham & Taylor, or approved equal.

2. Contractor shall furnish one (1) 6-foot T-handle operating wrenches for underground valves. Nut operator extensions for all valves buried deeper than 3 feet shall be provided with stem extensions sufficient to raise operator nut to within 3 feet of finished grade.
3. Valve boxes shall have extension stems, where necessary when operating nut is raised to be within 3 feet of the existing grade.

### **3.04 Hydrants**

#### **A. Yard Hydrants**

1. Yard hydrants shall be installed where described on the Drawings or directed by **Nashville Municipal Utilities** in accordance with the details shown. Hydrants shall be of the frostproof, compression type with all working parts removable without digging up the hydrants. Hydrants shall be equipped with hose connections (2-1/2" size), steamer connection (4-1/2" size) and bottom connection for 2-inch water line. Hydrants shall be Model A423 Centurion by Mueller or equal.
2. All hydrants shall be backfilled to within 12" of ground surface with crushed stone.
3. Exposed portions of hydrants shall be factory painted with an enamel finish. Coordinate with **Nashville Municipal Utilities** for color selection.
4. Below ground portions shall have two (2) coats of coal tar epoxy field applied.

#### **B. Fire Hydrants**

1. The Contractor shall furnish and install fire hydrants and auxiliary gate valves where shown on the Drawings or directed by **Nashville Municipal Utilities**. Hydrants shall conform in all respects to the most recent requirements of AWWA C502. Hydrant barrel shall have safety breakage feature above the ground line. All hydrants shall have 6-inch mechanical joint shoe connection, two (2) 2-1/2-inch discharge nozzles, and one (1) 4 1/2-inch pumper nozzle with rubber gasketed caps fitted with cap chains. Cap nuts are to be five (5) sided. Connection threads shall be National Standard Thread. Main valve shall have 5-1/4-inch full opening and be of the compression type opening against water pressure so that valve remains closed should barrel be broken

off.

2. Hydrants shall be fully bronze mounted. Main valve shall have a threaded bronze seat ring assembly of such design that it is easily removable by unscrewing from a threaded bronze drain ring. Bronze drain ring shall have multiple ports providing positive automatic drainage as the main valve is opened or closed. Drainage waterways shall be completely bronze to prevent rust and corrosion.
3. The operating nut shall be five (5) sided bronze or bronze with a five (5) sided ductile iron cap, and mounted so that a counter clockwise motion will open the valve. There must be cast on top an arrow and the word "Open" indicating the direction of turn to open the hydrant.
4. Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stop shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir protected from weather and the waterway with O-ring seals.
5. Hydrants shall be shop tested to 500 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drain shall function and there shall be no leakage into the bonnet.
6. Type of shoe connection shall be mechanical joint and size shall be six inches (6").
7. Hydrants shall be factory painted as follows:
  - a. Public Hydrants shall be Yellow.
  - b. Private Hydrants shall be Red.
8. Hydrants shall be Mueller Super Centurion 250, Model A-423, or approved equal.

#### **C. Flush/Blow-off Hydrants**

1. Flush type fire hydrants shall comply, where applicable, to AWWA Standard C-502, latest revision. Flush type fire hydrants shall be of the compression type, with the main valve opening against the pressure and closing with the pressure. The main valve opening shall be 2-1/4" diameter. Flush type fire hydrants shall be of a dry barrel design.
2. Flush type fire hydrants shall be rated at 150 psi water working pressure, tested at 300 pounds hydrostatic for structural soundness in the following manner; 300-pound hydrostatic test supplied from the inlet side, first with the main valve closed for the

testing of the valve seat; second, with the main valve open for testing of the drain valves and the hydrant barrel.

3. Hydrants shall be constructed of ASTM A-126 Class B cast iron. The main valve of the hydrant shall be made of rubber.
4. The bottom stem threads of the main valve rods shall be fitted with a cap nut for sealing the threads away from the water.
5. Changes in size or shape of the waterway shall be accomplished by means of easy curves. Exclusive of the main valve opening, the net area of the waterway of the barrel and the foot piece at the smallest part shall not be less than 120% of that of the net opening of the main valve, except for hydrants with 2-1/4" valve opening.
6. Hose and steamer caps shall be individually chained to the hydrant.
7. The operating threads of the hydrant shall be so designed as to avoid the working of any iron or steel parts against either iron or steel. The operating stem and operating nut threads shall be square or acme type.
8. Bonnet shall be weatherproof, free draining, and of a type that will maintain the operating mechanism in readiness for use under freezing conditions.
9. The operating nut shall be provided with a convenient means to afford lubrication to insure ease of operating and the prevention of wear and corrosion. Hydrants shall be of dry barrel type. Hydrant shoe shall have two (2) positive acting non-corrodible drain valves that shall drain the hydrant completely by opening when the main valve is closed, and also to close tightly when the main valve is open.
10. All like parts of hydrants of the same size and model produced by the same manufacturer shall be interchangeable.
11. Hydrants shall open by turning to the left.
12. Threads on hose and steamer nozzles shall be National Standard unless otherwise specified.
13. Operating nuts and cap nuts shall conform to National Standard unless otherwise specified.
14. Bury shall be 30" measuring depth from grade line to bottom of connecting pipe. Auxiliary shut-off (isolation) gate valves shall be of the same manufacturer as the hydrant when required.

15. Hydrants with a 2", 2-1/4" 2-1/2", or 3" shoe (Style 333) shall be supplied with one 2-1/2" hose outlet. Hydrant assembly shall include a cast iron box and cover for installation flush with grade level.
16. The inside of all hydrants shall be coated in accordance with AWWA standards except for bronze and machined surfaces. Exterior on hydrant nozzle section shall be painted fire hydrant red (or as specified).
17. Hydrant shoe shall have protective, thermosetting epoxy coating applied inside and out before assembly. Prior to application of coating, shoes shall be mechanically and chemically cleaned in compliance with SSPC Standards SP-5 and SP-8. A minimum average dry film thickness of 3 mils shall be applied on interior and exterior surfaces of hydrant shoe. Coating designation to be M&H 0271 epoxy and conform fully to AWWA C550-81, Section 3.
18. Hydrants shall be marked with name of manufacturer, year of manufacture, and size.

**D. Flush Hydrant Box**

1. Hydrant box and cover shall be cast iron with a minimum diameter of 16" and a minimum depth of 10".
2. The hydrant box shall not be attached to the hydrant at any point thus prohibiting loads from being transferred to the hydrant, standpipe, or connecting pipe. Hydrant box, when properly installed with cover, shall withstand a 25,000-pound load.

## Chapter 4 - Sewer Installation

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### 4.01 **Introduction**

The following Chapter addresses the minimum requirements for the installation of sanitary sewers and sewer force mains.

### 4.02 **Sanitary Sewer Installation (Gravity and Forcemain)**

#### **A. Excavation for Pipeline Trenches**

- a. Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the drawings and required by field conditions. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the pipe to be properly bedded. Installation shall be in accordance with ASTM-D-2321 except as modified herein.
- b. Excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe.
- c. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe. Trenches shall in no case be excavated or permitted to become wider than 2'-0" plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2'-0" at the level of or below the top of the pipe, special precaution may be necessary, such as providing compacted, granular fill up to top of the pipe or providing pipe with additional crushing strength as determined by the Engineer after taking into account the actual trench loads that may result and the strength of the pipe being used. The Contractor shall bear the cost of such special precautions as are necessary.
- d. The trench shall be straight and uniform so as to permit laying pipe to lines and grades shown on the drawings. It shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of trench water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. Temporary drainage ditches shall be installed as necessary to intercept or direct surface water which may affect work. All water shall be



pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

- e. Minimum cover of 30" shall be provided for all gravity pipelines, except those located in the State Highway Right of Way. Those shall have a minimum cover of 42". Minimum cover for all pressure forcemains shall be 48".

## **B. Pipe Bedding**

- a. All sewer pipe shall be supported on a bed of granular material. In no case shall pipe be supported directly on rock. Bedding shall be provided in earth bottom trenches, as well as rock bottom trenches. Bedding material shall be free from rock, foreign material and, frozen earth. Bedding shall be a minimum of 4" below pipe barrel.
- b. In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and insofar as possible where bell and spigot pipe is involved so that none of the load will be carried on the bells.
- c. Where flexible pipe is used, the granular bedding shall be placed up to at least the spring line (horizontal center line) of the pipe. The bedding material and procedures shall conform to ASTM D 2321 and any Technical Specifications set out hereinafter. Granular bedding shall be INDOT No. 8 or No. 11 crushed stone or Class II clean sand.
- d. Where undercutting and granular bedding are involved the undercutting shall be of such depth that the bottom of the bells of the pipe will be at least three inches above the bottom of the trench as excavated.
- e. In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. Yielding and mucky materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.
- f. Installation shall be in accordance with ASTM D 2321 except as modified hereinafter.

### **C. Special Granular Fill**

- a. "Special Granular Fill" when directed by the **Nashville Municipal Utilities** shall be INDOT No. 57.

### **D. Laying Pipe**

- a. The laying of pipe in finished trenches shall be commenced at the lowest point so the spigot ends point in the direction of flow.
- b. All pipes shall be laid with ends abutting and true to line and grade as shown on the Drawings. Supporting of pipes shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipes on blocks be permitted.
- c. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.
- d. Pipe shall not be laid on solid rock. A pad of granular material as specified in "Pipe Bedding", shall be used as a pipe bedding. Irregularities in sub-grade in an earth trench shall be corrected by use of granular material.
- e. Unsuitable materials in sub-grades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.
- f. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.
- g. No backfilling (except for securing pipe in place) over pipe will be allowed until **Nashville Municipal Utilities** has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

### **E. Backfilling Pipeline Trenches**

- 1. General

- a. Backfilling of pipeline trenches shall be accomplished with the requirements set forth in ASTM D 2321, in accordance with the details as shown on the Standard Details, and as described hereinafter.
2. Method “A” – Backfilling in Open Trench
- a. The lower portion of the trench (Initial Backfill), from the pipe bedding to a point 12" above the top of the pipe, shall be backfilled with INDOT No. 8 or No. 11 crushed stone or Class II Clean Sand per ASTM C12. This material shall be placed in 6" lifts and shall be carefully compacted to avoid displacement of the pipe.
  - b. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.
  - c. The upper portion of the trench (Final Backfill) above the compacted portion shall be backfilled with native excavated Class I, II, III, or IV materials per ASTM C12. Incorporation of rock larger than 3" is prohibited.
  - d. Final grading and seeding or sodding shall be in accordance the specifications herein.
3. Method “B” – Backfilling under Sidewalk & Unpaved Gravel Drives
- a. The lower portion of the trench (Initial Backfill), from the pipe bedding to a point 12 inches above the top of the pipe, shall be backfilled with INDOT No. 8 crushed stone or Class II Clean Sand per ASTM C12. This material shall be placed in 6" lifts to avoid displacement of the pipe.
  - b. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.
  - c. The middle portion of the trench (Final Backfill), from a point 12" above the top of the pipe to a point 6" below the grade line, shall be backfilled with INDOT B Borrow material free from rock. This material shall be placed and compacted in layers of approximately 6 inches.
  - d. The upper portion of the trench shall be temporarily backfilled and maintained with crushed stone or gravel until such time as the sidewalk is constructed or the driveway surface is restored.
4. Method “C” – Backfilling under Streets, Roads, and Paved Drives
- a. The lower portion of the trench (Initial Backfill), from the pipe bedding to a point 12 inches above the top of the pipe, shall be backfilled with INDOT No.

8 or No. 11 crushed stone or Class II Clean Sand per ASTM C12. This material shall be placed in 6" lifts to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

- b. The middle portion (Final Backfill) of the trench from the pipe bedding to a point 6" below the bottom of the pavement or concrete sub-slab, shall be backfilled with compacted INDOT B Borrow. This material shall be placed in 6" lifts to avoid displacement of the pipe.
- c. Compaction shall be accomplished by hand tamping or approved mechanical methods.
- d. The upper portion of the trench, from a point 6" below the bottom of the pavement or concrete sub-slab to grade, shall be backfilled with compacted INDOT No. 53 Crushed Stone. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

#### 5. Trenches

- a. Trenches outside existing sidewalks, driveways, streets, and highways shall be backfilled in accordance with Method "A". Trenches within the limits of sidewalk and unpaved driveways shall be backfilled in accordance with Method "B". Trenches within the paving limits of existing streets, highways, driveways and paved areas shall be backfilled in accordance with Method "C".
- b. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-ways and/or private property all excess earth or other materials resulting from construction.
- c. In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

#### **F. Installation of Identification Tape (Gravity and Forcemain)**

- 1. Identification tape shall be installed over the centerline of all (open cut) buried pipe in accordance with the manufacturer's installation instructions and as specified herein.
- 2. Identification tape shall be installed 12 inches (for 3" wide tape) to 20 inches (for 6" wide tape) below final grade over centerline of pipe.

#### **G. Installation of Location/Tracer Wire (Forcemain)**

1. For Open Cut Excavation:

- a. Tracer wire shall be installed over the centerline of all buried pressure pipe in accordance with the manufacturer's installation instructions and as specified herein.
- b. Location wire shall be taped to the top center of the buried pipe.
- c. Location wire for open cut applications shall be provided in sufficient quantity and redundancy (minimum of 1 wire).
- d. Tracer wire shall be brought up into terminating box for connection to a locating device (at the B.O.P. and E.O.P. of the forcemain). **Contractor shall meet with Nashville Municipal Utilities to establish locations of tracer wire terminating boxes before beginning pipe installation.** The wire shall be one continuous piece from end to end.
- e. For each wire installed, Contractor shall leave 3' of additional wire measured from the top of the terminating box. Contractor shall strip insulation 1" from ends of each wire installed and coil in top of terminating box.
- f. Contractor shall test tracer wire using **Nashville Municipal Utilities** locating device after installation of pipe to ensure continuity from end to end. If the tracer wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire at his own expense.
- g. In the event tracer wire cannot be installed as one continuous piece from end to end for Open Cut Excavation, Contractor may be allowed to use tracer wire connectors, subject to **Nashville Municipal Utilities** approval. Open cut excavation splice kit shall be "DryConn Direct Bury Lug Aqua Model #90220" as manufactured by King Innovation; as manufactured by 3M; or approved equal.

2. For Horizontal Directional Drilling:

- a. Tracer wire shall be installed with all horizontal directional drilled pipe in accordance with the manufacturer's installation instructions and as specified herein.
- b. Location wire shall be looped up into marker posts for connection to a locating device (maximum 250 feet of forcemain between marker posts and each side of creek/stream and railroad crossings). The wire shall be one continuous piece from end to end.

- c. Location wire for horizontal directional drilling applications shall be provided in sufficient quantity and redundancy (minimum of 2 wires). Contractor shall test each tracer wire using **Nashville Municipal Utilities** locating device after installation of pipe to ensure continuity from end to end. If the tracer wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire at his own expense.

#### **H. Installation of Utility Marker (Forcemain)**

1. Marker shall be installed at a minimum every 500 feet along pipe, each side of creek/stream, each side of railroad crossings, and immediately adjacent to all new sewage air release vaults located within open terrain (outside of pavement limits) as shown on the Drawings, unless otherwise directed by **Nashville Municipal Utilities**. Marker locations shall be approved by **Nashville Municipal Utilities**.
2. Marker shall be installed in accordance with the manufacturer's recommendations and tools to provide 48 inches exposed length above the finished grade and minimum ground embedment depth of 24 inches.

#### **I. Settlement of Trenches**

1. Whenever lines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement that occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor at no extra cost to **Nashville Municipal Utilities**. Repair of settlement damage shall meet the approval of **Nashville Municipal Utilities**, Town of Nashville Engineering Dept., and/or the State Department of Transportation.

#### **J. Pre-Fabricated Trench Baffles**

1. Pre-fabricated trench baffles shall be installed where shown on the Drawings, required by the specifications or as directed by the Engineer. The product shall be installed according to the manufacturer's recommendations, and shall provide a watertight seal around the pipe. Contractor shall insure that the correct line and grade of the pipe is maintained before backfilling around the trench baffle.

#### **K. Concrete Highway, Street, and Drive Replacement**

1. The Contractor shall replace those sections of existing roads, streets and driveways required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

2. Concrete Highway, Street, and drive replacement shall be completed according to INDOT and/or Town of Nashville Engineering Standards.

**L. Portland Cement Concrete Drive Replacement**

1. Wherever Portland cement concrete driveways are removed, they shall be reconstructed to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than existed prior to the operation.
2. Concrete Drive replacement shall be completed according to INDOT and/or Town of Nashville Engineering Standards.

**M. Concrete Curb and Gutter Replacement**

1. The Contractor shall remove the curb and gutter when encountered when required for laying the sewer. Only that portion of the curb and gutter needed to lay the sewer line shall be removed.
2. Concrete Curb and Gutter replacement shall be completed according to INDOT and/or Town of Nashville Engineering Standards.

**N. Mailbox, Culvert, Clothes Line Posts, Fences and other Replacements**

1. Existing mail boxes, drainage culverts, clothes line posts, fences and the like shall not be damaged or disturbed unless necessary, in which case, they shall be replaced in as good condition as found as quickly as possible. Existing materials shall be reused in replacing such facilities when materials have not been damaged by the Contractor's operations. Existing facilities damaged by Contractor's operation shall be replaced with new materials of the same type at the Contractor's expense.
2. Replacement of paved drainage ditches within highway right-of-way shall be accomplished in accordance with Department of Transportation specifications.

**O. New Sanitary Sewer to Existing Manhole Connection (Gravity Sewer)**

1. Core Drill existing structure and connect with flexible, watertight connection. Bench shall be reconstructed per **Nashville Municipal Utilities** Standards.
2. At the time the new sewer is placed into permanent service, as designated by **Nashville Municipal Utilities**, the Contractor shall remove the old sewer pipe from the manhole, patch and seal the wall with an expansive cement mortar,

construct new manhole bench in accordance with the standard details, and remove plug from the new sewer. All temporary pumping, piping, excavation, etc. as required to maintain or divert the sewage flow shall be included by the Contractor.

#### **4.03 Sanitary Sewer Manhole Installation**

##### **A. Excavation for Manhole Installation**

1. Excavation in which manholes are to be installed shall be excavated in open cut to the depths required on the drawings and by field conditions. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the manhole to be properly bedded.
2. Excavation may be undercut to a depth below the required invert elevation that will permit installing the manhole on a bed of granular material to provide continuous support for the manhole base.
3. Excavations shall be of sufficient dimensions to provide free working space on all sides of the manhole and to permit proper backfilling around the manhole. All excavated materials shall be placed a minimum of two feet (2') back from the edge of the excavation.
4. The excavation shall be straight and uniform so as to permit installation of the manhole to lines and grades shown on the drawings. It shall be kept free of water during the installation of the manhole and until the manhole has been backfilled. Removal of water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

##### **B. Manhole Bedding**

1. All manholes shall be supported on a bed of compacted INDOT No. 53 stone. In no case shall manhole be supported directly on rock. Bedding shall be provided in earth bottom excavations, as well as rock bottom excavations. Bedding shall be a minimum of 6" below manhole base.



2. A minimum 4" layer of Size #2 crushed stone over filter fabric shall be used in wet conditions.
3. Where undercutting and granular bedding is involved it shall be of such depth that the bottom of the manhole will be at least six inches above the bottom of the excavation.
4. In wet, yielding, mucky locations where the manhole is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe and/or manhole might take place during the placing of the backfill, the pipe and/or manhole must be weighted or secured permanently in place by such means as will prove effective. Yielding and mucky materials in sub-grades shall be removed below ordinary excavation depth in order to prepare a proper bed for the manhole. Crushed stone or other such granular material, if necessary, to replace poor sub-grade material classified as "Special Granular Fill".

### **C. Manhole Lining**

1. All manholes with a forcemain discharge connection, and three (3) manholes downstream of such a connection shall receive a protective lining.
2. Protective Lining system shall be Mainstay Composite Liner System by Madewell Products Corporation or **Nashville Municipal Utilities** approved equal.
3. The liner system shall be comprised of the following:
  - a. Hydraulic Cement Mortar: Mainstay ML-10
  - b. Restoration Mortar: Mainstay ML-72
  - c. Corrosion Barrier: Mainstay DS-5
  - d. Manhole Frame Seal: Madewell 806 Flexible Epoxy
3. The liner system shall be accompanied by a warranty against failure for a minimum of 10-years and be transferable to **Nashville Municipal Utilities**. This warranty shall, at a minimum, cover the following:
  - a. Failure of the liner to protect against the interior deterioration or corrosion of the structure.
  - b. Failure to protect the substrate and environment from contamination by effluent.
  - c. Failure to prevent groundwater infiltration.

Any such failures shall be repaired and restored at no cost to **Nashville Municipal**

**Utilities** within 60 days of notice of failure.

**D. Converting Existing Pump Station to Manhole**

1. Where noted on the Drawings, wet wells shall be converted to manholes as described herein. Structure shall be filled with compacted crushed stone or sand to a level approximately one foot below the invert elevation shown on the Drawings.
2. The invert shall be constructed with 3000 psi concrete, approximately one foot thick, with bench and channel(s) formed and finished per **Nashville Municipal Utilities** Standards. New outlet pipe openings shall be core drilled in the wall of the structure, and the pipe installed with a PSX Direct Drive Manhole Adapter, or approved equal. Areas around pipe shall be grouted to achieve a smooth surface.

**E. Concrete Highway, Street, and Drive Replacement**

1. Reference Section 4.02 K of this document.

**F. Concrete Curb and Gutter Replacement**

1. Reference Section 4.02 M of this document.

**G. Mailbox, Culvert, Clothes Line Posts, Fences and other Replacements**

1. Reference Section 4.02 N of this document.

**H. Manhole Frame Installation**

1. The manhole frame casting shall be centered over the opening in the cone or grade ring of the manhole, with a bituminous mastic joint sealing compound applied between the concrete and the casting.
2. The frame shall be bolted to the cone or grade ring with wedge anchors.

**4.04 Grinder Pump Station Installation**

## **A. Installation**

1. CONTRACTOR shall install grinder pump units in accordance with the MANUFACTURER'S Drawings, shop drawings and instructions.
  - a. Contractor shall remove all spoil, resulting from the excavation for grinder pump installation, from the site within 14 days after the completed grinder pump installation.
  - b. Contractor shall complete the temporary grading of the grinder pump site within 14 days of the completed installation.
2. The CONTRACTOR shall coordinate the orientation of gravity service stub location with Manufacturer to minimize bends in the gravity service connections. During installation, Contractor shall orient gravity service stubs in the direction that minimizes pipe bends in gravity service.
3. Install HDPE service line per Sanitary Sewer Installation for Forcemains.

## Chapter 5 - Water Installation

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### 5.01 Introduction

The following Chapter addresses the minimum requirements for the installation of water distribution facilities.

### 5.02 Hydrant Installation

#### A. Valves

##### 1. Location

- a. Valves shall be spaced no greater than 600 feet apart on water mains 12-inches and smaller.
- b. Valves shall be spaced no greater than 1,200 feet apart on water mains 16-inches and larger.

#### B. Fire Hydrants

##### 1. Location

- a. Fire hydrants shall be spaced no greater than 500 feet apart.
- b. Hydrants shall be located as shown or as directed by **Nashville Municipal Utilities** so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.
- c. When placed behind the curb, the hydrant barrel shall be set so that the pumper or hose nozzle cap will be a minimum of 18-inches and a maximum of 24-inches from the back of curb in developed areas.
- d. When placed behind the edge of pavement, the hydrant barrel shall be set so that the pumper or hose nozzle cap will be a minimum of 3-feet and a maximum of 5-feet from the edge of pavement in undeveloped areas. Deviations from these standards will only be allowed at **Nashville Municipal Utilities** discretion on a case-by-case basis.
- e. When set in the lawn space between the curb and the sidewalk or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within six inches (6") of the sidewalk.

2. Position: All hydrants shall be set plumb with not less than two (2) cubic feet of crushed stone and shall have their nozzles parallel with the roadway, with the pumper nozzle facing toward the roadway. Hydrants shall be set to the established grade, with nozzles at least eighteen inches (18") above the ground.
3. Connection to Water Main: Each hydrant shall be connected to the main with a six-inch (6") restrained joint ductile iron branch controlled by an independent six -inch (6") min. gate valve, unless otherwise specified.
4. Hydrant Drain (Pervious Soil): Whenever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing INDOT No. 8 crushed stone from the bottom of the trench to at least six inches (6") above the drain opening in the hydrant and to a distance of one foot (1') around the elbow. No drainage system shall be connected to a sewer.
5. Hydrant Drain (Impervious Soil): Whenever a hydrant is set in clay or impervious soil, a drainage pit two feet (2') in diameter and three feet (3') deep shall be excavated below each hydrant and filled compactly with INDOT No. 8 crushed stone under and around the elbow of the hydrant and to a level of six inches (6") above the drain opening. No drainage pit shall be connected to a sewer (see Standard Details).

### C. Yard Hydrants

1. Location: Hydrants shall be located as shown on the Contract Drawings or as directed by **Nashville Municipal Utilities** so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.
2. Position: All hydrants shall be set plumb with not less than two (2) cubic feet of crushed stone. Hydrants shall be set to the established grade, with nozzles at least thirty-six inches (36") above the ground, as shown on the Details in the Drawings, or as directed by **Nashville Municipal Utilities**. Hydrants shall be backfilled with crushed stone, which is encased by a section of an 18" diameter concrete pipe.
3. Connection to Water Main: Each hydrant shall be connected to the main with a tapping saddle, two (2) inch poly line and be controlled by an independent two (2) inch gate valve, unless otherwise specified.
  - a. Yard hydrants located on sanitary sewer lift station sites are not required to be metered.

- b. Other yard hydrant installations may require metering as determined by **Nashville Municipal Utilities**.
- 4. Hydrant Drain (Pervious Soil): Whenever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing INDOT No. 8 crushed stone from the bottom of the trench to at least six inches (6") above the drain opening in the hydrant and to a distance of one foot (1') around the elbow. No drainage system shall be connected to a sewer.
- 5. Hydrant Drain (Impervious Soil): Whenever a hydrant is set in clay or impervious soil, a drainage pit two feet (2') in diameter and three feet (3') deep shall be excavated below each hydrant and filled compactly with INDOT No. 8 crushed stone under and around the elbow of the hydrant and to a level of six inches (6") above the drain opening. No drainage pit shall be connected to a sewer (see Standard Details).

#### **D. Flush Hydrants**

- 1. Location: Hydrants shall be located as shown on the Contract Drawings or as directed by **Nashville Municipal Utilities** so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.
- 2. Position: Hydrants shall be set plumb and to the established grade.
- 3. Connection to Water Main: Hydrants shall be connected to the main by mechanical joint, screwed or flanged shoe. Mechanical joint shoes shall be fitted with strapping lugs.
- 4. Hydrant Drain (Pervious Soil): Whenever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing INDOT No. 8 crushed stone from the bottom of the trench to at least six inches (6") above the drain opening in the hydrant and to a distance of one foot (1') around the elbow. No drainage system shall be connected to a sewer.
- 5. Hydrant Drain (Impervious Soil): Whenever a hydrant is set in clay or impervious soil, a drainage pit two feet (2') in diameter and three feet (3') deep shall be excavated below each hydrant and filled compactly with INDOT No. 8 crushed stone under and around the elbow of the hydrant and to a level of six inches (6") above the drain opening. No drainage pit shall be connected to a sewer (see Standard Details).

6. Hydrant Box: Hydrant box shall be installed at grade and per manufacturer's recommendations. Box shall not be attached to the hydrant at any point.

**E. Hydrant Anchorage:**

The bowl of each hydrant shall be tied to the pipe with suitable anchor couplings, as directed by **Nashville Municipal Utilities**.

**F. Fire Hydrant Wrenches:**

One (1) hydrant wrench shall be furnished for each ten (10) hydrants or less. When the number of hydrants furnished and installed exceeds ten (10), one (1) hydrant repair kit shall be supplied at no additional cost to **Nashville Municipal Utilities**.

**5.03 Water Distribution Pipe Installation (Open Cut)**

**A. Excavation for Pipeline Trenches**

1. Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the Drawings and required by field conditions. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the pipe to be properly bedded. Installation shall be in accordance with ANSI/AWWA C600 for ductile iron and Cast Iron O.D. (AWWA) PVC pipe or ASTM F-645 for Iron Pipe O.D. (ASTM) PVC pipe except as modified herein.
2. Excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe.
3. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe. Trenches shall in no case be excavated or permitted to become wider than 2'-0" plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2'-0" at the level of or below the top of the pipe, special precaution may be necessary, such as providing compacted, granular fill up to top of the pipe or providing pipe with additional crushing strength as determined by the Engineer after taking into account the actual trench loads that may result and the strength of the pipe being used. The Contractor shall bear the cost of such special precautions as are necessary.
4. The trench shall be straight and uniform so as to permit laying pipe to lines and grades shown on the Drawings. It shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of trench water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times.

All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

5. Minimum cover of 48" shall be provided for all water main pipe and fittings.

**B. Pipe Bedding**

1. Reference Section 4.02 B of this document.

**C. Special Granular Fill**

1. Reference Section 4.02 C of this document.

**D. Laying Pipe**

1. Reference Section 4.02 D of this document.

**E. Backfilling Pipeline Trenches**

1. Reference Section 4.02 E of this document.

**F. Installation of Identification Tape (Water Main)**

1. Reference Section 4.02 F of this document.

**G. Installation of Location/Tracer Wire (Water Main)**

1. Reference Section 4.02 G of this document.

**H. Installation of Utility Marker (Water Main)**

1. Reference Section 4.02 H of this document.

**I. Settlement of Trenches**

1. Reference Section 4.02 I of this document.

**J. Pre-Fabricated Trench Baffles**

1. Reference Section 4.02 J of this document.

**K. Concrete Highway, Street, and Drive Replacement**



1. Reference Section 4.02 K of this document.

**L. Portland Cement Concrete Drive Replacement**

1. Reference Section 4.02 L of this document.

**M. Concrete Curb and Gutter Replacement**

1. Reference Section 4.02 M of this document.

**N. Mailbox, Culvert, Clothes Line Posts, Fences and other Replacements**

1. Reference Section 4.02 N of this document.

**O. Rip-Rap Stream Bank Slope Protection**

1. Reference Section 4.02 O of this document.

**P. Water Main Termination**

1. All water mains shall be terminated with a perpendicular hydrant tee and hydrant assembly, Gate Valve the size of the water main, and restraint ductile iron cap or plug.

## Chapter 6 - Sanitary Sewer Inspection, Testing, and Acceptance

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### **6.01 Introduction**

The following Chapter describes the minimum requirements and general procedures for the inspection and testing of sanitary and storm sewers to be dedicated to **Nashville Municipal Utilities**.

Any section of sewer not passing the tests prescribed herein shall be repaired to the satisfaction and approval of **Nashville Municipal Utilities**, retested and re-inspected.

### **6.02 Testing**

#### **A. Gravity Sanitary Sewers**

1. Cleanup: Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.
2. Inspect Lines and Laterals: Provide post installation sanitary sewer line jet cleaning and television inspection of the sewer line. All video recordings are to be turned over to **Nashville Municipal Utilities** for Engineer review and final approval. Any video deemed incomplete or otherwise deficient shall be re-televised before **Nashville Municipal Utilities** acceptance. Televising will be on an acceptable form of digital media, such as CD/DVD or portable external hard drive (flash media).
3. Deflection Test: Deflection tests shall be performed on a flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system. No pipe shall exceed a deflection of 5 percent. If deflection exceeds 5 percent, pipe shall be replaced or corrected. The mandrel used for the deflection test shall have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM Specification, including the appendix, to which the pipe is manufactured. The pipe shall be measured in compliance with ASTM D2122 Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings. The test shall be performed without mechanical pull devices.

4. Replacement of Defective Lines: All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.
5. Low Pressure Air Test:
  - a. To test for leaks, all completed piping as specified herein after backfilling shall be tested by low-pressure air test, exfiltration, or infiltration test. Should the low pressure air test results be inconclusive, an exfiltration or infiltration test will be required on the low pressure air tested segments. Labor, equipment and supplies required for all tests shall be furnished by the Contractor.
  - b. The low pressure air test shall consist of meeting a required holding time during a measured pressure drop. The initial test pressure shall be 4.0 psi, with the allowable pressure loss being 1.0 psi during the calculated holding time. PVC pipe shall be tested in accordance with ASTM F1417. Test time shall be calculated as follows:

$$T = \frac{0.085DK}{Q}$$

Where:

T = shortest time allowed for the air pressure to drop 1.0 psig, s;

K = 0.000419 DL but not less than 1.0;

Q = Leak rate in cubic feet/minute/square feet of internal surface  
= 0.0015 cfm/sf;

D = measured average inside diameter of sewer pipe, in.;

L = length of test section, ft.

6. Exfiltration Test: In order to test for infiltration **Nashville Municipal Utilities** may also require exfiltration tests on each section of pipe between manholes after it has been laid but prior to back filling of joints. Exfiltration tests shall be conducted by plugging the lower end of the section of sewer to be tested and filling the sewer with water to a point approximately five feet above the invert at the lower end and at least one foot above the pipe at the upper end, observing for leakage at all joints and measuring the amount of leakage for a given interval of time. Exfiltration shall not exceed 110 percent times the infiltration limits set out

hereinbefore. All observed leaks shall be corrected even though exfiltration is within the allowable limits.

7. Infiltration Test: To test for infiltration, **Nashville Municipal Utilities** may also require that the Contractor plug the open ends of all lines at the manhole so that measurements may be made at each section of the sewer line. Infiltration tests shall consist of weir measurement to determine quantities of any infiltration. Measurements shall be taken at line locations determined on-site. This infiltration test will not be made until the sewer line is completed, and the Contractor will be required to correct all conditions that are conducive to excessive infiltration and may be required to relay such sections of the line that may not be corrected even though infiltration is within allowable limits.
8. Smoke Test: Smoke testing may be used only to locate leaks and in no case shall be considered conclusive. In all cases the smoke test shall be accompanied by an air test, exfiltration test or infiltration test. Smoke testing may only be performed where ground water is low and smoke is blown into a conduit that is properly sealed. All such leaks or breaks discovered by the smoke tests shall be repaired and/or corrected by the Contractor at his own expense. Equipment and supplies required from smoke tests shall be furnished by the Contractor. The Contractor may also be required to smoke test the first section (manhole-to-manhole) of each size of pipe and type of joint on each construction contract prior to backfilling to establish and check laying and jointing procedures. Other supplementary smoke tests prior to backfilling may be performed by the Contractor at his option; however, any such tests shall not supplant the final tests of the completed work.
9. I & I Limit Test: I & I Limits: The Contractor shall lay sewer lines, including house connections so that the access of ground water or loss of water from the sewer system or other gravity flow piping which does not normally flow full will be limited to 10 gallons per inch diameter per mile per day. This limitation is inclusive of manholes, sewers, house connections, and appurtenances. This requirement may be applied to a portion of the contract work, such as the sewers in a separate drainage area or to a single section of the line between two manholes.

## **B. Sanitary Sewer Forcemains**

### **1. Hydrostatic Test (Ductile Iron and PVC)**

- a. Hydrostatic leak testing shall be done in accordance with AWWA or ASTM Standards based on force main material, in accordance with ASTM E1003 (latest revision), and as follows:

- b. All pressure piping (lines not laid to grade) shall be given a hydrostatic leak test after final backfill is placed and air and/or vacuum release valves are installed.
- c. Contractor shall furnish a hydrostatic test pump (jockey pump); continuous recording gauge (4" diameter, 0-200 psi range, 1 psi increments); calibrated/graduated chamber for measuring water used during leakage test; recording pressure charts during duration of test; pipe plugs/caps with openings for filling/draining the force main and bleeding air from the line.
- d. The procedures for hydrostatic test are as follows:
  - i. After the force main has been backfilled to final grade, securely plug and/or bulkhead the ends being tested. Thrust blocking restraints may be installed at each bulkhead in accordance with the bulkhead manufacturer's recommendations.
  - ii. All air/vacuum release valves shall be installed and in open in-service position during the test.
  - iii. The force main shall be slowly pressurized with water to 1.5 times the working pressure (including surge pressure), or 150 psi, whichever is greater. Trapped air shall be expelled through high point bleed off valves as the force main is being filled. When the pressure is reached, the test pump shall be shut-off. After the force main is pressurized, measure the pressure drop for two (2) continuous hours.
  - iv. If no (zero) pressure drop occurs within the two (2) hour test time as determined by the Contractor and observed by **Nashville Municipal Utilities**, the force main shall have passed the test.
  - v. Allowable leakage shall be per AWWA C600. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

In inch-pound units:

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

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

- e. All pipe, fittings, valves, and other materials found to be defective under test shall be removed and replaced at no additional expense to **Nashville Municipal Utilities**.
- f. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.
- g. **All water for testing shall be metered and cost of water shall be paid for by Contractor.**

## 2. **Hydrostatic Test (HDPE)**

- a. All new HDPE sanitary sewer forcemain shall be hydrostatic tested to ensure water tightness and integrity in accordance with ASTM F 2164 (latest revision) *“Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure”*.
- b. The Contractor shall furnish a recording gauge and water meter for measuring water used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall be turned over to the Engineer at conclusion of test. The pressure recording device (calibrated gage or sensor) shall be suitable for outside service, with a full scale value not to exceed twice the test pressure with scale gradations no greater than two percent (2%) of the full scale value, be accurate to within two percent (2%) of full scale, and approved by the Engineer.
- c. **Nashville Municipal Utilities** shall witness all tests. The procedure for testing shall be approved by **Nashville Municipal Utilities** and in accordance with the following steps.
  - i. Preparation:

- 1) Before testing, heat fusion joints shall be completely cooled. Mechanical joints shall be completely assembled. Concrete supports or blocking shall be sufficiently cured to withstand test pressure thrust forces.
- 2) Interior pipe shall be free of dirt or debris.
- 3) Testing may be conducted on the entire system or sections of the system. Test section length shall be determined by the Contractor by the capacity of the filling and pressurizing equipment within the allotted overall time for the test.

ii. Initial Expansion:

- 1) Fill the test section with water and remove all air from the line and service laterals. Allow the test section and test liquid to equalize to a common temperature.
- 2) Pressurize the test section at a steady rate. The test pressure should not exceed 1.5 times the system design pressure where lower pressure-rated components or devices are not present, or have been removed or isolated from the test section. The maximum test pressure is not to exceed the pressure rating of the lowest pressure-rated component in the test section, where lower pressure-rated components or devices cannot be removed or isolated from the test section. Pressure readings shall be measured as close as possible to the lowest point of the line.
- 3) The pipe test section shall be allowed to stand for four (4) hours to allow for expansion of the pipe. Make-up water should be added to the system at hourly intervals to return the test section to the test pressure.
- 4) After equilibrium is established within the pipe test section, begin the final hydrostatic test.

iii. Test Phase:

- 1) At the end of the fourth hour, reduce test pressure by 10 psi and monitor pressure for one (1) hour. Do not increase pressure or add make-up water.
- 2) If there are no visual leaks and pressure during the test phase remains steady (zero tolerance for leaking at 100 psi) for the one (1) hour test period, the test section passes the test.

