

SECTION 02610

PIPE & FITTINGS

PART 1 – GENERAL

1.1 SUMMARY

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Project Name

Issue Date: \_\_\_\_\_

A. CONTRACTOR shall provide all labor, materials, equipment, incidentals, and services as shown, specified, and required for furnishing, installing, and testing all buried piping, fittings, and specials specified herein. Piping herein specified includes force main & gravity sewer for sanitary and storm applications. Remove and replace all existing piping that interferes with installation of new pipe or structures or that is damaged by new installations in a manner approved by the ENGINEER.

B. The work includes, but is not limited to, the following:

1. Piping beneath structures.

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2. Supports and restraints.
  
3. Pipe encasements.
  
4. Work on or affecting existing piping.
  
5. Testing.
  
6. Cleaning and disinfecting.

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7. Installation of all jointing and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other work required to complete the buried piping installation.
  
8. Incorporation of valves, meters and special items shown or specified into the piping systems as required.
  
9. Unless otherwise specifically shown, specified, or included under other Sections, all buried piping work required, beginning at the outside face of structures or structure foundations and extending away from structure.

- C. Review installation procedures under other Sections and other contracts and coordinate with the work that is related to this Section.

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1.2 RELATED WORK

1. Section 02110, Clearing and Grubbing
  
2. Section 02220, Excavation and Backfill
  
3. Section 02606, Sanitary & Storm Structures

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4. Section 03300, Cast-In-Place Concrete
  
5. Section 09900, Painting
  
6. Division 15, Sections on Piping, Valves & Appurtenances
  
7. Section 15052, Exposed Piping Installation
  
8. Section 15100, Valves and Appurtenances
  
9. Section 15121, Wall Pipes, Floor Pipes and Pipe Sleeves

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10. Section 15122, Piping Specialties

11. Section 15140, Pipe Hangers and Supports

1.3 LIMITATIONS

- A. All existing piping as shown on the Design Drawings is based on the best information available, but SD1 and the ENGINEER makes no guarantees as to the accuracy of the locations or type of piping depicted. All new piping which ties into existing lines must be made compatible with that piping. So that piping conflicts may be avoided, CONTRACTOR shall open up his trench well ahead of the pipe laying operation to confirm exact locations and sizes of existing piping before installing any new piping.

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CONTRACTOR shall provide all fittings and adapters necessary to complete all connections to existing piping as approved by SD1.

1.4 QUALITY ASSURANCE

Requirements of Regulatory Agencies:

- A. Comply with requirements of UL, FM and other jurisdictional authorities, where applicable.

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- B. Refer to the General and Supplementary Conditions regarding permit requirements for this Project.

1.5 REFERENCES

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

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D. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

E. AWWA C115, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

F. AWWA C150, Standard for Thickness Design of Ductile-Iron Pipe.

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G. AWWA C151, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

H. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

I. AWWA C606, Grooved and Shouldered Joints.

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J. AWWA C800, Underground Service Line Valves and Fittings.

K. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In.-12 In. (100 mm-300 mm), for Water Dist.

L. AWWA M23, PVC—Design and Installation

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M. ASTM A 27, Standard Specification for Steel Castings, Carbon, for General Application.

N. ASTM A 82, Standard Specification for Steel Wire, Plain for Concrete Reinforcement.

O. ASTM A 185, Welded Steel Wire Fabric for Concrete Reinforcement.

P. ASTM A 496, Deformed Steel Wire for Concrete Reinforcement.

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Q. ASTM A 497, Steel Welded Wire Fabric, Deformed for Concrete Reinforcement.

R. ASTM A 1011, Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

S. ASTM A 615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

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T. ASTM C 14, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe.

U. ASTM C 76, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

V. ASTM C 118, Concrete Pipe for Irrigation or Drainage.

W. ASTM C 150, Standard Specification for Portland Cement

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X. ASTM C 361, Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.

Y. ASTM C 443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

Z. ASTM C 478, Standard Specification for Precast Reinforced Concrete Manhole Sections.

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AA. ASTM D 1238, Measuring Flow Rates of Thermoplastics by Extrusion Plastometer.

BB. ASTM D 1598, Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

CC. ASTM D 1599, Short Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.

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DD. ASTM D 1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

EE. ASTM D 1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

FF. ASTM D 2122, Determining Dimensions of Thermoplastic Pipe and Fittings

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GG. ASTM D 2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

HH. ASTM D 2464, Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

II. ASTM D 2467, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

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JJ. ASTM D 2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

KK. ASTM D 2774, Practice for Underground Installation of Thermoplastic Pressure Piping.

LL. ASTM D 3034, Bell and Spigot-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

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MM. ASTM D 3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

NN. ASTM D 3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

OO. ASTM D 3262, Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

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PP. ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

QQ. ASTM D 3754, "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

RR. ASTM D 4161 Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

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SS. ASTM D 5685, "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pressure Pipe Fittings.

TT. ASTM F 437, Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

UU. ASTM F 439, Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

VV. ASTM F 441, Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

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WW. ASTM F 493, Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

XX. ASTM F 714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

YY. ASCE MOP No. 37, Design and Construction of Sanitary and Storm Sewers

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ZZ. ASTM C 507, Standard Specification for Reinforced Concrete Elliptical Culvert,  
Storm Drain and Sewer Pipe

AAA. ASTM F 679, Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter  
Plastic Gravity Sewer Pipe and Fittings

BBB. ASTM F 794, Standard Specification for Polyvinyl Chloride (PVC) Profile Gravity  
Sewer Pipe and Fittings Based on Controlled Inside Diameter

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CCC. ASTM F 949, Standard Specification for Polyvinyl Chloride (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

DDD. ASTM F 477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

EEE. ASTM F 2306, Standard Specification for 12-60 inch Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

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FFF. ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.6 SUBMITTALS

A. In addition to the requirements of Section 01300, provide the following:

1. Size, class and other details of pipe to be used.

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2. Full details of piping, specials, joints, harnessing, and connections to existing piping, structures, equipment and appurtenances.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Prepare and submit report for each test.

C. Certificates: Submit certificates of compliance with referenced standards.

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D. As requested by SD1, all pipe manufacturers that supply pipe for the project shall provide a detailed structural design taking in account the depth of burial, highway loads, bedding and backfill requirements, water elevation, soil conditions and installation procedures. All designs submitted shall have a Professional ENGINEER's stamp from Kentucky. Such design shall be received, reviewed, and approved prior to manufacture.

E. As requested by SD1, pipe manufacturer for each pipe type used shall be present and instruct CONTRACTOR on proper installation technique per shop drawings and manufacturer's recommended procedures. As requested by SD1, pipe manufacturer's representative shall visit job site to monitor progress of pipe installation and shall notify in writing the CONTRACTOR and SD1 of any discrepancy, changes, or incorrect procedures that would prevent the pipe from performing as designed.

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- F. Record Drawings: Submit record drawings in accordance with Section 01720 and Section 01721.

## PART 2 – PIPING & FITTINGS

### 2.1 MATERIALS

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- A. Piping herein specified includes force main & gravity sewer. Refer to the pipe material schedule shown below to determine which pipe materials are acceptable for each application.