Allowance for Expansion of HDPE Pipe\* (U.S. Gallons/100 Feet of Pipe)

Nominal Pipe Size (inches)	2-Hour Test
0.75	0.055
1	0.060
1 ¼	0.085
1 ½	0.100
2	0.120
3	0.150
4	0.250
6	0.600
8	1.000

iv. Test Duration:

- 1) If the maximum test pressure is between the system design pressure and 1.5 times the system design pressure or at 1.5 times the system design pressure, total testing time including the time required to pressurize, stabilize, hold test pressure, and depressurize shall not exceed eight (8) hours.
- 2) If the maximum test pressure is the system design pressure or less, the total test time including the time required to pressurize, stabilize, hold test pressure, and depressurize shall not exceed 72 hours.

v. Retesting:

- 1) If any defects or leaks are revealed during the test phase resulting in a failed test section, the test section shall be retested. The test section shall be depressurized at a controlled rate and any defects or leaks shall be rectified/corrected at the Contractor's expense. The pipeline shall be re-tested after a minimum 8-hour recuperation period. No pipeline shall be placed into service or accepted by the Engineer until it has passed the testing requirement.

vi. **All water for testing shall be metered and cost of water shall be paid for by Contractor.**

**C. Sanitary Sewer Manholes**



1. Testing Prior to Backfilling

- a. This specification shall govern the vacuum testing of sanitary sewer manholes and structures and shall be used as a method of determining acceptability by **Nashville Municipal Utilities**, in accepting maintenance of a sanitary sewer manhole or structure on behalf of the public. This test shall be performed in accordance with ASTM C 1244 prior to backfilling. Other forms of testing of some manholes may be required, as deemed necessary by **Nashville Municipal Utilities**.
- b. Manholes shall be tested after installation with all connections in place.
- c. Lift holes, if any, shall be plugged with an approved, non-shrinkable grout prior to testing.
- d. Drop connections shall be installed prior to testing.
- e. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab or grade rings.
- f. Test Procedure
  - (1) Temporarily plug, with the plugs being braced to prevent the plugs or pipes from being drawn into the manhole, all pipes entering the manhole at least eight inches into the sewer pipe(s). The plug must be inflated at a location past the manhole/pipe gasket.
  - (2) The test head shall be placed inside the frame at the top of the manhole and inflated, in accordance with the manufacturer's recommendations.
  - (3) A vacuum of 10" of mercury shall be drawn on the manhole. Shut the valve on the vacuum line to the manhole and disconnect the vacuum line.
  - (4) The pressure gauge shall be liquid filled, having a 3.5-inch diameter face with a reading from zero to thirty inches of mercury.

- (5) The manhole shall be considered to pass the vacuum test if it holds at least 9 inches of mercury for the following time durations:

<u>Time (Seconds)</u>			
<u>Manhole Depth</u>	<u>4' Diameter</u>	<u>5' Diameter</u>	<u>6' Diameter</u>
20 Feet or Less	50	65	81
20.1 to 30 Feet	74	98	121

- (6) If a manhole fails the vacuum test, the manhole shall be repaired with a non-shrinkable grout or other suitable material based on the material of which the manhole is constructed and retested, as stated above.
- (7) All temporary plugs and braces shall be removed after each test. Manholes will be accepted as having passed the vacuum test requirements if they meet the criteria stated above.

## Chapter 7 - Water Inspection, Testing, and Acceptance

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### 7.01 Introduction

The following Chapter describes the minimum requirements and general procedures for the inspection and testing of water distribution systems to be dedicated to **Nashville Municipal Utilities**.

Any section of the system not passing the tests prescribed herein shall be repaired to the satisfaction and approval of **Nashville Municipal Utilities**, retested and re-inspected.

### 7.02 Testing

#### A. Water Distribution Systems

1. Cleanup: Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.
2. Water Pressure Testing (Ductile Iron and PVC)
  - a. Hydrostatic leak testing shall be done in accordance with AWWA or ASTM Standards based on water main material, in accordance with ASTM E1003 (latest revision), and as follows:
  - b. Potable water shall be used for testing potable water systems. Non-potable water shall be used for testing non-potable water systems
  - c. All pressure piping (lines not laid to grade) shall be given a hydrostatic leak test after final backfill is placed and air and/or vacuum release valves are installed.
  - d. Contractor shall furnish a hydrostatic test pump (jockey pump); continuous recording gauge (4" diameter, 0-200 psi range, 1 psi increments); calibrated/graduated chamber for measuring water used during leakage test; recording pressure charts during duration of test; pipe plugs/caps with openings for filling/draining the water main and bleeding air from the line.
  - e. The procedures for hydrostatic test are as follows:

- i. After the water main has been backfilled to final grade, securely plug and/or bulkhead the ends being tested. Thrust blocking restraints may be installed at each bulkhead in accordance with the bulkhead manufacturer's recommendations.
- ii. All air/vacuum release valves shall be installed and in open in-service position during the test.
- iii. The water main shall be slowly pressurized with water to 1.5 times the working pressure (including surge pressure), but not less than 150 psi. Trapped air shall be expelled through high point bleed off valves as the water main is being filled. When the pressure is reached, the test pump shall be shut-off. After the water main is pressurized, measure the pressure drop for two (2) continuous hours.
- iv. If no (zero) pressure drop occurs within the two (2) hour test time as determined by the Contractor and verified by the Engineer, the water main shall have passed the test.
- v. Allowable leakage shall be per AWWA C600. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

In inch-pound units:

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

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge).

- h. All pipe, fittings, valves, and other materials found to be defective under test shall be removed and replaced at no additional expense to **Nashville Municipal Utilities**.

- i. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.
- j. **All water for testing shall be metered and cost of water shall be paid for by Contractor.**

3. Water Pressure Testing (HDPE)

- a. All new HDPE water main shall be hydrostatic tested to ensure water tightness and integrity in accordance with ASTM F 2164 (latest revision) "*Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure*".
- b. The Contractor shall furnish a recording gauge and water meter for measuring water used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall be turned over to the Engineer at conclusion of test. The pressure recording device (calibrated gage or sensor) shall be suitable for outside service, with a full scale value not to exceed twice the test pressure with scale gradations no greater than two percent (2%) of the full scale value, be accurate to within two percent (2%) of full scale, and approved by the Engineer.
- c. **Nashville Municipal Utilities** shall witness all tests. The procedure for testing shall be approved by **Nashville Municipal Utilities** and in accordance with the following steps.
  - i. Preparation:
    - 1) Before testing, heat fusion joints shall be completely cooled. Mechanical joints shall be completely assembled. Concrete supports or blocking shall be sufficiently cured to withstand test pressure thrust forces.
    - 2) Interior pipe shall be free of dirt or debris.
    - 3) Testing may be conducted on the entire system or sections of the system. Test section length shall be determined by the Contractor by the capacity of the filling and pressurizing equipment within the allotted overall time for the test.
  - ii. Initial Expansion:

- 1) Fill the test section with water and remove all air from the line and service laterals. Allow the test section and test liquid to equalize to a common temperature.
- 2) Pressurize the test section at a steady rate. The test pressure should not exceed 1.5 times the system design pressure where lower pressure-rated components or devices are not present, or have been removed or isolated from the test section. The maximum test pressure is not to exceed the pressure rating of the lowest pressure-rated component in the test section, where lower pressure-rated components or devices cannot be removed or isolated from the test section. Pressure readings shall be measured as close as possible to the lowest point of the line.
- 3) The pipe test section shall be allowed to stand for four (4) hours to allow for expansion of the pipe. Make-up water should be added to the system at hourly intervals to return the test section to the test pressure.
- 4) After equilibrium is established within the pipe test section, begin the final hydrostatic test.

iii. Test Phase:

- 1) At the end of the fourth hour, reduce test pressure by 10 psi and monitor pressure for one (1) hour. Do not increase pressure or add make-up water.
- 2) If there are no visual leaks and pressure during the test phase remains steady (zero tolerance for leaking at 100 psi) for the one (1) hour test period, the test section passes the test.

Allowance for Expansion of HDPE Pipe\*  
(U.S. Gallons/100 Feet of Pipe)

Nominal Pipe Size (inches)	2-Hour Test
0.75	0.055
1	0.060
1 ¼	0.085
1 ½	0.100
2	0.120
3	0.150
4	0.250
6	0.600
8	1.000

iv. Test Duration:

- 1) If the maximum test pressure is between the system design pressure and 1.5 times the system design pressure or at 1.5 times the system design pressure, total testing time including the time required to pressurize, stabilize, hold test pressure, and depressurize shall not exceed eight (8) hours.
- 2) If the maximum test pressure is the system design pressure or less, the total test time including the time required to pressurize, stabilize, hold test pressure, and depressurize shall not exceed 72 hours.

v. Retesting:

- 1) If any defects or leaks are revealed during the test phase resulting in a failed test section, the test section shall be retested. The test section shall be depressurized at a controlled rate and any defects or leaks shall be rectified/corrected at the Contractor's expense. The pipeline shall be re-tested after a minimum 8-hour recuperation period. No pipeline shall be placed into service or accepted by the Engineer until it has passed the testing requirement.

vi. **All water for testing shall be metered and cost of water shall be paid for by Contractor.**

3. Disinfection of Water Piping:

a. Disinfection:

- (1) All pipe installed by a contractor shall be disinfected in accordance with AWWA C651 and all applicable Federal, State and Local requirements. If required, the trench/point(s) of access shall be prepared in such a manner as to comply with all applicable OSHA regulations and as directed by **Nashville Municipal Utilities**.
- (2) The chlorination point and supply shall be accessible above grade.
- (3) All flushing water shall be dechlorinated prior to disposal of flushing water.

b. Bacteriological Samples: **Nashville Municipal Utilities** will collect water samples for bacteriological testing. The main will not be approved for final

connection to the existing distribution system until sampling results are obtained and approved by **Nashville Municipal Utilities**. Sampling requirements for service lines 2" and larger shall be conducted consistent with AWWA C651.



## Chapter 8 - Sanitary Sewer Lift Stations

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### 8.01 Introduction

This Chapter pertains to the requirements for the design and construction of submersible type lift stations, which are the primary type typically constructed as part of private development. Dry well stations are not acceptable. **Design and approval will be handled on a case by case basis by the Nashville Municipal Utilities.**

Lift stations meeting or exceeding the requirements set herein will be approved. Any proposed alteration of the pump station dimensions, equipment, controls, etc. from the standards set forth herein will be approved only upon the submittal of plans and specifications of the proposed changes to **Nashville Municipal Utilities**, and upon the **Nashville Municipal Utilities** written approval. **Nashville Municipal Utilities** reserves the right to alter any standard set forth hereinafter.

Lift Stations, in general, shall be submersible type including a minimum of two (2) pumps and motors, wetwell basin, separate valve pit, valves, piping hatches, guide rails, pump removal components, control center, level control switches, remote monitor package, interconnecting electrical wiring, incoming power and radio supply, and all other features regularly and normally required as a part of a complete and functional facility. All work shall be in accordance with site requirements, details in the Plans, these Standards and the manufacturer's recommendations.

### 8.02 Lift Station Site Requirements

#### A. Security Fencing

1. A security fence shall be installed at all lift station sites. The type of fencing to be used shall be determined by **Nashville Municipal Utilities** and shall consist of the following:
  - a. Chain Link Fencing:
    - i. Fencing shall be a minimum of 6-feet tall, commercial grade, black PVC coated steel chain link fencing. Fencing shall also include 3-strand barbed wire (for Industrial Sites) and black privacy slats.
    - ii. Access gate shall consists of a double swing type gate with black PVC coated chain link fabric and black privacy slats. Access gate shall also have 3-strand barbed wire. Each gate shall have a black PVC coated industrial strong arm latch and "hold back" to prevent the gate from inadvertently closing. An additional 4-foot wide access gate may also be installed

adjacent to the double swing gate if required by **Nashville Municipal Utilities**. This gate shall be constructed of black PVC coated chain link fabric, black privacy slats and 3-strand barbed wire (for Industrial Sites).

- iii. Minimum gate post diameter shall be 6-<sup>5</sup>/<sub>8</sub>" with black powder coated finish.

## **B. General Site**

- 1. Areas inside of the security fencing and not paved shall be covered with landscaping geotextile fabric and 6-inches of compacted INDOT No. 8 Stone.
- 2. Provide a yard hydrant for wash down maintenance of the lift station.

## **8.03 Type I Pump Station**

### **A. Scope of Work**

#### **1. Quality Assurance:**

- a. All similar components shall be manufactured and furnished by one manufacturer unless specifically approved by **Nashville Municipal Utilities** in writing.
- b. Equipment shall be in accordance with the following standards, as applicable and as indicated in each equipment specification:
  - i. American Society for Testing and Materials (ASTM).
  - ii. American National Standards Institute (ANSI).
  - iii. American Society of Mechanical Engineers (ASME).
  - iv. American Water Works Association (AWWA).
  - v. American Welding Society (AWS).
  - vi. National Fire Protection Association (NFPA).
  - vii. National Electrical Manufacturers Association (NEMA).
  - viii. Manufacturer's published recommendations and specifications.

#### **2. Submittals**

##### **a. Shop Drawings:**

Shop Drawings for the lift station and associated equipment shall be submitted. Submittals shall include, but not be limited to, the following documentation:

- i. Descriptive literature including materials of construction, equipment weight, motor data, pressure ratings, certification of all applicable ASTM standards;

- ii. Predicted performance curves developed for the specific application. Performance curves shall plot speed, capacity, head, horsepower, efficiency, and NPSH requirements over the manufacturer's recommended range of operation;
- iii. Dimensional factory drawings including cross sectional views of pumps and all equipment showing details of construction;
- iv. Written report on the factory test results;
- v. Manufacturer's installation instructions.
- vi. Control panel schematics and wiring diagrams.

b. Operation and Maintenance Manuals:

Contractor shall submit one (1) hard copy and one (1) USB flash memory stick copy of the Operation and Maintenance Manuals to **Nashville Municipal Utilities**. Manuals shall include, at a minimum, the following:

- (1) Warranty Statement
- (2) Pump down test procedures and results from the start-up tests;
- (3) Operation Instructions;
- (4) Maintenance Instructions;
- (5) Recommended spare parts list;
- (6) Lubrication schedules;
- (7) Structural diagrams;
- (8) As-built wiring diagrams;
- (9) Piping and Instrumentation Drawings (P&ID); and
- (10) Bill of materials

3. Experience Qualifications:

The equipment to be furnished hereunder shall be made by a manufacturer regularly engaged in such work, and who has furnished similar installations and had them in successful and continuous operation for a period of 10 years.

2. Factory Testing:

Each pump to be delivered under this Section shall be tested for performance at the pump manufacturer's factory to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points that are specified. All tests shall be

run in accordance with the latest edition of the American Hydraulic Institute Standards and Submersible Wastewater Pump Association and at the appropriate voltage and frequency. Testing shall also include, but not be limited to, the following:

- a. Head vs. flow with five (5) equally spaced points including shutoff and maximum flow shall be certified.
- b. The input KW, speed, power factor, no load current, and torque characteristics shall be certified.
- c. Impeller, motor rating, and electrical connections shall first be checked for compliance to the specifications.
- d. Insulation Test: A motor and cable insulation test for moisture content or insulation defects shall be made.
- e. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
- f. Operational Test: The pump shall be run for 30 minutes submerged, under a minimum of six feet of water.
- g. After the operational test (described in line F) has been conducted, the insulation test (described in line D above) shall be performed again.
- h. After testing, the pump shall be inspected to insure that the pump maintains full watertight integrity.
- i. A written report stating the tests have successfully been completed and providing the results of the test shall be provided for each pump. The pump manufacturer shall also certify that similar tests have been conducted on pumps of a similar size for a period of not less than five (5) years.

## B. Products

1. Manufacturers:
  - a. Hydromatic
  - b. Alternates and substitutions to be approved by **Nashville Municipal Utilities.**
2. Schedule:
  - a. Include the following example schedule in the construction drawings:

Parameter	Pump Schedule
Manufacturer	Hydromatic
Pump Model	XXXXXXXXXXXXXX
Quantity	Two (2)
Impeller Size	XX.XXX inch
Motor HP	XX

RPM	X,XXX
Electric Service	460 volt / 60 Hz / 3 phase
Operating Point (1 pump)	X,XXX gpm @ XXX' TDH
Operating Point (2 Pumps)**	X,XXX gpm @ XXX' TDH
Minimum Pump Efficiency	XX%
Maximum NPSH Required	XX ft.
NEC Classification	Above min. pump submergence level = Class 1, Div 2, Groups C & D
Cooling Jacket Equipped	No
Discharge Connection	X inch
Shut-Off Head	XXX ft.

(\*\*) Basis of Design at full speed

### 3. Wetwell & Valve Vault:

#### a. Wetwell Design

- i. Submit wetwell sizing calculations to determine required internal diameter, or approved alternative from **Nashville Municipal Utilities** in writing.
- ii. All hardware shall be stainless steel.
- iii. All piping connections inside the wetwell shall be bolted flange connections. Mechanical joint connections shall not be permitted.
- iv. Provide a stainless steel cable hanger assembly, mounted to the pump station lid, opposite the pump discharge piping. The assembly shall provide one double hook for each power cable(s) and level control cable(s). The hanging of multiple cables on one hook will not be permitted.
- v. All control and pump cables/cords shall have a stainless steel double hook style with stainless steel Hubbel Kellem Heavy Duty Single Eye strain relief.

- vi. The wetwell vent shall be per Standard Details.
- vii. Aluminum access hatch shall be cast into top lid. Access hatch shall be sized by pump manufacturer to allow removal of pumps without entering wetwell.
- viii. At the discretion of **Nashville Municipal Utilities**, the interior of the wetwell may be required to have an epoxy liner system applied.
- ix. Piping shall be coated with a protective coating as follows, or as approved in writing by **Nashville Municipal Utilities** :

(1) Piping and fittings in wetwell shall have the following coatings:

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Primer	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Field Preparation	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Field 1st Coat	Tnemec Perma-Shield Series 435-5020	30-40	SW Dura-Plate 6000	30-40

(2) Piping, fittings, valves in valve vault shall have the following coatings:

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Primer	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Field Preparation	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Field 1st Coat	N69 Hi-Build Epoxoline II	4.0 – 6.0	Macropoxy 646 FC	4.0 – 6.0
Field 2nd Coat	N69 Hi-Build Epoxoline II – 34GR	2.0 – 3.0	Macropoxy 646 FC – SW4025	2.0 – 3.0

(3) Exterior Piping and fittings above wetwell and valve vault shall have the following coatings:

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Primer	Per Manufacturer Recommendation		Per Manufacturer Recommendation	

Field Preparation	Per Manufacturer Recommendation		Per Manufacturer Recommendation	
Field 1st Coat	N69 Epoxoline II	4.0 – 6.0	Macropoxy 646 FC	4.0 – 6.0
Field 2nd Coat	1074U Endura –Shield II – 34GR	2.0 – 3.0	HiSolids Polyurethane or Acrolon 218 HS - SW4025	2.0 – 3.0

b. Valve vault Design:

- i. All piping connections inside the valve vault shall be bolted flange connections. Mechanical joint connections are not permitted.
- ii. All hardware shall be stainless steel.
- iii. Refer to Sewage Valve Section for valve manufacturers.
- iv. Minimum valve vault dimensions shall be per Standard Details, or approved alternative from **Nashville Municipal Utilities** in writing.
- v. All forcemain piping shall have a minimum of 48-inches depth of cover.
- vi. Valve vault shall have aluminum access hatch cast into top lid, located over valves.
- vii. Piping shall be coated with a protective coating as outlined for the wetwell above, or as approved in writing by **Nashville Municipal Utilities**.
- viii. Flow Meter: A flow meter shall be required at the discretion of **Nashville Municipal Utilities**. Flow meter shall be Endress + Hauser W400 Promag electromagnetic flow meter shall be installed in a meter vault at the lift station.

4. Submersible Pumps and Appurtenances

a. Pump Design:

- i. The pump shall be centrifugal, non-clog, solids handling, submersible type capable of handling raw water or unscreened sewage. The discharge connection elbow shall be permanently installed in the wetwell along with the discharge piping. The pump shall be automatically and firmly connected to the discharge connection elbow

when lowered into place and shall be easily removed for inspection or service. There shall be no need for personnel to enter the wetwell. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

- ii. The pump mounting base shall include guide rail supports and a discharge connection with a 125-lb. standard flange, faced and drilled. The base and the discharge piping shall be permanently mounted in place. The base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or equal. No portion of the pump shall bear directly on the floor of the sump.

b. Pump Construction:

- i. Pump volute, motor and seal housing are to be high quality gray cast iron ASTM A-48, Class 30 (Hydromatic). All mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton/FKM rubber O-rings. Sealing shall be accomplished when metal-to-metal contact is made, resulting in controlled compression of the rubber O-rings without requirement of a specific torque limit.

c. Rail System:

- i. A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The entire weight of the pump shall be guided by no less than two (2) stainless steel guide rails, size as recommended by pump manufacturer, extending from the top of the station to the discharge connection. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by an attachment to the access hatch frame. Stainless steel intermediate guide rail support(s) shall be required in accordance with pump manufacturer's spacing recommendations.
- ii. The rails shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing the pump housing. The rail system shall function to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable.

d. Motor:

- i. Hydromatic:



- (1) The stator winding, rotor and bearings are to be mounted in a sealed submersible type housing. Insulation utilized in the stator windings shall be Class H with maximum temperature capability of 155°C. Motor housing shall be filled with a high-dielectric oil, NEMA B design, to give superior heat transfer and allow the bearings to run in a clean, well lubricated environment; or the housing shall be air filled with grease lubricated bearings. The pump and motor are to be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. Stators shall be securely held in place with a removable end ring and threaded fasteners so that it may be easily removed in the field without use of heat or a press. Motor shall be provided with heat sensing units attached to the motor windings, which shall be connected to the control panel to shut down the pump if overheating occurs.
- (2) The minimum motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

e. Power Cable:

- i. The power cable shall be sized according to the NEC standards and shall be of sufficient length to reach the junction box without the need of any splices. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity. The motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire pump performance curve, from shut-off through run-out.

f. Hydromatic Bearings and Shaft:

- (4) An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil that fills the motor housing. The upper radial bearing shall have a minimum B-10 life at the specified condition of 50,000 hours, and the lower thrust bearing shall have a minimum B-10 life at the specified condition of 50,000 hours.

- (5) The shaft shall be machined from a solid 303 stainless steel forging and be a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

g. Hydromatic Mechanical Seals:

- i. The pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly lubricated lapped seal faces. The lower seal unit between the pump and oil chamber shall consist of one (1) stationary seat and one (1) rotating ring held in place by its own spring. The lower seal shall be removable without disassembling the seal chamber. The upper seal between the motor and the seal chamber shall be of the same design with its own separate spring system. The lower and upper seals shall be tungsten-carbide. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The shaft sealing system shall be capable of operating submerged to pressures equivalent to two hundred (200) feet. No seal damage shall result from operating the pump unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The seal chamber shall also be equipped with a seal failure sensor probe which will sense water intrusion through the lower seal. This sensor is to be connected to an alarm in the control panel to indicate lower seal failure.

h. Hydromatic Impeller:

- i. Impeller shall be ductile iron ASTM A-536 of a non-clog design capable of handling minimum three (3) inch sphere solids, fibrous material, heavy sludge and other matter found in normal sewage applications. Impeller shall be of the two-vane, enclosed non-clogging design and have pump-out vanes on the front and backside of the impeller to prevent grit and other materials from collecting in the seal area.
- ii. Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames. The tolerance is to be split equally between the two balance planes that are the two impeller shrouds.

<b>RPM</b>	<b>Tolerance</b>
1750	.02 in. – oz./lb. of impeller weight

- iii. Impeller shall be either slip fit or taper fit with key to securely lock the impeller to the driving shaft. A 300 series stainless steel washer and impeller bolt shall be used to secure the impeller to the shaft for both threaded and tapered shafts. Straight end shafts for attachment of the impeller shall not be acceptable.

i. Hydromatic Volute:

- i. The casing shall be of the end suction volute type, cast iron ASTM A-48 Class 30, having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.
- ii. A volute case wear ring shall be provided to minimize impeller wear. The wear ring shall be Alloy 230 brass, ASTM B-43 and held by 300 series stainless steel fasteners. The wear ring shall be easily replaceable in the field.
- iii. The impeller and volute case coating shall be as follows:

	Product	Dry Thickness (mils)
Surface Preparation	Per Manufacturer Recommendation	Per Manufacturer Recommendation
Shop 1 <sup>st</sup> Coat	Chesterton ARC 855 – Grey	15 – 20
Shop 2 <sup>nd</sup> Coat	Chesterton ARC 855 – Black	15 – 20

j. Lifting Systems:

- i. Each submersible pump shall be provided with a Type 316 stainless steel lifting chain and bale of sufficient length extending from the top of the station to the pump unit. The working load of the lifting system shall be 50% greater than the pump unit weight.

k. Protection:

- i. Each pump motor starter shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A seal probe shall be installed to signal if moisture is present in the seal chamber, and indicate an alarm on the control panel.

l. Control Panel:

- i. All of the automatic control equipment is to be supplied by one manufacturer. It shall be factory assembled, wired, tested and covered by complete electrical drawings and instructions.
- ii. Control panel shall be built to meet the requirements provided by NFPA 70 (National Electric Code) and Underwriters Laboratories (UL Listed) or built within a UL listed panel shop. Wiring interfacing between the wet well (classified space) and the control panel shall include an intrinsically safe barrier per Article 504 of the NEC to limit the voltage entering the classified space.
- iii. Control panel shall be NEMA 4X 316 Stainless Steel, pad-lockable, and sized appropriately for the installation.
- iv. Control Panel shall include inner swingout door to protect maintenance staff from hazardous electricity. All switches, lights, breakers, overload resets, etc operated through the door shall have permanently mounted tags indicating what the device controls/operates. The door shall have the following mounted through for access:
  - (1) Main, motor, and accessory circuit breakers
  - (2) Lights, buttons, switches
  - (3) Motor overload resets
  - (4) Elapsed Time Meters
  - (5) Pump Station Controller Display
  - (6) Pump Station Level Display
  - (7) Leak detection/ Hi Temp overload controller
  - (8) Convenience Receptacle
- v. The control panel shall be powered by one (1) single source of power 460VAC, 3 phase, 100A minimum, and shall include a main circuit breaker that will remove power from the entire panel in the event of overcurrent. 230VAC, 3phase may also be used, but 460VAC is preferred. Should 3 phase not be available contact the electric utility company for additional requirements.
- vi. Accessory Circuit Breakers shall be provided for the following:
  - (1) 15A: Site Lighting
  - (2) 10 A: Flow metering (if applicable)
  - (3) 10 A :Remote Monitoring unit (Omnisite)
  - (4) 10A: Panel Heater
  - (5) 15A: Convenience Receptacle
  - (6) 1 spare 10A breaker.

- vii. Provide a 200W, 115VAC, heater with integral thermostat and fan.
- viii. Provide a convenience receptacle rated for 15A, 125VAC, in a handy box
- ix. Control Power Transformer shall be provided to provide 120VAC control and accessory power to the station. Size the transformer to be loaded 75% capacity to provide spare accessory power for the future. Control power transformer shall be 2 kVA minimum.
- x. Across the line motor starters shall be provided and shall be NEMA rated. Starters shall be equipped with motor adjustable overloads for pump protection. The overload trips shall be capable of being reset through the inner door and shall not require access to the starters themselves. Sizing of the starters shall meet the following:
  - (1) 460VAC, 3 phase
    - a. NEMA size 1, 0 – 10HP
    - b. NEMA size 2, Greater than 10 HP but less than 25HP
  - (2) 230VAC, 3 phase
    - a. NEMA size 1, 0 – 5HP
    - b. NEMA size 2, Greater than 5 HP but less than 15HP
- xi. Pump Current Sensing Transducer
  - (1) Provide a pump current sensor probe to monitor the current to the pump. The output of the transducer shall be a 4-20mA signal to be monitored by the remote monitoring system (Omnisite). Transducer shall be a MagneLab MCT-0024-250 or equal.
- xii. Pump Sequence Controller
  - (1) Provide a pump sequencing controller that will provide automatic operation of the pumps using level based control. The controller shall be a readily available controller from a manufacturer in the wastewater industry with at least 10 years' experience. The controller shall operate utilizing continuous level and float backup. The controller shall also have the ability to alternate the pumps between operations. The pump controller shall provide power to the radar level transmitter as a +24V, 4-20mA loop.
  - (2) Continuous Radar Level Detector and loop powered display:
    - a. Radar Transmitter - Endress and Hauser, model FMR 20 order code: FMR20-CBPBNVCEXR02+R3R8
    - b. Display: Endress and Hauser RIA15, order code: RIA15-AAC3
  - (3) Float Backup – Primex KwikSwitch Float Connection System rated

for Class 1, Div 1 operation. Provide accessory mounting brackets from the manufacturer to meet the application needs. Float backup shall operate upon failure of the continuous level device and shall be operator selectable for continuous level or float operation.

- a. Hi Level Alarm
- b. Pump ON
- c. Pumps OFF
- d. Low Level Alarm and suction cutoff

- (4) Depending on the size and location of the system, floats may be acceptable on a case-by-case basis as primary level control as approved by **Nashville Municipal Utilities**.
- (5) The controller shall allow for adjustable level set points that can be easily configured by operations staff in the field.
- (6) Pump Selector Switches shall be provided to put the pumps in HAND-OFF-AUTO

xiii. Pump Selector Switches shall be provided to put the pumps in HAND-OFF-AUTO

- (1) Hand – Pump turns on and runs until switch is moved
- (2) OFF – Pumps are off
- (3) Auto – Pump Sequence Controller controls operation, but low suction cutoff float will still inhibit the pump from running at low level.

xiv. Panel LED 22MM Pilot Lights shall be provided for the following:

- (1) Green – Running per pump
- (2) Amber – Fail per pump
- (3) White – Control power on
- (4) Red – Hi Level

xv. The station shall include an audible and visual alarm beacon with local silence push button. The visual alarm shall be a weather sealed red alarm strobe wired to trigger upon hi level in the wet well. The audible alarm shall have a push to test feature.

xvi. Pump Elapsed Time Meters shall be provided to keep track of hours down 9999.99 digits.

xvii. Auxiliary Contacts shall be provided for the following:

- (1) Pump Fail via starter overload (each pump)
- (2) Pump Running (each pump)
- (3) Pump “In Auto” (each pump)
- (4) Control Power ON
- (5) Low Suction Cutoff

## (6) Hi Water Alarm

xviii. Remote monitoring system shall be provided to monitor the station over the cellular network. Prior to installation at the site the remote monitoring system supplier shall survey the site to provide the best fit cellular carrier for coverage. The system shall be setup and coordinated with the manufacturer's authorized service provider. The manufacturer's service provider shall provide any updates to the remote monitoring SCADA site to bring online the new station.

- (1) OmniSite Crystal Ball Cellular Dialer
- (2) GuardDog Web Browsing software
- (3) Power: 120 VAC
- (4) Enclosure: NEMA 4X, 316 stainless steel.
- (5) Communications: Cellular GSM 850/900/1800/1900 MHZ
- (6) Access Key: Smart security key to identify personnel on site
- (7) Terminal Blocks: Removable style accepts #14-18 AWG solid or stranded wire.
- (8) Operating Temperature -20/150 Deg. F
- (9) Operating Humidity: 0-90% RH Non-condensing
- (10) Certifications: UL Pending
- (11) Dimensions: 8.9"H x 9.4"W x 3.8"D
- (12) Memory Stick: Shall have one (1) gigabyte storage space
- (13) LCD Display: 4x20 rugged operation
- (14) Keypad: Eight (8) universal navigation buttons
- (15) Analog Inputs: Four (4) 4-20mA, isolated, 10 bit resolution
  - a. Pump No. 1 Amperage from transducer
  - b. Pump No. 2 Amperage from transducer
  - c. Station Continuous Level (feet)
  - d. Spare
- (16) Relay Outputs: Four (4) 20A @ 120 VAC resistive.
- (17) Digital Inputs: 14 Universal inputs accept 12 VAC/VDC – 120 VAC/VDC
  - a. High Level Alarm dedicated float wired directly to OmniSite
  - b. Pump No. 1 Run (Normally Open Contact)
  - c. Pump No. 2 Run (Normally Open Contact)
  - d. Pump No. 1 Over Temperature/Load Combined (Normally Closed Contact)
  - e. Pump No. 2 Over Temperature/Load Combined (Normally Closed Contact)
  - f. Pump No. 1 Seal Fail (Normally Open Contact)
  - g. Pump No. 2 Seal Fail (Normally Open Contact)
  - h. Phase Failure Alarm (Each Phase)
  - i. Station Power Loss
  - j. Station General Alarm Tied to:
    - 1) Low Suction cutoff float

2) Future alarm device

- xix. Mounting Structures for control panels shall be aluminum or stainless steel. No wood mounting is allowed.

m. **Lifting System:**

- i. Each submersible pump shall be provided with a Type 316 stainless steel lifting chain and bale of sufficient length extending from the top of the station to the pump unit. The working load of the lifting system shall be 50% greater than the pump unit weight.

n. **Electrical Equipment**

- i. Service Entrance Rated Manual Transfer Switch
- (1) Enclosure: NEMA 4X Stainless Steel
  - (2) Rating: 230/460, 3phase, 4w, 200A or 100A (depending upon station size), Service Entrance Rated
  - (3) Phase rotation monitor
  - (4) E1016 Series Male Camlok Panel mounts with flip covers for temporary generator connection.
  - (5) Removable access panel
  - (6) Conduit entry area
  - (7) By Trystar LLC, 480/277V version - Part #: TMTS-025W-LLM-IR

o. **Variable Frequency Drive (VFD)**

- i. Depending on lift station size and available power, VFDs may be required. This will be reviewed on a case-by-case basis by **Nashville Municipal Utilities**.

**C. Execution**

1. Preparation

- a. Coordinate with other trades, equipment and systems to the fullest extent possible.
- b. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this contract. All pertinent data and dimensions shall be verified by the Contractor.

2. Installation

- a. Installation shall be in strict accordance with the manufacturer's instructions



and recommendations in the locations shown on the Contract Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations and setting plans.

- b. The Contractor shall also provide from the submersible pump supplier the service of a qualified start-up engineer (factory representative) who has had prior on- site start-up experience to assist in performing start-up, check-out and initial operation services of the pumping units. The start-up engineer shall also instruct **Nashville Municipal Utilities** personnel on the operation and maintenance procedures for the station. Qualified supervisory services, including manufacturers' engineering representatives, shall be provided for a minimum of two (2) full working days to ensure that the work is done in a manner fully approved by the respective equipment manufacturer. The pump manufacturer's representatives shall specifically supervise the installation of the pump and the alignment of the connection piping. If there are difficulties in the start-up or operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to **Nashville Municipal Utilities**.
  - c. A certificate from the pump manufacturer shall be submitted stating that the installation of his/her equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.
3. Field Tests:
- (1) Plug all inlet lines before starting presoak period.
  - (2) Presoak period shall be at least 4.0 hours.
  - (3) Following the presoak period, fill the structure to a depth of 6-inches below the top structure joint.
  - (4) The test period shall be a minimum of 2.0 hours. Any detectable leakage shall be cause for rejection and the leakage shall be corrected prior to retesting.
- c. After installation of the pumping equipment, and after inspection, operation, testing, and adjustment have been completed by the qualified start-up engineer, each pump shall be given a running test in the presence of **Nashville Municipal Utilities**. Testing shall be conducted to indicate that the pumps, motors, and

drives generally conform to the efficiencies and operating conditions specified and its ability to operate without vibration, overheating, or over-loading. The pumps and motors shall operate at the specified capacities in the range of heads and capacity specified without undue noise or vibration. Any undue noise or vibration in the pumps or motors, which is objectionable, will be sufficient cause for rejection of the units.

3. Pump Warranty

- a. After successful completion of tests and trials under operating conditions on all equipment, the Contractor shall guarantee all equipment, materials and workmanship from undue wear and tear, from mechanical and electrical defects, and from any failure whatever except those resulting from proven carelessness or deliberate actions of the **Nashville Municipal Utilities**, for a minimum of one (1) year from date of substantial completion. This one (1) year minimum shall not replace a standard manufacturer's guarantee. This one (1) year minimum shall cover all parts and labor.
- b. The pump manufacturer shall warrant for minimum of five (5) years after the date of Utility Service Board Acceptance, that the pumps will be free from defects in material and workmanship.
- c. In the event a component fails to perform as specified or is proven defective in service during the warranty period, the manufacturer shall repair or replace, at his discretion such defective part. The manufacturer shall further provide, without cost, such labor as may be required to replace, repair or modify major components such as the pumps, motors, etc.

5. Spare Parts: Contractor is required to supply the following spare parts:

- Two (2) Impellers
- Two (2) Seal Kits
- One (1) Mechanical Ball Float (Compatible with Primex KwikSwitch)
- One (1) Transducer
- One (1) Control Panel Relay of each type
- Three (3) Control Panel Fuses of each type

## Appendices

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MAINTENANCE BOND

WE \_\_\_\_\_  
\_\_\_\_\_

as Developer, and \_\_\_\_\_

as Surety are held and firmly bound unto Nashville Municipal Utilities as Obligee in the penal sum of \_\_\_\_

\_\_\_\_\_ Dollars (\$ \_\_\_\_\_), for the payment of which well and truly  
to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors  
and assigns.

WHEREAS, the Specifications pertaining to said work require that the same shall be free from all  
defects caused by inferior materials or the result of poor workmanship for the period of three (3) years from  
the date of acceptance of the whole work of this system. The bond shall be for 20% of the total system  
installation cost.

NOW, THEREFORE, if the Principal shall in all things observe the guarantee described in the  
foregoing paragraph, and shall protect and indemnify said Obligee from and against any and all loss, costs,  
attorney's fees and expense of whatsoever kind and character which said Obligee shall sustain by reason  
for the failure of said Principal to faithfully observe the guarantee hereinbefore described that this obligation  
shall be void: otherwise the same shall be and remain in full force and effect.

Signed, Sealed and Dated this \_\_\_\_\_ day of \_\_\_\_\_,  
20\_\_\_\_.