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<b>Type</b>	<b>Size</b>	<b>Depth</b>	<b>Acceptable Materials</b>
Sanitary - Aerial	Any		Ductile Iron; PVC SDR 35 inside casing pipe
Sanitary - Gravity	Any	Less than 20'	PVC SDR 35; Fiberglass Polymer Mortar Pipe SN 46;

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			Ductile Iron; HDPE; RCP, polypropylene (HDPP)
Sanitary - Gravity	Any	20.1' to 30'	PVC SDR 26; Ductile Iron; Fiberglass Polymer Mortar Pipe SN 72
Sanitary - Gravity	Any	30.1' or greater	Fiberglass Polymer Mortar Pipe; Ductile Iron
Sanitary - Horizontal Directional Drill	Any	Any	HDPE ; Ductile Iron; Restrained Joint PVC C-900

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Sanitary - Force Main	Any	Any	HDPE; Ductile Iron; PVC C-900
Sanitary – Low Pressure Force Main	Smaller than 4”	Any	PVC SDR 21, PVC Schedule 40, HPDE
Sanitary – Low Pressure Force Main	4”and Larger	Any	PVC C900, HDPE, Ductile Iron

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Storm – Gravity	Any	Less than 20’	RCP; CMP; Ductile Iron; PVC SDR 35; HDPE Corrugated; Polypropylene (HDPP), Fiberglass Polymer Mortar Pipe SN 72
Storm – Gravity	Any	20.1’ or greater	RCP; CMP; Ductile Iron; PVC SDR 26; HDPE Corrugated; Polypropylene (HDPP), Fiberglass Polymer Mortar Pipe SN 72

**Note:** Pipe selected shall be designed for the cover and loading requirements to each project. Design calculations for pipe wall thickness and structural design shall be provided by the ENGINEER, as requested by SD1. Restrained joint calculations for force mains shall be provided for all projects. Depth is based on maximum cover to top of pipe between structures or manhole runs. Pipe shall be the same thickness between structures or manholes.

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B. Refer to applicable Sections for material specifications.

C. General:

1. Marking Piping:

a. Cast or paint material, type and pressure designation on each piece of pipe or fitting 4 inches in diameter and larger.

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- b. Pipe and fittings smaller than 4 inches in diameter shall be clearly marked by manufacturer as to material, type and rating.

2.2 DUCTILE IRON PIPE AND FITTINGS

- A. Piping furnished hereunder shall be complete with all joint gaskets, bolts, and nuts required for installation of valves and equipment furnished by others for installation under this contract.

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B. Pipe Manufacturer's Experience and Field Services.

1. All ductile iron pipe, fittings, and specials shall be fabricated, lined and coated by the pipe manufacturer. Minimum required experience shall include manufacture of a similar pipeline in length to this contract, of equal or larger diameter than the pipe to be provided with joints, lining, and coating suitable for the same or greater pressure rating specified herein, which has performed satisfactorily for the past 5 years.
  
2. An experienced, competent, and authorized field service representative shall be provided by the pipe manufacturer to perform all pipe manufacturer's field services specified herein. The field service representative's minimum required experience qualifications shall include 5 years of practical knowledge and experience installing ductile iron pipe with joints, lining, and coating of the pipe to be provided.

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3. All ductile iron pipe shall be installed in accordance with the pipe manufacturer's recommendations. The pipe manufacturer's field service representative shall visit the site and inspect, check, instruct, guide, and direct CONTRACTOR's procedures for pipe handling and installation at the start of the pipe installation. The pipe manufacturer's field service representative shall coordinate his services with CONTRACTOR.
  
4. Each joint, including all restrained joints, shall be checked by CONTRACTOR as instructed by the pipe manufacturer's field service representative to determine that the joint and the restraints are installed properly.
  
5. As requested, the pipe manufacturer's field service representative shall furnish to SD1, through ENGINEER, a written report certifying that CONTRACTOR's installation personnel have been properly instructed and have demonstrated the proper pipe handling and installation procedures. The pipe manufacturer's field service representative shall also furnish to SD1, through ENGINEER, a written report of each site visit. The pipe manufacturer's field service representative shall revisit the site as often as necessary until all trouble is corrected and the pipeline installation and operation are satisfactory in the opinion of the ENGINEER.

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6. All costs for these services shall be included in the Contract Price.

C. Materials

1. Where ductile iron pipe is required, it shall conform to ANSI/AWWA C151/A21.51, Table 1 or Table 3. Pressure class 350 shall be used for all piping, unless otherwise shown on the drawings or specified. Fittings shall conform to ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.53, with a minimum working pressure rating of 350 psi. All fittings shall be suitable for a test pressure as specified herein without leakage or damage.
2. All buried pressure piping shall be push-on joint or mechanical joint. Restrained joint pipe shall be installed at the station locations shown on the Contract Drawings. All above ground piping or piping in vaults shall be flanged.

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3. All gravity sewer piping shall be push-on joint or mechanical joint.
  
4. Push-on joints and mechanical joints shall be in accordance with ANSI/AWWA C111/A21.11.
  
5. As requested, restrained joint pipe shall be fabricated to the lengths required as determined by the laying schedule to be submitted as specified herein. If deviations from the approved laying schedule are required in the field as approved by SD1 and ENGINEER and field-cuts are required, CONTRACTOR shall provide restraint on the field-cut piping using, EBAA Iron “Megalug” restrained joints as specified below.
  
6. Field cuts shall be minimized and will be limited to only locations as necessary to install pipe, when no other alternative to using factory provided joint restraint exists.

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D. Joints

1. Certification of joint design shall be provided in accordance with ANSI/AWWA C111/A21.11-90, Section 4.5, Performance Requirements, as modified herein.
  
2. The joint test pressure for each type of joint used on this project shall be 1-1/2 times the working pressure at the lowest elevation of the pipeline for a duration of two hours or as specified by the design engineer. The same certification and testing shall also be provided for restrained joints. For restrained joints, the piping shall not be blocked to prevent separation and the joint shall not leak or show evidence of failure.
  
3. It is not necessary that such tests be made on pipe manufactured specifically for this project. Certified reports covering tests made on other pipe of the same size and design as specified herein and on the drawings and manufactured from materials of equivalent type and quality may be accepted as adequate proof of design.

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4. Nuts, bolts, and tie -rods used on buried pressure pipe and fittings shall be low alloy steel T- bolts with Zinc anode caps for all T-bolts and rods. The entire installation shall be wrapped in one layers of polyethylene encasement. Nuts, bolts and stiffener plates which will be in contact with sewage shall be stainless steel Type 316.