\_\_\_\_\_  
(Name of Developer)

\_\_\_\_\_  
(Name of Surety)

\_\_\_\_\_  
(Address)

\_\_\_\_\_  
(Address)

By:\_\_\_\_\_  
(Officer of Developer)

\_\_\_\_\_  
(Officer of Surety)

Printed Name and Title:

Printed Name and Title:

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

ATTEST

\_\_\_\_\_  
(Developer)

\_\_\_\_\_  
(Surety)

Printed Name and Title:

Printed Name and Title:

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

APPROVED AS TO FORM

BY\_\_\_\_\_

## Standard Nashville Municipal Utilities Details

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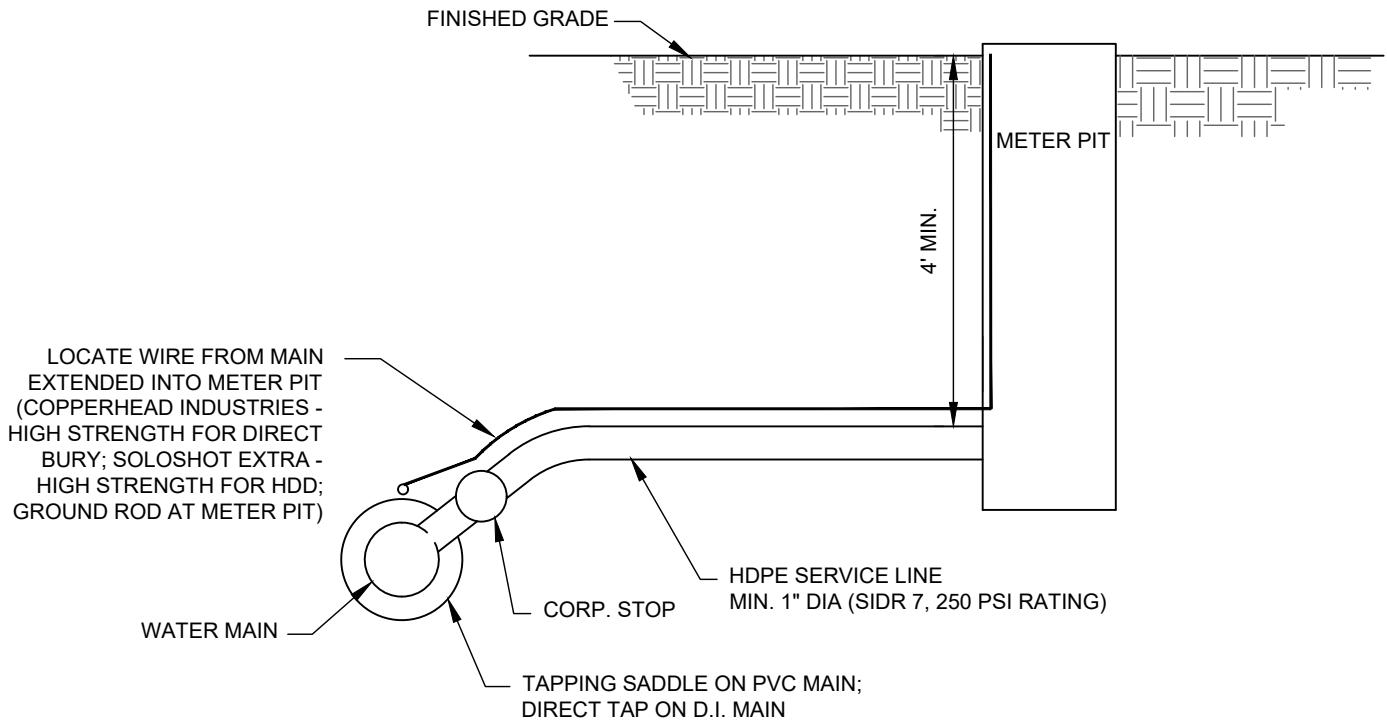
Detail No.	Description
1	UP TO 2" DIA. WATER SERVICE CONNECTION DETAIL
2	DUAL WATER SERVICE DETAIL
3	TYPICAL GATE VALVE AND VALVE BOX
4	TAPPING SLEEVE AND VALVE
5	VALVES AT INTERSECTIONS
6	STANDARD FIRE HYDRANT
7	WATER MAIN SAMPLING STATION
8	LEAK DETECTION METER DETAIL
9	LARGE DIAMETER METER VAULT (3"-10")
10	FIRE LINE DOUBLE DETECTOR ASSEMBLY WITH DOMESTIC/IRRIGATION METER(S)
11	FIRE LINE DOUBLE DETECTOR ASSEMBLY
12	WATERMAIN / FORCEMAIN TYPICAL TRENCH FOR D.I. OR PVC C900 IN PAVED AREAS
13	WATERMAIN / FORCEMAIN TYPICAL TRENCH FOR D.I. OR PVC C900 IN UNPAVED AREAS
14	GRAVITY SANITARY SEWER TYPICAL TRENCH IN PAVED AREAS
15	GRAVITY SANITARY SEWER TYPICAL TRENCH IN UNPAVED AREAS
16	DUCTILE IRON PIPE RESTRAINED JOINT TABLES
17	PVC PIPE RESTRAINED JOINT TABLES
18	RESTRAINT OF BENDS
19	RESTRAINT OF TEES
20	RESTRAINT OF REDUCERS
21	RESTRAINING OF VALVES
22	UTILITY CROSSING SUPPORT DETAIL
23	WATER MAIN TYPICAL STREAM CROSSING
24	GRAVITY SANITARY SEWER TYPICAL STREAM CROSSING
25	STEEL CASING
26	TYPE "A" STANDARD PRECAST MANHOLE
27	TYPE "B" OUTSIDE DROP MANHOLE CONNECTION
28	TYPE "B" INSIDE DROP MANHOLE CONNECTION
29	TYPE "C" SHALLOW MANHOLE – 5' OR LESS
30	TYPE "D" STANDARD PRECAST DOGHOUSE MANHOLE
31	EXISTING MANHOLE CONNECTION
32	SAMPLE STATION DOGHOUSE MANHOLE
33	STANDARD MANHOLE BENCH WALL
34	STANDARD MANHOLE BENCHES
35	SANITARY FORCEMAIN AIR RELEASE VALVE STRUCTURE
36	PRECAST ADJUSTING RING
37	TYPE "1" CLEANOUT
38	TYPE "2" CLEANOUT
39	SANITARY SEWER SERVICE CONNECTIONS
40	GREASE TRAP

41	SANITARY FORCEMAIN MAG METER VAULT
42	PUMP/FLOAT CABLE WET WELL JUNCTION BOX
43	ELECTRICAL DIAGRAM
44	TYPE "T" LIFT STATION GENERAL CONFIGURATION – UPPER PLAN
45	TYPE "T" LIF STATION GENERAL CONFIGURATION – LOWER PLAN
46	TYPE "T" LIF STATION GENERAL CONFIGURATION - SECTION
47	LIFT STATION SITE LAYOUT I
48	LIFT STATION SITE LAYOUT II
49	LIF STATION DESIGN DATA
50	SIMPLEX GRINDER PUMP STATION
51	DUPLEX GRINDER PUMP STATION



# WATER SERVICES GENERAL NOTES

1. LOCATION WIRE SHALL BE COLORED BLUE FOR WATER MAIN. LOCATE WIRE SPLICES SHALL BE CONNECTED WITH DRYCONN DIRECT BURY LUG AQUA MODEL #90220 AS MANUFACTURED BY KING INNOVATION: OR APPROVED EQUAL.
2. ALL NEW OR REPAIRED WATER MAIN SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA 651 AND HYDROSTATIC TESTED IN ACCORDANCE WITH AWWA C600 PRIOR TO BEING PLACED IN SERVICE.

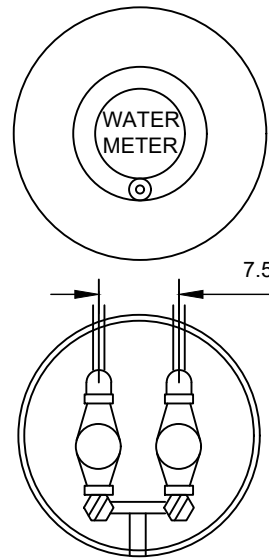


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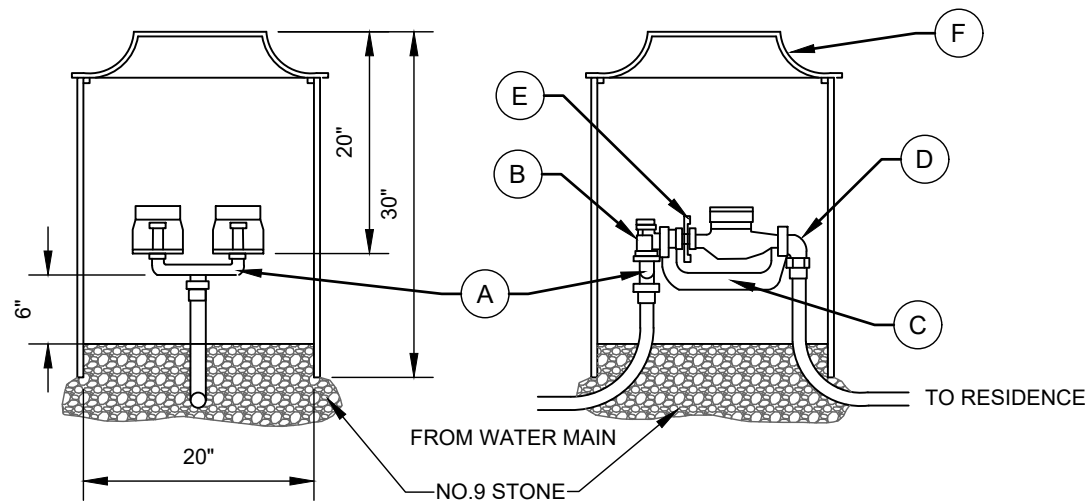
UP TO 2" DIA. WATER SERVICE CONNECTION DETAIL

STANDARD DETAILS  
**NASHVILLE MUNICIPAL UTILITY**

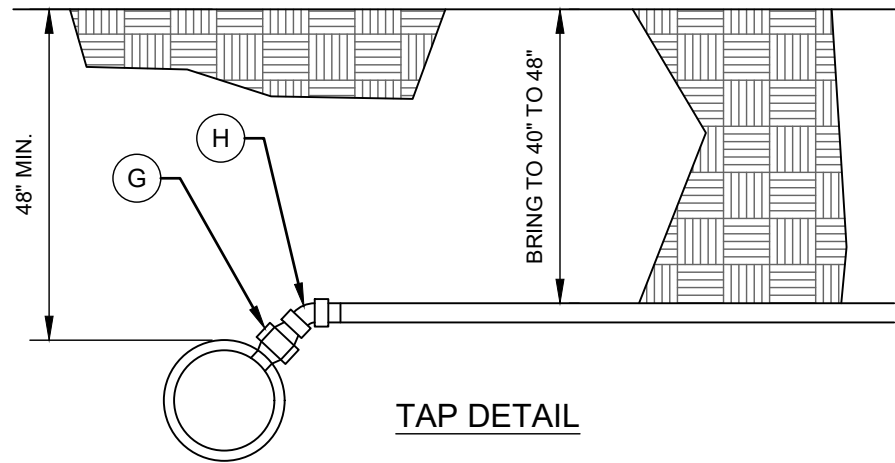
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SHEET NO.	1



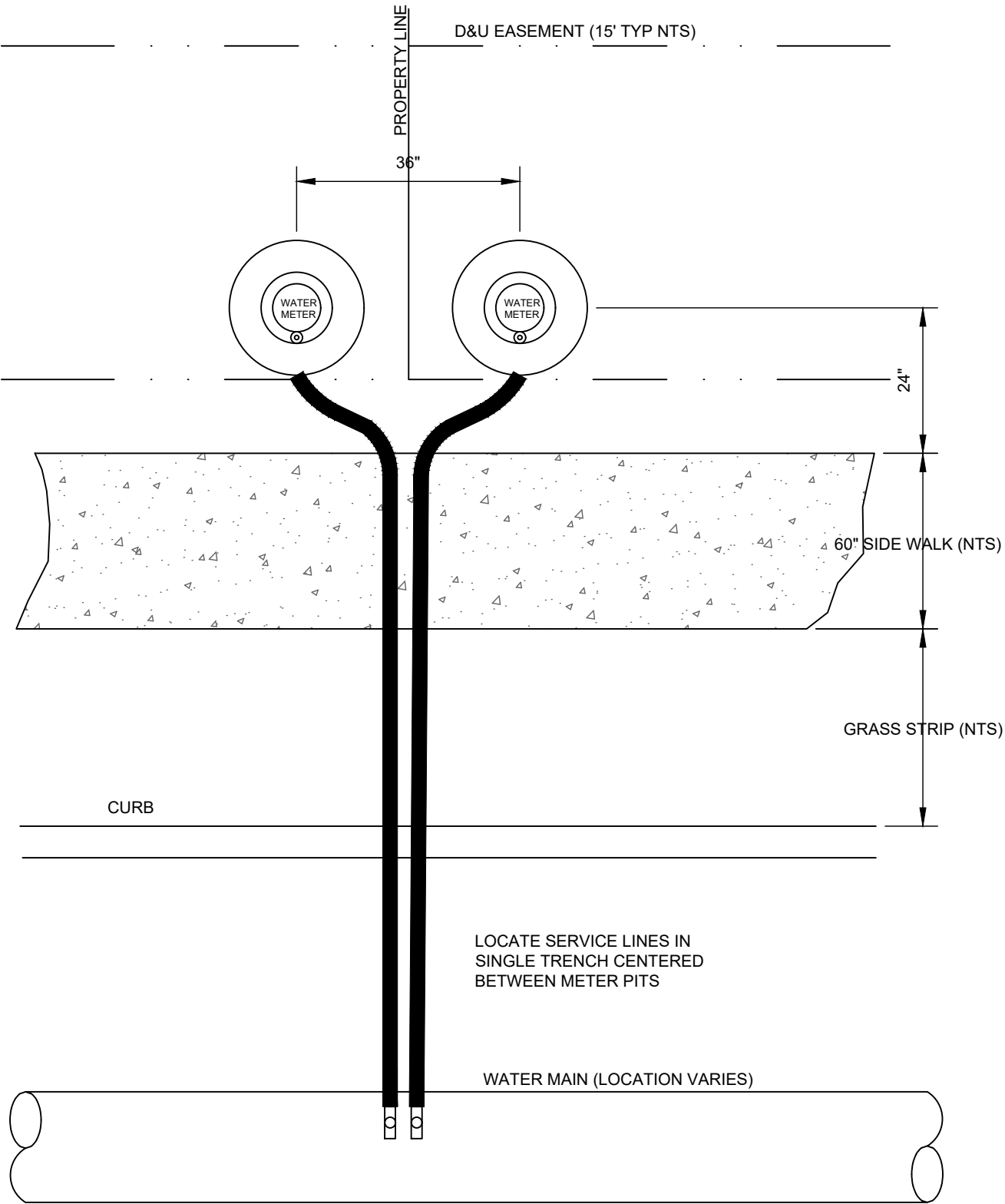
PARTS FOR DOUBLE METER PIT			
NOTE	QTY	DESCRIPTION	FORD PARTS NUMBER
A	1	1"X $\frac{3}{4}$ "X $\frac{3}{4}$ " BRANCH YOKE	U28-43-NL
B	2	3/4" ANGLE VALVE	AV91-323W-NL
C	2	$\frac{3}{4}$ "X $\frac{3}{4}$ " YOKE BARS	Y502
D	2	$\frac{1}{2}$ " YOKE ELL	L92-23-NL
E	2	EXPANSION CONNECTION	EC-23-NL
F	1	METER PIT COVER	X3-T
G	1	1" CORPORATION STOP	F600-4-NL
H	1	1" CORPORATION EIGHT BEND	LA02-44-NL



DUAL SERVICE METER PIT DETAIL



TAP DETAIL

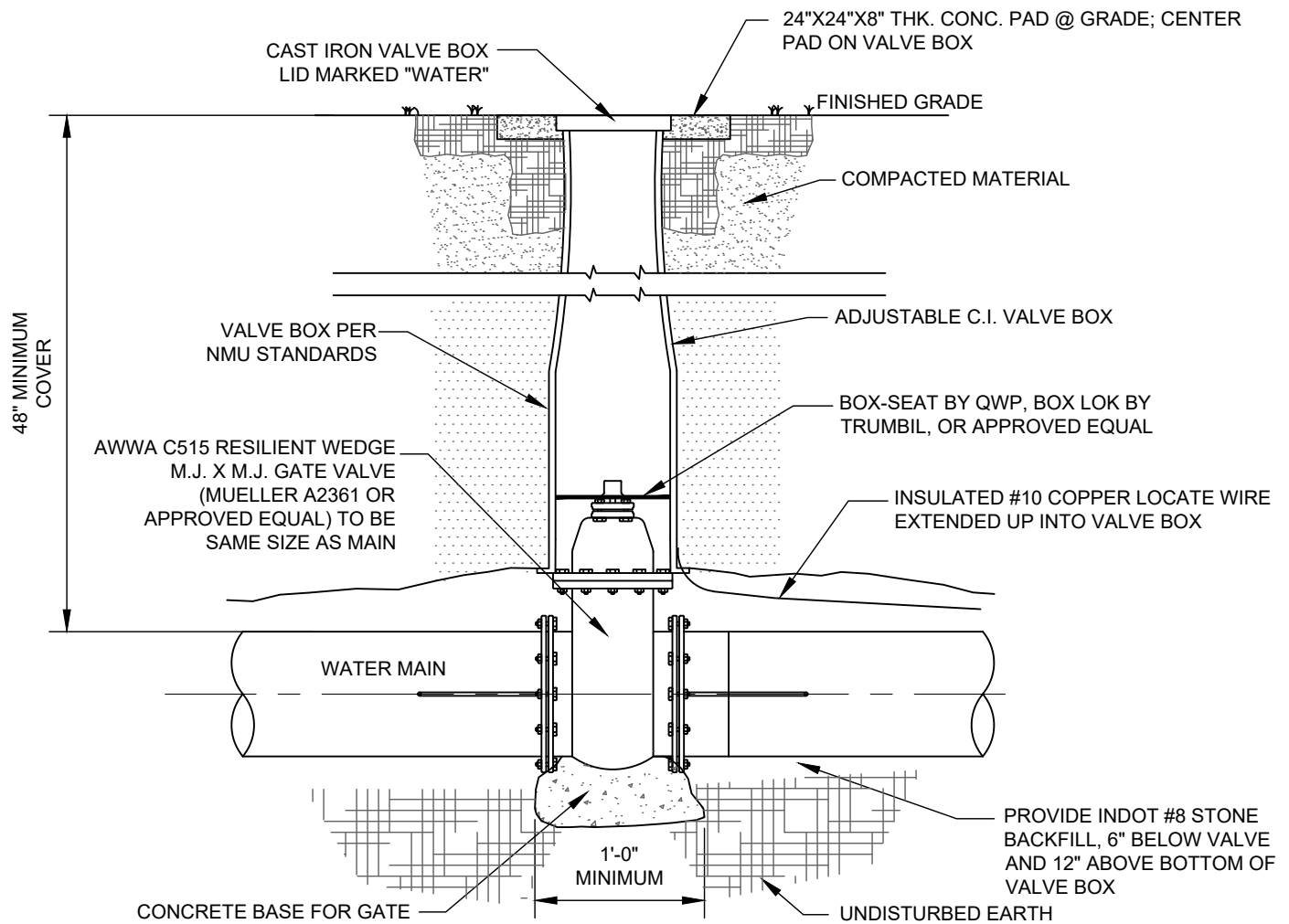


PIT LOCATION DETAIL

REVISIONS			
NO.	DESCRIPTION	DATE	BY

DUAL WATER SERVICE DETAIL  
STANDARD DETAILS  
NASHVILLE MUNICIPAL UTILITY

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	2



NOTES:

1. VALVE OPERATING NUT SHALL BE MAX. 36" FROM GRADE. IF DEEPER THAN 36", EXTENSION STEM SHALL BE PROVIDED.
2. VALVE JOINTS SHALL BE RESTRAINED. RESTRAIN PIPE PER NMU STANDARDS.
3. VALVE BOX SHALL NOT REST ON VALVE.

REVISIONS

NO.	DESCRIPTION	DATE	BY

TYPICAL GATE VALVE AND VALVE BOX

STANDARD DETAILS

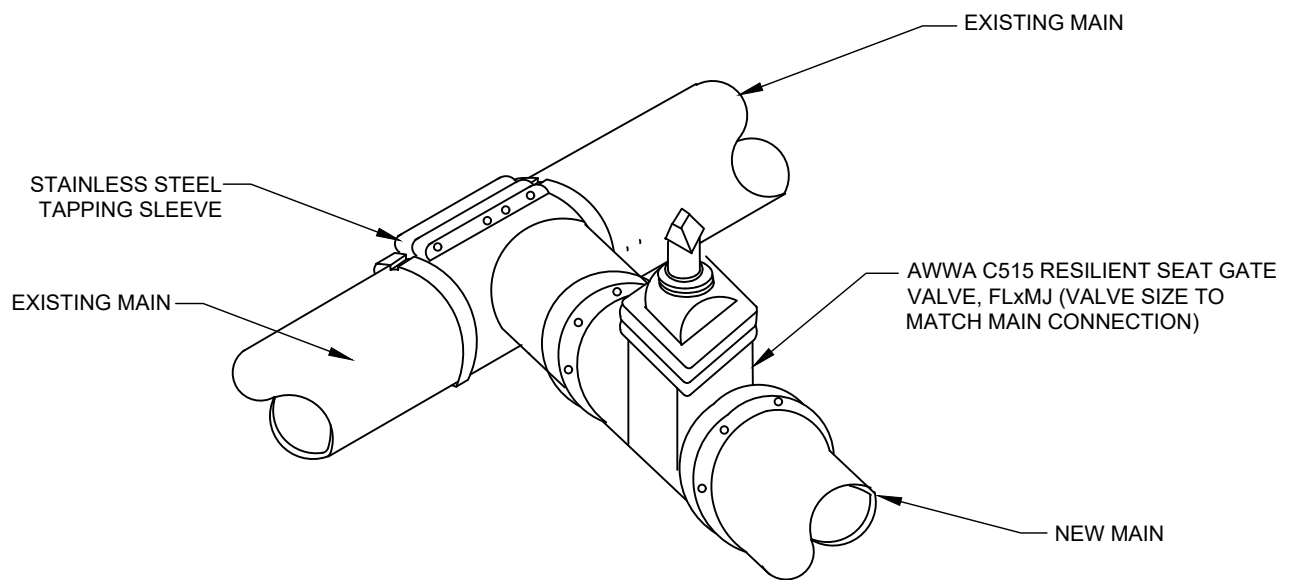
NASHVILLE MUNICIPAL UTILITY

DATE: 03/13/24

SCALE: NTS

SHEET NO.

3



NOTE:

1. NO MECHANICAL JOINT TAPPING SLEEVES WILL BE ACCEPTED.
2. BOLTS, NUTS, & WASHERS SHALL BE 304 STAINLESS STEEL.
3. STAINLESS STEEL BOLTS SHALL BE INSTALLED WITH ANTI-SEIZE.
4. CONTRACTOR SHALL COMPLETE HYDROSTATIC TESTING ON TAPPING SLEEVE FOR A MINIMUM OF 15 MINUTES AT 150 PSI.

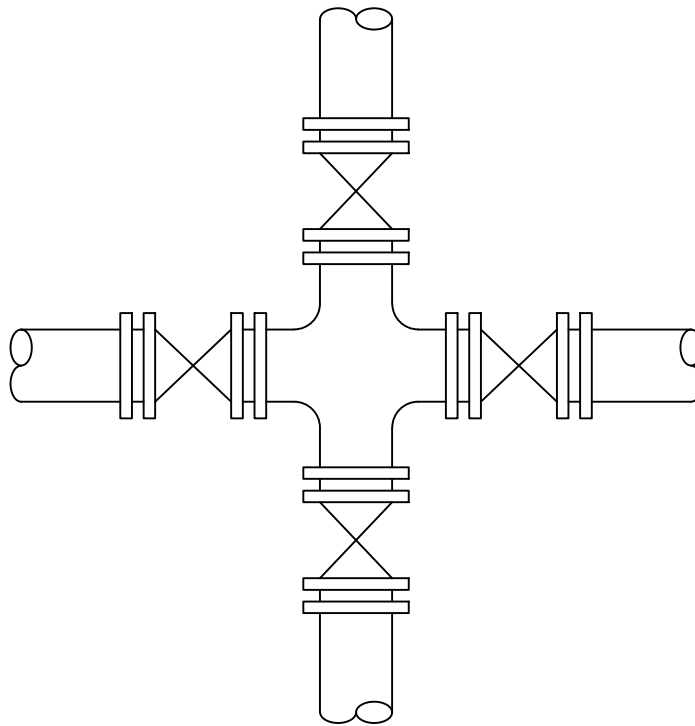
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TAPPING SLEEVE AND VALVE

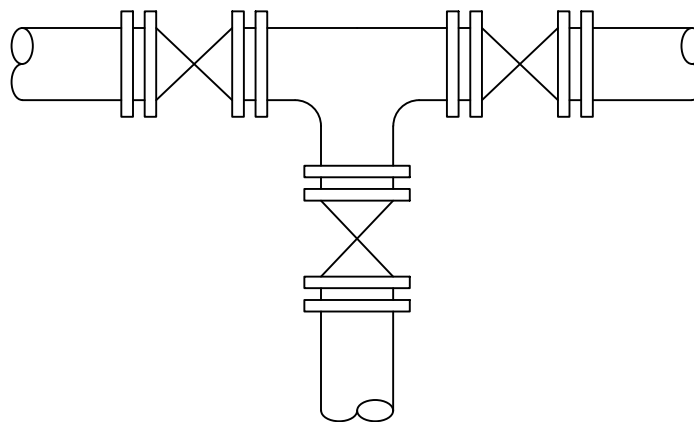
STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	4



4 VALVES REQUIRED AT "CROSS"



3 VALVES REQUIRED AT "TEE"

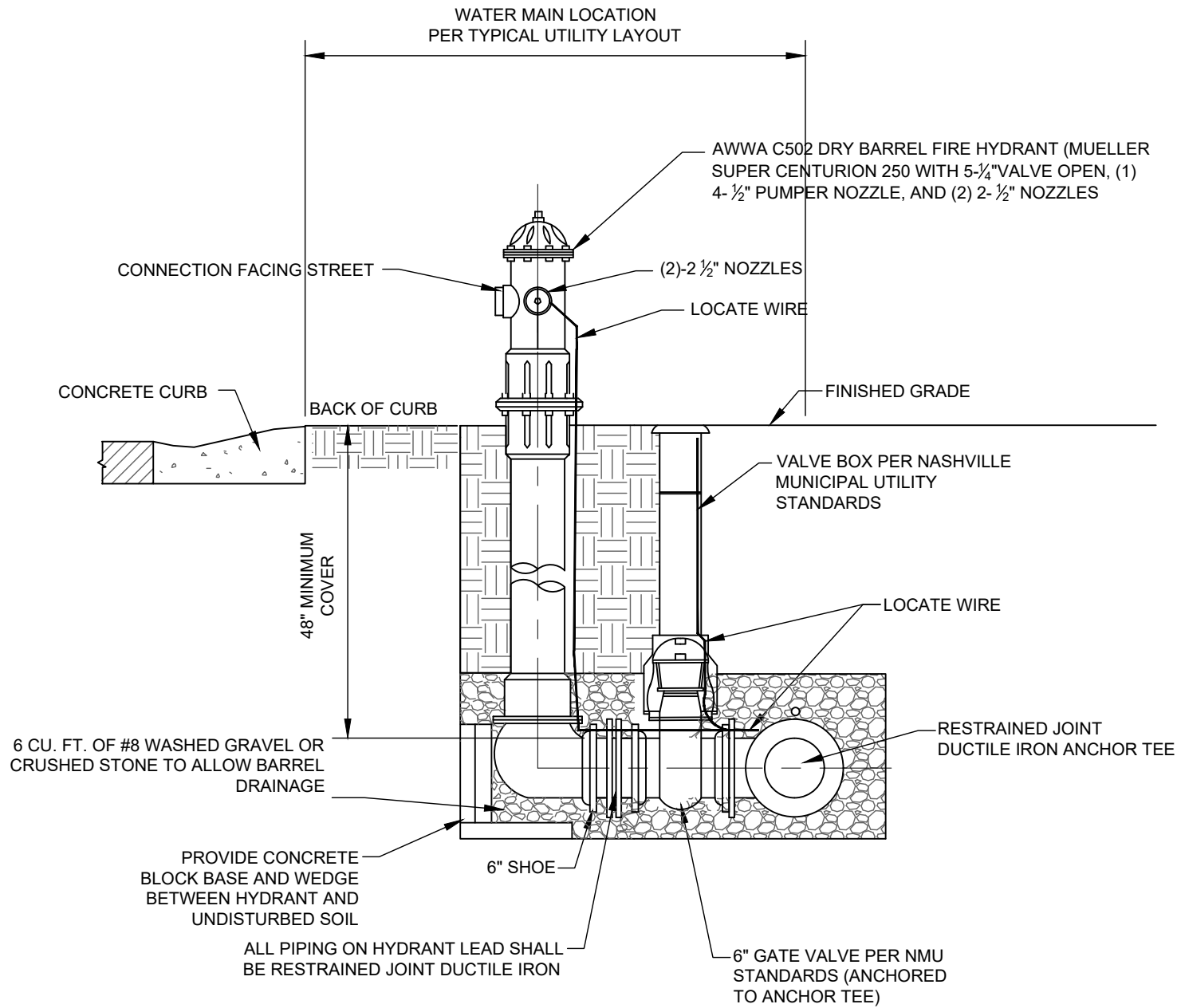
REVISIONS			
NO.	DESCRIPTION	DATE	BY

VALVES AT INTERSECTIONS

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	5



NOTE:

1. FIRE HYDRANT SHALL BE PAINTED SAFETY YELLOW (PRIVATE HYDRANT SHALL BE PAINTED RED)
2. SNOWPLOWABLE BLUE REFLECTORS SHALL BE INSTALLED IN CENTER OF ROAD AT ALL FIRE HYDRANTS; PROVIDE NASHVILLE MUNICIPAL UTILITY WITH AN OPERATING WRENCH AND TRAFFIC DAMAGE REPAIR KIT(S). SEE NASHVILLE MUNICIPAL UTILITY SPECIFICATIONS.

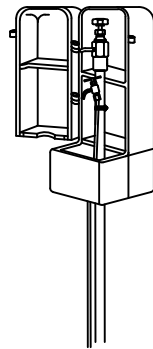
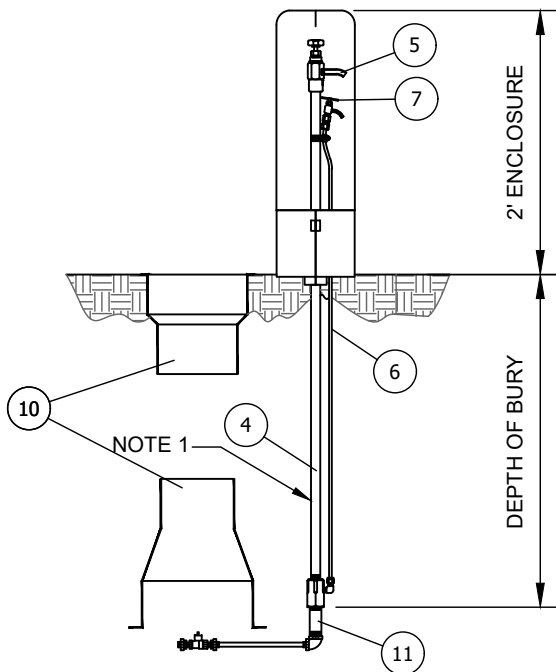
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STANDARD FIRE HYDRANT

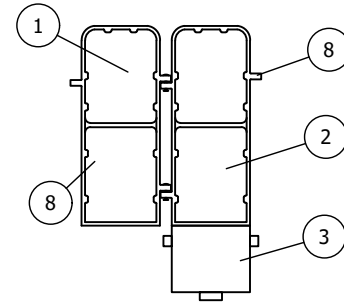
STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	6



3D VIEW



ENCLOSURE OPEN VIEW

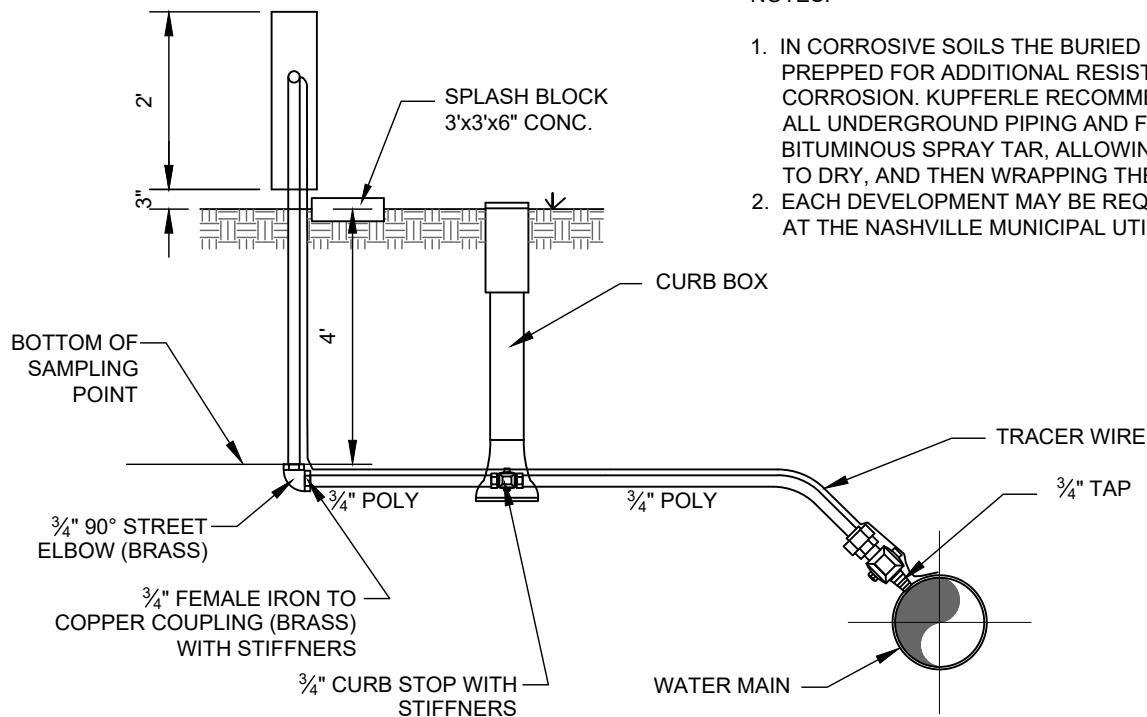
#88-SS SAMPLING STATION TO BE INSTALLED AT THE FOLLOWING LOCATIONS:

ITEM	ITEM / DESCRIPTION	NOTES
1	88 FRONT DOOR ( COVER A )	
2	88 REAR DOOR ( COVER B )	
3	88 BASE	2 PIECES
4	1/2" S.S. WATERWAY	
5	BLOW OFF & SAMPLING BIBB	
6	1/4" S.S. TUBING	
7	PET COCK	
8	LOCKING HOLE	
9	NOT USED	
10	CURB BOX	
11	3/4" S.S. NIPPLE	

1. SAMPLING STATION SHALL BE 4'-0" BURY, WITH A 3/4" FIP INLET, AND 7/16" UNTHREADED BLOW OFF AND SAMPLING BIBB. STATION SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE ALUMINUM BOX WITH HINGED OPENINGS. WHEN OPEN, THE STATION SHALL REQUIRE NO KEY FOR OPERATION, AND ALL WATER FLOW SHALL PASS THRU AN ALL STAINLESS STEEL WATERWAY.
2. ALL WORKING PARTS SHALL BE OF STAINLESS STEEL AND SERVICABLE FROM ABOVE GROUND WITH NO DIGGING OR REPLACEMENT NEEDED.
3. A STAINLESS STEEL PET COCK WILL BE LOCATED BELOW THE SAMPLING BIBB TO ALLOW PUMPING OF ANY WATER REMAINING INSIDE THE STATION TO INSURE NON-FREEZING.
4. THE STATION SHALL BE MODEL #88WC-SS AS MANUFACTURED BY THE KUPFERLE FOUNDRY, ST. LOUIS MO. 63102 OR APPROVED EQUAL.

NOTES:

1. IN CORROSIVE SOILS THE BURIED PIPE SHOULD BE PREPPED FOR ADDITIONAL RESISTANCE TO CORROSION. KUPFERLE RECOMMENDS SPRAYING ALL UNDERGROUND PIPING AND FITTINGS WITH BITUMINOUS SPRAY TAR, ALLOWING PROPER TIME TO DRY, AND THEN WRAPPING THE PARTS
2. EACH DEVELOPMENT MAY BE REQUIRED TO INSTALL AT THE NASHVILLE MUNICIPAL UTILITY DISCRETION.



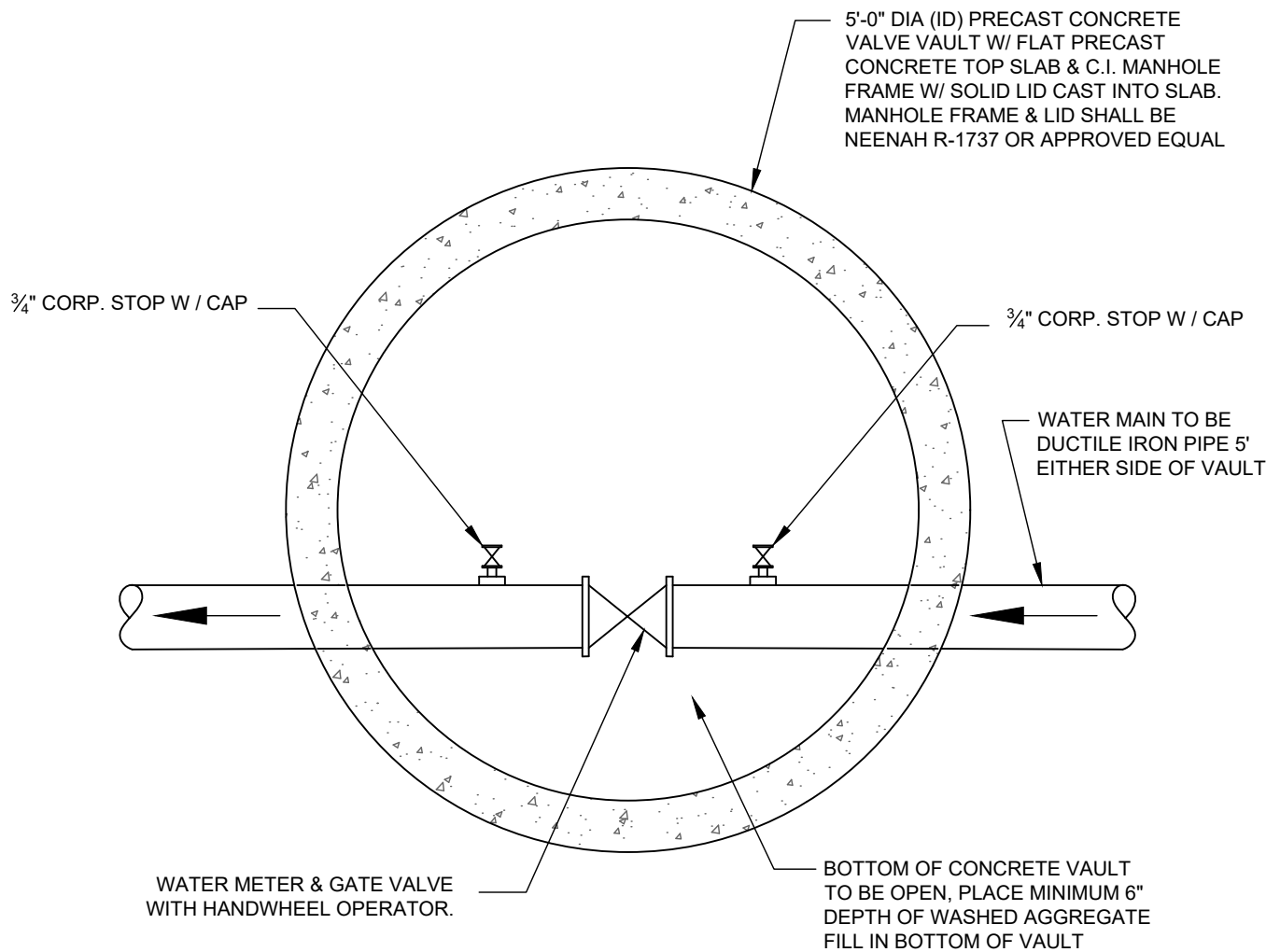
REVISIONS			
NO.	DESCRIPTION	DATE	BY

WATER MAIN SAMPLING STATION

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	7



REVISIONS			
NO.	DESCRIPTION	DATE	BY

LEAK DETECTION METER DETAIL

STANDARD DETAILS

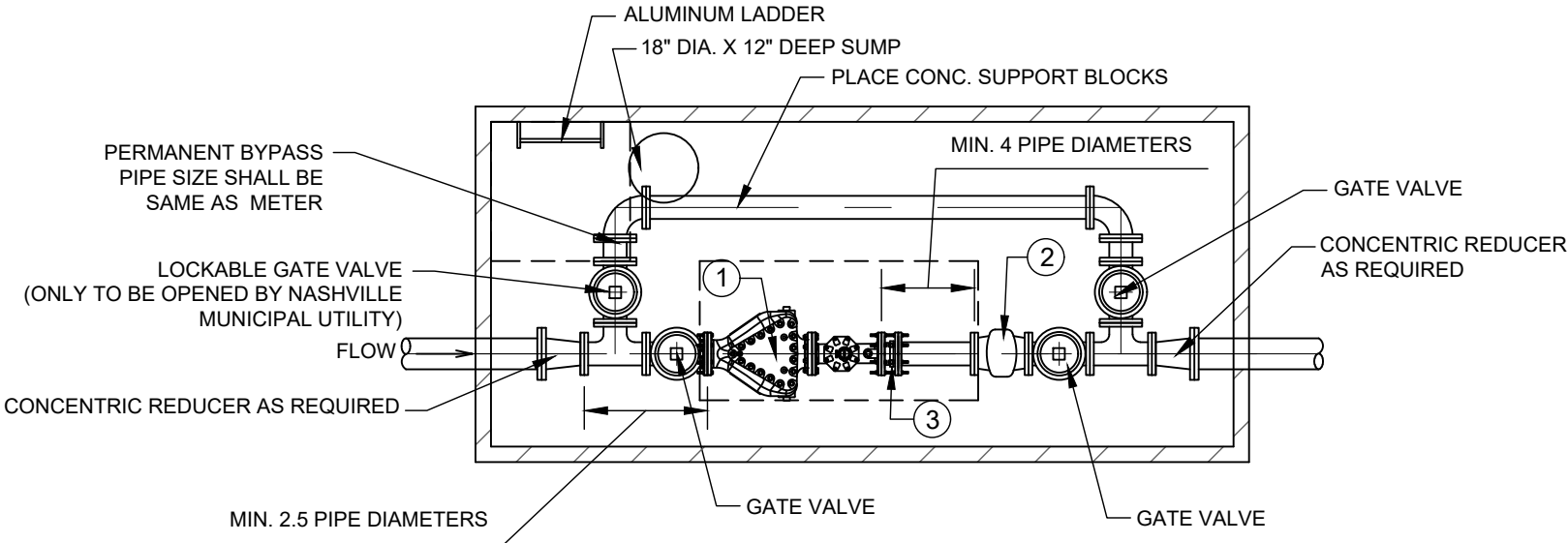
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	8

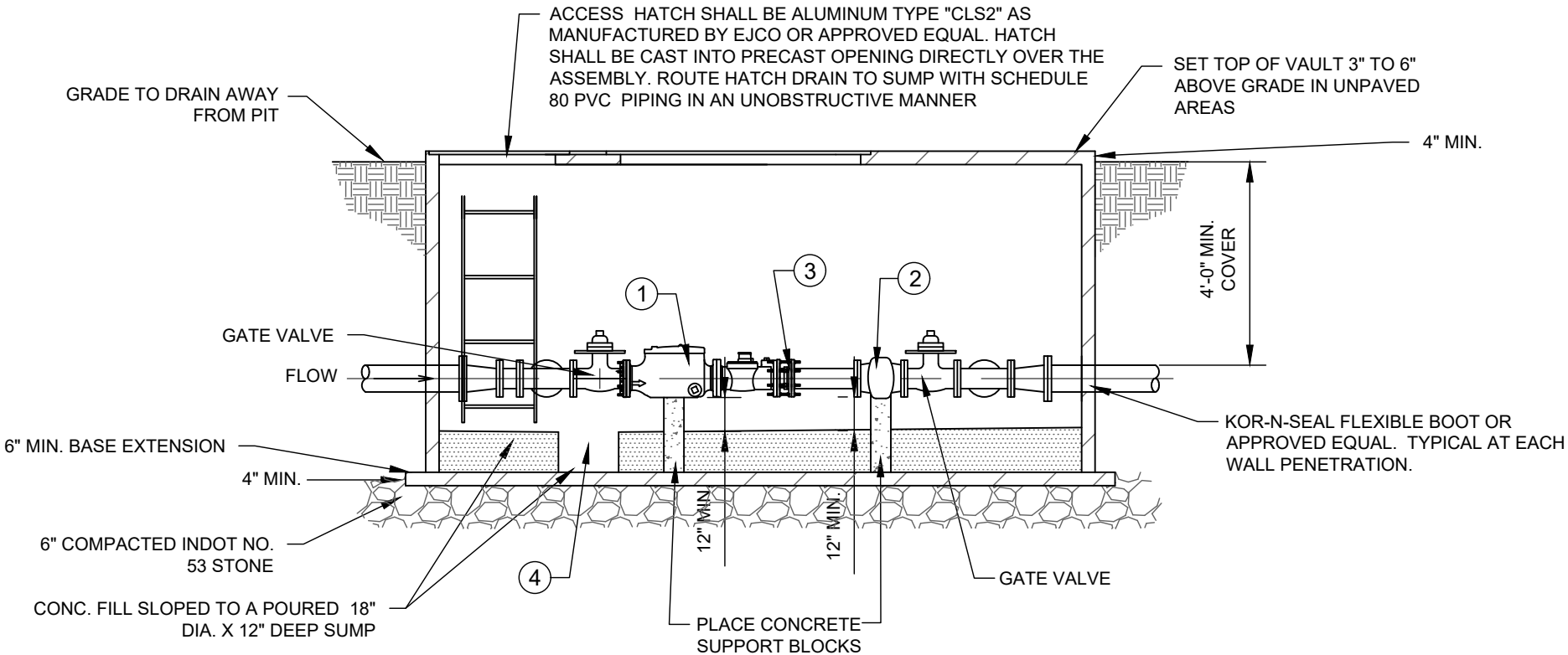


NOTES:

1. VAULT IS A GENERAL REPRESENTATION ONLY. THE DEVELOPER'S ENGINEER SHALL SUBMIT A SPECIFIC VAULT DETAIL FOR THE PLANNED FACILITY.
2. ALL METER ASSEMBLIES SHALL BE SPECIFIED BY THE NASHVILLE MUNICIPAL UTILITY. THE DEVELOPER'S ENGINEER SHALL PROVIDE FIXTURE UNIT FLOW AND PRESSURE LOSS CALCULATIONS FOR NASHVILLE MUNICIPAL UTILITY REVIEW AND ACCEPTANCE TO ALLOW A PROPER METER TO BE SELECTED.
3. EACH METER VAULT SHALL BE EQUIPPED WITH A DOOR MOUNTED ELECTRONIC DEVICE FOR USE WITH A RADIO READING SYSTEM.
4. VAULT SIZE TO PROVIDE 12" MINIMUM CLEARANCE FROM ALL PIPING AND FITTINGS.
5. PIT/VAULT (NON-TRAFFIC AREA)  
PIT SHALL BE REINFORCED CAST-IN-PLACE CONCRETE, PRECAST CONCRETE, OR LAID BLOCK. APPLY APPROVED WATERPROOFING AGENT TO INTERIOR AND EXTERIOR OF WALLS. SPECIFICATIONS FOR PITS IN TRAFFIC AREAS SHALL BE DETERMINED BY DESIGN REQUIREMENTS.
6. INTERIOR PIPING SHALL BE FLANGED D.I.
7. ALL INTERIOR GATE VALVES SHALL BE HANDWHEEL OPERATED
8. SUMP PUMP SHALL HAVE 1 1/2"Ø SCH. 80 PVC DISCHARGE PIPE W/ CHECK VALVE AND PVC BALL VALVE ON VERTICAL DISCHARGE PIPE INSIDE VAULT. COORDINATE DISCHARGE LOCATION W/ NMU. ALL PIPE AND CONDUIT PENETRATIONS THROUGH VAULT WALL SHALL BE LINK SEALED AND GROUTED FLUSH BOTH SIDES.