E. Material Schedule

Push-on Joints and Mechanical Joints	ANSI/AWWA C111/A21.11
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<p>Restrained Push-on Joints</p> <p>Positive locking segments and/or rings (4 inch through 64 inch)</p>	<p>American “Flex-Ring”, or “Lok-Ring”; U.S. Pipe “TR Flex”; Clow Corp., “Super-Lock”, or equal</p>
<p>Restrained Push-on Joints, (field-cut spigot)</p> <p>locking wedge type</p>	<p>EBA Iron “Megalug” Series 1700, or equal. Shall only be used in locations approved by the ENGINEER.</p>
<p>Restrained Mechanical Joints (Factory prepared spigot) (4 inch through 48 inch)</p>	<p>American “MJ coupled Joints”</p>

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<p>Restrained Mechanical Joints (field cut spigot)</p>	<p>EBA Iron “Megalug” Series 1100, without exception. Shall only be used in locations approved by the ENGINEER.</p>
<p>Fittings</p>	<p>ANSI/AWWA C110/A21.1, or ANSI/AWWA C153/A21.53, all with minimum working pressure of 350 psi, and suitable for the test pressure based on the project design without leakage or damage.</p>
<p>Flanged Joints &amp; Fittings</p>	<p>Ductile Iron, ANSI/AWWA C115/A21.5 suitable for the test pressure based on the project design without leakage or damage. Faced and drilled, ANSI B16.1 125-pound flat face. Threaded conforming to AWWA C115/A21.15.</p>

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<p>Bolting</p>	<p>125-pound flat-faced flange: ASTM A 307, Grade A carbon steel hex head bolts and ASTM A563 Grade A carbon steel hex head nuts</p>
<p>Gaskets</p>	<p>Restrained Push-on and Mechanical Joints: Synthetic rubber conforming to AWWA C111/A21.11. Natural rubber is not acceptable.</p> <p>Flanged: 1/8 inch thick, red rubber (SBR), hardness 80 (Shore A), rated to 200 degrees F., conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Full face for 125-pound flat-faced flanges, or specially</p>

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	<p>designed gaskets with required properties per ANSI/AWWA C111/A21.11 to meet the test pressure rating. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange.</p> <p>Gasket pressure rating to equal or exceed the system hydrostatic test pressure.</p>
<p>Joint Lubricant</p>	<p>Manufacturer's standard</p>
<p>Tapping Sleeves</p>	<p>316 SS, with 316 SS body and bolting, and rubber sealing gasket, suitable for the test</p>

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	pressure specified herein. JCM Industries, Model JCM 452 or approved equal.
Polyethylene Encasement	Seamless, ANSI/AWWA C105/A21.5; LLD-8 mil or HDCL-4 mil

F. Lining and Coating Ductile Iron Pipe and Fittings (For Sanitary Sewers Only)

1. All buried ductile iron pipe and fittings shall have manufacturers outside standard asphaltic coating and ceramic epoxy lining inside, factory applied. Ceramic epoxy lining shall be Protecto 401 as manufactured by Vulcan Painters, Inc. of Birmingham, AL, or NovoCoat SP-2000W as manufactured by NovoCoat Protective Coatings, of Addison, Texas, or equal, and as

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specified herein. Flange faces shall be coated externally with a suitable manufacturer's standard rust-preventative compound.

2. Application of Lining:

The interior of the pipe exposed to liquids and gases shall be blasted and cleaned to remove all loose oxides and rust. After cleaning, the lining material shall be applied to yield 40 mils for the complete system using a centrifugal lance applicator. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate. The compound shall not be applied when the substrate temperature is below 40 degrees F., or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.

3. Lining material

The material shall be a two component epoxy with the following minimum Requirements:

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- a. A permeability rating of 0.0 perms when measured by ASTM E96-66, Procedure A. Duration of test - 6 weeks.
  
- b. A direct impact resistance of 125 inches-pounds with no cracking when measured by ASTM-D-2794.
  
- c. The ability to build at least 50 mils dry in one coat.
  
- d. The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
  
- e. The material shall contain at least 20% by volume of ceramic quartz pigment.

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- f. A test and service history demonstrating the ability of the material to withstand the service expected.
  
- g. Each requirement of 2.2.F.3 above must be certified by the material supplier.

4. Field Cuts

- a. All manufacturer's procedures and recommendations shall be followed when making field cuts. Note proper field preparations and curing time of the coating.

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- G. All items used for jointing pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. If requested, three (3) copies of such instructions shall be delivered to the ENGINEER at start of construction.

H. Encasement

1. Polyethylene encasement shall be provided for all buried ductile iron pipe, including all straight pipe, bends, tees, wyes, adapters, closure pieces, field restraint devices, valves and other fittings or specials, in accordance with ANSI/AWWA C105/A21.5, Method A. Preparation of the pipe shall include, but not be limited to: removing lumps of clay, mud, cinders, etc., prior to installation.
2. Where ductile iron pipe is also embedded or encased in concrete the polyethylene encasement shall be installed over the ductile iron pipe prior to

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concrete placement. Polyethylene encasement is only required in a casing pipe, if grouting of the annular space is required.

3. The pipe shall be wrapped with 8-mil thickness polyethylene tube wrap, using the recommended minimum flat tube widths for the specified pipe sizes. The polyethylene tube wrap shall be of virgin polyethylene as produced from DuPont Alathan resin or equal.
  
4. The polyethylene tube seams and overlaps shall be wrapped and held in place by means of 2-inch wide plastic backed adhesive tape. The tape shall be Polyken Number 900, Scotchrap Number 50, or equal. The tape shall be such that the adhesive shall bond securely to both metal surfaces and polyethylene film.
  
5. The polyethylene film supplied shall be clearly marked at a minimum of 2-ft along its length, containing the following information:
  - a. Manufacturer's name or trademark
  
  - b. Year of Manufacture

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c. ANSI/AWWA C105/A21.5

d. Minimum film thickness and material type (LLDPE or HDCLPE)

e. Applicable range of nominal pipe diameter size(s)

f. Warning--Corrosion Protection--Repair any Damage

2.3 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (GRAVITY LINES)

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A. Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) Piping –  
Schedule Rated Pipe:

1. Pipe and Fitting Material:

a. Standard: ASTM D 1784.

b. Type: Type I, Grade 1, rigid (12454-B).

2. Pipe:

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a. PVC:

1) Standard: ASTM D 1785.

2) Designation: PVC 1120.

b. CPVC:

1) Standard: ASTM F 441.

3. Joints:

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a. General: Connect pipe by solvent cementing except where flanged or threaded fittings are required at expansion joints, valves, flow meters, equipment connections or otherwise shown or directed.

b. Flanged Joints:

1) Use flanges joined to pipe by solvent cementing.

2) Flange Drilling and Dimensions: Comply with ANSI B16.1.

3) Flange Gaskets: Viton full face.

4) Bolts, Nuts and Washers: Type 316 stainless steel.

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5) Provide washers on each face of the bolted connection.

c. Threaded Joints:

1) Taper Pipe Threads: ANSI B2.1.

2) Joint Preparation: Teflon tape.

3) Use PVC dies for taper pipe threads.

d. Primer and Solvent Cement:

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1) Standard:

a) PVC: ASTM D 2564.

b) CPVC: ASTM F 493.

4. Fittings:

a. Socket-Type:

1) PVC:

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a) Standard: ASTM D 2467.

b) Designation: PVC I.

2) CPVC:

a) Standard: ASTM F 439.

b) Threaded Type:

i. PVC:

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(a) Standard: ASTM D 2464.

(b) Designation: PVC I.

ii. CPVC:

(a) Standard: ASTM F 437.

B. Polyvinyl Chloride (PVC) Piping – Gravity Sewer Pipe and Fittings:

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Project Name

Issue Date: \_\_\_\_\_

1. Pipe and Fitting Material:

a. Standard: ASTM D 1784.

2. Pipe and Fittings:

a. Standard:

1) 4-inch through 15-inch diameter: ASTM D 3034.

2) 18-inch through 27-inch diameter: ASTM F 679.