SECTIONAL PLAN VIEW



LEGEND	
①	SENSUS OMNI F <sup>2</sup> COMPOUND METER W/ STRAINER (OR APPROVED EQUAL)
②	VAL-MATIC SWING-FLEX SERIES #500 CHECK VALVE W/ MECHANICAL INDICATOR
③	RESTRAINED FLANGE COUPLING ADAPTOR EBAA IRON MEGA FLANGE SERIES 2100
④	SUMP PUMP (PROVIDE 120VAC, 20A SERVICE)

REVISIONS			
NO.	DESCRIPTION	DATE	BY

LARGE DIAMETER METER VAULT (3"-10" )

STANDARD DETAILS  
NASHVILLE MUNICIPAL UTILITY

DATE: 03/13/24

SCALE: NTS

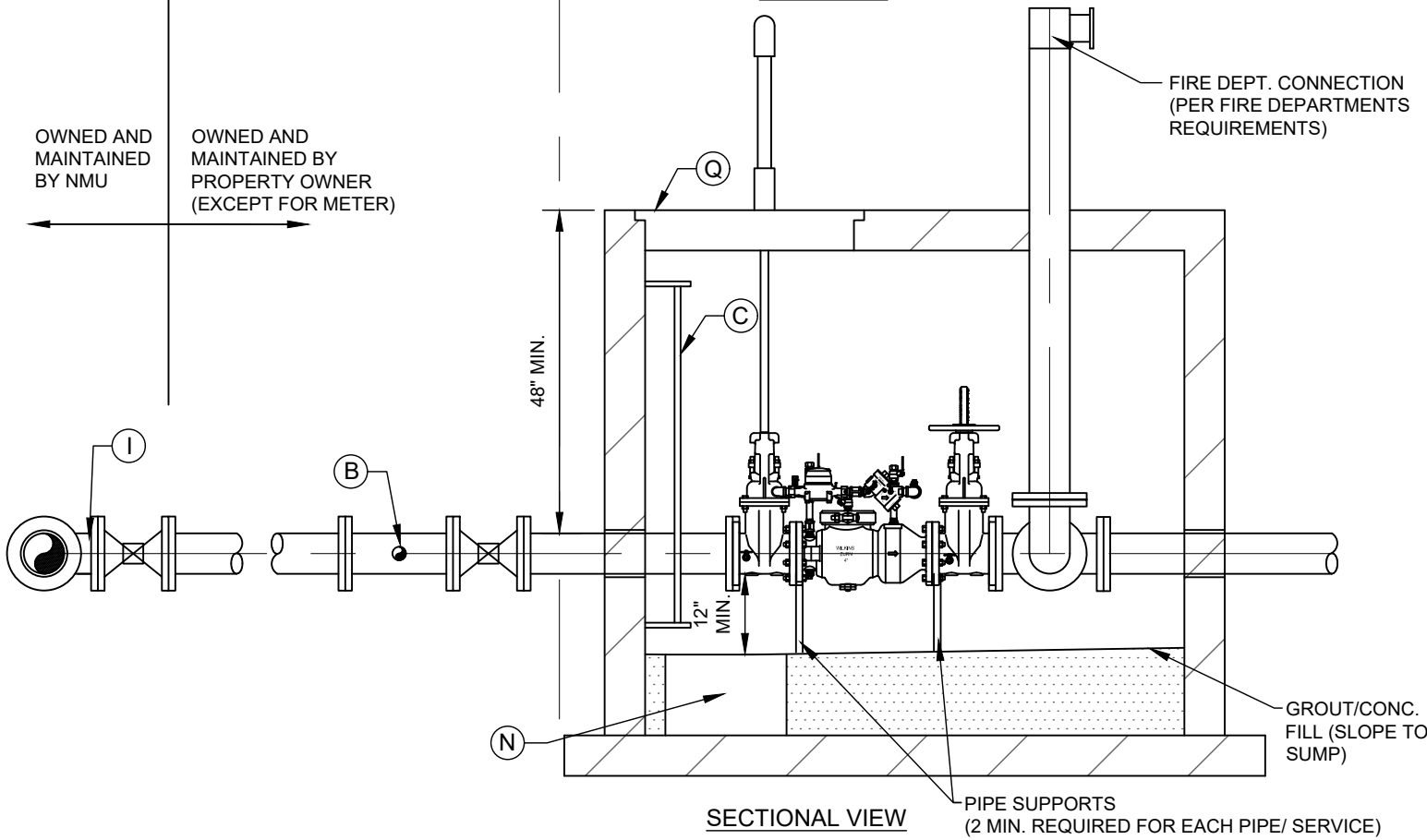
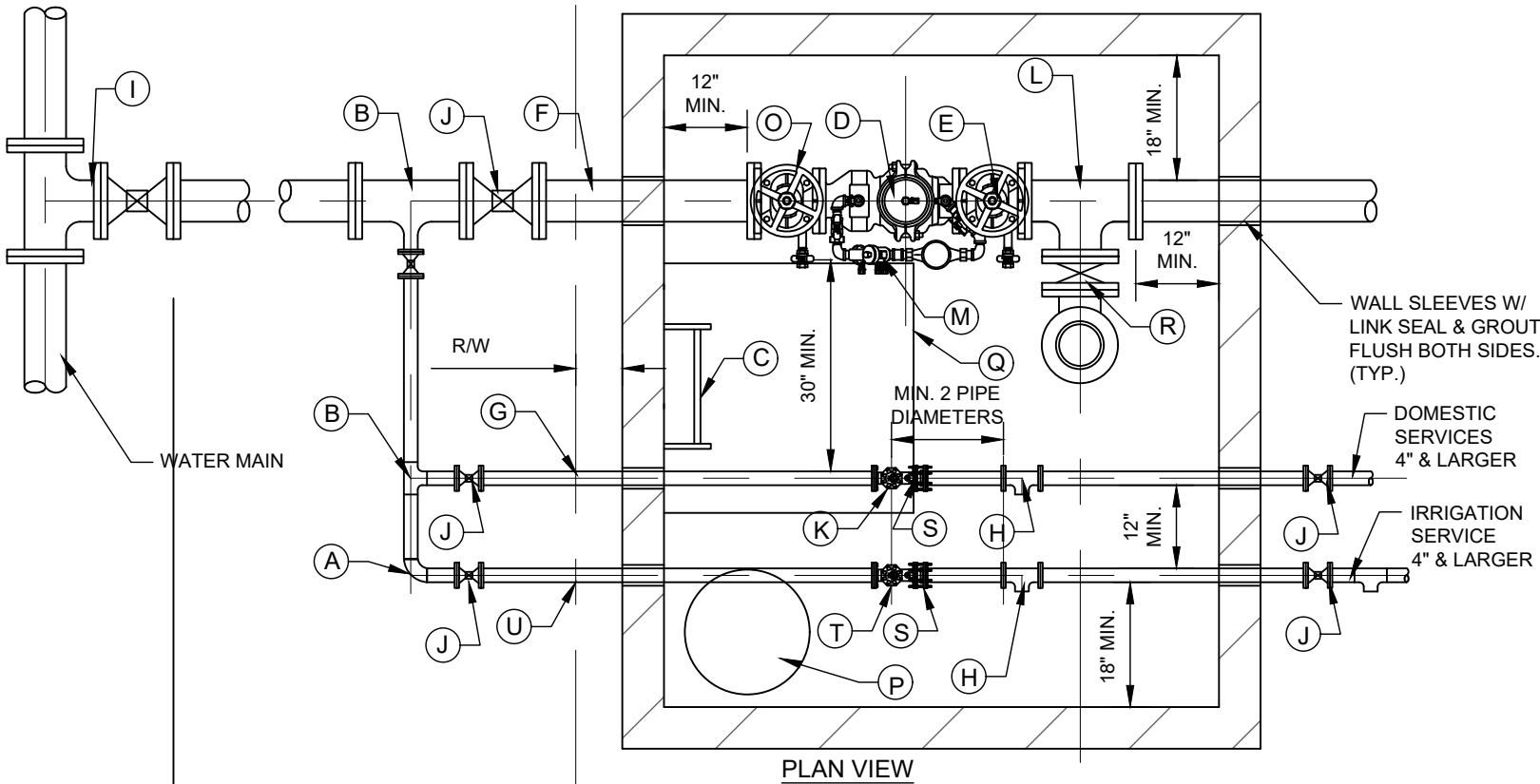
SHEET NO.

NOTES:

1. CUSTOMER SHALL FURNISH & INSTALL VAULT, INCLUDING ALL APPURTENANCES EXCEPT AS NOTED BELOW.
2. VAULT CONSTRUCTION MATERIALS SHALL BE 8"x8"x16" CMU, OR PRECAST, OR CAST IN PLACE CONCRETE AT CUSTOMER'S SELECTION.
3. INSIDE DIMENSIONS PER DRAWING NOTES, VAULT TO BE SET LENGTHWISE WITH SERVICE.
4. TOP OF VAULT TO BE CONCRETE, AT LEAST 4" THICK WITH REINFORCING SUITABLE FOR ANTICIPATED LOADING. WHEN VAULT IS CONSTRUCTED IN PAVED AREAS, PAVED AREAS, PAVEMENT IS TO BE LEVEL WITH TOP OF VAULT, AND THE TOP REINFORCED AS REQUIRED TO SUPPORT TRAFFIC LOADS (i.e. H-20 WHEEL LOADS). WHEN VAULT IS CONSTRUCTED IN GRASS PLOT, TOP OF VAULT SHALL BE 3" ABOVE FINISHED GRADE.
5. BOTTOM OF VAULT TO BE MINIMUM 4" CONCRETE PER FIRE DEPARTMENT'S REQUIREMENT. MINIMUM CLEARANCE OF 12" BELOW BOTTOM OF FIRE SERVICE AND DOMESTIC SERVICE LINES IS REQUIRED.
6. DOUBLE CHECK DETECTOR ASSEMBLY SHALL BE A MODEL APPROVED BY THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT, WITH FLANGED OS&Y GATE VALVE ON INLET AND OUTLET SIDES. DETECTOR METER IS FURNISHED BY UTILITY AND INSTALLED BY CUSTOMER. STAINLESS STEEL BOLTS ARE REQUIRED.
7. ACCESS HATCH IN TOP OF VAULT SHALL BE 36"x36". THE ACCESS HATCHES SHALL BE ALUMINUM TYPE "CLS2" AS MANUFACTURED BY EJCO OR APPROVED EQUAL. ACCESS HATCH SHALL HAVE SAME OR GREATER LOADING CAPACITY AS VAULT LID. PIPE HATCH FRAME DRAIN TO VAULT SUMP, AS APPLICABLE. A SUMP PUMP SHALL BE INSTALLED IN THE VAULT, ELECTRICAL DISCONNECT IS REQUIRED ON TOP OF VAULT, INSTALLED ABOVE GRADE, PER LOCAL ELECTRICAL CODE.
8. METER SHALL BE SIZED APPROPRIATELY FOR REQUIRED FLOWS. IF REDUCERS ARE REQUIRED, THERE SHALL BE ADEQUATE SPACING UPSTREAM (5 PIPE DIAMETERS) AND DOWNSTREAM (2 PIPE DIAMETERS) FOR METER ACCURACY. A 2" TEST PLUG SHALL BE INSTALLED AT LEAST 2 PIPE DIAMETERS DOWNSTREAM OF METERS.
9. AS DIRECTED BY NASHVILLE MUNICIPAL UTILITY, ADDITIONAL PIPE SUPPORTS MAY BE REQUIRED.
10. ABOVE GROUND BACKFLOW PREVENTER APPROVED BY INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT SHALL BE INSTALLED ON IRRIGATION SERVICE OUTSIDE OF VAULT.
11. RPZ BACKFLOW PREVENTER APPROVED BY INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT SHALL BE INSTALLED ON DOMESTIC SERVICE INSIDE OF BUILDING.
12. FOR DOMESTIC/IRRIGATION SERVICE 2" AND SMALLER, METER(S) MAY BE IN SEPARATE METER PIT(S) AT RIGHT-OF WAY.
13. UNLESS OTHERWISE NOTED, ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON OUTSIDE OF VAULT AND FLANGED JOINT DUCTILE IRON INSIDE OF VAULT.

LEGEND:

- (A) RJDI BEND
- (B) RJDI TEE
- (C) ALUM. LADDER W/SAFETY UP POST
- (D) DOUBLE CHECK DETECTOR ASSEMBLY
- (E) FLANGED OS&Y VALVE
- (F) FIRE LINE
- (G) DOMESTIC SERVICE (MIN. 4" DIAMETER INSIDE VAULT; SEE NOTE 8)
- (H) 2" TEST PLUG (SEE NOTE 8)
- (I) TAPPING SLEEVE W/TAPPING VALVE & BOX (COORDINATE W/ NMU)
- (J) RLDI GATE VALVE
- (K) DOMESTIC SERVICE METER (SEE NOTE 8)
- (L) FLANGED TEE
- (M) DETECTOR METER (SEE NOTE 8)
- (N) SUMP PUMP (18"x12" DEEP)
- (O) FLANGED OS&Y VALVE WITH PIT TYPE POST INDICATION
- (P) SUMP PUMP LID (METER PIT LID WITH TRANSMITTERS)
- (Q) ACCESS HATCH (SEE NOTE 7)
- (R) CHECK VALVE W/ BALL DRIP VALVE
- (S) RESTRAINED FLANGE COUPLING ADAPTOR EBAA IRON MEGA FLANGE SERIES 2100
- (T) IRRIGATION SERVICE METER (SEE NOTE 8)
- (U) IRRIGATION SERVICE (MIN. 4" DIAMETER INSIDE VAULT; SEE NOTE 8)



REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIRE LINE DOUBLE DETECTOR ASSEMBLY WITH  
DOMESTIC/IRRIGATION METER(S)  
STANDARD DETAILS  
NASHVILLE MUNICIPAL UTILITY

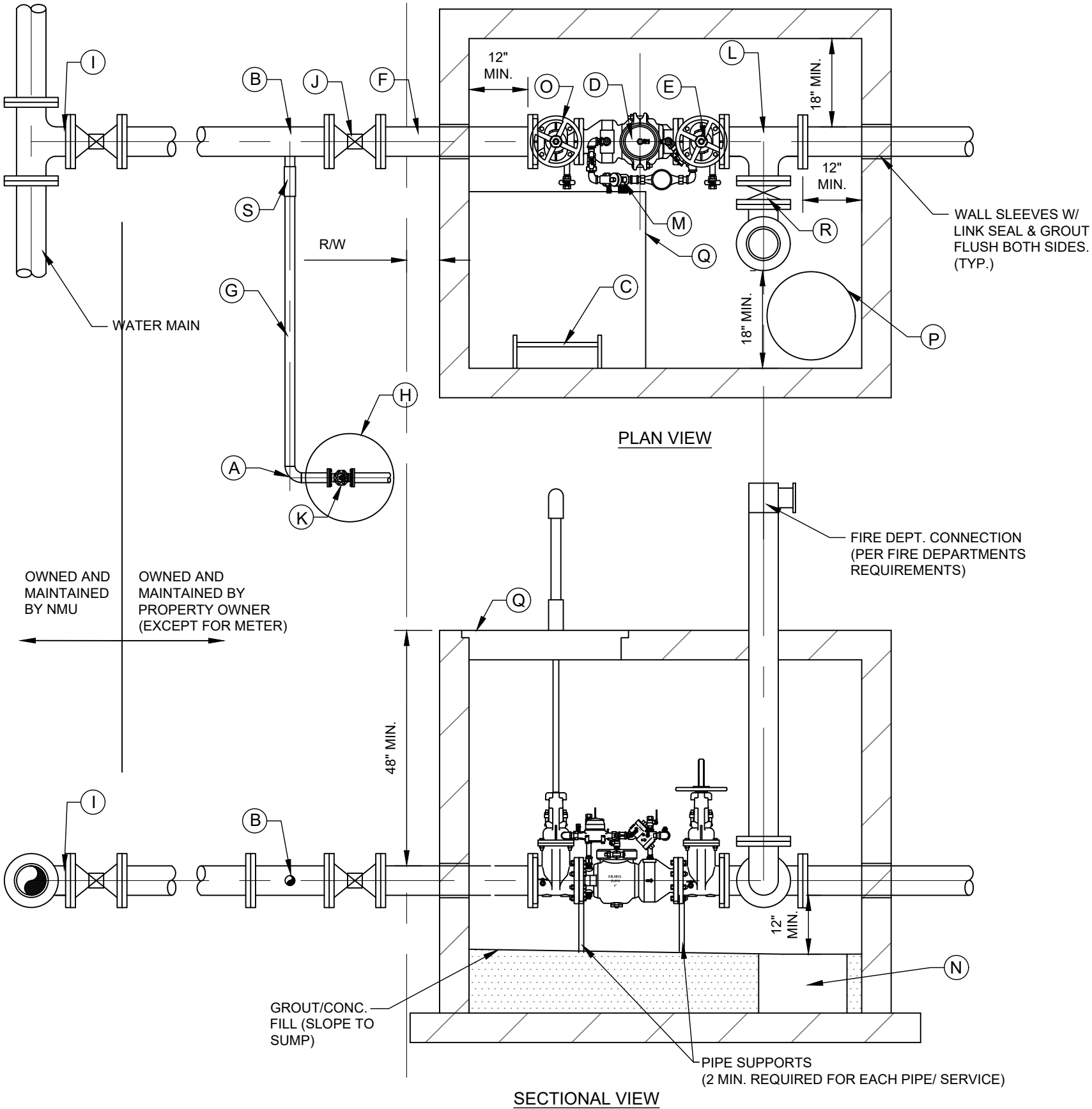
DATE:	03/13/24
SCALE:	NTS
SHEET NO.	10

NOTES:

1. CUSTOMER SHALL FURNISH & INSTALL VAULT, INCLUDING ALL APPURTENANCES EXCEPT AS NOTED BELOW.
2. VAULT CONSTRUCTION MATERIALS SHALL BE 8"x8"x16" CMU, OR PRECAST, OR CAST IN PLACE CONCRETE AT CUSTOMER'S SELECTION.
3. INSIDE DIMENSIONS PER DRAWING NOTES, VAULT TO BE SET LENGTHWISE WITH SERVICE.
4. TOP OF VAULT TO BE CONCRETE, AT LEAST 4" THICK WITH REINFORCING SUITABLE FOR ANTICIPATED LOADING. WHEN VAULT IS CONSTRUCTED IN PAVED AREAS, PAVED AREAS, PAVEMENT IS TO BE LEVEL WITH TOP OF VAULT, AND THE TOP REINFORCED AS REQUIRED TO SUPPORT TRAFFIC LOADS (i.e. H-20 WHEEL LOADS). WHEN VAULT IS CONSTRUCTED IN GRASS PLOT, TOP OF VAULT SHALL BE 3" ABOVE FINISHED GRADE.
5. BOTTOM OF VAULT TO BE MINIMUM 4" CONCRETE PER FIRE DEPARTMENT'S REQUIREMENT. MINIMUM CLEARANCE OF 12" BELOW BOTTOM OF FIRE SERVICE AND DOMESTIC SERVICE LINES IS REQUIRED.
6. DOUBLE CHECK DETECTOR ASSEMBLY SHALL BE A MODEL APPROVED BY THE INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT, WITH FLANGED OS&Y GATE VALVE ON INLET AND OUTLET SIDES. DETECTOR METER IS FURNISHED BY UTILITY AND INSTALLED BY CUSTOMER. STAINLESS STEEL BOLTS ARE REQUIRED.
7. ACCESS HATCH IN TOP OF VAULT SHALL BE 36"x36". THE ACCESS HATCHES SHALL BE ALUMINUM TYPE "CLS2" AS MANUFACTURED BY EJCO OR APPROVED EQUAL. ACCESS HATCH SHALL HAVE SAME OR GREATER LOADING CAPACITY AS VAULT LID. PIPE HATCH FRAME DRAIN TO VAULT SUMP, AS APPLICABLE. A SUMP PUMP SHALL BE INSTALLED IN THE VAULT, ELECTRICAL DISCONNECT IS REQUIRED ON TOP OF VAULT, INSTALLED ABOVE GRADE, PER LOCAL ELECTRICAL CODE.
8. METER SHALL BE SIZED APPROPRIATELY FOR REQUIRED FLOWS.
9. AS DIRECTED BY NASHVILLE MUNICIPAL UTILITY, ADDITIONAL PIPE SUPPORTS MAY BE REQUIRED.
10. ABOVE GROUND BACKFLOW PREVENTER APPROVED BY INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT SHALL BE INSTALLED ON IRRIGATION SERVICE OUTSIDE OF VAULT.
11. RPZ BACKFLOW PREVENTER APPROVED BY INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT SHALL BE INSTALLED ON DOMESTIC SERVICE INSIDE OF BUILDING.
12. FOR DOMESTIC/IRRIGATION SERVICE LINES 2" AND SMALLER, METER(S) MAY BE IN SEPARATE METER PIT(S) AT RIGHT-OF WAY. FOR SERVICE LINES LARGER THAN 2", METERS SHALL BE PUT INSIDE FIRE VAULT (REFER TO OTHER DETAIL THAT DEPICTS THIS SET UP).
13. UNLESS OTHERWISE NOTED, ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON OUTSIDE OF VAULT AND FLANGED JOINT DUCTILE IRON INSIDE OF VAULT.

LEGEND:

- (A) RJDI BEND
- (B) RJDI TEE
- (C) ALUM. LADDER W/SAFETY UP POST
- (D) DOUBLE CHECK DETECTOR ASSEMBLY
- (E) FLANGED OS&Y VALVE
- (F) FIRE LINE
- (G) DOMESTIC SERVICE (SEE NOTE 12)
- (H) METER PIT (SEE NOTE 12)
- (I) TAPPING SLEEVE W/TAPPING VALVE & BOX (COORDINATE W/ NMU)
- (J) RLDI GATE VALVE
- (K) DOMESTIC SERVICE METER (SEE NOTE 8 AND 12)
- (L) FLANGED TEE
- (M) DETECTOR METER (SEE NOTE 8)
- (N) SUMP PUMP (18"x12" DEEP)
- (O) FLANGED OS&Y VALVE WITH PIT TYPE POST INDICATION
- (P) SUMP PUMP LID (METER PIT LID WITH TRANSMITTERS)
- (Q) ACCESS HATCH (SEE NOTE 7)
- (R) CHECK VALVE W/ BALL DRIP VALVE
- (S) 1" CORP. STOP OR 2" SADDLE W/ 2" CORP



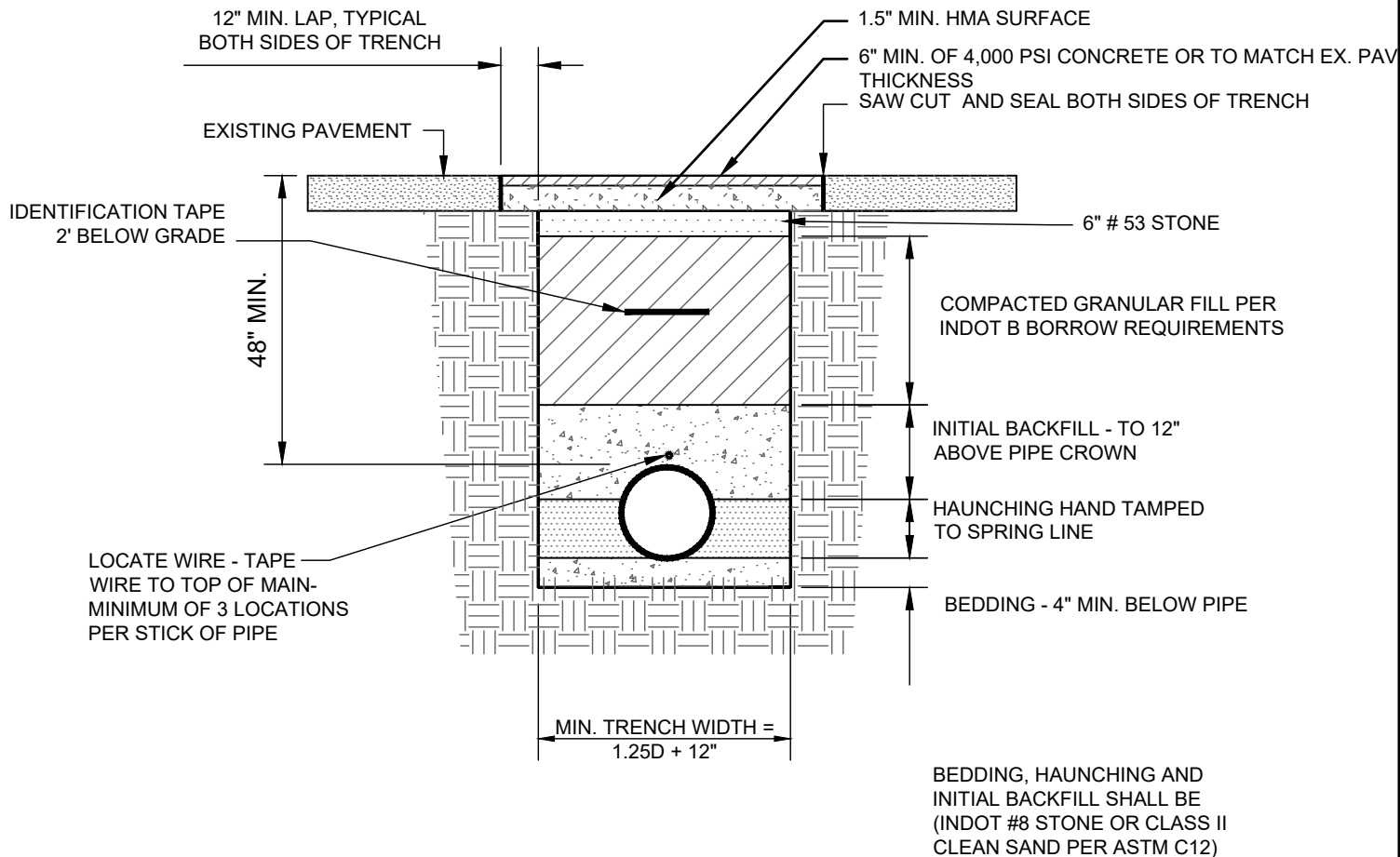
REVISIONS			
NO.	DESCRIPTION	DATE	BY

FIRE LINE DOUBLE DETECTOR ASSEMBLY

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	11



NOTES:

1. EXISTING PAVEMENT IS TO BE SAW CUT FOR A CLEAN BREAK.
2. TRENCH SPOIL IS TO BE REMOVED FROM THE WORK SITE.
3. NEW SURFACE TO BE SLOPED AT SAME RATE AS THE EXISTING SURFACE.
4. GRANULAR FILL SHALL BE PROVIDED WITHIN 5' OF PAVED SURFACE.

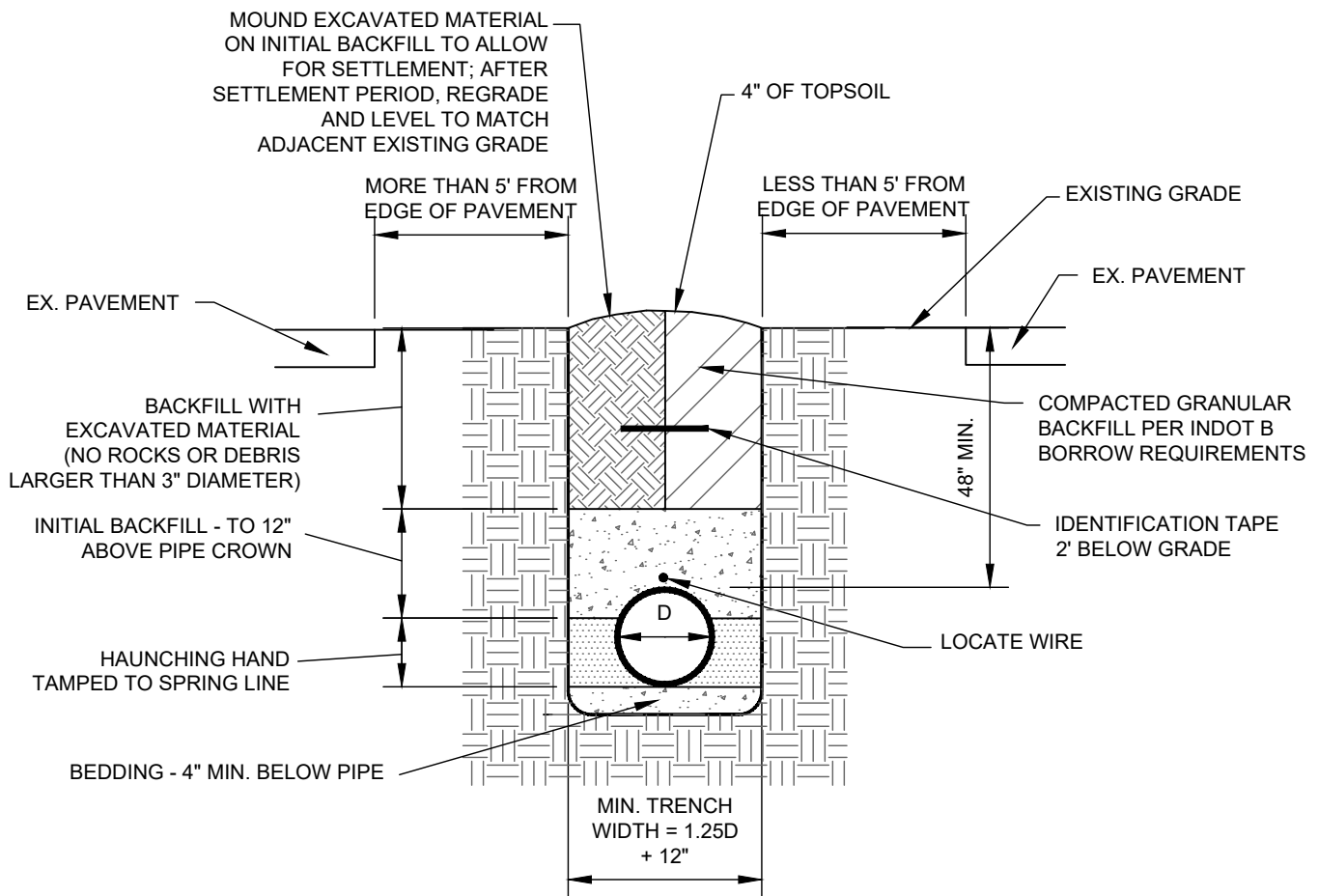
REVISIONS			
NO.	DESCRIPTION	DATE	BY

WATERMAIN / FORCEMAIN TYPICAL TRENCH  
FOR D.I. OR PVC C900 PIPE IN PAVED AREAS

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	12

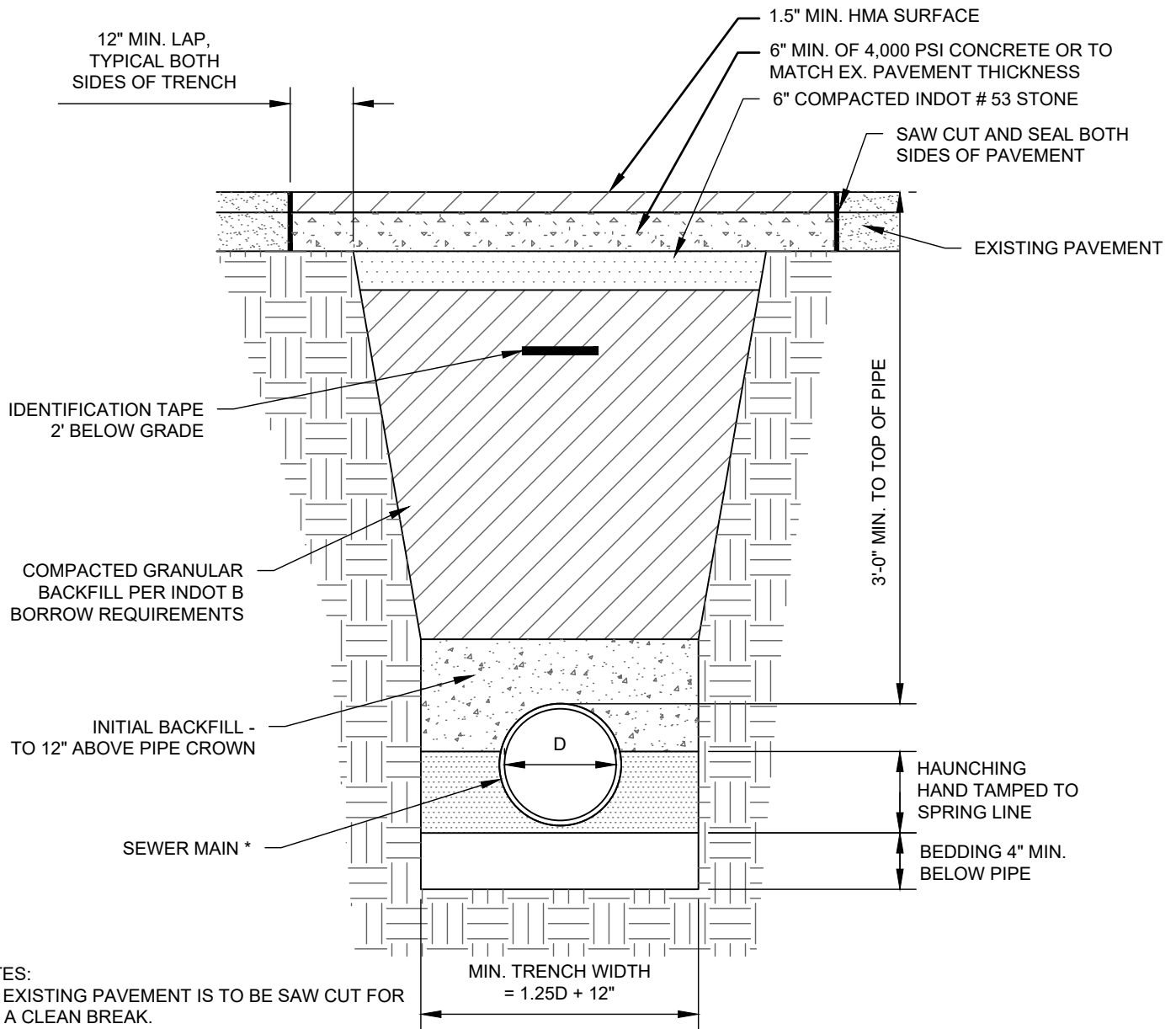


BEDDING, HAUNCHING AND INITIAL BACKFILL SHALL BE (INDOT #8 STONE OR CLASS II CLEAN SAND PER ASTM C12)

REVISIONS			
NO.	DESCRIPTION	DATE	BY

**WATERMAIN / FORCEMAIN TYPICAL TRENCH FOR D.I.  
 OR PVC C900 PIPE IN UNPAVED AREAS**  
**STANDARD DETAILS**  
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	13



**NOTES:**

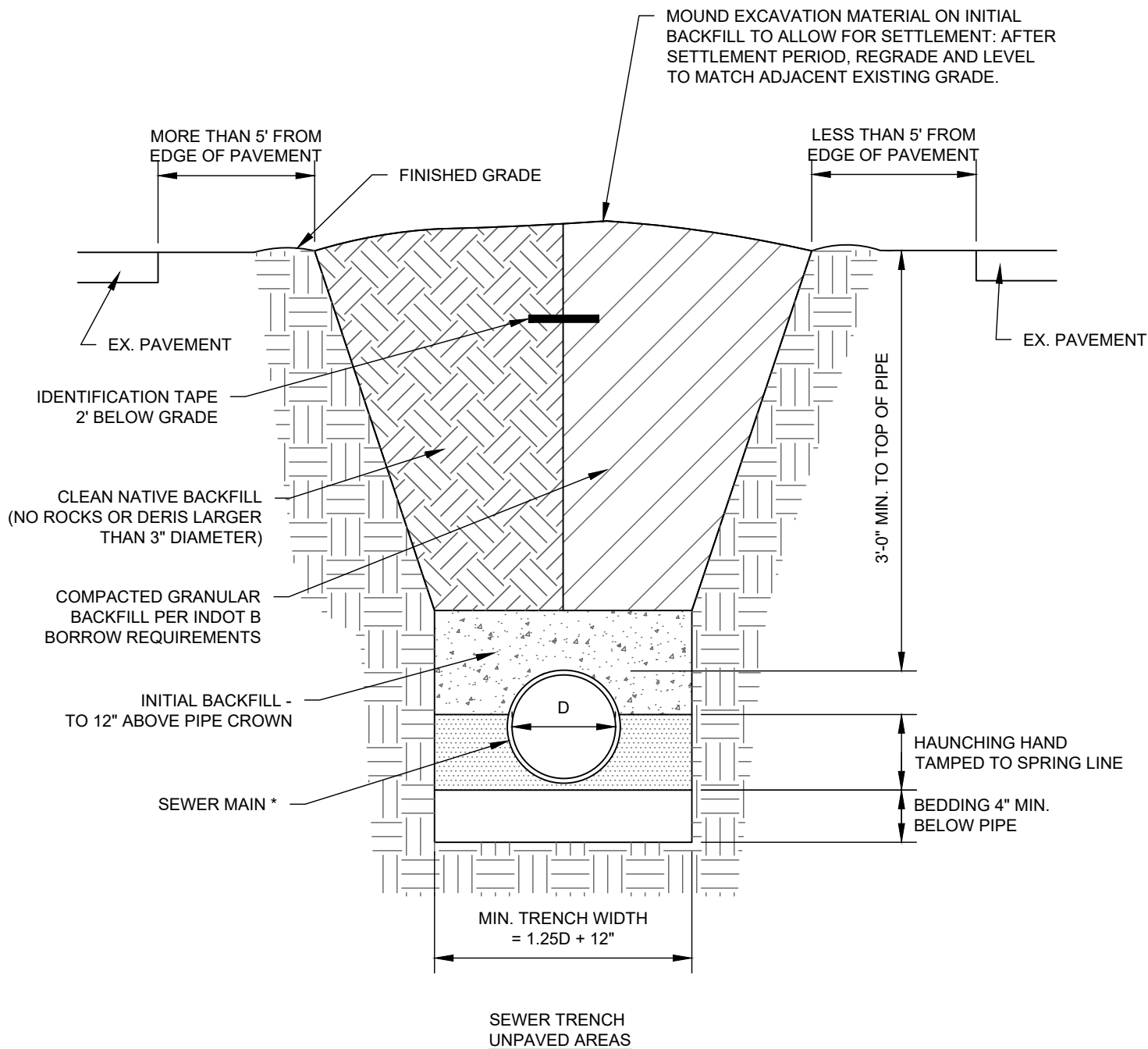
1. EXISTING PAVEMENT IS TO BE SAW CUT FOR A CLEAN BREAK.
2. TRENCH SPOIL IS TO BE REMOVED FROM THE WORK SITE
3. NEW SURFACE TO BE SLOPED AT SAME RATE AS THE EXISTING SURFACE.
4. GRANULAR FILL TO BE USED WITHIN 5' OF ALL PAVED AREAS.
5. EXISTING PAVEMENT SHALL BE BACKFILLED WITH FLOWABLE FILL.
6. OVER EXCAVATE FOR PIPE BELL.
7. FORCEMAIN TO BE INSTALLED PER THE TYPICAL TRENCH DETAILS FOR WATERMAINS

BEDDING, HAUNCHING AND INITIAL BACKFILL SHALL BE (INDOT #8 STONE OR CLASS II CLEAN SAND PER ASTM C12)

REVISIONS			
NO.	DESCRIPTION	DATE	BY

**GRAVITY SANITARY SEWER TYPICAL TRENCH IN  
PAVED AREAS**  
**STANDARD DETAILS**  
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	14



NOTE:

1. FORCEMAINS ARE TO BE INSTALLED  
PER THE TYPICAL TRENCH DETAILS FOR  
WATER MAINS
2. OVER EXCAVATE FOR PIPE BELL

BEDDING, HAUNCHING AND INITIAL BACKFILL  
SHALL BE (INDOT #8 STONE OR CLASS II CLEAN  
SAND PER ASTM C12)

REVISIONS			
NO.	DESCRIPTION	DATE	BY

GRAVITY SANITARY TYPICAL SEWER TRENCH IN  
UNPAVED AREAS  
STANDARD DETAILS  
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	15

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 4" DI PIPE W/ POLY WRAP						
TYPE OF BEND	4" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	56	20	10	10	10	65
VERT. BEND			27 UPPER	13 UPPER	10 UPPER	
			10 LOWER	10 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 12" DI PIPE W/ POLY WRAP										
TYPE OF BEND	4" TEE	6" TEE	8" TEE	10" TEE	12" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	39	74	106	133	160	53	22	11	10	169
VERT. BEND							70 UPPER	34 UPPER	17 UPPER	
							19 LOWER	10 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 6" DI PIPE W/ POLY WRAP							
TYPE OF BEND	4" TEE	6" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	52	82	29	12	10	10	91
VERT. BEND				38 UPPER	19 UPPER	10 UPPER	
				10 LOWER	10 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 16" DI PIPE W/ POLY WRAP											
TYPE OF BEND	4" TEE	6" TEE	8" TEE	10" TEE	12" TEE	16" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	30	68	102	129	157	209	68	28	14	10	218
VERT. BEND								90 UPPER	44 UPPER	22 UPPER	
								25 LOWER	12 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 8" DI PIPE W/ POLY WRAP								
TYPE OF BEND	4" TEE	6" TEE	8" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	48	80	11	37	16	10	10	120
VERT. BEND					50 UPPER	24 UPPER	12 UPPER	
					14 LOWER	10 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 20" DI PIPE W/ POLY WRAP											
TYPE OF BEND	6" TEE	8" TEE	10" TEE	12" TEE	16" TEE	20" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	61	97	125	154	206	256	82	34	17	10	265
VERT. BEND								110 UPPER	53 UPPER	27 UPPER	
								30 LOWER	15 LOWER	10 LOWER	

1. CONTRACTOR SHALL INSTALL RJDI FITTINGS FOR ALL VERTICAL AND HORIZONTAL BENDS.
2. RESTRAINED LENGTHS WERE CALCULATED USING EBAA IRON'S RESTRAINT LENGTH CALCULATOR (V7.1.2), ASSUMING 48" DEPTH OF BURY, A 2.0 FACTOR OF SAFETY, TYPE 3 TRENCH CONDITIONS, "CL" SOIL CLASSIFICATION, POLYWRAPPED, AND 150 PSI HYDROSTATIC TEST PRESSURES. DESIGNER AND CONTRACTOR SHALL VERIFY INSTALLATION CONDITIONS AND MODIFY RESTRAINT LENGTHS AS REQUIRED TO MEET ACTUAL CONDITIONS SUBJECT TO REVIEW BY NASHVILLE MUNICIPAL UTILITY.
3. ALL WATER MAIN APPURTENANCES AND JOINTS WITHIN RJDI LIMITS MUST BE RESTRAINED AT EACH JOINT.
4. AT A MINIMUM, THE NEXT JOINT EITHER WAY FROM A FITTING SHALL BE RESTRAINED.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

DUCTILE IRON PIPE RESTRAINED JOINT TABLES

STANDARD DETAILS

NASHVILLE MUNICIPAL UTILITY

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	16



LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 4" PVC						
TYPE OF BEND	4" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	31	19	10	10	10	36
VERT. BEND			22 UPPER	11 UPPER	10 UPPER	
			13 LOWER	10 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 12" PVC										
TYPE OF BEND	4" TEE	6" TEE	8" TEE	10" TEE	12" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	22	41	60	76	92	50	21	10	10	97
VERT. BEND							58 UPPER	28 UPPER	14 UPPER	
							33 LOWER	16 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 6" PVC							
TYPE OF BEND	4" TEE	6" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	29	46	27	11	10	10	51
VERT. BEND				31 UPPER	15 UPPER	10 UPPER	
				18 LOWER	10 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 16" PVC												
TYPE OF BEND	4" TEE	6" TEE	8" TEE	10" TEE	12" TEE	16" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS	
HORIZ. BEND	17	38	57	73	90	122	64	27	13	10	127	
VERT. BEND								75 UPPER	36 UPPER	18 UPPER		
								42 LOWER	21 LOWER	10 LOWER		

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 8" PVC								
TYPE OF BEND	4" TEE	6" TEE	8" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS
HORIZ. BEND	27	45	63	35	15	10	10	68
VERT. BEND					41 UPPER	20 UPPER	10 UPPER	
					24 LOWER	12 LOWER	10 LOWER	

LENGTH IN FT. TO BE REST. ON EACH SIDE OF FITTING FOR 20" PVC												
TYPE OF BEND	6" TEE	8" TEE	10" TEE	12" TEE	16" TEE	20" TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	DEADENDS	
HORIZ. BEND	34	55	71	88	120	151	78	33	16	10	156	
VERT. BEND								92 UPPER	45 UPPER	22 UPPER		
								51 LOWER	25 LOWER	13 LOWER		

1. CONTRACTOR SHALL INSTALL RJDI FITTINGS FOR ALL VERTICAL AND HORIZONTAL BENDS.
2. RESTRAINED LENGTHS WERE CALCULATED USING EBAA IRON'S RESTRAINT LENGTH CALCULATOR (V7.1.3), ASSUMING 48" DEPTH OF BURY, A 2.0 FACTOR OF SAFETY, TYPE 3 TRENCH CONDITIONS, "CL" SOIL CLASSIFICATION, AND 150 PSI HYDROSTATIC TEST PRESSURES. DESIGNER AND CONTRACTOR SHALL VERIFY INSTALLATION CONDITIONS AND MODIFY RESTRAINT LENGTHS AS REQUIRED TO MEET ACTUAL CONDITIONS SUBJECT TO REVIEW BY NASHVILLE MUNICIPAL UTILITY.
3. ALL WATER MAIN APPURTENANCES AND JOINTS WITHIN RJDI LIMITS MUST BE RESTRAINED AT EACH JOINT.
4. AT A MINIMUM, THE NEXT JOINT EITHER WAY FROM A FITTING SHALL BE RESTRAINED.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

PVC PIPE RESTRAINED JOINT TABLES

STANDARD DETAILS

NASHVILLE MUNICIPAL UTILITY

DATE:

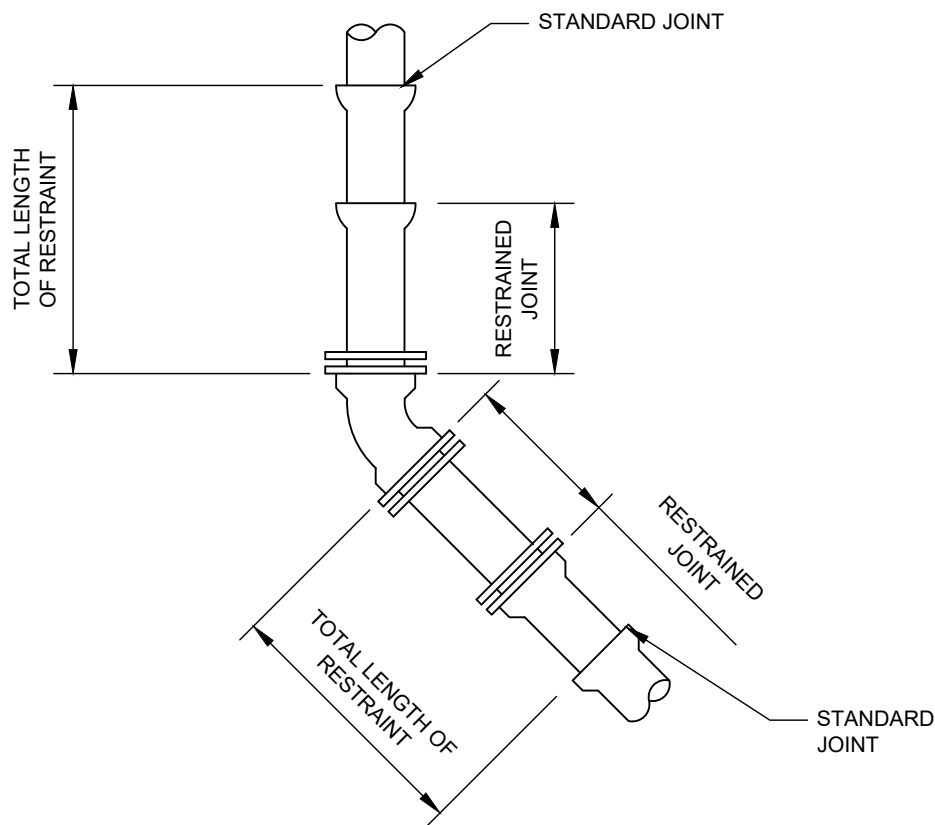
03/13/24

SCALE:

NTS

SHEET NO.

17



NOTE:  
SEE CONSTRUCTION STD. FOR "LENGTH AND METHOD OF  
RESTRAINT"

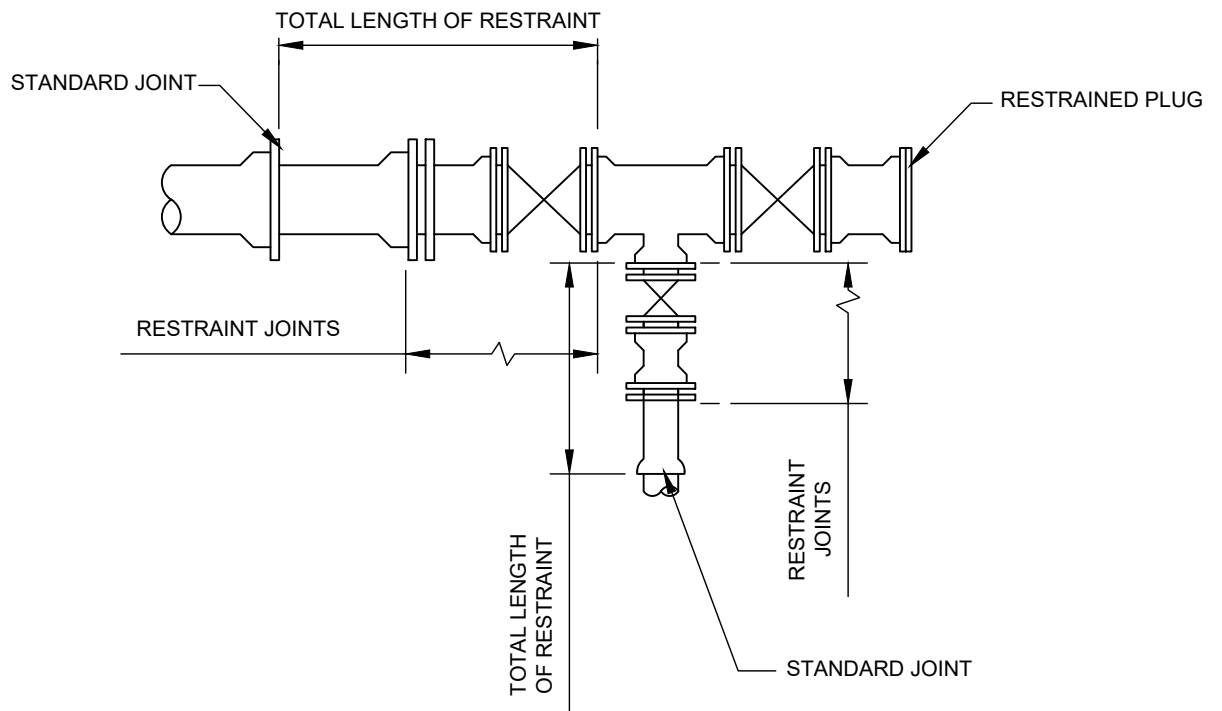
REVISIONS			
NO.	DESCRIPTION	DATE	BY

RESTRAINT OF BENDS

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	19



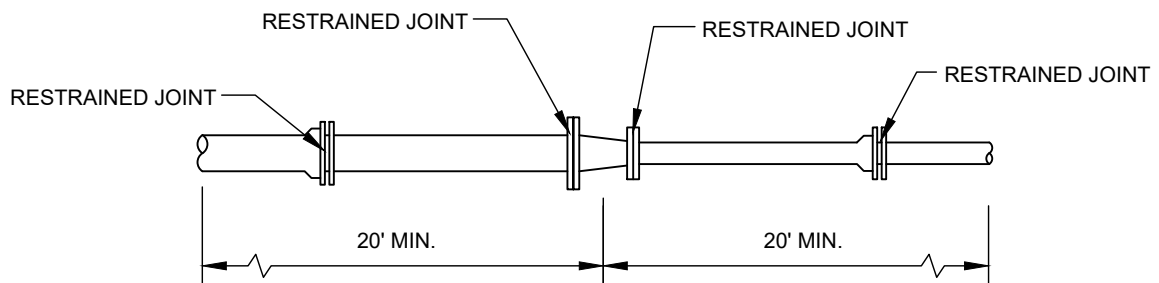
NOTE:

1. LENGTH OF RESTRAINT SAME AS FOR 90° BENDS & DEAD ENDS.  
SEE CONSTR. STD. "LENGTH AND METHOD OF RESTRAINT"
2. MIN. FIRST JOINT FROM TEE ALONG RUN SHALL BE RESTRAINED.

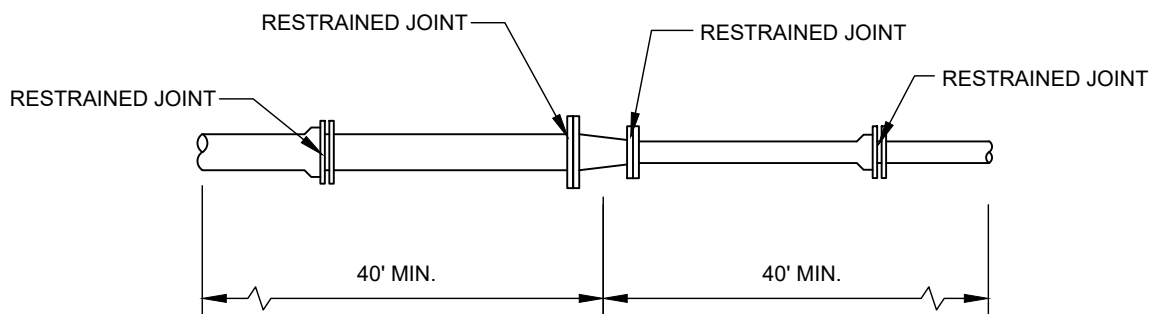
REVISIONS			
NO.	DESCRIPTION	DATE	BY

**RESTRAINT OF TEES**  
**STANDARD DETAILS**  
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	18



REDUCERS, LARGER PIPE DIAMETER IS 8" OR SMALLER



REDUCERS, LARGER PIPE DIAMETER IS 12" OR LARGER

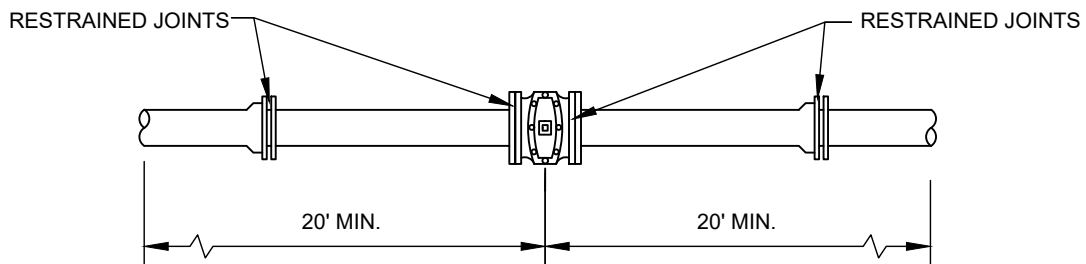
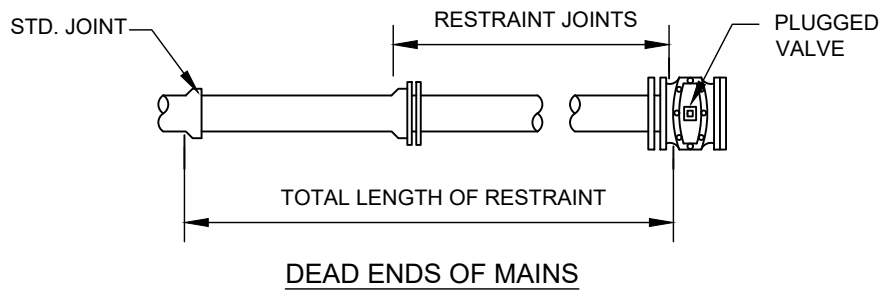
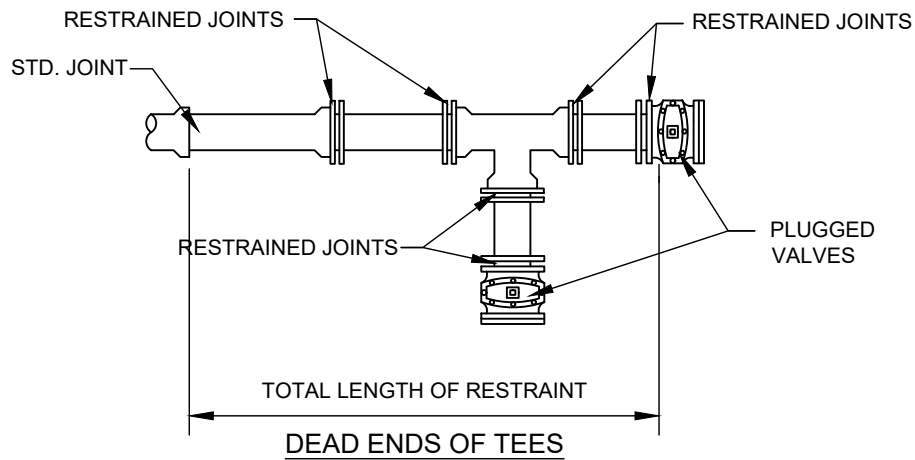
REVISIONS			
NO.	DESCRIPTION	DATE	BY

RESTRAINT OF REDUCERS

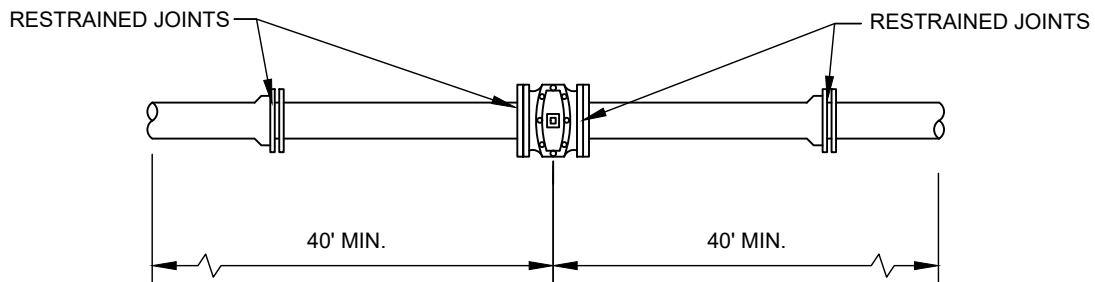
STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	20



VALVES (NON-DEAD END) 8" AND SMALLER



VALVES (NON-DEAD END) 12" AND LARGER

REVISIONS			
NO.	DESCRIPTION	DATE	BY

RESTRAINING OF VALVES

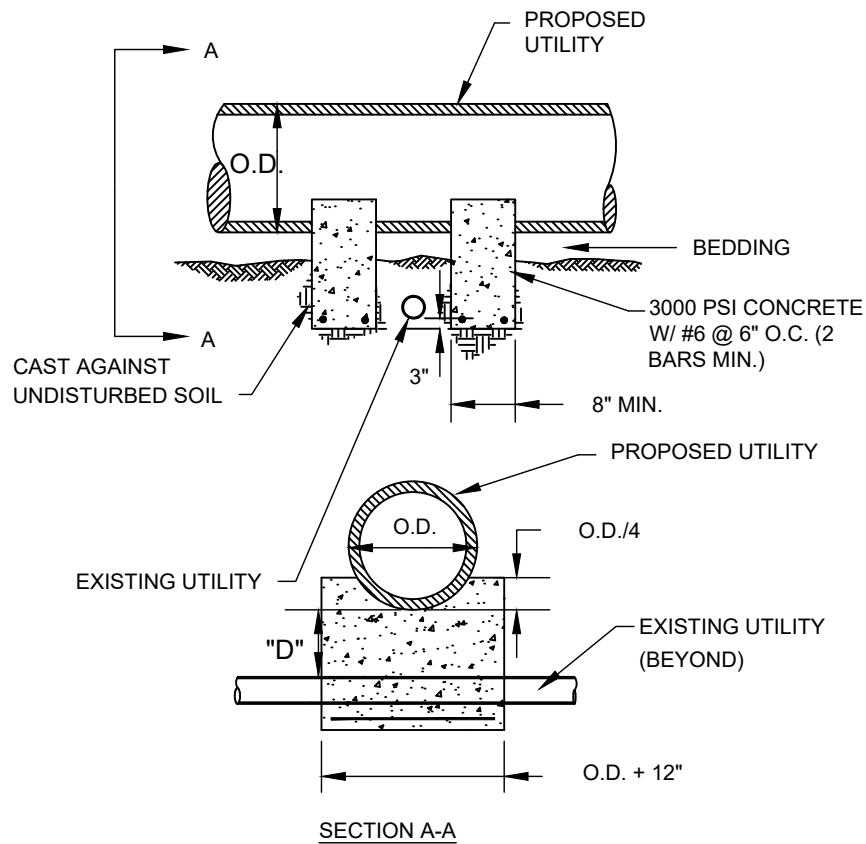
STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

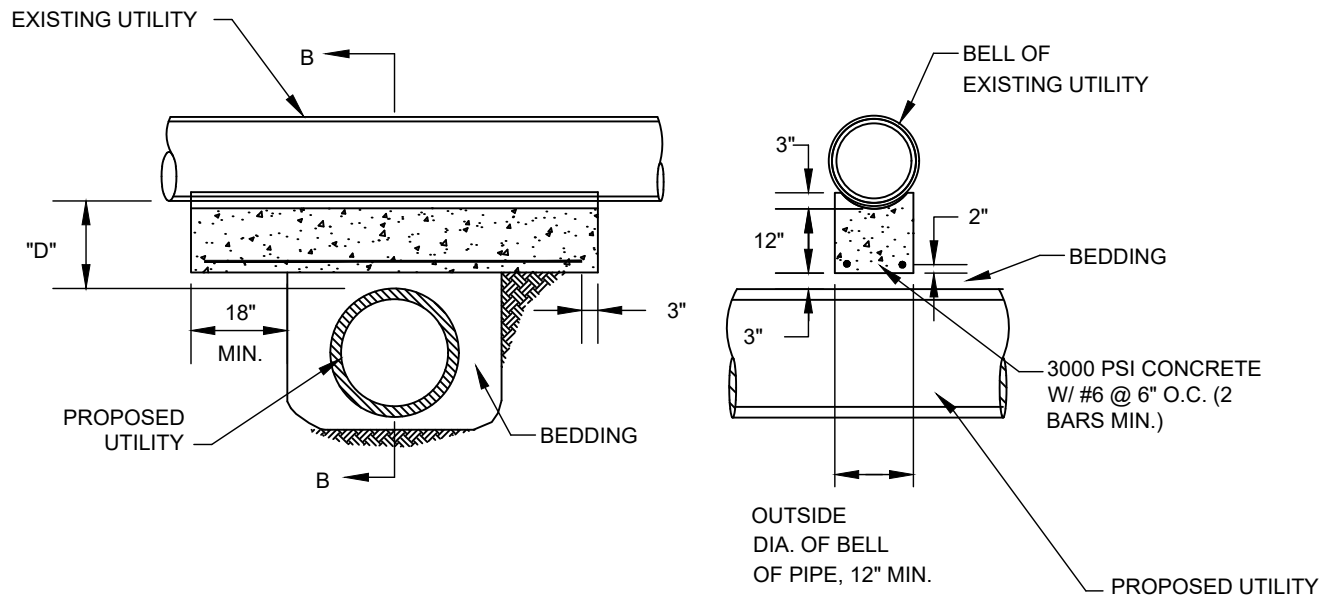
DATE: 03/13/24

SCALE: NTS

SHEET NO. 21



**PROPOSED UTILITY CROSSING ABOVE EXISTING UTILITY**



**PROPOSED UTILITY CROSSING BELOW EXISTING UTILITY**

**NOTES:**

1. PROVIDE UTILITY SUPPORT WHEN "D" IS LESS THAN 18 INCHES.
2. EXISTING UTILITIES SHALL MEAN: STEEL GAS MAINS, ELECTRIC/TELEPHONE CONDUITS, FIBER OPTIC BANKS, SANITARY SEWER PIPING, STORM SEWER PIPING, WATER MAIN PIPING, ETC.

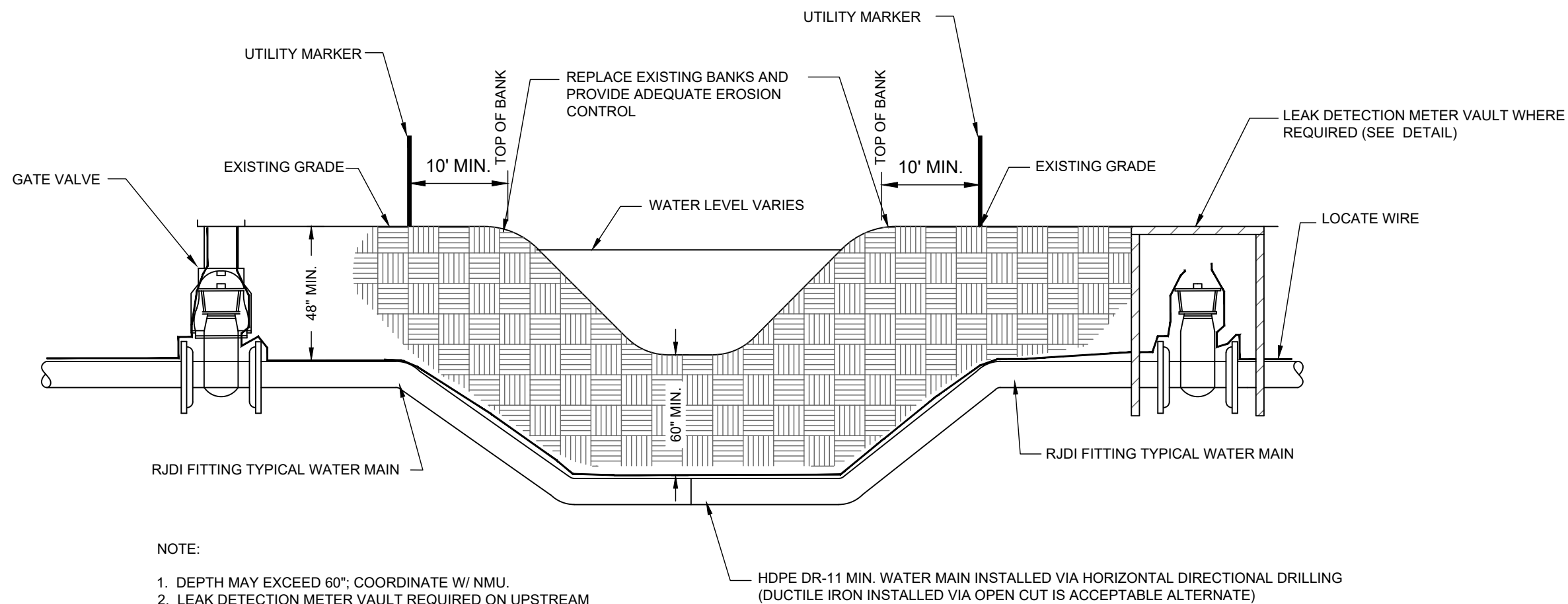
REVISIONS			
NO.	DESCRIPTION	DATE	BY

UTILITY CROSSING SUPPORT DETAIL  
STANDARD DETAILS  
**NASHVILLE MUNICIPAL UTILITY**

DATE: 03/13/24

SCALE: NTS

SHEET NO.



NOTE:

1. DEPTH MAY EXCEED 60"; COORDINATE W/ NMU.
2. LEAK DETECTION METER VAULT REQUIRED ON UPSTREAM SIDE FOR ALL CREEK CROSSINGS GREATER THAN 15' IN WIDTH (SEE DETAIL).
3. DEVELOPER / CONTRACTOR SHALL OBTAIN ALL APPLICABLE PERMITS IF PIPE IS TO BE INSTALLED BY OPEN CUT.

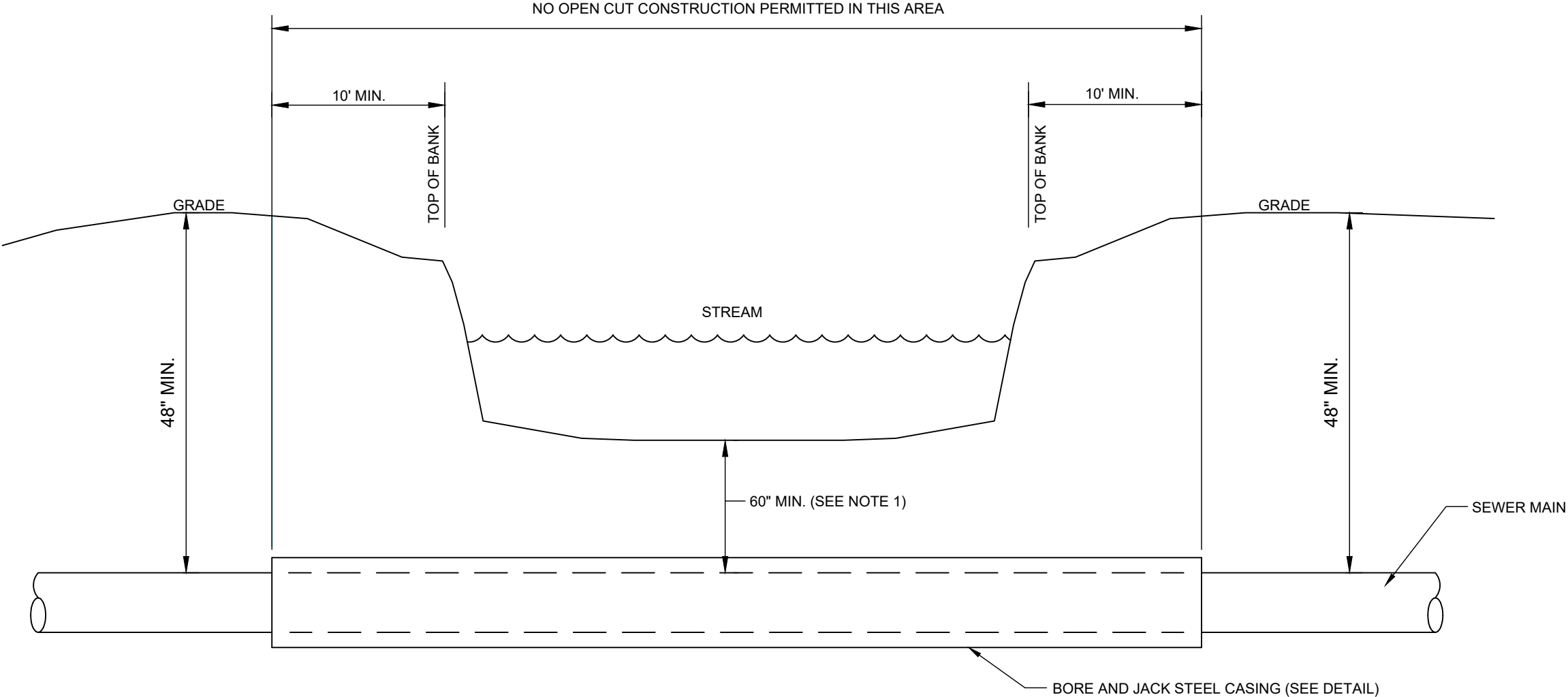
REVISIONS			
NO.	DESCRIPTION	DATE	BY

WATER MAIN TYPICAL STREAM CROSSING

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	23



NOTE:  
1: DEPTH MAY EXCEED 60"; COORDINATE W/ NMU.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

GRAVITY SEWER TYPICAL STREAM CROSSING

STANDARD DETAILS

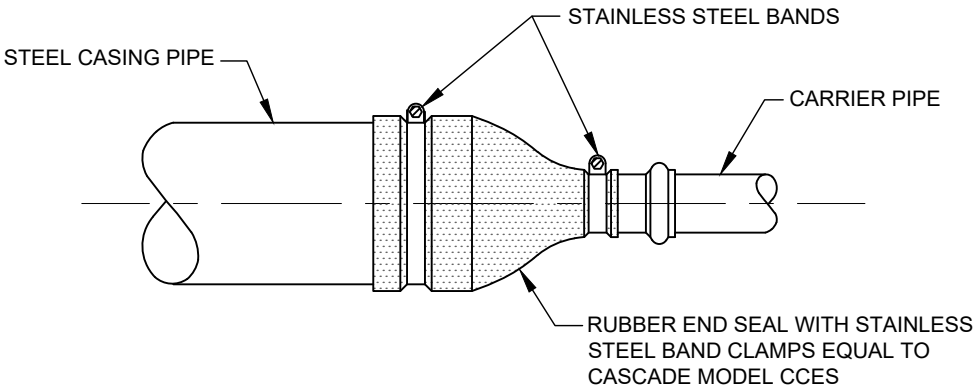
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	24



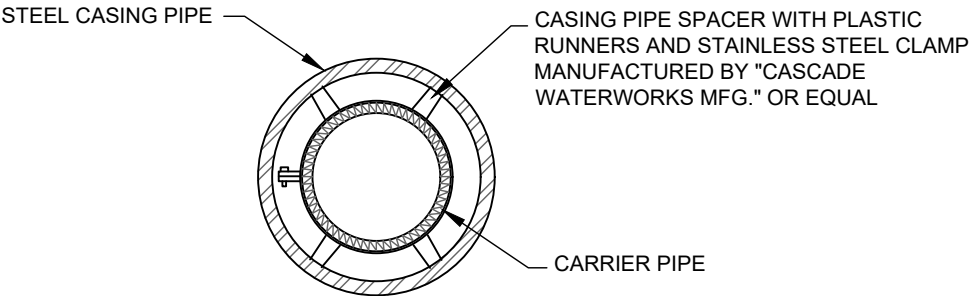
NOTES

- 1. CASING SHALL BE WELDED STEEL PIPE; MATERIAL IN ACCORDANCE WITH ASTM A-139; MINIMUM YIELD STRENGTH = 35,000 PSI.
- 2. CASING SPACERS REQUIRED. MAXIMUM 10'-0" SPACING FOR DUCTILE IRON CARRIER PIPES. MAXIMUM SPACING FOR PVC CARRIES PIPES SHALL BE 6'-0". FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR PLACEMENT AND SPACING.
- 3. THE INSIDE DIAMETER OF THE CASING SHALL BE A MINIMUM OF SIX (6) INCHES LARGER THAN THE LARGEST DIAMETER OF THE CARRIER PIPE JOINT.
- 4. THE ABOVE GIVEN CASING SIZES DO NOT APPLY TO RAILROAD CROSSINGS. CONTACT SPECIFIC RAILROAD FOR REQUIREMENTS.