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b. Thickness Class: As shown in item 1.1 this section.

3. Joints:

a. Push On Joints: Connect pipe with integral wall bell and spigot joints. The bell shall consist of an integral wall section with a solid cross section rubber gasket, factory assembled, securely locked in place to prevent displacement during assembly. Joints shall be assembled in accordance with the pipe manufacturer's recommendations and ASTM D 3212.

b. Gaskets: Rubber gaskets shall be in compliance with ASTM F 477 and shall be suitable for the service specified.

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C. Profile Wall Polyvinyl Chloride (PVC) Piping (For Storm Sewers Only)

1. PVC open or closed profile pipe meeting the requirements of ASTM F 794, Standard Specification for Polyvinyl Chloride (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
  
2. Joints for PVC pipe shall be gasket, bell and spigot, push-on types which meet the requirements of ASTM D 3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals. Gaskets shall meet the requirements of ASTM F 477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. Corrugated Polyvinyl Chloride (PVC) Piping (For Storm Sewers Only)

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1. Corrugated PVC pipe meeting the requirements of ASTM F 949, Latest Revision, "Polyvinyl Chloride (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings".
  
2. Joints for PVC pipe shall be gasket, bell and spigot, push-on types which meet the requirements of ASTM D 3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals. Gaskets shall meet the requirements of ASTM F 477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

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2.4 POLYVINYL CHLORIDE (PVC) PIPE – C900 PIPING (FORCE MAINS)

- A. This pipe shall meet the requirements of AWWA C900-75 for Polyvinyl Chloride (PVC) Pressure Pipe. The pipe shall be PVC 1120 pipe with cast iron pipe equivalent ODs. See Table 1 below for pipe material depth and pressure limitations.

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- B. Provisions must be made for expansion and contraction at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the laboratory performance of ASTM D3139. The bell section shall be designed to be at least as strong as the pipe wall.
  
- C. Standard laying lengths shall be 20 feet  $\pm$  for all sizes. At least 85 percent of the total footage of pipe of any class and size shall be furnished in standard lengths, the remaining 15% in random lengths. Random lengths shall not be less than 10 feet long. Each standard and random length of pipe shall be tested to four times the class pressure. The integral bell shall be tested with the pipe.
  
- D. Fittings for all lines 4 inches in diameter or larger shall be restrained ductile iron and in accordance with AWWA C153 and have a body thickness and radii of curvature conforming to ANSI A21.10 or ANSI A21.53 for compact fittings.

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E. Fittings for all lines less than 4 inches in diameter shall be PVC gasketed push on type or socket glue-type manufactured specifically for the pipe class being utilized. All socket-glue type connections shall be joined with PVC solvent cement conforming to ASTM D2564. Product and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility. Solvent cement joints shall be made up in accordance with the requirements of ASTM D2855.

F. Appropriate restraint shall be provided for all fittings. Fittings shall be restrained with EBAA Iron Mega-Lugs, or equal. Pipe joints on either side of the fittings shall also be restrained to the distance required by the restrained joint calculations with the appropriate EBAA Iron Mega- Lug. The appropriate restraints are listed below:

1. Series 2000SV& 2000PV: MEGALUG Restraint for existing C900 PVC Pipe at DIP
  
2. Series 2800: MEGALUG Restraint Harness for C900

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3. Series 2200: MEGALUG Restraint for C900 at DIP Mechanical Joint fitting

G. Pipe material depth and pressure limitations (Table 1)

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TABLE -1                      Pipe Material Depth and Pressure Limitations

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Project Name

Issue Date: \_\_\_\_\_

<b>Pipe Material</b>	<b>Minimum Depth of Bury<sup>1, 2</sup></b>	<b>Maximum Depth of Bury<sup>1, 2</sup></b>	<b>Pressure  Class / Rating</b>	<b>Maximum Surge Pressure  Capacity</b>
Pressure Class 350 – DIP	3 ft.	30 ft.	350 psi	450 psi
DR 25 – C900 PVC	3 ft.	10 ft.	165 psi. <sup>3</sup>	264 psi <sup>5</sup>

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DR 18 – C900 PVC	3 ft.	20 ft.	235 psi. <sup>3</sup>	376 psi <sup>5</sup>
DR 14 – C900 PVC	3 ft.	30 ft.	305 psi. <sup>3</sup>	488 psi <sup>5</sup>

Table Notes:

1. Depth of bury limitations are provided as a general rule. At the discretion of SD1, greater depths may be allowed provided special pipe bedding is provided. Under some combinations of pipe material, soil type and bedding conditions, maximum acceptable depths may be reduced. For all applications where depth of bury is greater than or equal to thirty (30) feet, DIP shall be used.

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2. Design ENGINEER shall consult appropriate references to ensure selected pipe material is suitable for each application. Such references may include the DIPRA *Design of Ductile Iron Pipe* brochure, *Uni-Bell Handbook of PVC Pipe Design and Construction*, PWEagle Technical Bulletins TB-D5 and TB-D8 (for PVC pipe), or Performance Pipe Bulletin PP 503 and PP 508 (for HDPE pipe) or other appropriate sources.
  
3. Total System Pressure (i.e. maximum working pressure plus any routine pressure surge) shall be less than the Pressure Class, as defined by AWWA C900-07 (values given in the above table are at 73.4°F). “Maximum working pressure” is the maximum steady-state, sustained operating pressure applied to the pipe exclusive of transient pressures.
  
4. Maximum working pressure shall be less than the Pressure Class, and Total System Pressure (i.e. maximum working pressure plus any routine pressure surge) shall be less than 1.5 times the Pressure Class, as defined by AWWA C906-07 (values given in the above table are at 73.4°F). “Maximum working pressure” is the maximum steady-state, sustained operating pressure applied to the pipe exclusive of transient pressures.

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5. For C900 PVC pipe, maximum working pressure plus occasional or “emergency” surges shall not be greater than the Maximum Surge Pressure Capacity (1.6 times the Pressure Class of the pipe) as defined by AWWA C900(2007).

## 2.5 HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

### A. Smooth Wall

1. Qualification of Manufacturers: Qualified manufacturers shall be firms

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regularly engaged in the manufacture of HDPE pipe and pipe fittings of the same size, type, and joint configuration specified, and whose products have been in satisfactory use for not less than five (5) years.

2. Heat Fusion Training/Certification: The CONTRACTOR shall ensure and certify that persons making heat fusion joints have received training in the manufacturer's recommended procedure not more than 12 months prior to commencing construction.

a. An experienced, competent, and authorized field service representative shall be provided by the pipe manufacturer to perform all pipe manufacturer's field services specified herein. The field service representative's minimum required experience qualifications shall include 5 years of practical knowledge and experience in making heat fusion joints and installing HDPE pipe.

b. All HDPE pipe shall be installed in accordance with the pipe manufacturer's recommendations. The pipe manufacturer's field service representative shall visit the site and inspect, check, instruct, guide, and direct CONTRACTOR's procedures for pipe handling and installation at the start of the pipe installation. The fusion pipe manufacturer's field service representative shall coordinate his services with CONTRACTOR.

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- c. Each joint shall be checked by CONTRACTOR as instructed by the pipe manufacturer's field service representative to determine that the pipe is properly fused.
  