CASING END SEAL DETAIL

TABLE OF STEEL CASING SIZES		
CASING DIAMETER IN INCHES	WALL THICKNESS (WITH PROTECTIVE COATING) IN INCHES	WALL THICKNESS (WITHOUT PROTECTIVE COATING) IN INCHES
12"	0.188"	0.250"
16"	0.219"	0.281"
18"	0.250"	0.312"
20"	0.281"	0.344"
24"	0.312"	0.375"
30"	0.406"	0.469"
36"	0.469"	0.532"



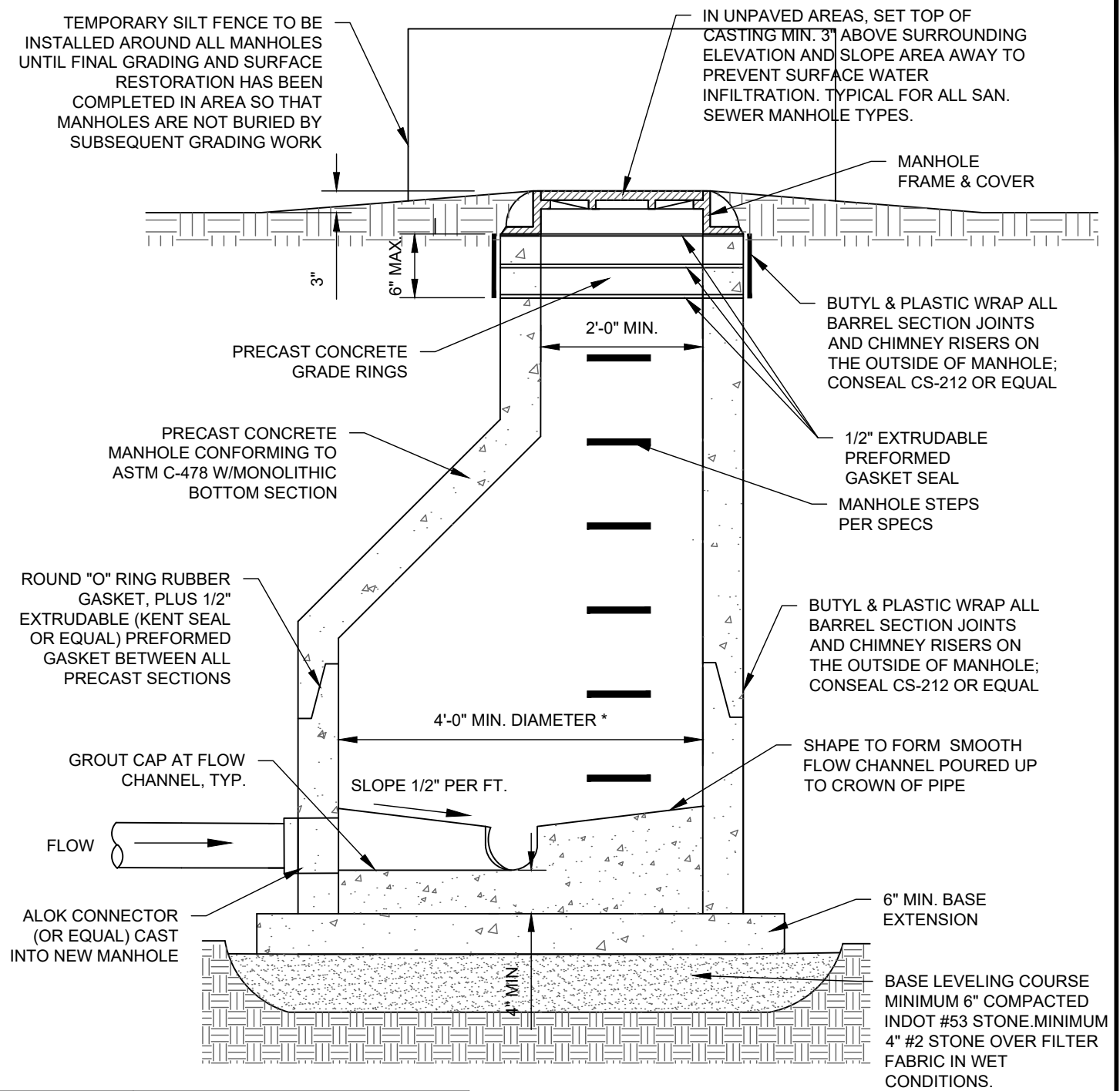
NOTE: CONFIGURE CASING SPACERS PER MFGR. RECOMMENDATIONS FOR GRAVITY CARRIER PIPES TO CORRECT FOR GRADE.

CENTERING CARRIER PIPE WITH CASING SPACER (PRESSURE PIPES)

REVISIONS			
NO.	DESCRIPTION	DATE	BY

STEEL CASING  
STANDARD DETAILS  
NASHVILLE MUNICIPAL UTILITY

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	25



PIPE SIZE (INCHES)	MINIMUM MANHOLE DIAMETER (INCHES)	
	PIPES ENTERING OR LEAVING AT UP TO 45° ANGLE	PIPES ENTERING OR LEAVING AT 46°-90° ANGLE
18 OR LESS	48	48
LARGER THAN 18"	TO BE REVIEWED BY NMU	TO BE REVIEWED BY NMU

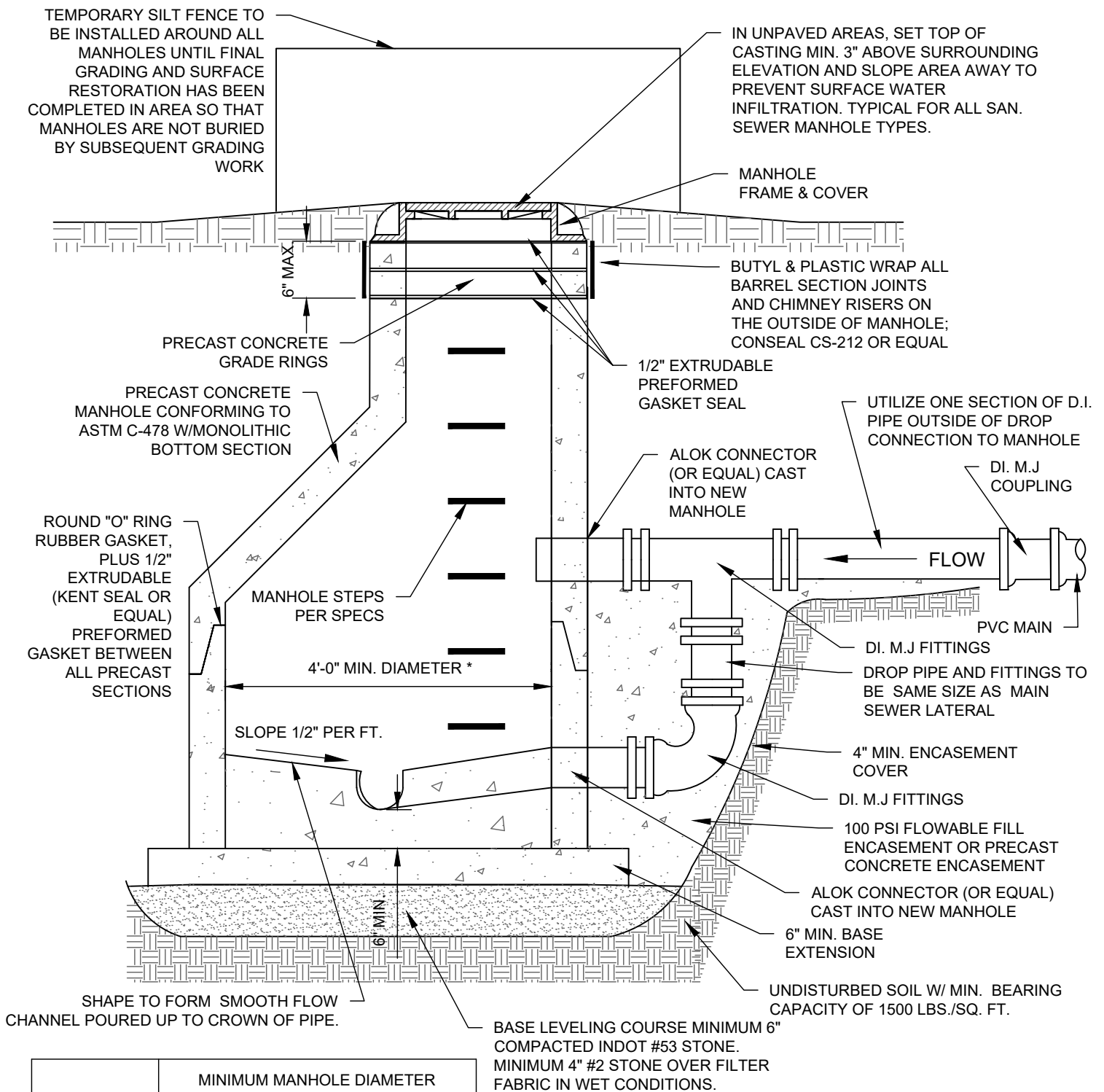
- NOTES:
1. LIFT HOLES SHALL BE PLUGGED AFTER SETTING MANHOLE.
  2. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MIN. OF 6".
  3. MANHOLES SHALL BE VACUUM TESTED IN ACCORDANCE WITH ASTM C1244.

MIN. PIPE INVERT DROP THROUGH MANHOLE	
THROUGH DEFLECTION	MIN. DROP (FT.)
0-45	0.10
45-90	0.20

REVISIONS			
NO.	DESCRIPTION	DATE	BY

**TYPE "A" STANDARD PRECAST MANHOLE**  
**STANDARD DETAILS**  
**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	26



PIPE SIZE (INCHES)	MINIMUM MANHOLE DIAMETER (INCHES)	
	PIPES ENTERING OR LEAVING AT UP TO 45° ANGLE	PIPES ENTERING OR LEAVING AT 46°-90° ANGLE
18 OR LESS	48	48
LARGER THAN 18"	TO BE REVIEWED BY NMU	TO BE REVIEWED BY NMU

#### NOTES:

1. LIFT HOLES SHALL BE PLUGGED AFTER SETTING MANHOLE.
2. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MIN. OF 6".
3. MANHOLES SHALL BE VACUUM TESTED IN ACCORDANCE WITH ASTM C1244.

MIN. PIPE INVERT DROP THROUGH MANHOLE	
THROUGH DEFLECTION	MIN. DROP (FT.)
0-45	0.10
45-90	0.20

REVISIONS			
NO.	DESCRIPTION	DATE	BY

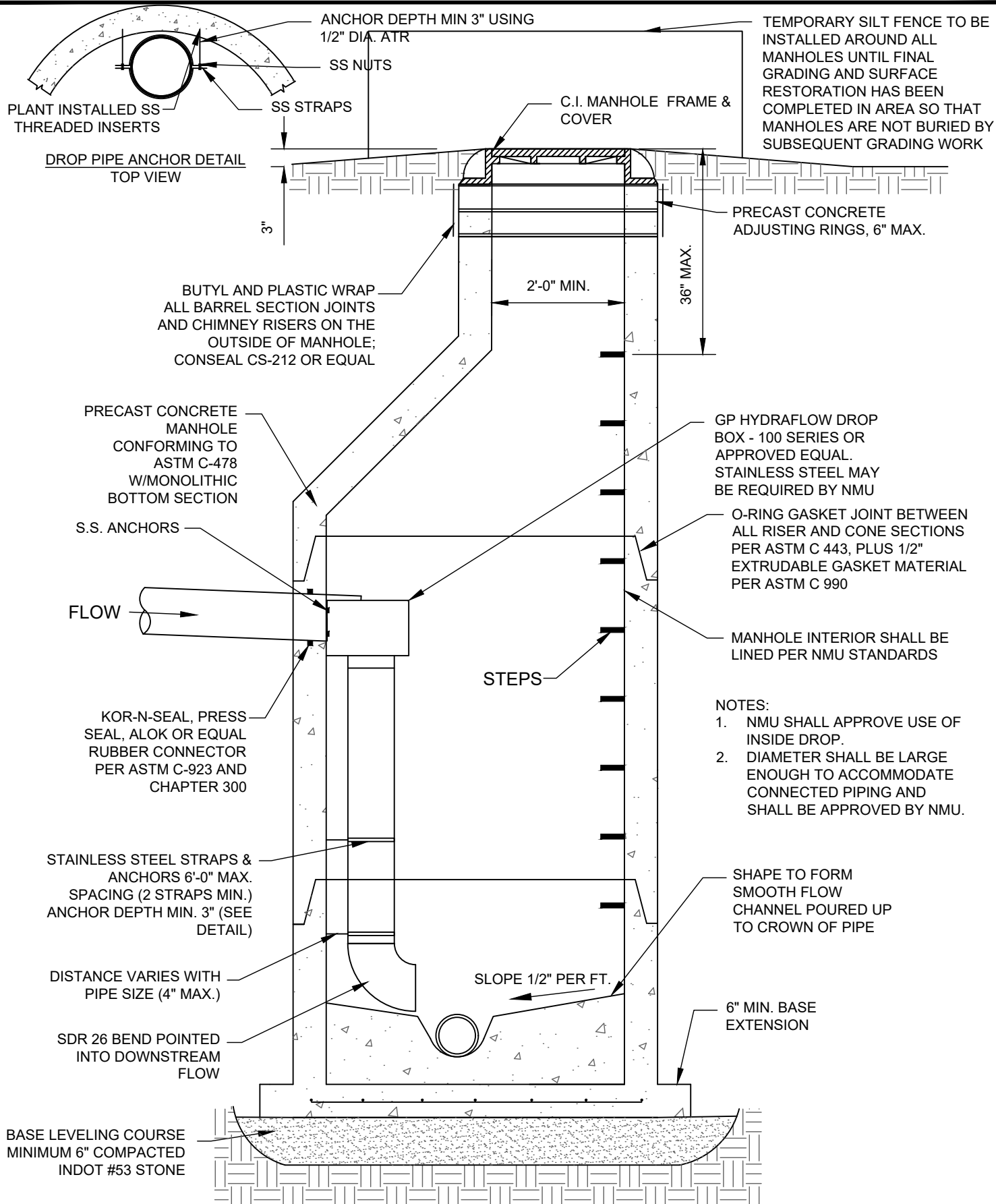
## TYPE "B" OUTSIDE DROP MANHOLE CONNECTION

## STANDARD DETAILS NASHVILLE MUNICIPAL UTILITY

DATE:  
03/13/24

SCALE:  
NTS

SHEET NO.



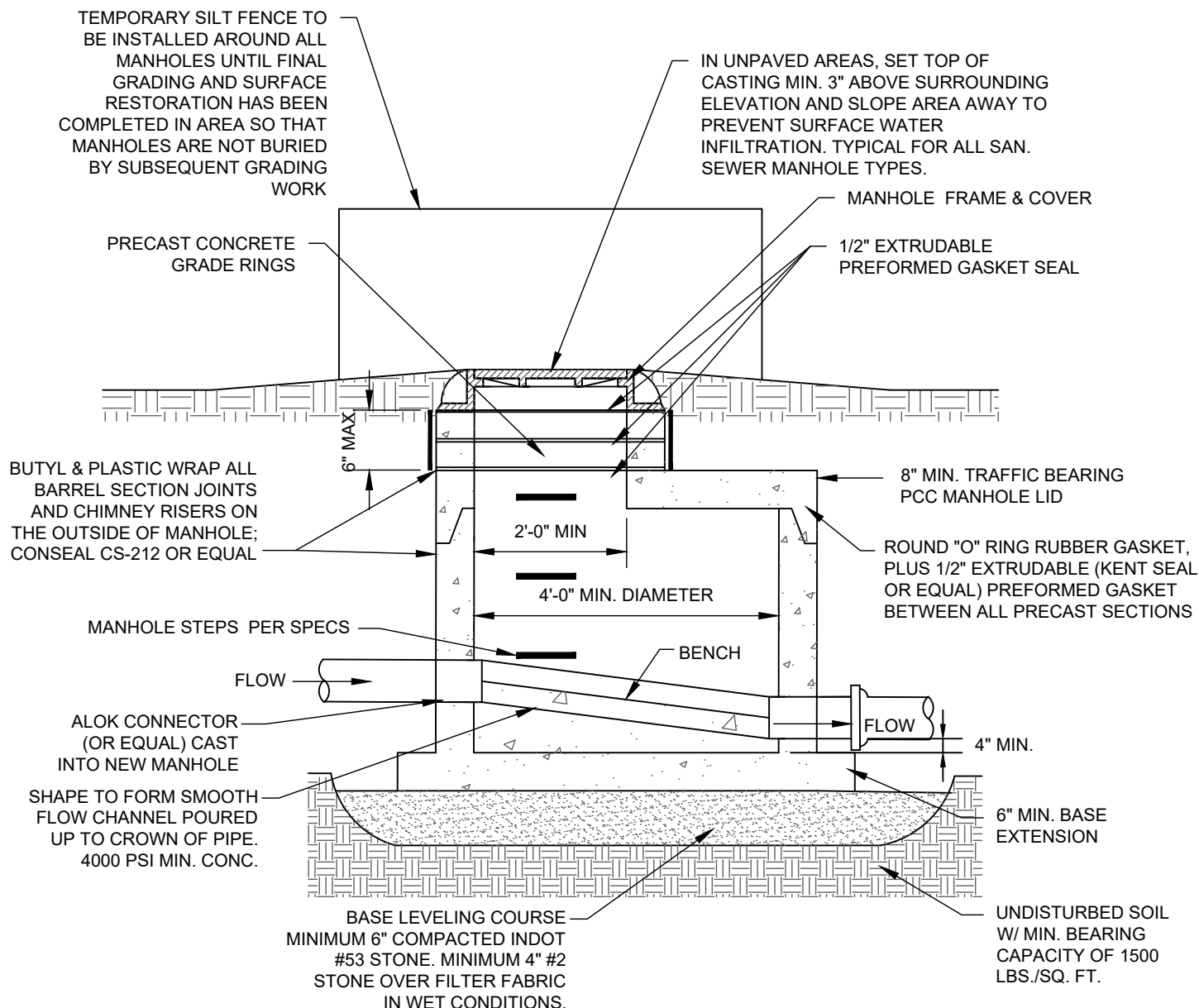
REVISIONS			
NO.	DESCRIPTION	DATE	BY

TYPE "B" INSIDE DROP MANHOLE CONNECTION

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	28



PIPE SIZE (INCHES)	MINIMUM MANHOLE DIAMETER (INCHES)	
	PIPES ENTERING OR LEAVING AT UP TO 45° ANGLE	PIPES ENTERING OR LEAVING AT 46°-90° ANGLE
18 OR LESS	48	48
LARGER THAN 18"	TO BE REVIEWED BY NMU	TO BE REVIEWED BY NMU

#### NOTES:

1. LIFT HOLES SHALL BE PLUGGED AFTER SETTING MANHOLE.
2. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MIN. OF 6".
3. MANHOLES SHALL BE VACUUM TESTED IN ACCORDANCE WITH ASTM C1244.

MIN. PIPE INVERT DROP THROUGH MANHOLE	
THROUGH DEFLECTION	MIN. DROP (FT.)
0-45	0.10
45-90	0.20

REVISIONS			
NO.	DESCRIPTION	DATE	BY

TYPE "C" SHALLOW MANHOLE - 5' OR LESS

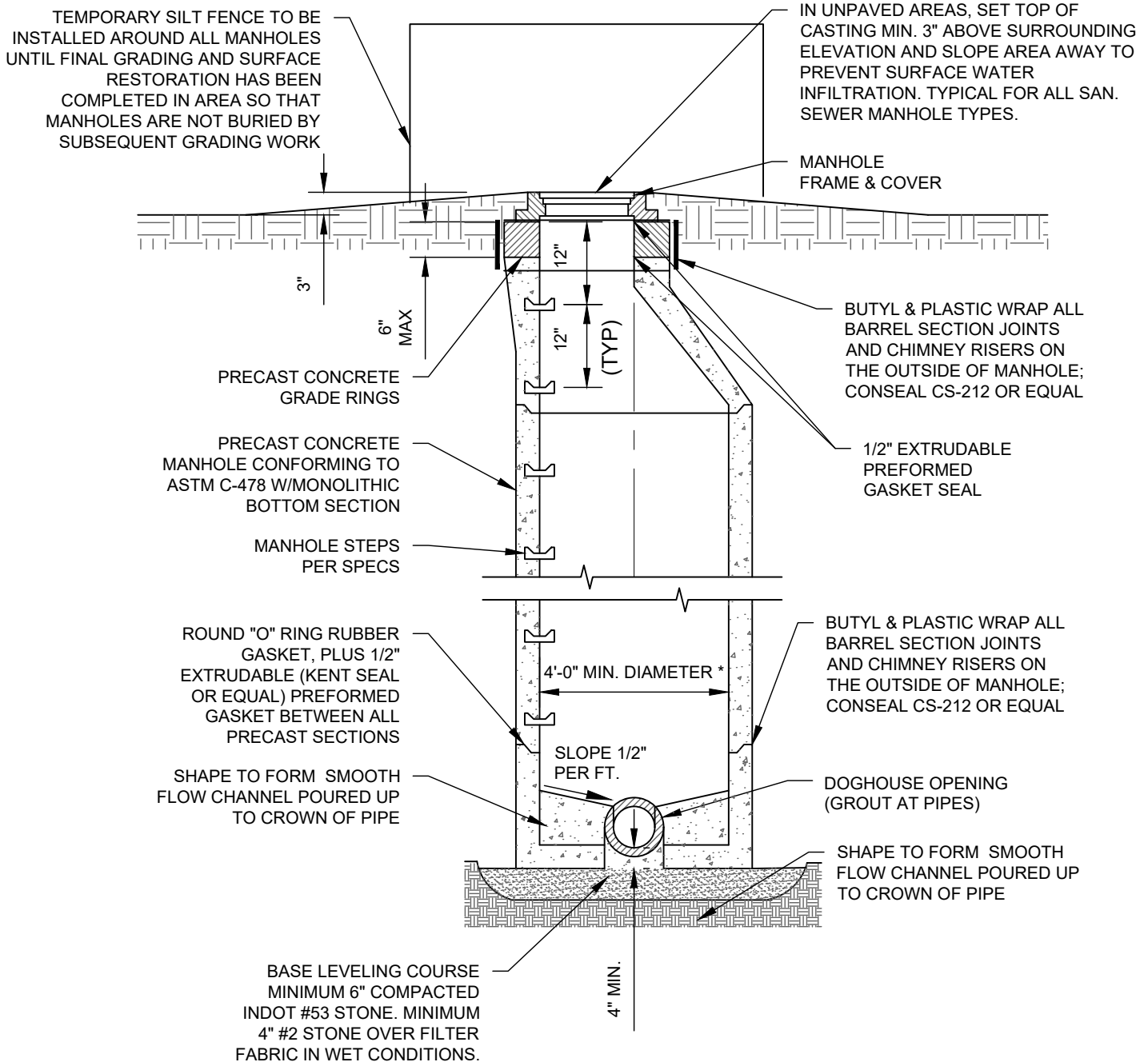
STANDARD DETAILS  
**NASHVILLE MUNICIPAL UTILITY**

DATE:  
03/13/24

SCALE:  
NTS

SHEET NO.

29



PIPE SIZE (INCHES)	MINIMUM MANHOLE DIAMETER (INCHES)	
	PIPES ENTERING OR LEAVING AT UP TO 45° ANGLE	PIPES ENTERING OR LEAVING AT 46°-90° ANGLE
18 OR LESS	48	48
LARGER THAN 18"	TO BE REVIEWED BY NMU	TO BE REVIEWED BY NMU

- NOTES:
1. LIFT HOLES SHALL BE PLUGGED AFTER SETTING MANHOLE.
  2. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MIN. OF 6".
  3. MANHOLES SHALL BE VACUUM TESTED IN ACCORDANCE WITH ASTM C1244.

MIN. PIPE INVERT DROP THROUGH MANHOLE	
THROUGH DEFLECTION	MIN. DROP (FT.)
0-45	0.10
45-90	0.20

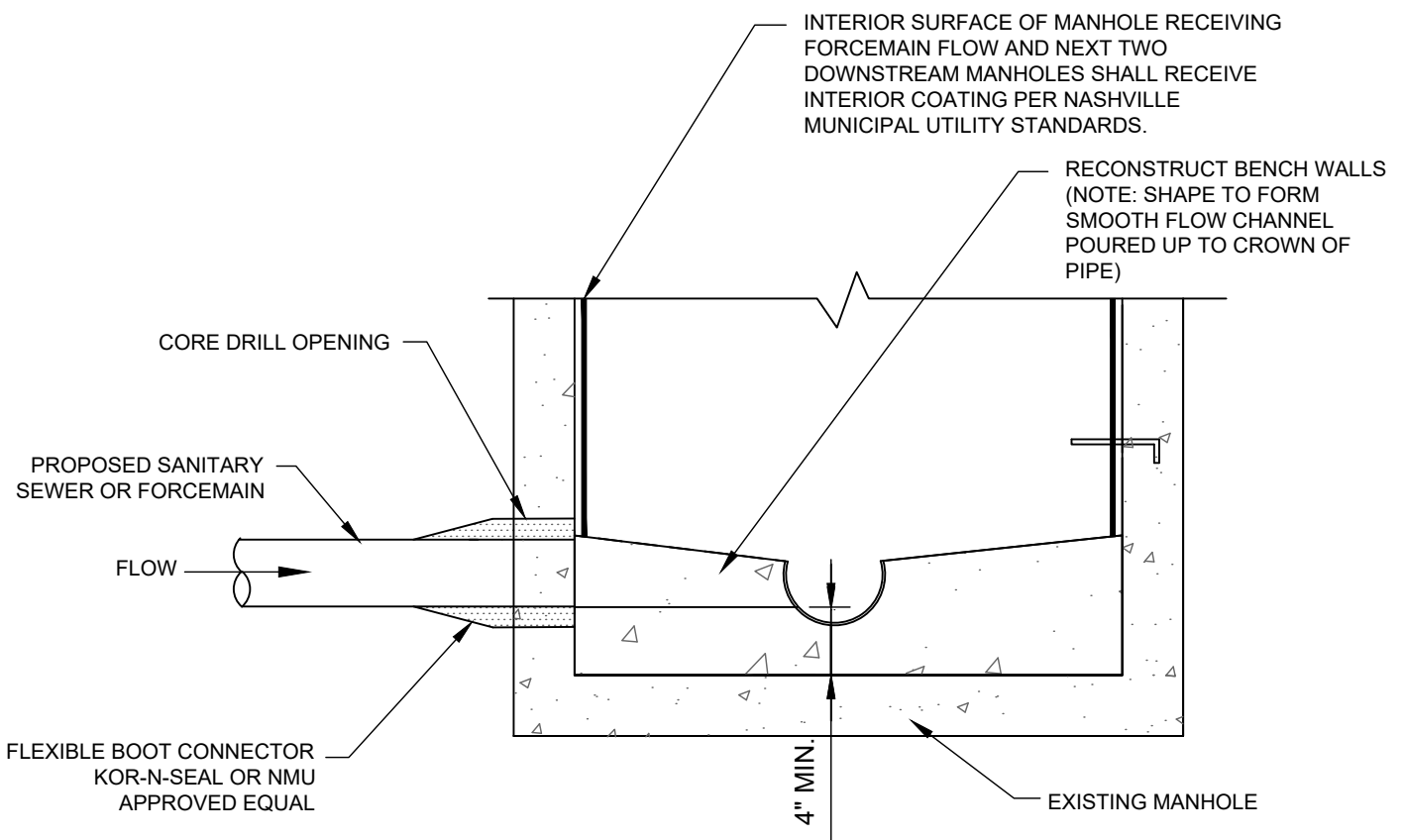
REVISIONS			
NO.	DESCRIPTION	DATE	BY

TYPE "D" STANDARD PRECAST DOGHOUSE MANHOLE

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	30



# REVISIONS

NO.	DESCRIPTION	DATE	BY

## EXISTING MANHOLE CONNECTION

### STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

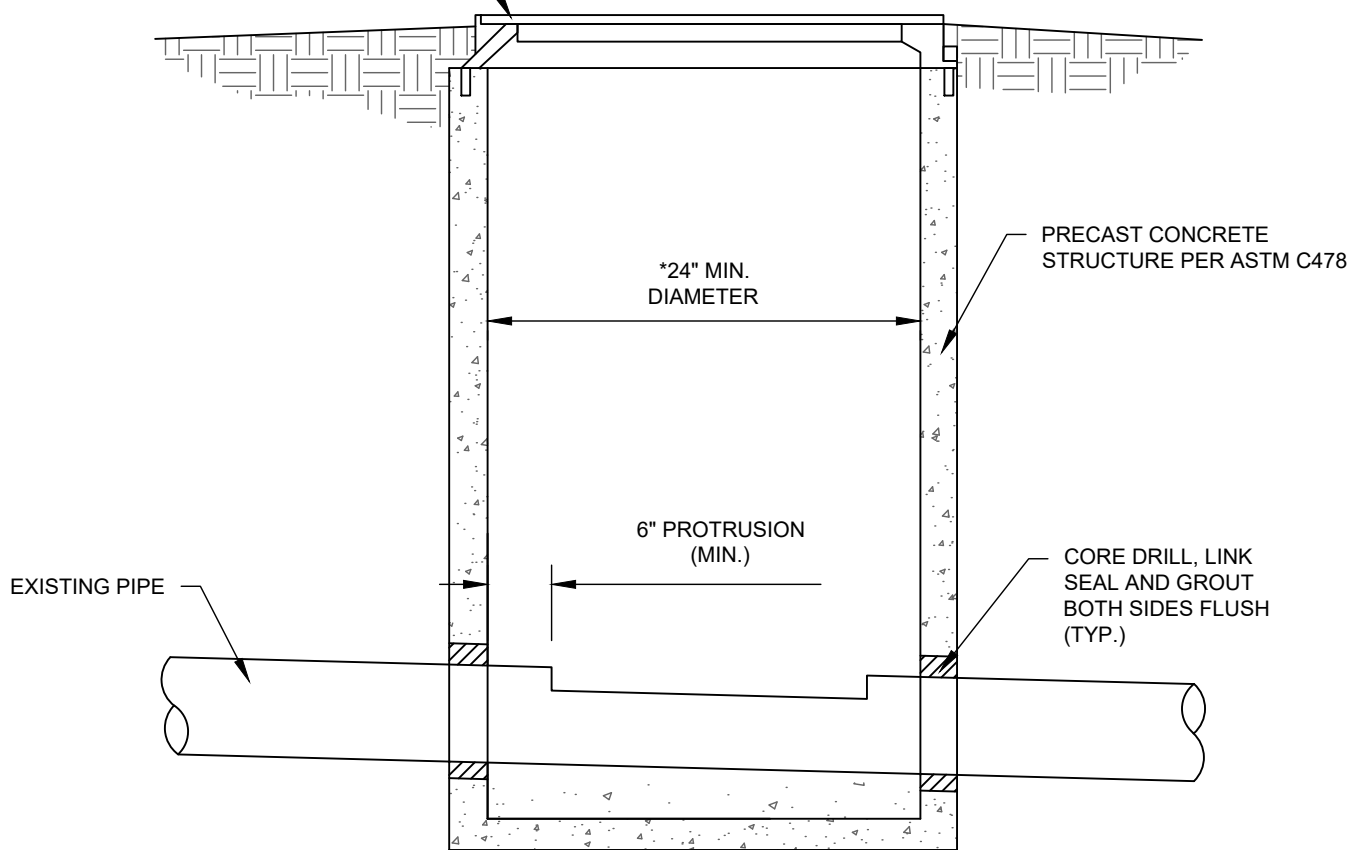
DATE: 03/13/24

SCALE: NTS

SHEET NO.

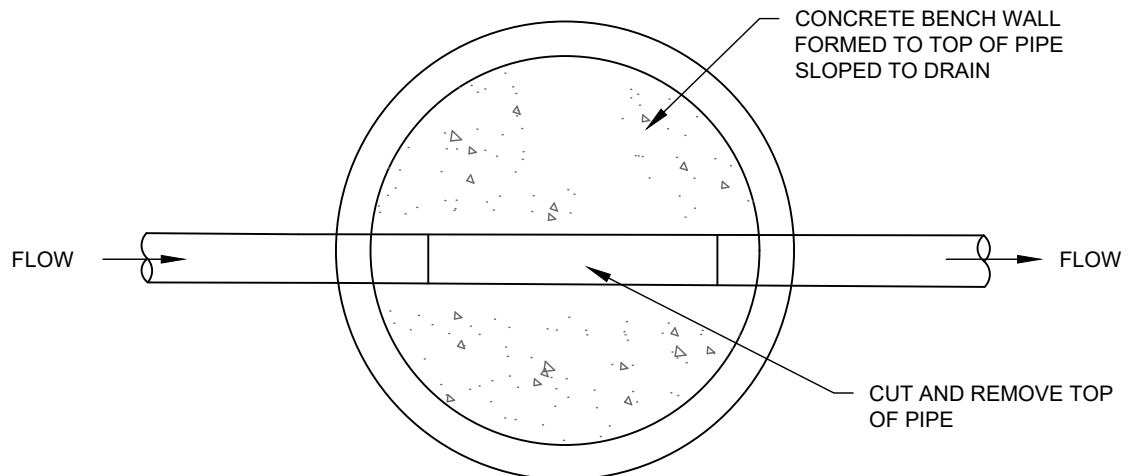
**31**

STANDARD MANHOLE CASTING  
SET RIM 3" ABOVE GRADE AND  
SLOPE SURROUNDING AREA  
TO DRAIN AWAY FROM CASTING  
IN UNPAVED AREAS. SET FLUSH TO  
PAVEMENT IN PAVED AREAS.



**\*NOTES:**

1. WHERE DEPTH OF STRUCTURES EXCEEDS 4'-0", A 4FT. DIAMETER MANHOLE SHALL BE PROVIDED, THE PIPING CONFIGURATION SHALL BE THE SAME. MANHOLE STEPS SHALL BE INCLUDED.
2. SAMPLE MANHOLE STRUCTURES ARE PROPERTY OF THE OWNER AND WILL NOT BE MAINTAINED BY NMU.
3. SAMPLE MANHOLE SHALL BE VAC TESTED PER NMU STANDARDS.



**REVISIONS**

NO.	DESCRIPTION	DATE	BY

**SAMPLE STATION DOGHOUSE MANHOLE**

**STANDARD DETAILS**

**NASHVILLE MUNICIPAL UTILITY**

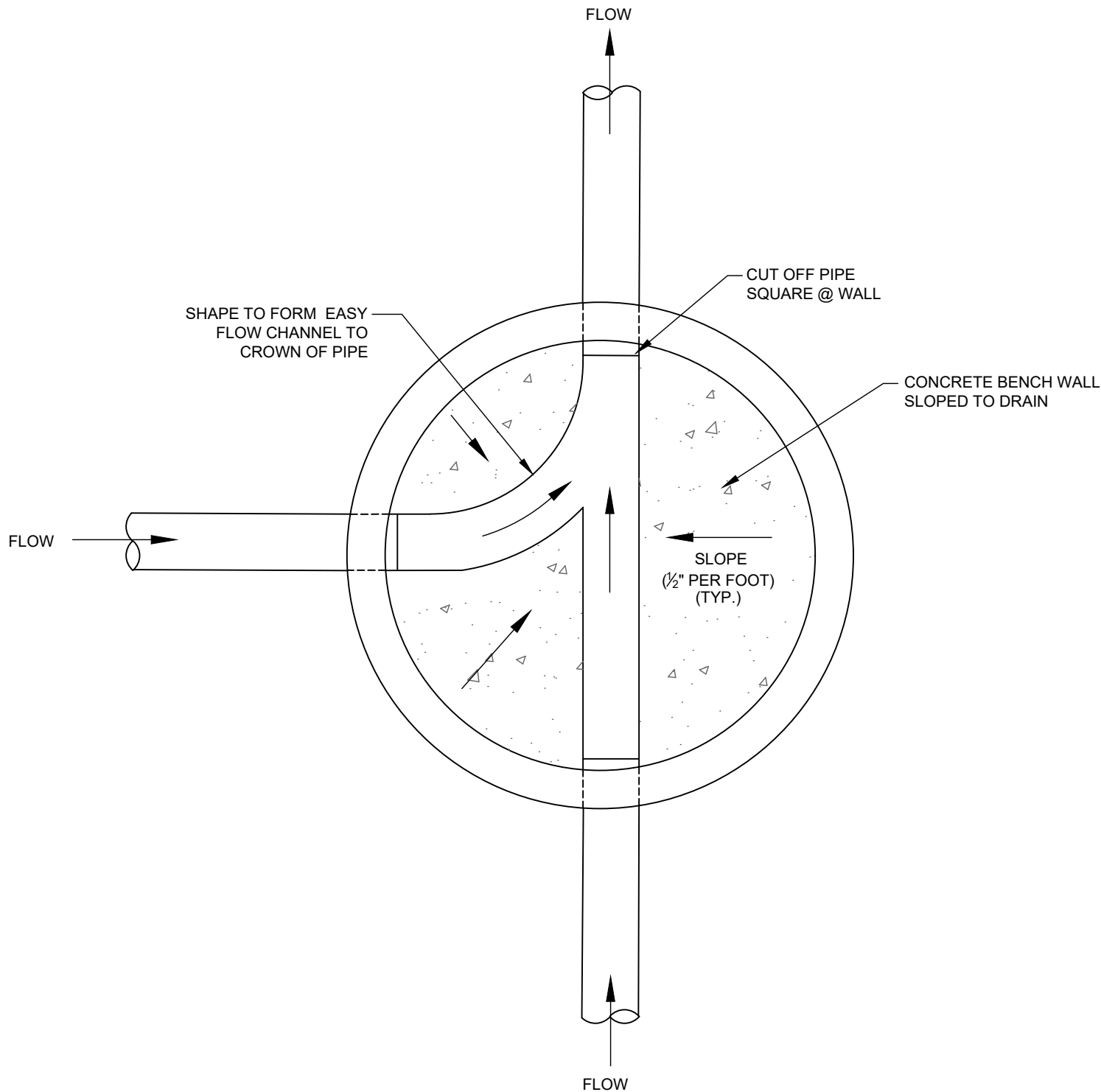
DATE: 03/13/24

SCALE: NTS

SHEET NO.