  - d. As requested, the pipe manufacturer's field service representative shall furnish to SD1, through ENGINEER, a written report certifying that CONTRACTOR's installation personnel have been properly instructed and have demonstrated the proper pipe handling, fusion, and installation procedures. The pipe manufacturer's field service representative shall also furnish to SD1, through ENGINEER, a written report of each site visit. The pipe manufacturer's field service representative shall revisit the site as often as necessary until all trouble is corrected and the pipeline installation and operation are satisfactory in the opinion of the ENGINEER.
  
  - e. All costs for these services shall be included in the Contract Price.
3. Interchangeability of Pipe and Fittings: Within Contract limits, pipe and fittings from different approved manufacturers shall not be interchanged.

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4. HDPE shall be manufactured in accordance with ASTM F 714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, percent carbon, (from pipe) dimensions and ring tensile strength.
  
5. Materials used for the manufacture of HDPE pipe and fittings shall be PE3408 HDPE, meeting cell classification 345434C or 345434E per ASTM D 3350 and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM D 1248; and shall be listed in the name of the pipe and fitting manufacturer in Plastics Pipe Institute (PPI) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1,600 psi at 73° F. The manufacturer shall certify that the materials used to manufacture pipe and fittings meet those requirements.
  
6. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe. Directional fittings 16-inch IPS and larger such as elbows, tee, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

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7. Molded fittings shall be manufactured in accordance with ASTM D 3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE ) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D 3261.
  
8. Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small V-shaped grooves to provide gasketless sealing, or to restrain the gasket against blow-out.
  
9. Flange adapters shall be fitted with back-up rings pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.
  
10. Joints between HDPE pipes and between HDPE fittings and pipes shall be fusion bonded as described in Section 3.5.

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11. The exterior of the HDPE pipe shall be color coded and striped in a way to identify the difference in pipe service, size and application.
  
12. HDPE pipe shall be black.
  
13. All piping used for horizontal directional drilling shall be permanently striped.
  
14. Internal 316 stainless steel stiffeners as manufactured by JCM Industries, Inc., or approved equal shall be used at all locations where external connectors or restraint clamps are installed. MJ adapters as manufactured by Central Plastics Company or equal, with creation of positive restraint to the pipe from heat fusion of the adapter to the pipe, and creation of positive restraint at the connection through bolting of the backup ring to the MJ valve or fitting, can be used in lieu of the JCM internal stainless steel stiffeners and external restraint clamps.
  
15. Except as noted in item 14 above, all mechanical connections shall be

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stiffened and restrained. Restraints shall be as manufactured by JCM Industries, Inc., or approved equal.

16. External restraint clamps utilized for transition from ductile iron pipe to polyethylene pipe shall be as manufactured by JCM Industries, Inc., or approved equal. Restraints must be compatible with stiffeners and pipe. JCM restraints shall not be used with HDPE pipe in locations where test pressures will exceed 150 psi. In locations where HDPE pipe will have test pressures exceeding 150 psi, provide an MJ adapter as described in item 14 above.

17. The Dimension Ratios (DR's) are shown on the table (Table 2) below:

Table 2 – Pipe Material Depth and Pressure Limitations

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<b>Pipe Material</b>	<b>Minimum Depth of Bury<sup>1, 2</sup></b>	<b>Maximum Depth of Bury<sup>1, 2</sup></b>	<b>Pressure  Class / Rating</b>	<b>Maximum Surge Pressure  Capacity</b>
DR 17 – HDPE	3 ft.	10 ft.	100 psi <sup>4</sup>	200 psi <sup>6</sup>

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DR 13.5 – HDPE	3 ft.	15 ft.	128 psi <sup>4</sup>	256 psi <sup>6</sup>
DR 11 – HDPE	3 ft.	20 ft.	160 psi <sup>4</sup>	320 psi <sup>6</sup>
DR 9 – HDPE	3 ft.	25 ft.	200 psi <sup>4</sup>	400 psi <sup>6</sup>
DR 7.3 – HDPE	3 ft.	25 ft.	254 psi <sup>4</sup>	508 psi <sup>6</sup>

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Table Notes:

1. Depth of bury limitations are provided as a general rule. At the discretion of SD1, greater depths may be allowed provided special pipe bedding is provided. Under some combinations of pipe material, soil type and bedding conditions, maximum acceptable depths may be reduced. For all applications where depth of bury is greater than or equal to thirty (30) feet, DIP shall be used.
  
2. Design ENGINEER shall consult appropriate references to ensure selected pipe material is suitable for each application. Such references may include the DIPRA Design of Ductile Iron Pipe brochure, Uni-Bell Handbook of PVC Pipe Design and Construction, PWEagle Technical Bulletins TB-D5 and TB-D8 (for PVC pipe), or Performance Pipe Bulletin PP 503 and PP 508 (for HDPE pipe) or other appropriate sources.
  
3. Total System Pressure (i.e. maximum working pressure plus any routine pressure surge) shall be less than the Pressure Class, as defined by AWWA C900-07 (values given in the above table are at 73.4°F). “Maximum working pressure” is the maximum steady-state, sustained operating pressure applied to the pipe exclusive of transient pressures.

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4. Maximum working pressure shall be less than the Pressure Class, and Total System Pressure (i.e. maximum working pressure plus any routine pressure surge) shall be less than 1.5 times the Pressure Class, as defined by AWWA C906-07 (values given in the above table are at 73.4°F). “Maximum working pressure” is the maximum steady-state, sustained operating pressure applied to the pipe exclusive of transient pressures.
  
5. For C906 HDPE pipe, maximum working pressure plus occasional or “emergency” surges shall not be greater than the Maximum Surge Pressure Capacity (2.0 times the Pressure Class of the pipe) as defined by AWWA C906(2007).
  - a. The DR’s shall be verified by the Design ENGINEER and the manufacturer for the laying and pressure conditions shown on the drawings, including full consideration of vacuum, with calculations submitted to SD1 for review. NOTE: Manufacturers who do not comply with this requirement will not be considered an equal. The CONTRACTOR shall be liable if the pipe fails or pulls apart. The minimum DR shown above shall be used unless a thicker wall DR is recommended by the manufacturer during his verification. For horizontal directional drilling (HDD), pipe installed at depths from 0’-15’ deep shall have a minimum DR 9 rating or manufacturer’s minimum recommended DR, whichever is more conservative. HDD

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pipe installed at depths greater than 15' shall also have a minimum DR 9 rating or manufacturer's minimum recommended DR, whichever is more conservative. **CONTRACTOR shall note that depending on the wall thickness of the pipe to be furnished, an increase in pipe size may be required to provide comparable internal diameter to ductile iron pipe.**

18. Mechanical joint ductile iron fittings for DIP sized HDPE pipe meeting all requirements of ANSI A211.11 (AWWA C111) may be used in lieu of HDPE pipe fittings. Restraints shall be Sur-Grip as manufactured by JCM Industries, Inc., or approved equal.
  
19. Nuts, bolts, and tie -rods used on buried pressure pipe and fittings shall be low alloy steel T- bolts with Zinc anode caps for all T-bolts and rods. The entire installation shall be wrapped in two layers of polyethylene encasement. Nuts, bolts and stiffener plates which will be in contact with sewage shall be stainless steel Type 316.
  
20. HDPE pipe shall have OD of ductile iron pipe.
  
21. HDPE pipe shall be as manufactured by CP Performance Pipe, or equal.

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B. Corrugated HDPE (For Storm Sewer Only)

1. Corrugated polyethylene pipe with an integrally formed smooth interior shall meet the requirements of AASHTO M 294, Standard Specification for Corrugated Polyethylene Pipe, 12 to 36 inch diameter, for Type S pipe. SD1 will consider the use of large diameter HDPE on a case-by-case basis; approval shall be at SD1's discretion
  
2. HDPE pipe shall be joined using an inline bell (IB) & spigot joint or fitting meeting AASHTO M294 or ASTM F2306. The joint or fitting shall be soil-tight and gaskets shall meet the requirements of ASTM F477.

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2.6 FIBERGLASS REINFORCED POLYMER MORTAR (FIBERGLASS) PIPE AND

FITTINGS (GRAVITY LINES)

- A. Fiberglass reinforced polymer mortar (fiberglass) pipe and fittings for gravity sewers shall conform to the requirements of ASTM D-3262, current approval, “Standard Specification for ‘Fiberglass’ (Glass-Fiber-Reinforced Thermosetting Resin) Sewer Pipe.”

- B. Materials

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1. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.
  
2. Glass Reinforcements: Chopped glass reinforcement fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins. Continuous circumferential glass reinforcement fibers, where utilized, shall be of grade ECR-glass with binder and sizing compatible with impregnating resins.
  
3. Silica Sand: Sand shall be a minimum of 98% silica with a maximum moisture content of 0.2%.
  
4. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally affect the performance of the product.

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5. Elastomeric Gaskets: Gaskets shall be supplied by qualified gasket manufacturers and be suitable for the service intended.

C. Manufacture and Construction

1. Pipes: Manufacture pipe by a process that will result in a dense, non-porous, corrosion-resistant, consistent composite structure.
  
2. Joints: Unless otherwise specified, the pipe shall be field connected with fiberglass couplings that utilize elastomeric EPDM or REKA sealing gaskets as the sole means to maintain joint watertightness. The joints shall meet the performance requirements of ASTM D4161. Additionally, the joints shall be

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rated to a pressure of 80% of -14.7 psi as installed. Joints at tie-ins, when needed may utilize fiberglass, gasket-sealed closure couplings.

3. Fittings: Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They must be made and delivered from Manufacturer. All fittings and couplings shall be pressure rated for a minimum of 50 psi.
  
4. End Coating: Protective spigot end resin coating shall be applied at the time of manufacture. CONTRACTOR shall similarly coat the ends of all field cut pipes if the wall of the pipe is completely de-aerated during the production process and glass and sand are not impregnated with 100% pure resin to form a wall that cannot be penetrated by water.
  
5. Fiberglass pipe shall be as manufactured by: Hobas Pipe USA, Inc., or approved equal.
  
6. For bury depths greater than 20 feet, CONTRACTOR shall comply with special trench construction requirements recommended by the manufacturer.

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D. Dimensions:

1. Diameters: The actual outside diameter of the pipe barrel shall be in accordance with ASTM D3262. The internal diameters of all pipes shall be as specified on the Contract Drawings for each pipe diameter.
  
2. Lengths: Pipe shall be supplied in nominal lengths of 20 feet. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.
  
3. Wall Thickness: The minimum wall thickness shall be the required design thickness for the laying conditions. Manufacturer shall provide information in writing to SD1 per the submittal requirements.

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4. End Squareness: Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/4".

E. Testing:

1. Pipes: Pipes shall be manufactured and tested in accordance with ASTM D3262.
2. Joints: Joints shall meet the requirements of ASTM D4161.
3. Stiffness: As tested in accordance with ASTM D2412. Any fiberglass pipe

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run that exceeds 20 feet, but less than 30 feet, in depth to invert anywhere along the run length from one manhole or structure to a second manhole or structure shall be a minimum stiffness of 72 psi for the entire run.

F. Customer Inspection

1. SD1 or other designated representative shall be entitled to inspect pipes at the factory or witness the pipe manufacturing.
  
2. Manufacturers Notification to Customer: Should SD1 request to see specific pipes during any phase of the manufacturing process, the manufacture must provide SD1 with adequate advance notice of when and where the production of those pipes will take place.

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- G. Packaging, Handling, and Shipping shall be done in accordance with the manufacturer's instructions.

2.7 REINFORCED CONCRETE PIPE (RCP)

- A. Circular reinforced concrete pipe shall meet the requirements of ASTM C 76, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Storm Pipe. Elliptical reinforced concrete pipe shall meet the requirements of ASTM C 507, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.

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B. Rubber and plastic joints, or approved equal, shall be the jointing method for RCP and shall meet the requirements of AASHTO M 315 / ASTM C 443. Other methods of joining RCP will only be allowed upon explicit approval from SD1.

C. When RCP is used under pavement or driveways, a minimum of Class III RCP shall be required or higher class as noted on drawings.

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2.8 CORRUGATED METAL PIPE (CMP) (FOR STORM SEWERS ONLY)

- A. Corrugated steel pipe shall meet the requirements of AASHTO M36. Corrosion protection shall be provided through an aluminized coating conforming to AASHTO M274. Aluminum alloy spiral pipe shall meet the requirements of AASHTO M196.

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Coating materials shall be evaluated on a per project basis. Asphalt coatings shall not be permitted for corrugated metal pipe.

- B. Joints for CMP shall be made using coupling bands and gaskets meeting the requirements of AASHTO M 36 and AASHTO M 274.

2.9 HIGH-PERFORMANCE POLYPROPYLENE PIPE

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Project Name

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- D. For storm sewer application, pipe shall be joined with a extended reinforced integral bell & gasketed spigot in accordance with ASTM D32212.2.9

2.10 TRACER WIRE

- A. All pressure pipe shall have marking tape 6” wide. Marking tape for the manhole shall be green with the words “Sanitary Sewer” installed approximately twelve (12) inches above the pipe and shall continue for the length of the pipe installation.

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- B. All pipe for sanitary force mains shall be installed with a twelve (12) gauge solid copper (PVC coated) tracing wire taped to the top of the pipe every five (5) feet. No tracing wire length shall exceed fifteen hundred (1500) feet between air release valves and/or discharge manhole, where system becomes gravity, without terminating in a curb stop box marked with "Sewer". Tracing wire must run continuously through air release valves and made accessible from ground level. Sanitary force mains that end in a discharge manhole, at which point system becomes gravity, shall terminate tracing wire in a curb stop box next to the discharge manhole. Curb stop boxes shall not be located in pavement areas. Splices in the tracing wire shall be kept to a minimum and approved by SD1. If splices are required, they shall be made with copper split bolt (IlSCO #1K-8 or approved equal) and taped with electrical tape. Tracer wire shall be tested to confirm it is functioning properly after installation.