**32**





NOTE:  
INSIDE OF ALL SAN. MANHOLE TYPES SHALL BE FREE OF EXCESS MORTAR, MASTIC  
AND OTHER LIKE MATERIAL

REVISIONS			
NO.	DESCRIPTION	DATE	BY

STANDARD MANHOLE BENCH WALL

STANDARD DETAILS

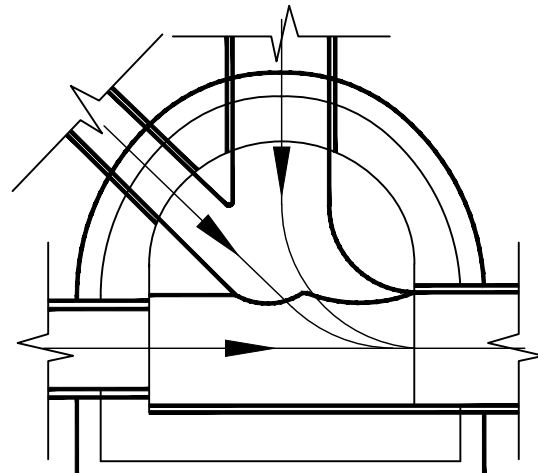
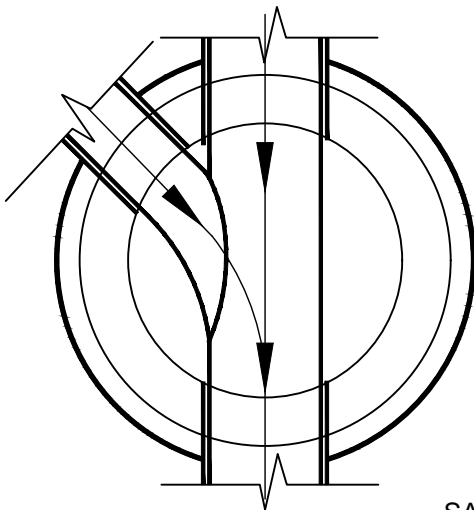
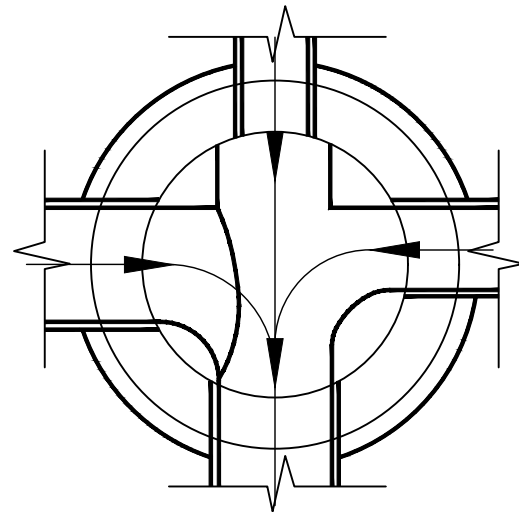
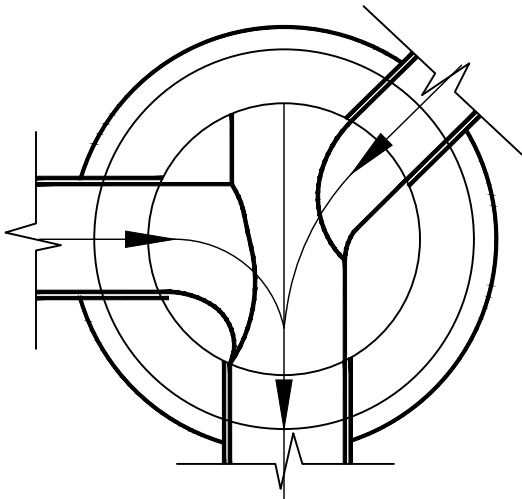
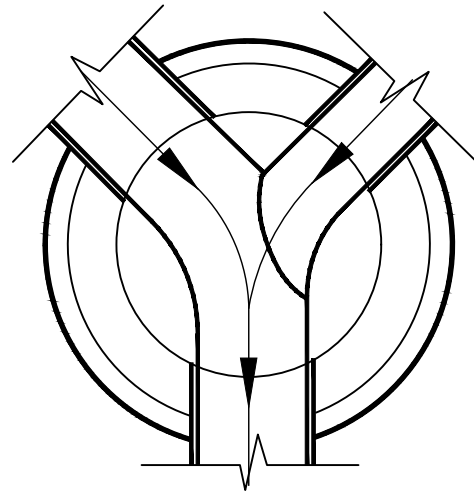
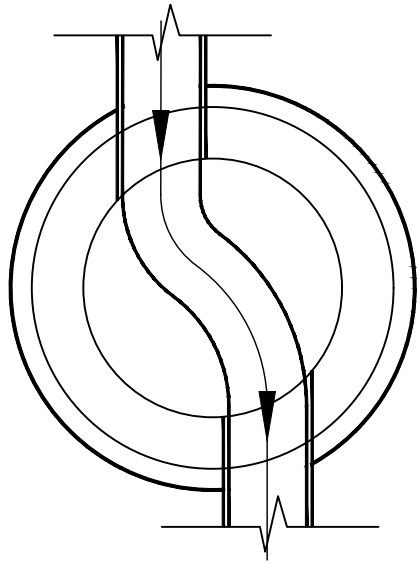
**NASHVILLE MUNICIPAL UTILITY**

DATE:  
03/13/24

SCALE:  
NTS

SHEET NO.

**33**



SANITARY SEWER  
BENCH SLOPE: 1/2" PER FOOT

REVISIONS			
NO.	DESCRIPTION	DATE	BY

STANDARD MANHOLE BENCHES

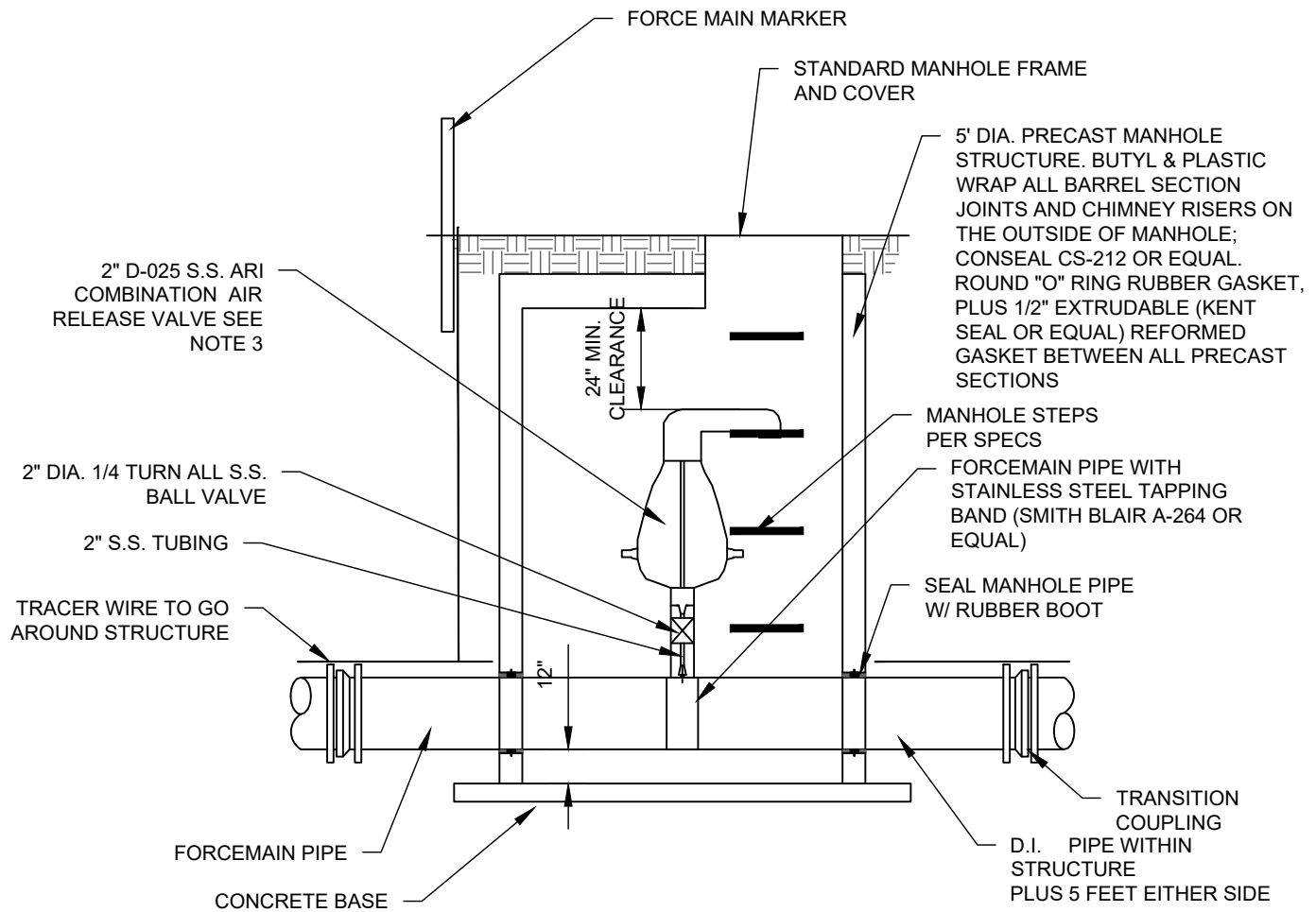
STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE: 03/13/24

SCALE: NTS

SHEET NO.



**NOTES:**

1. IF MORE THAN ONE AIR RELEASE VALVE IS INSTALLED WITH A FORCEMAIN, THE DEVELOPER SHALL PROVIDE ONE SPARE AIR RELEASE VALVE TO NMU.
2. AIR RELEASE VALVES MUST BE INSTALLED AT ALL HIGH SPOTS IN PRESSURE PIPE.
3. THE DESIGN ENGINEER SHALL VERIFY ARV SIZING REQUIRED FOR THE FORCE MAIN SYSTEM BEING PLANNED.
4. ARV TRACER WIRE TO BE TERMINATED AT MARKER POST AND WIRE RAN AROUND ARV PIT.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

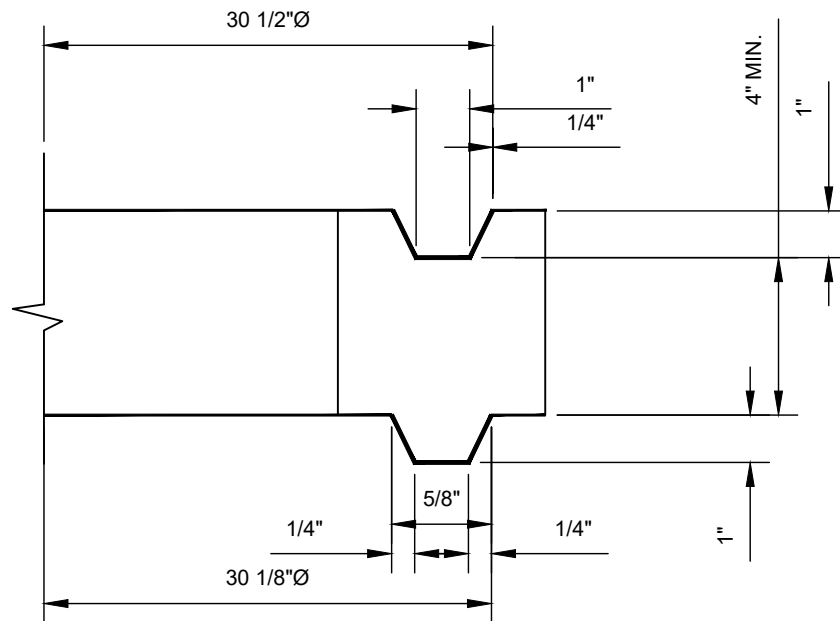
**SANITARY FORCEMAIN AIR RELEASE VALVE  
STRUCTURE**  
**STANDARD DETAILS**  
**NASHVILLE MUNICIPAL UTILITY**

DATE: 03/13/24

SCALE: NTS

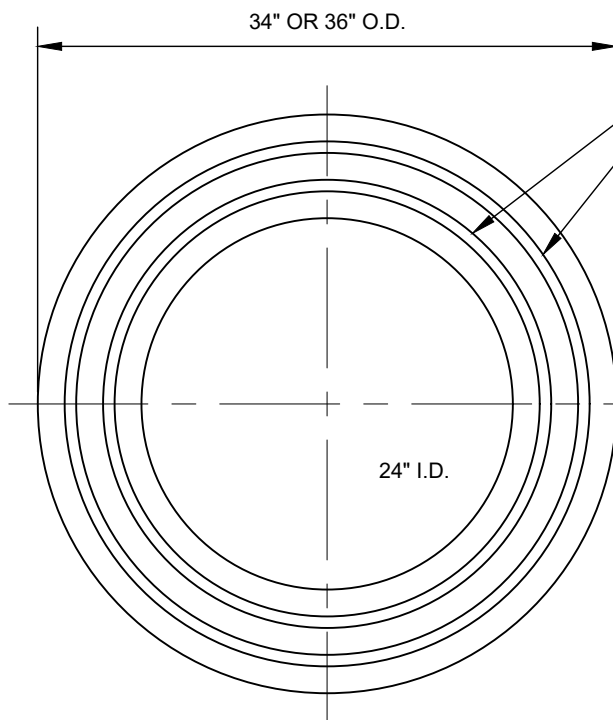
SHEET NO.

**35**



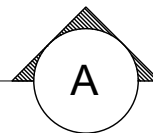
RISER RING THICKNESS 4" - 12"  
OUTSIDE DIA. 34" OR 36"

### SECTION A-A



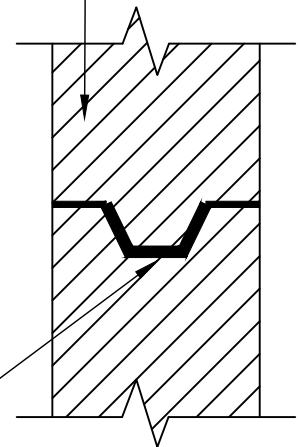
PLAN VIEW

INSTALL 1/2"Ø EXTRUDABLE  
PREFORMED GASKET MATERIAL  
IN EACH KEYWAY (SEE DETAIL)



NOMINAL 1/2" BUTYL  
RUBBER BASE EXTRUDABLE  
PREFORMED GASKET  
MATERIAL (TYP.)

PRECAST CONCRETE  
ADJUSTING RING OR  
FLANGE OF CASTING



GASKET DETAIL

#### REVISIONS

NO.	DESCRIPTION	DATE	BY

PRECAST ADJUSTING RING

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

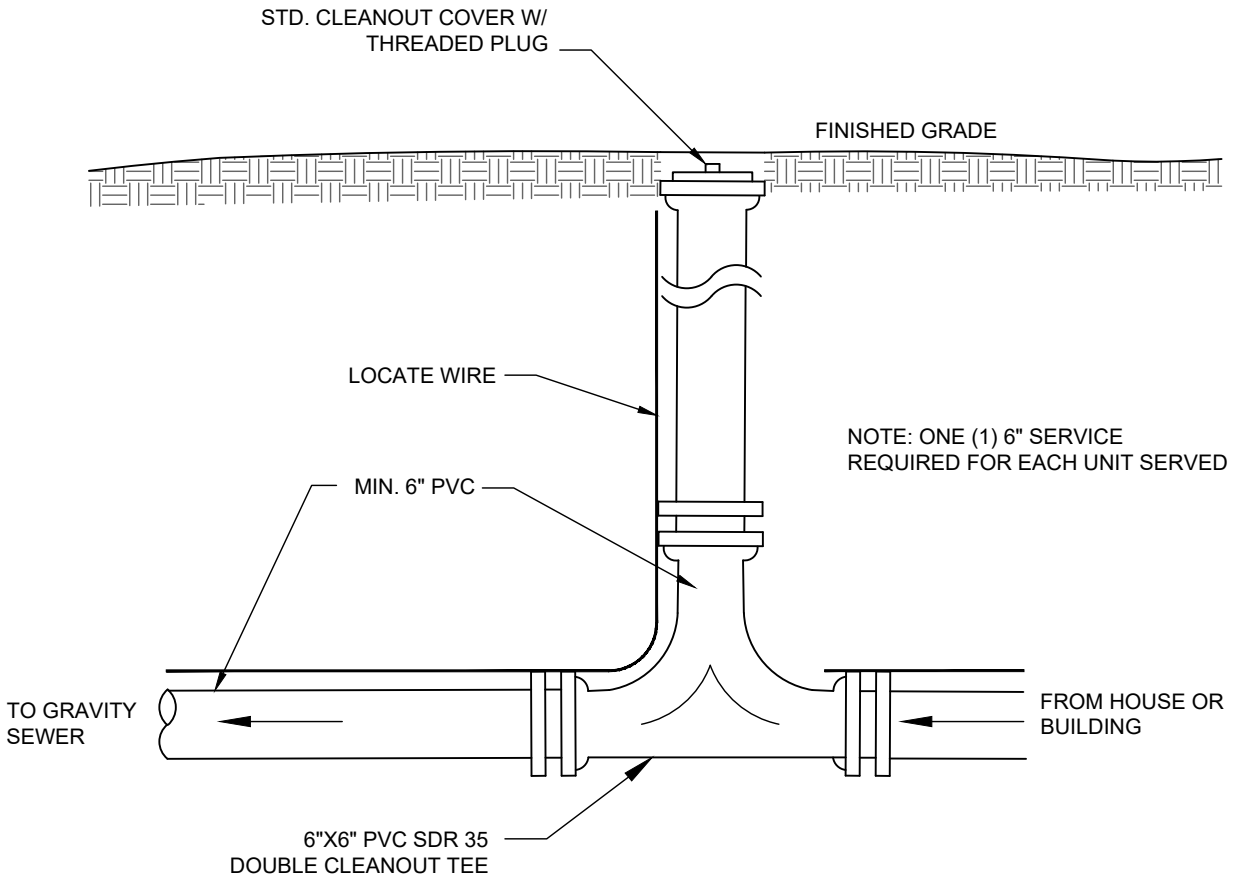
DATE:  
03/13/24

SCALE:  
NTS

SHEET NO.  
**36**

NOTES

1. CLEANOUTS SHALL BE INSTALLED NO MORE THAN A MAX. 5'-0" FROM OUTSIDE FACE OF BUILDING FOUNDATION WALL AND EVERY 100'-0" MAX. THEREAFTER OR WHERE SERVICE LATERAL CHANGES DIRECTION BEFORE REACHING MAIN SANITARY SEWER LINE.
2. CLEANOUT PLUGS SHALL NOT BE COVERED WITH CEMENT PLASTER, OR ANY OTHER PERMANENT FINISHING MATERIAL, WHERE IT IS NECESSARY TO CONCEAL A CLEAN OUT PLUG, A COVERING PLATE OR ACCESS DOOR SHALL BE PROVIDED WHICH WILL PERMIT READY ACCESS TO THE PLUG.



REVISIONS

NO.	DESCRIPTION	DATE	BY

TYPE "1" CLEANOUT

STANDARD DETAILS

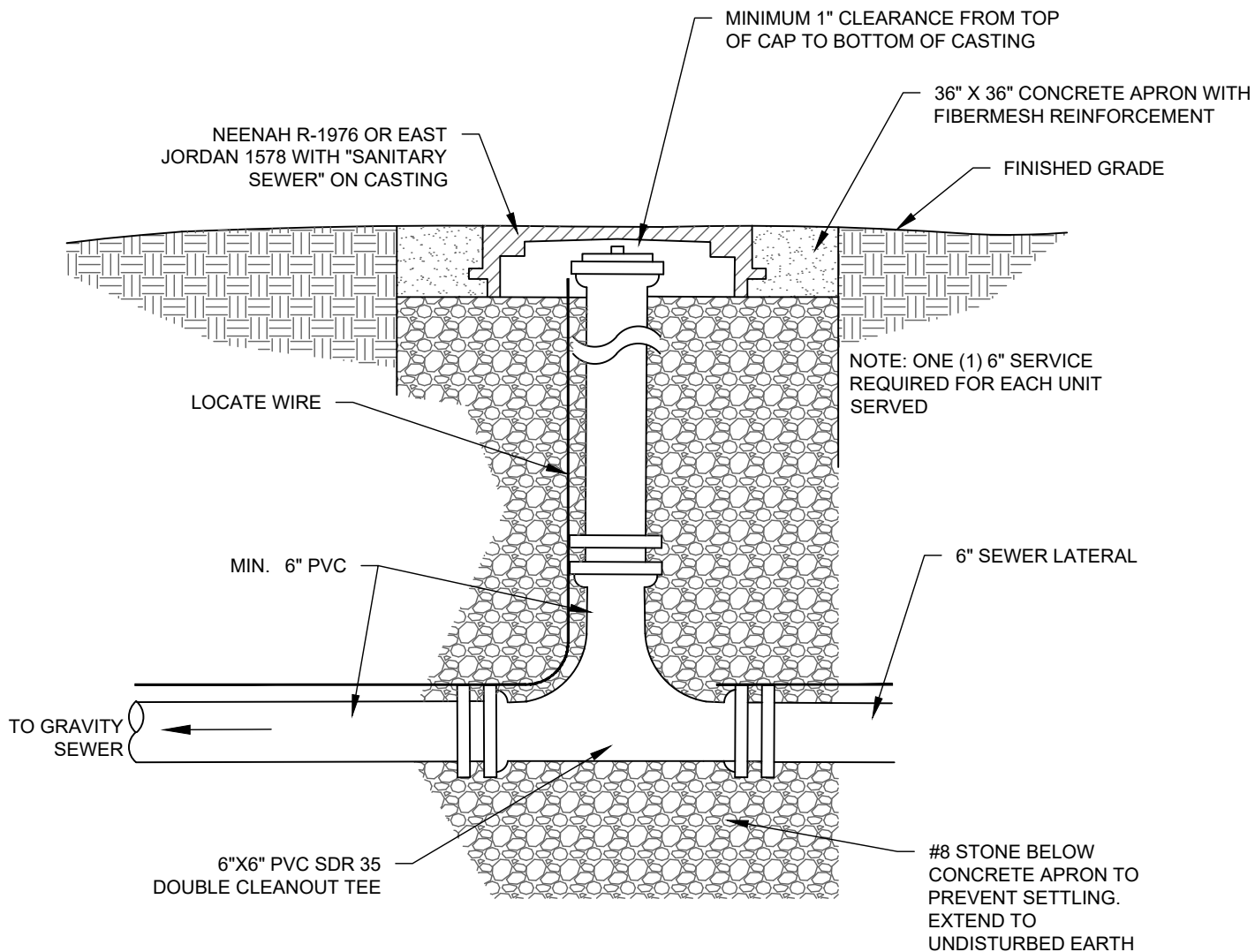
**NASHVILLE MUNICIPAL UTILITY**

DATE:  
03/13/24

SCALE:  
NTS

SHEET NO.

**37**



**NOTE:**

1. CONCRETE APRON AND CASTING SHALL BE INSTALLED SO THAT THEY DO NOT CONTACT THE LATERAL OR LATERAL CAP
2. CLEANOUTS SHALL BE INSTALLED NO MORE THAN A MAX. 5'-0" FROM OUTSIDE FACE OF BUILDING FOUNDATION WALL AND EVERY 100'-0" MAX. THEREAFTER OR WHERE SERVICE LATERAL CHANGES DIRECTION BEFORE REACHING MAIN SANITARY SEWER LINE.
3. TO BE USED IN PAVED AREAS OR SIDEWALKS

REVISIONS			
NO.	DESCRIPTION	DATE	BY

TYPE "2" CLEANOUT

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE: 03/13/24

SCALE: NTS

SHEET NO.

**38**

SANITARY SEWER TESTING:

1. ALL GRAVITY SANITARY SEWERS SHALL BE TESTED AS FOLLOWS (SEE SPECIFICATIONS):
  - 1.1. ALL MAINS SHALL BE TESTED FOR DEFLECTION WITH A GO-NO-GO MANDREL TEST CONDUCTED 30 DAYS AFTER BACKFILL.
  - 1.2. ALL MAINS SHALL BE TESTED FOR LEAKAGE WITH A LOW-PRESSURE AIR TEST.
  - 1.3. TELEVISION INSPECTION - SEWER SHALL BE FLOODED PRIOR TO INSPECTION.
2. ALL FORCEMAIN SHALL BE SUBJECT TO HYDROSTATIC TEST PRIOR TO BEING PLACED INTO OPERATION (SEE SPECIFICATIONS FOR REQUIREMENTS)

FORCE MAIN LOCATION WIRE AND MARKERS:

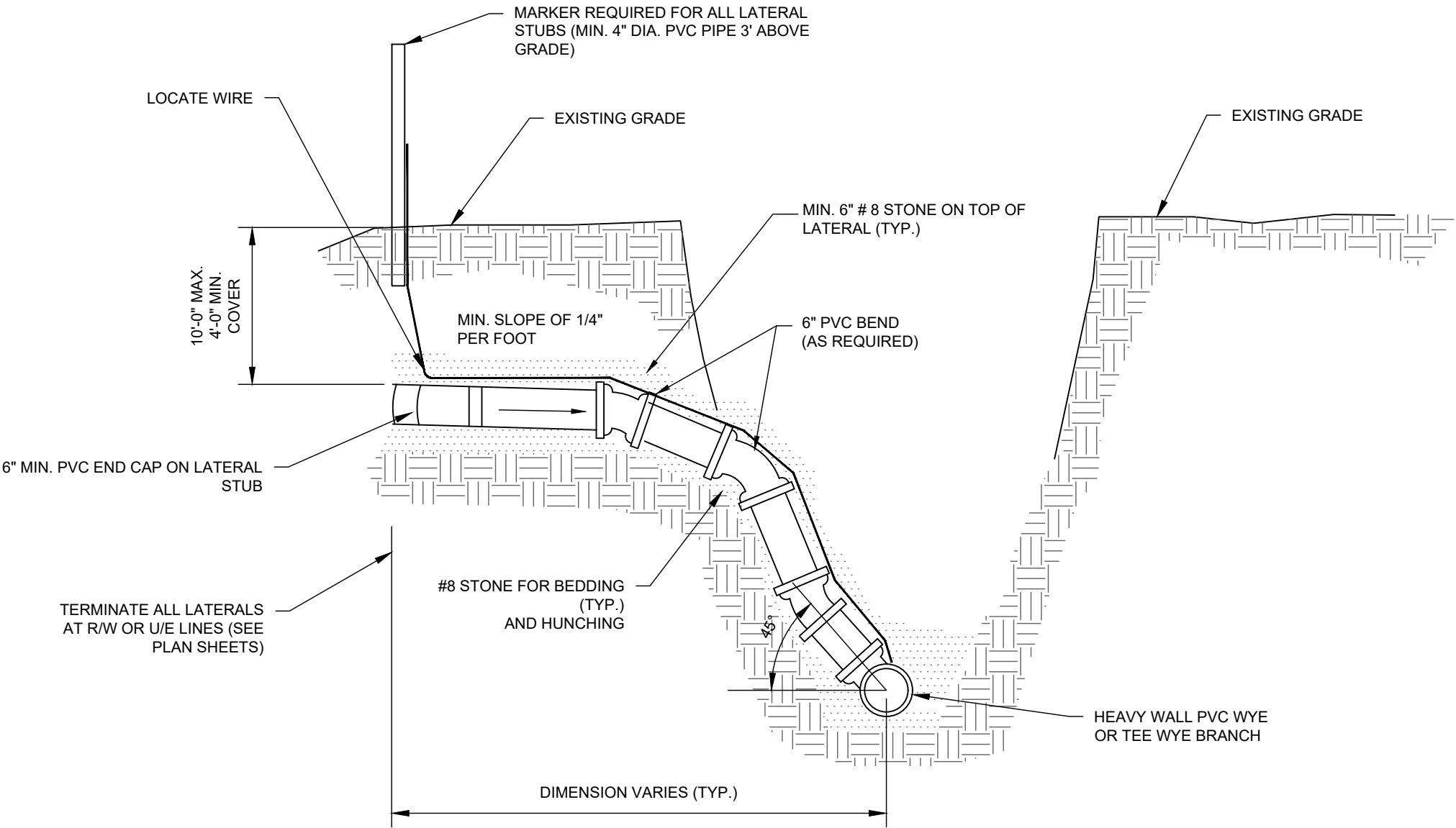
LOCATION WIRE TO BE INSTALLED ON ALL UNDERGROUND PIPE; COLORED GREEN FOR SANITARY SEWER. INSTALL FORCE MAIN POST MARKER WITH TERMINAL CONNECTION EVERY 400'. FORCE MAIN MARKER SHALL BE EQUIVALENT TO HANDLEY INDUSTRIES MODEL PMP 7CE WITH LID C2. WIRE MUST BE CONTINUOUS BETWEEN MARKERS. ALL JOINTS SHALL BE OVERHAND KNOTTED AND SOLDERED THEN COVERED WITH A WATER PROOF SEAL.

OPEN CUT PIPE INSTALLATION REQUIRES ONE #12 AWG HIGH-STRENGTH COPPER CLAD, STEEL CONDUCTOR LOCATE WIRE.

DIRECT DRILL / BORE PIPE INSTALLATION REQUIRES TWO #12 AWG EXTRA HIGH-STRENGTH COPPER CLAD, STEEL CONDUCTOR LOCATE WIRES (SEE TOWN SPECIFICATIONS).

NOTES:

1. ROAD CURB TO BE STAMPED WITH AN "S" TO INDICATE SANITARY SEWER LOCATION.
2. FINISHED FLOOR ELEVATION OF ADJACENT BUILDINGS SHALL BE SET A MINIMUM OF 12" HIGHER THAN THE RIM ELEVATION OF THE UPSTREAM MANHOLE OF THE CONNECTED SEWER MAIN TO PREVENT SANITARY BACKUPS. OTHERWISE, BACKFLOW PREVENTION MUST BE PROVIDED ON THE SERVICE CONNECTIONS.
3. SAMPLE STATION MANHOLES AND GREASE TRAPS SHALL BE INCLUDED ON ALL COMMERCIAL AND INDUSTRIAL SERVICE CONNECTIONS.
4. CONTRACTOR SHALL NOT BACKFILL SERVICE CONNECTION UNTIL NMU HAS INSPECTED AND TAKEN MEASUREMENTS AND OTHER INFORMATION REQUIRED FOR RECORDS.



REVISIONS			
NO.	DESCRIPTION	DATE	BY

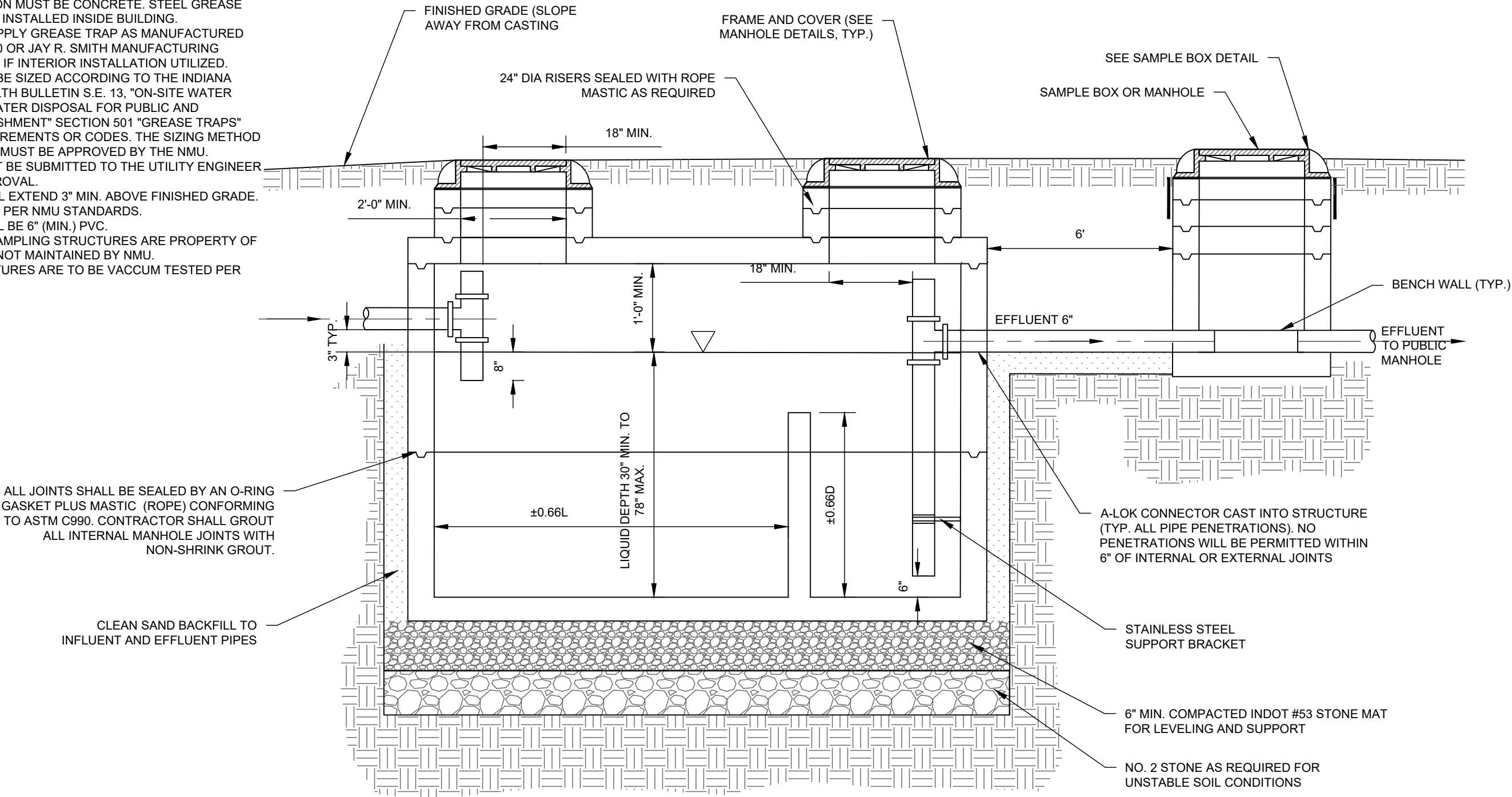
SANITARY SEWER SERVICE CONNECTIONS

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	39

- NOTES:
- 1. GREASE TRAP SHALL CONFORM TO ASTM C858/C913. UTILIZING 4000 PSI CONCRETE. STRUCTURE SHALL BE DESIGNED TO SUPPORT LOADING IN PLANNED LOCATION.
  - 2. EXTERIOR INSTALLATION MUST BE CONCRETE. STEEL GREASE TRAPS SHALL ONLY BE INSTALLED INSIDE BUILDING.
  - 3. CONTRACTOR MAY SUPPLY GREASE TRAP AS MANUFACTURED BY ZURN SERIES Z-1170 OR JAY R. SMITH MANUFACTURING COMPANY SERIES 8000 IF INTERIOR INSTALLATION UTILIZED.
  - 4. GREASE TRAPS MUST BE SIZED ACCORDING TO THE INDIANA STATE BOARD OF HEALTH BULLETIN S.E. 13, "ON-SITE WATER SUPPLY AND WASTEWATER DISPOSAL FOR PUBLIC AND COMMERCIAL ESTABLISHMENT" SECTION 501 "GREASE TRAPS" AND PER LOCAL REQUIREMENTS OR CODES. THE SIZING METHOD FOR ALL STRUCTURES MUST BE APPROVED BY THE NMU.
  - 5. SHOP DRAWINGS MUST BE SUBMITTED TO THE UTILITY ENGINEER FOR REVIEW AND APPROVAL.
  - 6. TOP OF CASTING SHALL EXTEND 3" MIN. ABOVE FINISHED GRADE.
  - 7. SAMPLE BOX SHALL BE PER NMU STANDARDS.
  - 8. INTERIOR PIPING SHALL BE 6" (MIN.) PVC.
  - 9. GREASE TRAPS AND SAMPLING STRUCTURES ARE PROPERTY OF THE OWNER AND ARE NOT MAINTAINED BY NMU.
  - 10. ALL SAMPLING STRUCTURES ARE TO BE VACCUM TESTED PER NMU STANDARDS

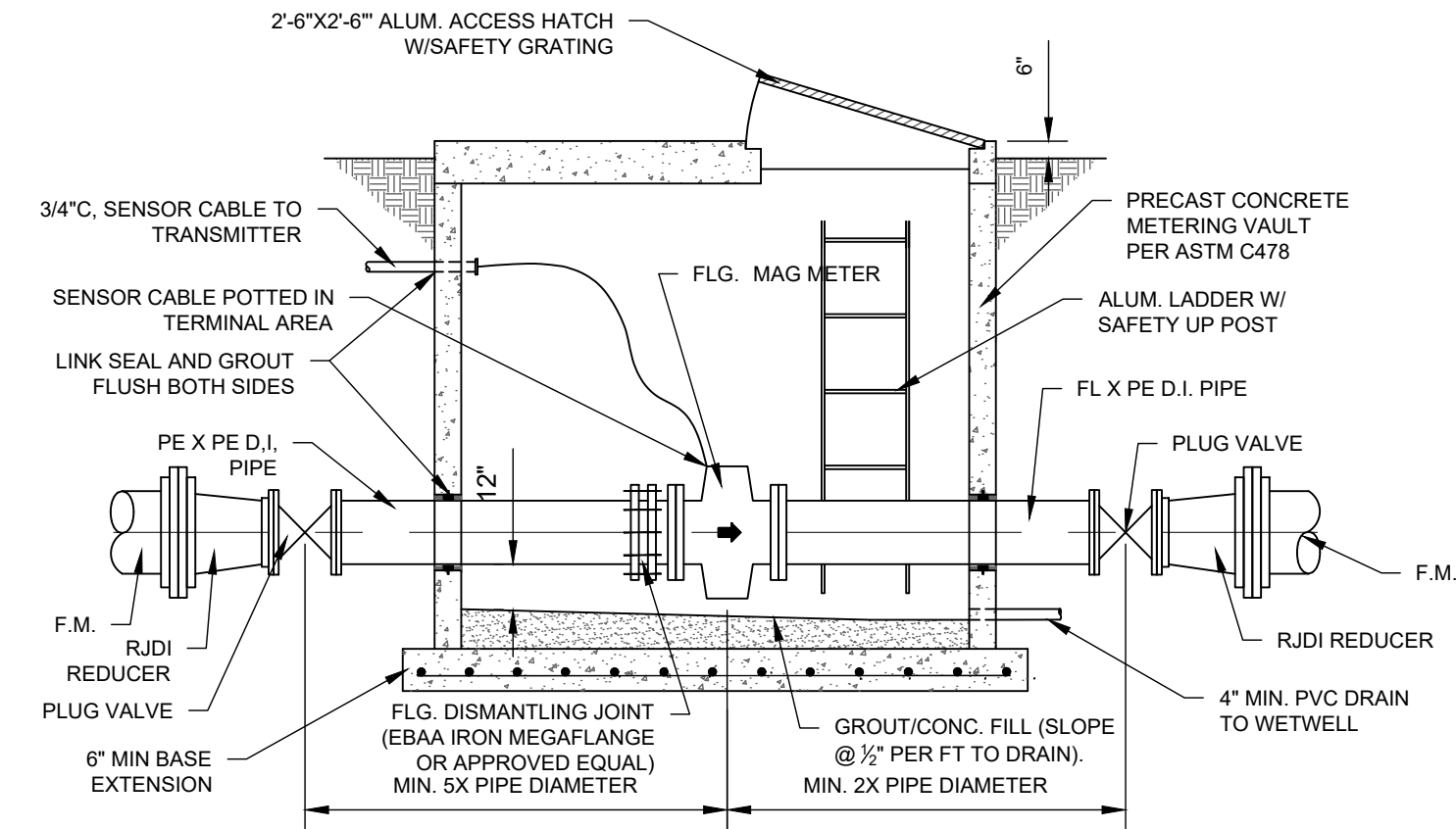


REVISIONS			
NO.	DESCRIPTION	DATE	BY

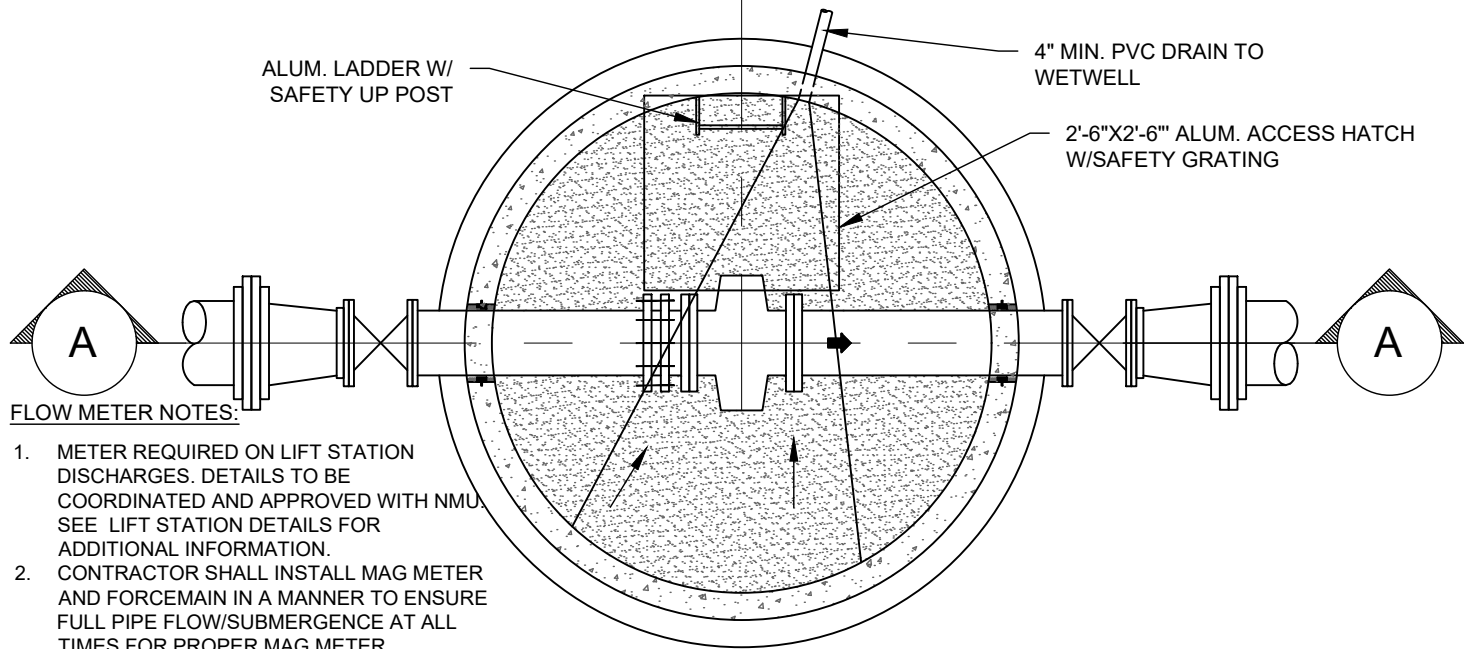
GREASE TRAP  
STANDARD DETAILS  
NASHVILLE MUNICIPAL UTILITY

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	40





SECTION A-A



**FLOW METER NOTES:**

1. METER REQUIRED ON LIFT STATION DISCHARGES. DETAILS TO BE COORDINATED AND APPROVED WITH NMU. SEE LIFT STATION DETAILS FOR ADDITIONAL INFORMATION.
2. CONTRACTOR SHALL INSTALL MAG METER AND FORCEMAIN IN A MANNER TO ENSURE FULL PIPE FLOW/SUBMERGENCE AT ALL TIMES FOR PROPER MAG METER OPERATION.
3. PROVIDE A SPOOL PIECE TO REPLACE MAGMETER BODY IF REMOVAL IS REQUIRED FOR REPAIR/REPLACEMENT.
4. CONTRACTOR SHALL INSTALL MAG METER VAULT IN A MANNER TO ENSURE THAT A MINIMUM DISTANCE OF 5 PIPE DIAMETERS UPSTREAM AND 2 PIPE DIAMETERS DOWN STREAM OF THE MAG METER IS FREE FROM BENDS OR OTHER APPURTANCES.