## 2.11 PIPE COUPLINGS

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- A. For new pipe installation, transition between two differing pipe materials must be done at manhole terminations, unless another method is approved by SD1. For connections to existing sewers of differing pipe material, Frengo “flexible couplings” or equal shall be used.
- B. For any other field cut connection, the pipe couplings shall be of a gasketed, sleeve-type with diameter to properly fit the pipe. Each coupling shall consist of one (1) stainless steel middle ring, of thickness and length specified, two (2) stainless steel followers, two (2) rubber-compounded wedge section gaskets and sufficient track-head steel bolts to properly compress the gaskets. The couplings shall be assembled on the job in a manner to insure permanently tight joints under all reasonable conditions of expansion, contraction, shifting and settlement, unavoidable variations in trench gradient, etc. The coupling shall be Dresser, Style 38, as manufactured by Dresser Manufacturing Division, Bradford, PA, or equal.

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2.12 WYE BRANCH FITTINGS AND LATERALS FOR NEW CONSTRUCTION

- A. Tee or wye branch fittings shall be used for household or service connection lines to the sewer collector line. The fittings shall meet the requirements of the mainline pipe materials as specified herein. The wyes and tees shall be located as shown on the Contract Drawings or as directed by the ENGINEER. The wyes and tees shall be positioned as to require the least number of fittings per lateral connection. Regular wye connections shall be in accordance with Standard Drawing No. 120. Stack wye connections shall include vertical piping, elbows, wye, and concrete encasement in accordance with Standard Drawing No. 108. If a single sweep tee connection is used, the sweep must be in the direction of sanitary sewer main

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- B. Inserta Tee pipe fittings are permitted as an alternate lateral tap connection in lieu of wye fittings when main pipe nominal diameter is greater than 12” or on a case by case basis for new construction. Inserta Tee type shall be compatible for the pipe type be tapped. Contractor shall be responsible for supplying the proper Tee. Install Inserta Tees using procedures and equipment as referenced in the manufacturer’s written installation instructions and in accordance with standard drawing 102.
- C. Lateral extensions shall be installed from the end of the regular or stack wye connection to the limit of easement or public right-of-way in accordance with Standard Drawing No. 120.

2.13 CONNECTIONS TO EXISTING SEWERS

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Issue Date: \_\_\_\_\_



A. Connections to existing public sewers shall be made at the nearest wye or tee available on the public sewer. Connections to existing sewers where wyes or tees are not available shall be made by one of the following methods:

1. Install a wye or tee branch fitting per the manufacturer's recommendations or an approved method by SD1.
  
2. Inserta Tee Pipe Fittings: Install Inserta Tees using procedures and equipment as referenced in the manufacturer's written installation instructions and in accordance with standard drawings 102.

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3. Tapping Saddles: Tapping saddles shall only be used with the explicit approval of SD1 on a case by case basis. If approved install per manufacturer's recommendations.

#### 2.14 STORM LATERAL CONNECTIONS

- A. Roof downspouts, footing or foundation drains, and sump pumps shall discharge in accordance with the local governing subdivision regulations. All storm lateral connections (downspouts, footing or foundation drains, sump pumps, etc) to the storm sewer shall be prohibited unless explicitly reviewed and approved by SD1 due to

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uncommon circumstances (i.e. inadequate discharge distances from foundations, narrow side yards, etc).

### PART 3 – EXECUTION

#### 3.1 GENERAL

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and foreign matter immediately prior to jointing. The contact surfaces shall be coated with the lubricant, primer or adhesive recommended by the manufacturer, and then the pipe shall be pushed together until the joint snaps distinctly in place. The pushing together of the pipe may be done by hand or by the use of a bar.

D. Place pipe to the grades and alignment indicated, runs of pipe between manholes shall be within 95% of the slope shown on the plans unless otherwise directed by the ENGINEER. Remove and relay pipes that are not laid correctly. Slope piping uniformly between elevations shown.

E. Trenches shall be kept dry during pipe laying. Before pipe laying is started, all water that may have collected in the trench shall be removed. Ensure that ground water level in trench is at least 12 inches below bottom of pipe before laying piping. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete and protect and keep clean water pipe interiors, fittings and valves.

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F. All pipe shall be laid starting at the lowest point and proceed towards the higher elevations, unless otherwise approved by ENGINEER. Place bell and spigot pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.

G. When laying of the pipe is stopped, the end of the pipe shall be securely plugged or capped. Plugging shall prevent the entry of animals, liquids, or persons into the pipe or the entrance or insertion of deleterious material.

1. Install standard plugs into all bells at dead ends, tees or crosses. Cap all spigot ends.

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2. Fully secure and block all plugs and caps installed for pressure testing to withstand the specified test pressure.
  
3. Where plugging is required for phasing of the Work or for subsequent connection of piping, install watertight, permanent type plugs.

H. As required by SD1, pipe manufacturer for each pipe type used shall be present and instruct CONTRACTOR on proper installation technique per shop drawings and manufacturer's recommended procedures prior to the start of the Work.

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L. Touch up protective coatings in a satisfactory manner prior to backfilling. See pipe material section for specific requirements.

M. Place concrete pipe containing elliptical reinforcement with the minor axis of the reinforcement in a vertical position.

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N. Laying Pipe and Service Laterals

1. Conform to manufacturer's instructions and requirements of the standards listed below, where applicable:

- a. Ductile Iron Pipe: AWWA C600, AWWA C105.

- b. Concrete Pipe: AWWA M9, Concrete Pipe Handbook.

- c. Thermoplastic Pipe: ASTM D 2774.

- d. ASCE Manual of Practice No. 37.

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### 3.2 PIPE INSTALLATION – GENERAL

- A. Excavation for Pipeline Trenches: Refer to Section 02220. Trenches in which pipes are to be laid shall be excavated to the depths shown on the Drawings or as specified by the ENGINEER. Minimum cover for all pipelines shall be 36 inches minimum cover as measured from top of pipe, unless otherwise shown on the Drawings or approved by the ENGINEER. Trench excavations maybe inspected by ENGINEER prior to laying pipe. Notify SD1 48 hours in advance of all excavating, bedding and pipe laying operations.

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B. Jointing: The types of joints described herein shall be made in accordance with the manufacturer's recommendations.

C. Separation of Sanitary Sewers and Potable Water Pipe Lines:

1. Horizontal Separation:

- a. Wherever possible, existing and proposed potable water mains and service lines, and sanitary and storm sewers and service lines shall be separated horizontally by a clear distance of not less than 10 feet.

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b. If local conditions preclude a clear horizontal separation of not less 10 feet, the installation will be permitted provided the potable water main is in a separate trench or on an undistributed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

c. Exception:

1) Where it is not possible to provide the minimum horizontal separation described above, the potable water main must be constructed of cement lined ductile iron slip-on or mechanical joint pipe complying with the public water supply design standards of the governing agency. Sewer must be constructed of epoxy lined ductile iron slip-on or mechanical joint pipe complying with SD1's requirements.

2. Crossings:

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- a. Provide a minimum vertical distance of 18 inches between the outsides of pipes.
  
- b. Center one full length section of potable water main over the sewer so that the sewer joints will be equidistant from the potable water main joints.
  
- c. Provide adequate structural support where a potable water main crosses under a sewer to maintain line and grade.
  
- d. Exceptions:
  - 1) See requirements in paragraph 3.2.C.1.c.(1) above.

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2) Concrete encase as directed by SD1.

D. Permanent slope anchors shall be installed on all pipe with slopes over twenty (20) percent. See the SD1's standard detail for Concrete Anchor Block. Consult with SD1 on spacing of the anchors.