**REVISIONS**

NO.	DESCRIPTION	DATE	BY

**SANITARY FORCEMAIN MAG METER VAULT**

**STANDARD DETAILS**

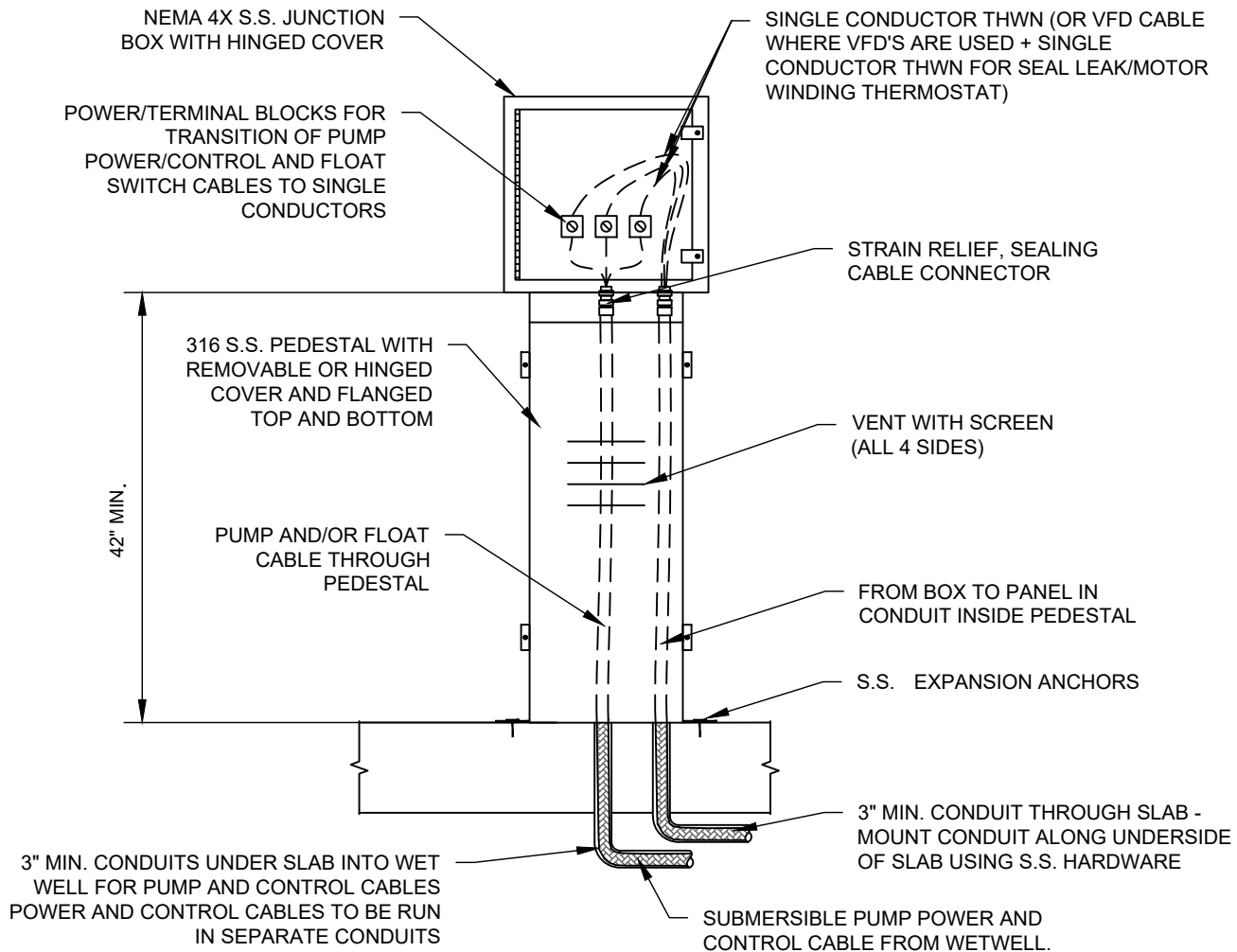
**NASHVILLE MUNICIPAL UTILITY**

DATE: 03/13/24

SCALE: NTS

SHEET NO.

**41**



#### NOTES:

1. JUNCTION BOX SHALL BE SIZED AS REQUIRED TO ACCOMMODATE POWER/TERMINAL BLOCKS AND NUMBER OF CABLES.
2. PROVIDE ADEQUATE POWER AND TERMINAL BLOCKS FOR TRANSITION OF PUMP POWER/CONTROL OR FLOAT CABLES TO SINGLE CONDUCTORS.
3. CONVERT MULTITRODE FACTORY CABLE TO 24 STRAND/12 CONDUCTOR CABLE (GARLAND PART NO. TEM134802008) AT JUNCTION BOX AND EXTEND 12 CONDUCTOR CABLE IN 1" C TO PUMP CONTROL PANEL.
4. PROVIDE STRAIN RELIEF CABLE GRIP AND SEALING CABLE CONNECTORS FOR ALL CABLES ENTERING WETWELL.
5. SEALING CONNECTORS SHALL BE RATED FOR CLASS I, DIVISION 2, GROUP D HAZARDOUS LOCATIONS AND SHALL BE HAWKE 710, OR EQUAL.
6. GROUND LUG IS NOT SHOWN, BUT IS REQUIRED.
7. CONTRACTOR SHALL PROVIDE CONDUIT UNDER SLAB TO ALLOW ROUTING OF PUMP POWER/CONTROL CABLES, TRANSDUCER CABLE AND CAPACITANCE PROBE FROM WETWELL TO JUNCTION BOX. SEPARATE CONDUIT FOR EACH PUMP POWER CORD. ONE CONDUIT FOR PUMP CONTROL CORDS, ONE FOR LEVEL CONTROL.
8. CONTRACTOR SHALL FURNISH AND INSTALL SEALING CONNECTORS FOR PUMP POWER/CONTROL CABLE, TRANSDUCER CABLE AND LEVEL SENSING PROBE CABLE.
9. MANUFACTURER SUPPLIED CABLE FROM PRESSURE TRANSDUCER TO JUNCTION BOX.
10. ALL JUNCTION BOX TERMINAL BLOCKS NEED TO BE LUG TYPE TERMINAL BLOCKS.
11. BELOW GROUND CONDUIT SHALL BE SCHEDULE 80 PVC.
12. ALL CONDUIT SHALL BE SCHEDULE 80.
13. MINIMUM DIAMETER CONDUIT FOR POWER SHALL BE 4" DIA. CONTROL WIRE CONDUIT SHALL BE 3" DIA. MINIMUM.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

## PUMP/FLOAT CABLE WET WELL JUNCTION BOX

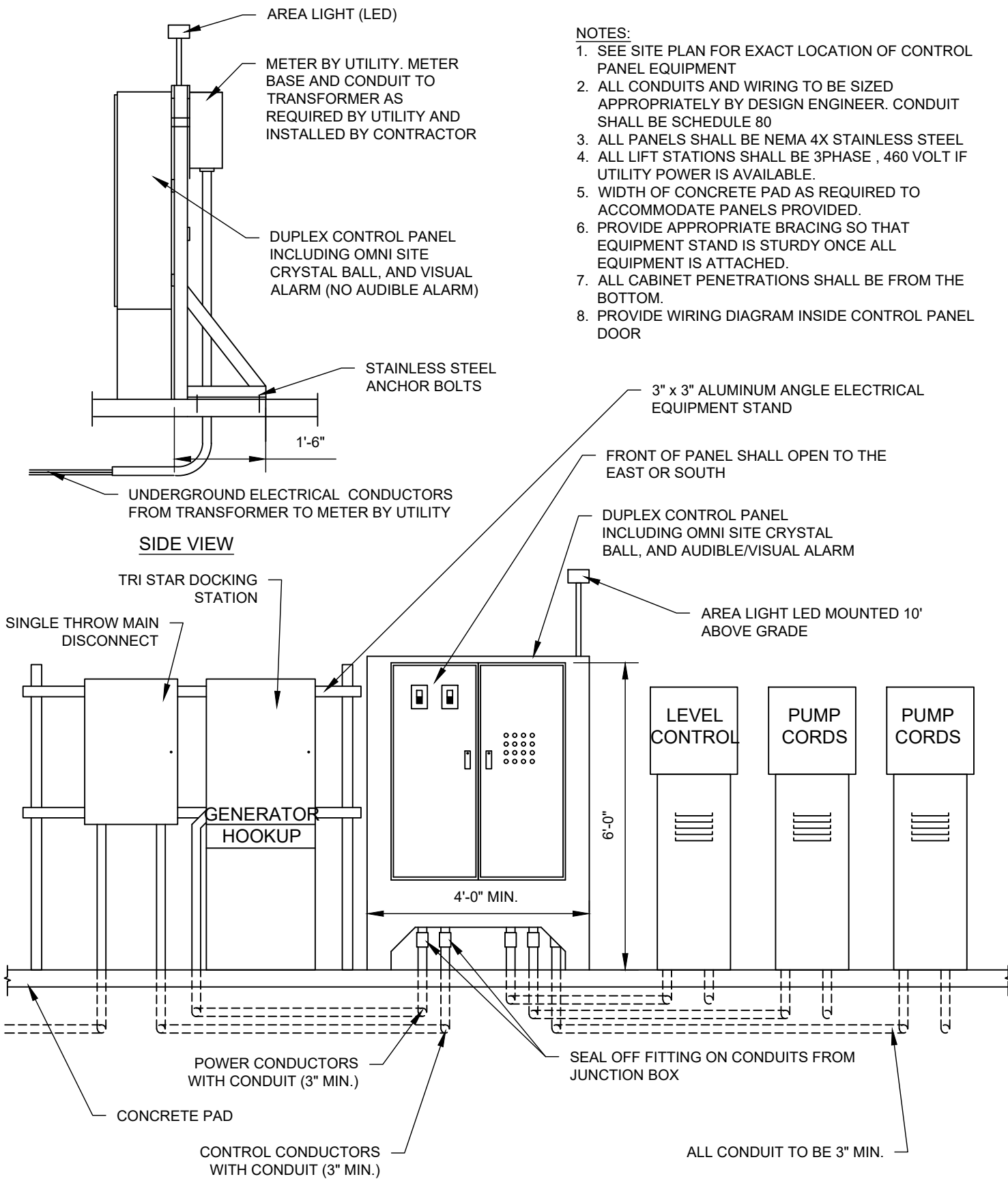
STANDARD DETAILS  
NASHVILLE MUNICIPAL UTILITY

DATE:  
03/13/24

SCALE:  
NTS

SHEET NO.

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**NOTES:**

1. SEE SITE PLAN FOR EXACT LOCATION OF CONTROL PANEL EQUIPMENT
2. ALL CONDUITS AND WIRING TO BE SIZED APPROPRIATELY BY DESIGN ENGINEER. CONDUIT SHALL BE SCHEDULE 80
3. ALL PANELS SHALL BE NEMA 4X STAINLESS STEEL
4. ALL LIFT STATIONS SHALL BE 3PHASE , 460 VOLT IF UTILITY POWER IS AVAILABLE.
5. WIDTH OF CONCRETE PAD AS REQUIRED TO ACCOMMODATE PANELS PROVIDED.
6. PROVIDE APPROPRIATE BRACING SO THAT EQUIPMENT STAND IS STURDY ONCE ALL EQUIPMENT IS ATTACHED.
7. ALL CABINET PENETRATIONS SHALL BE FROM THE BOTTOM.
8. PROVIDE WIRING DIAGRAM INSIDE CONTROL PANEL DOOR

**FRONT VIEW**

REVISIONS			
NO.	DESCRIPTION	DATE	BY

**ELECTRICAL DIAGRAM**

**STANDARD DETAILS**

**NASHVILLE MUNICIPAL UTILITY**

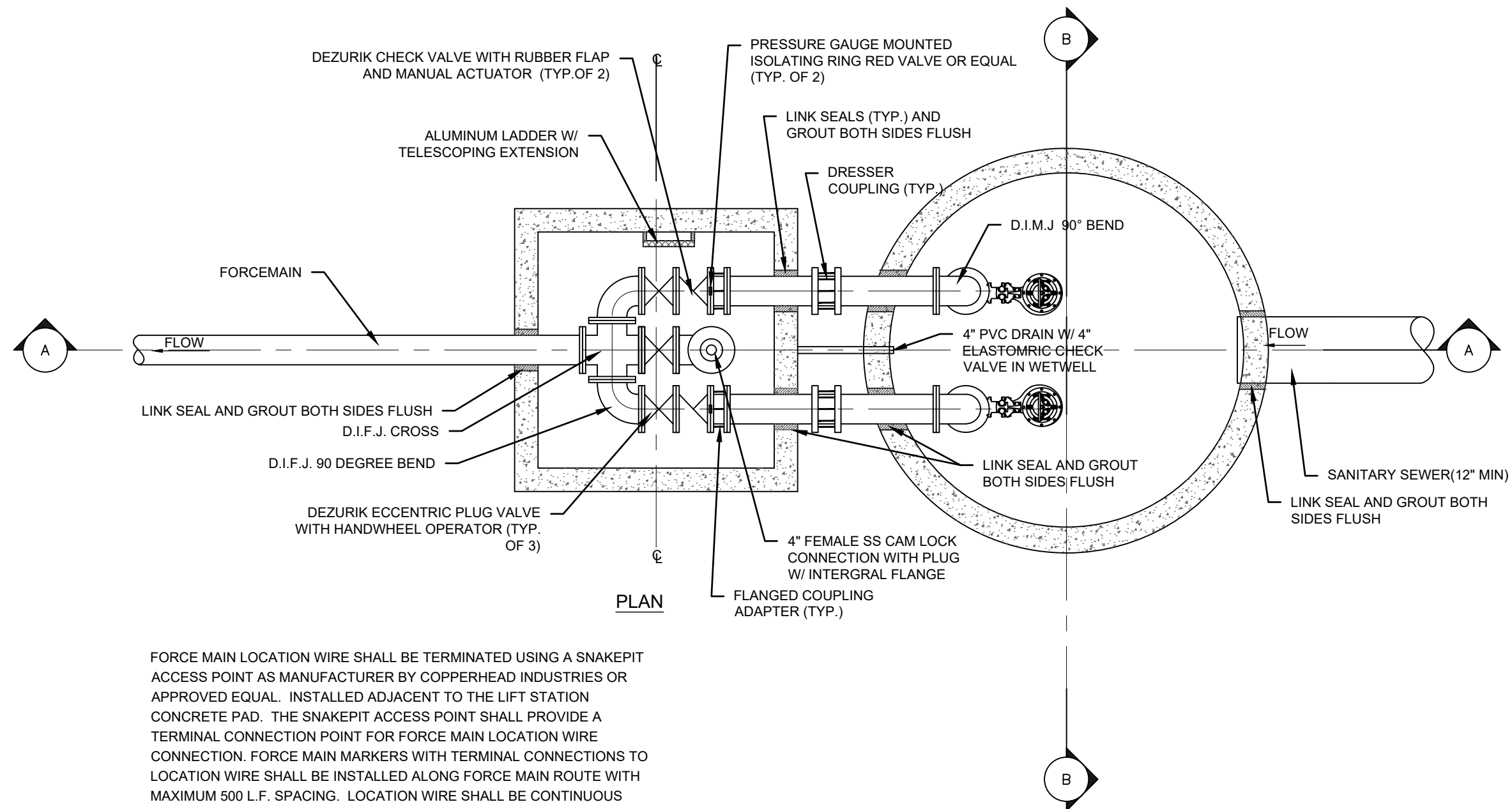
DATE: 03/13/24

SCALE: NTS

SHEET NO.

**43**





FORCE MAIN LOCATION WIRE SHALL BE TERMINATED USING A SNAKEPIT ACCESS POINT AS MANUFACTURER BY COPPERHEAD INDUSTRIES OR APPROVED EQUAL. INSTALLED ADJACENT TO THE LIFT STATION CONCRETE PAD. THE SNAKEPIT ACCESS POINT SHALL PROVIDE A TERMINAL CONNECTION POINT FOR FORCE MAIN LOCATION WIRE CONNECTION. FORCE MAIN MARKERS WITH TERMINAL CONNECTIONS TO LOCATION WIRE SHALL BE INSTALLED ALONG FORCE MAIN ROUTE WITH MAXIMUM 500 L.F. SPACING. LOCATION WIRE SHALL BE CONTINUOUS BETWEEN LOCATION MARKERS (NO SPLICING). COORDINATE MARKER LOCATIONS WITH THE NASHVILLE MUNICIPAL UTILITY. STATION SHALL BE EQUIVALENT TO HANDLEY INDUSTRIES MODEL PMP 7CE WITH LID C2. THE FOLLOWING INFORMATION SHALL BE CLEARLY PRINTED ON FORCE MAIN MARKER POST: "NASHVILLE MUNICIPAL UTILITY", "SANITARY SEWER LINE BURIED BELOW", "EMERGENCY CONTACT XXX-XXX-XXXX" AND "CAUTION SEWER PIPELINE". CONTRACTOR SHALL LOCATE ALL PIPE IN PRESENCE OF NASHVILLE MUNICIPAL UTILITY REPRESENTATIVE FOLLOWING COMPLETION OF CONSTRUCTION.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

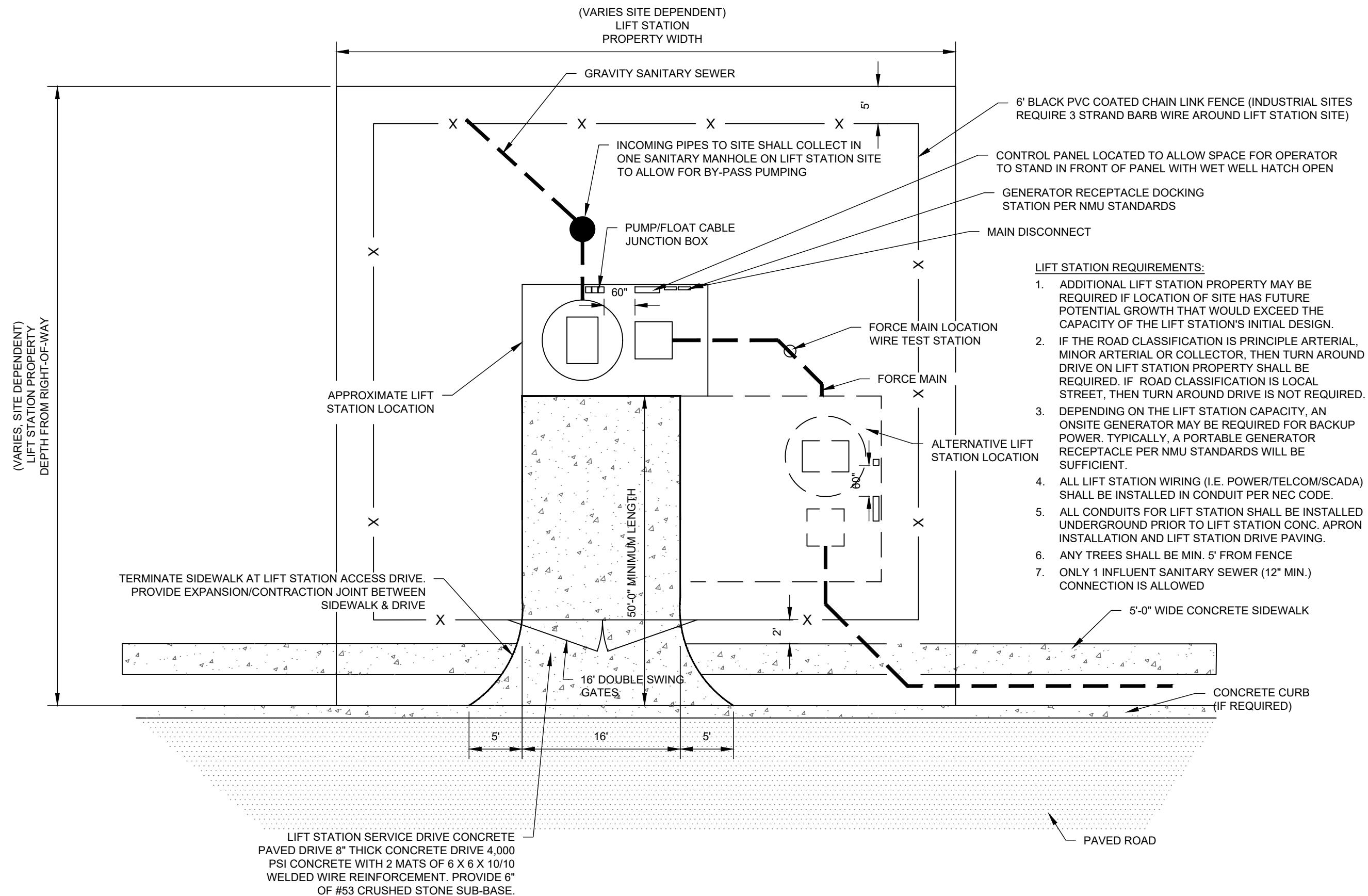
TYPE "I" LIFT STATION GENERAL CONFIGURATION

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	45





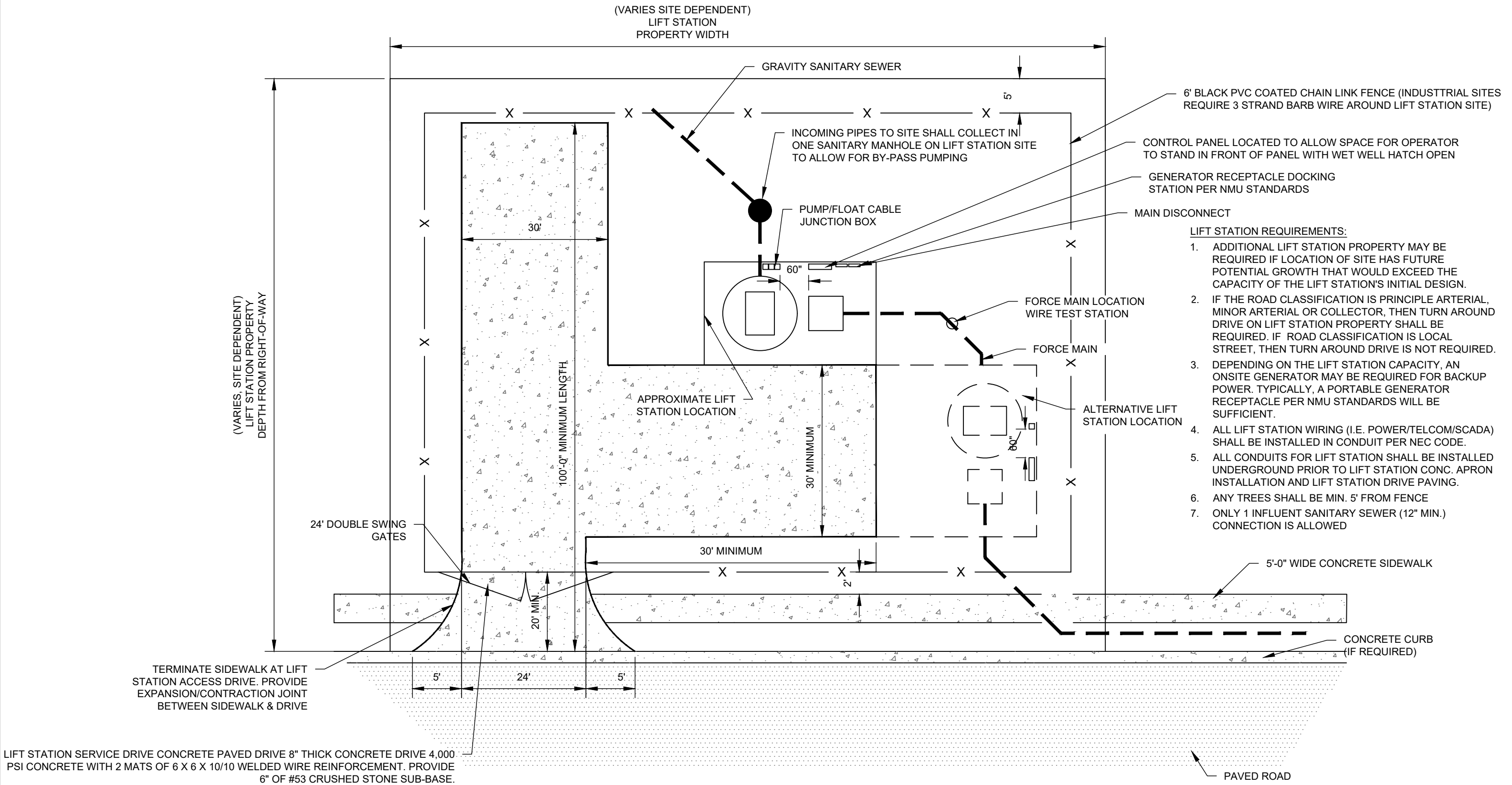
REVISIONS			
NO.	DESCRIPTION	DATE	BY

LIFT STATION SITE LAYOUT I

STANDARD DETAILS

**NASHVILLE MUNICIPAL UTILITY**

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	47



REVISIONS			
NO.	DESCRIPTION	DATE	BY

LIFT STATION SITE LAYOUT II

STANDARD DETAILS

NASHVILLE MUNICIPAL UTILITY

DATE:	03/13/24
SCALE:	NTS
SHEET NO.	48

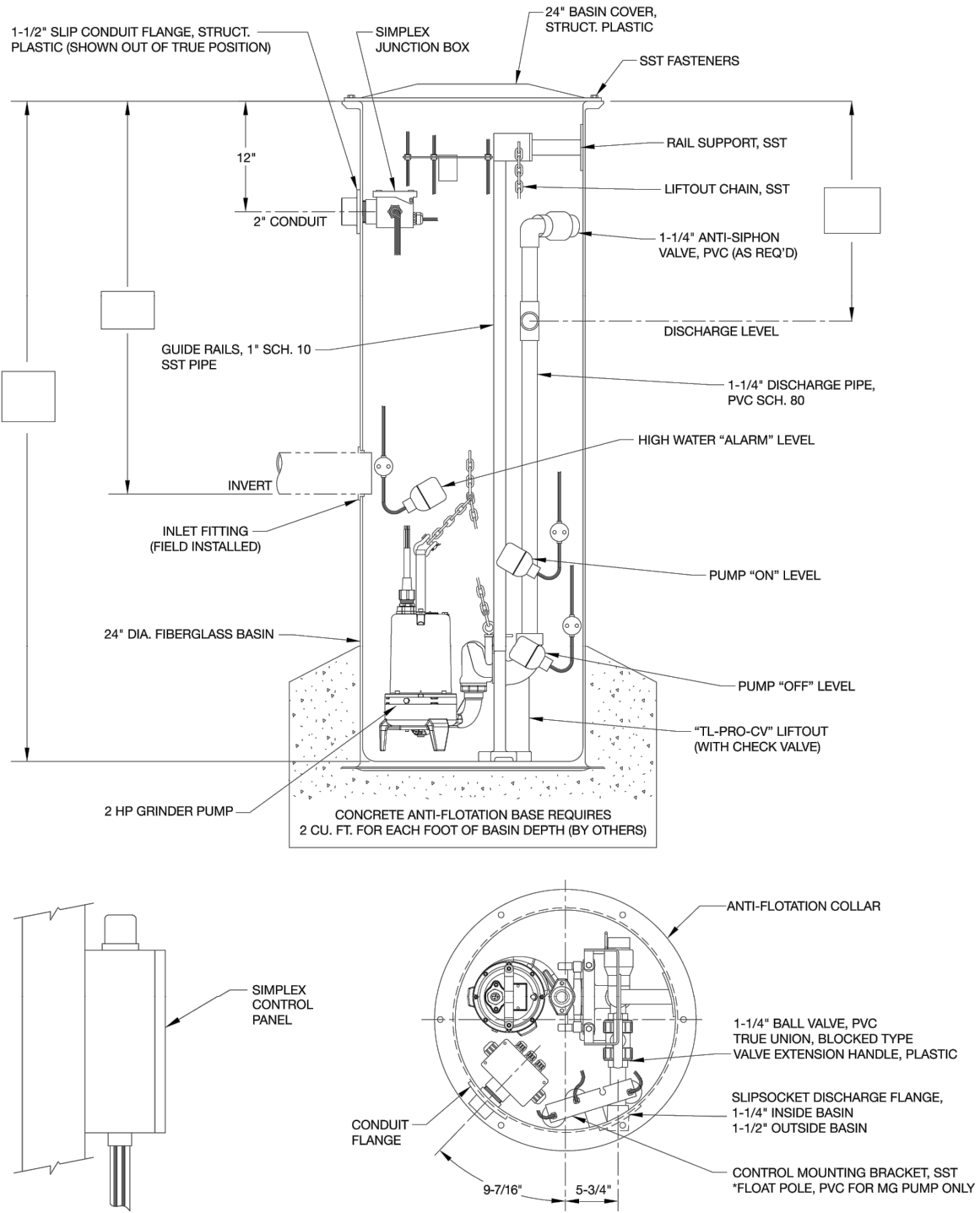


LIFT STATION DESIGN DATA			
DESCRIPTION	LIFT STATION ID NO. LS1	DESCRIPTION	LIFT STATION ID NO. LS1
	INITIAL DESIGN		INITIAL DESIGN
NUMBER OF DWELLINGS		NEMA STARTER SIZE	
GALLONS PER DAY PER RESIDENCE		CHECK VALVE SIZE (IN.)	
TOTAL AVERAGE DAILY FLOW (GPD)		PLUG VALVE SIZE (IN.)	
TOTAL AVERAGE FLOW (GPM)		VALVE VAULT DIMENSIONS	
PEAK FLOW RATE (GPM)		VALVE VAULT ACCESS HATCH SIZE	
PUMP FLOW RATE (GPM) * FUTURE		WETWELL INSIDE DIAMETER (FT.)	
FORCE MAIN DIAMETER (IN.)		WETWELL DEPTH (FT.)	
FORCE MAIN LENGTH (FT.)		WETWELL ACCESS HATCH SIZE	
FORCE MAIN VELOCITY (FT./SEC.)		VISUAL LIGHT & AUDIBLE ALARM	
C' VALUE		EMERGENCY GENERATOR MALE END CONNECTION	
FORCE MAIN HEAD LOSS (FT.)		BUILT-IN EMERGENCY GENERATOR TRANSFER SWITCH	
FORCE MAIN LIFT (FT.)		TOP OF LIFT STATION ELEVATION	
PUMP WEAR ALLOWANCE (FT.)		INFLUENT INVERT ELEVATION	
FITTING MINOR LOSSES (FT.)		BOTTOM OF LIFT STATION ELEVATION	
TOTAL DYNAMIC HEAD (FT.)		HIGH LEVEL ALARM ELEVATION	
MANUFACTURER		LAG PUMP ON ELEVATION	
MODEL NUMBER		LEAD PUMP ON ELEVATION	
PUMP HORSEPOWER		PUMP OFF ELEVATION	
PUMP SPEED (RPM)		VOL. BETWEEN OFF & LEAD PUMP ON (GAL.)	
IMPELLER DIAMETER (IN.)		DETENTION TIME @ TOTAL AVERAGE FLOW (MIN.)	
POWER SUPPLY			

NOTE:  
DEVELOPER SHALL COMPLETE AND SUBMIT ABOVE TABLE TO NASHVILLE  
MUNICIPAL UTILITY WHEN PLANNING A LIFT STATION.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

LIFT STATION DESIGN DATA  STANDARD DETAILS <b>NASHVILLE MUNICIPAL UTILITY</b>	DATE: 03/13/24
	SCALE: NTS
	SHEET NO. <b>49</b>



**NOTES:**

1. REMOTE MOUNTED CONTROL PANEL REQUIRED. CONFIRM LOCATION AND REQUIREMENTS WITH NMU.
2. BASIN SHALL HAVE HATCHED COVER.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

SIMPLEX GRINDER PUMP STATION

STANDARD DETAILS

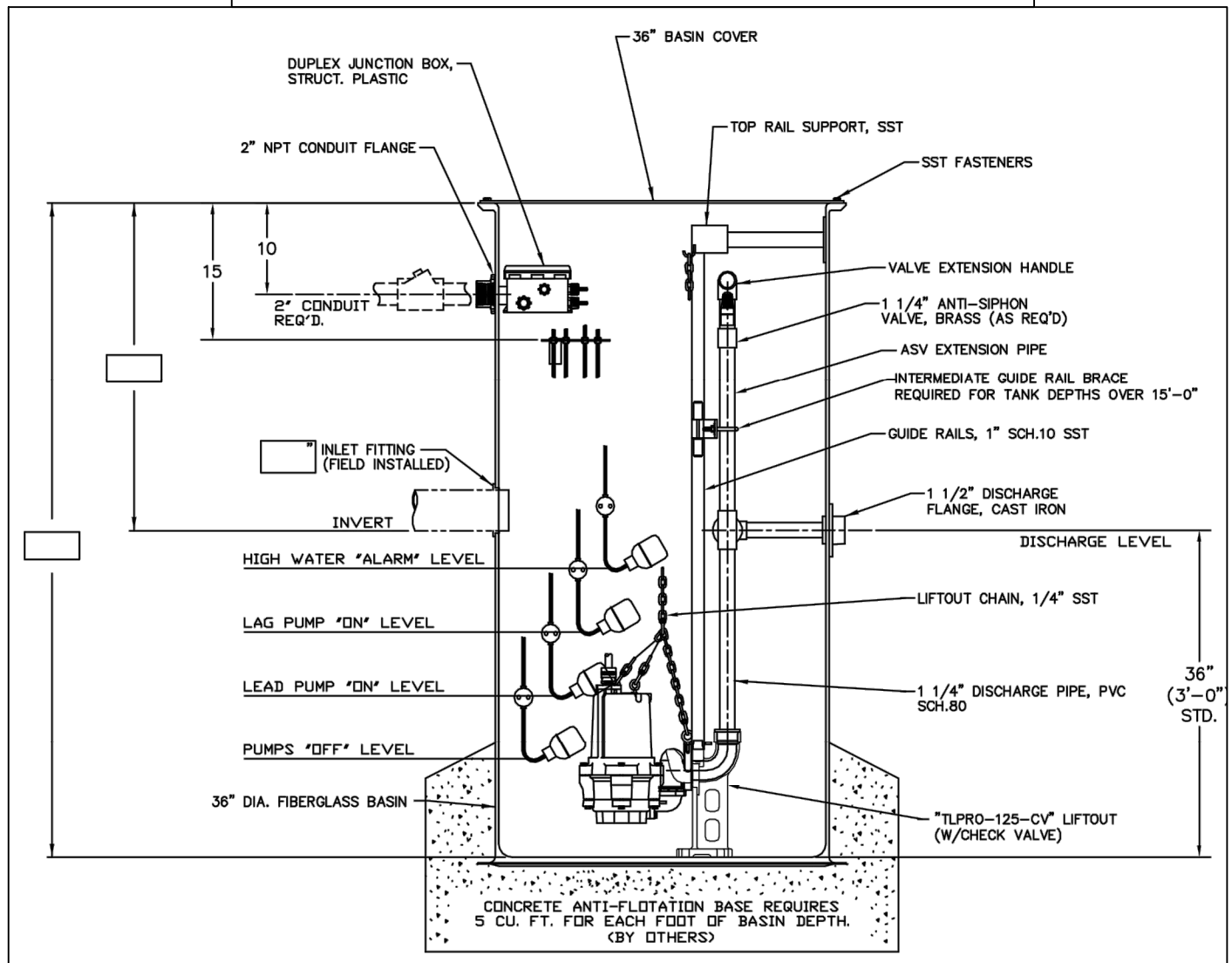
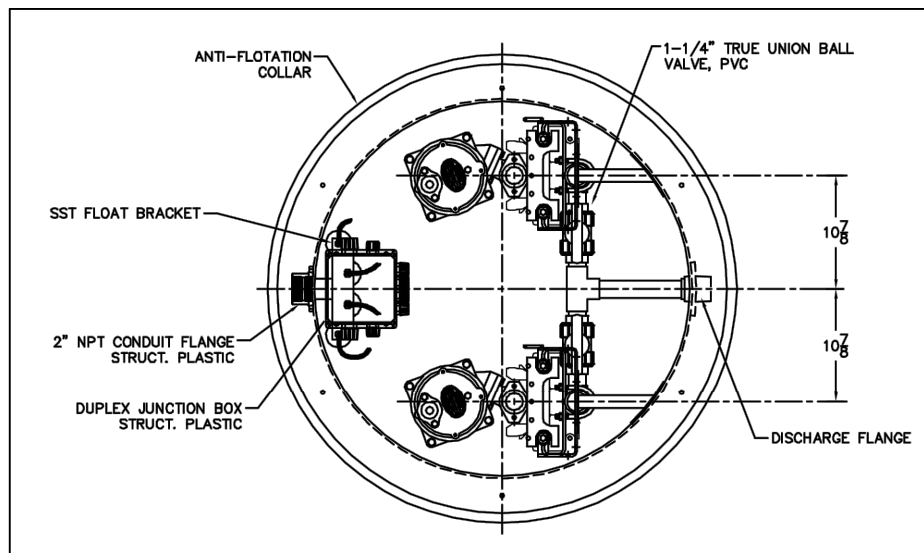
**NASHVILLE MUNICIPAL UTILITY**

DATE: 03/13/24

SCALE: NTS

SHEET NO.

**50**



**NOTES:**

1. REMOTE MOUNTED CONTROL PANEL REQUIRED. CONFIRM LOCATION AND REQUIREMENTS WITH NMU.
2. BASIN SHALL HAVE HATCHED COVER.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

**DUPLEX GRINDER PUMP STATION**  
**STANDARD DETAILS**  
**NASHVILLE MUNICIPAL UTILITY**

DATE:  
 03/13/24  
 SCALE:  
 NTS  
 SHEET NO.