E. Reaction Anchorage (Pressure Pipe Only):

1. All tees, Y-branches, bends deflecting 11-1/4 degrees or more, and plugs

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which are installed in buried piping shall be provided with proprietary restrained joint systems for preventing movement of the pipe and joints caused by the internal test pressure.

F. Thrust Restraint

1. Provide thrust restraint on pressure piping systems where shown and specified.
  
2. Thrust restraint for DIP shall be accomplished by means of restrained pipe joints.
  
3. Thrust restraints shall be designed for the axial thrust exerted by the system design pressures as specified by the Design ENGINEER.

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G. Dewatering and Ground Water

1. Discharging of sediment laden groundwater or rainwater from excavations directly to watercourses or storm sewers is prohibited. Failure of the CONTRACTOR to comply with the requirements of this specification may result in SD1 issuing a stop work order or non-approval of pay estimates until the CONTRACTOR puts measures in place to comply with this specification. All costs associated with the stop work or non-approval of pay estimates shall be at the CONTRACTOR's sole expense.
  
2. Pipe trenches and excavations for appurtenances shall be kept free from water during trench bottom preparation, pipe laying and jointing, pipe embedment and building of appurtenances in an adequate and acceptable manner.
  
3. Where the trench or excavation bottom is mucky or otherwise unstable

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because of ground water, or where the ground water elevation is above the bottom of the trench or excavation, the ground water shall be lowered by means acceptable to the ENGINEER to the extent necessary to keep the trench or excavation free from water while the trench or excavation is in progress. The discharge of ground water from the trench or excavation area shall be by the methods specified below to natural drainage channels, gutters, drains, or storm sewers which will conduct the water away from the trench or excavation area. Means of diverting any surface water away from the trench or excavation area shall be taken and surface water prevented from entering the trench or excavation area.

4. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during sub grade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
  
5. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations a minimum of 6 inches or more below the bottom of the excavation.
  
6. Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.

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7. Groundwater and rainwater removed during dewatering shall be discharged onto undisturbed ground where vegetative cover exists or through sediment and erosion controls and allowed to flow overland to filter out any sediments before discharging to any drain, storm sewer, or watercourse specified above. No such flows are permitted onto exposed soils, stream banks, or other areas subject to erosion.
  
8. Where overland flow on existing undisturbed ground is not sufficient to adequately remove all sediment from dewatering operations prior to discharge to any drain, storm sewer, or watercourse, or other erosion control measure acceptable to SD1 or ENGINEER shall be used to remove the sediment from the water prior to discharge. The method of discharging ground water or rain water from the trench or excavation area shall be such as to not create any erosion of existing ground.
  
9. All discharge locations shall be approved prior to construction by the ENGINEER and SD1.

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10. CONTRACTOR shall take measures to prevent damage to properties, structures, sewers, and other utility installations and other work.
  
11. CONTRACTOR shall repair all damage, disruption, or interference resulting directly or indirectly from groundwater control system operations at no additional cost to SD1.
  
12. The CONTRACTOR shall maintain the components of the dewatering system and surface water erosion and sediment controls within the project site. Deficiencies identified during visual inspection by SD1, SD1's representatives, or the governing regulatory authority shall be remedied by the CONTRACTOR at no additional cost to SD1.
  
13. Dewatering system components shall be located where they will not interfere with construction activities adjacent to the work area.
  
14. The CONTRACTOR shall be responsible for the condition of any pipe or

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conduit which he may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

H. Ground Water Barriers:

1. Where specified, continuity of bedding material shall be interrupted by low permeability groundwater barriers to impede passage of water through the bedding. Groundwater barriers for all pipelines shall be soil plugs of 3 feet in thickness, extending the full depth and width of the pipe bedding material in the trench, and spaced not more than 400 feet apart. The soil plugs shall be constructed from soil meeting ASTM D2487 classification GC, SC, CL, or ML, and compacted to 95 percent of maximum density at or near the optimum moisture content (ASTM D698).

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I. Pipe Encasements:

1. Concrete Encasement

- a. Wherever pipe encasement is called for on the plans or ordered in by SD1, the CONTRACTOR shall construct the encasement as shown on the drawings or in accordance with SD1's standard drawings.
  
- b. Support the pipe sections on solid concrete blocks, being sure to keep the pipe sections on line and grade and then pour concrete, completely under each section, along each side and up to a point at least twelve (12) inches above the top of each section, making sure that all voids

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are filled. In lieu of blocks, the CONTRACTOR may use a bed of concrete, to initially support the pipe sections.

- c. The minimum dimension of concrete under the pipe sections shall be six (6) inches and on each side of the sections shall be twelve (12) inches. This encasement shall be reinforced around the top and sides of the pipe as shown on the Contract Drawings for creek crossings and other locations. If the trench walls are nearly vertical from the bottom of the trench up to a point to which the encasement is to be poured, forms for forming the encasement may be omitted and the concrete poured to and against the trench walls. Where trench walls are not nearly vertical, proper forms shall be set for forming the encasement, unless otherwise called for by SD1. The space between the trench walls and any formed encasement shall be filled and compacted with approved pipe bedding or backfilling material.
  
- d. Care shall be taken to assure that the pipe sections remain on line and grade during the placing of concrete and that the joints are not disturbed. Backfill shall not be placed for a minimum of six (6) hours after encasement is completed, unless otherwise approved by SD1.
  
- e. Exercise care to avoid flotation when installing pipe in cast-in-place concrete.

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## 2. Casing Pipe

- a. Whenever casing pipe is called for on the plans, the CONTRACTOR shall install a casing pipe of the size and of the material called for on the plans by means of jacking, boring, or trenching.
  
- b. When the casing pipe is to be installed under a highway or railroad, and at other locations specifically designated on the Drawings, the method of installation shall be jacking or boring as specified in Section 02400, unless trenching is specifically allowed.
  - 1) For force mains inside casing pipe all pipe joints shall be restrained joint connections. Casing spacers shall be used to center the pipe in the casing. The annular space between the force main and casing pipe shall be completely filled with 500 psi or higher compressive strength grout.

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2) For gravity pipe inside casing pipe, casing spacers shall be used to center the pipe within the casing. The annular space does not have to be filled.

c. Casing Spacers- Include in casing pipe. Centered/Restrained Casing spacers shall be installed to position the carrier pipe within the center of the casing pipe. The required spacing and installation shall be per the manufacturer's recommendation, except that for PVC carrier pipe, a minimum of 3 spacers shall be installed on each length of pipe with a maximum 6 feet spacing between spacers. All spacers shall be 316 stainless steel as manufactured by Cascade Waterworks MFG Co., Advance Products and Systems (APS) or other approved equal. Casing spacers shall also be provided with height field-adjustment capability for installation of gravity sewer on a constant slope.

d. Casing pipe end seals shall be installed at each end of the casing pipe and shall consist of a proper sized rubber seal and attached to the carrier and casing pipe with stainless steel bands per the manufacturers recommendation. Casing pipe end seals shall be manufactured by Cascade Waterworks MFG Co., Advanced Products and Systems (APS) or other approved equal.

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J. Work Affecting Existing Piping

1. Location of Existing Piping:

a. Locations of existing piping shown should be considered approximate.

b. CONTRACTOR shall determine the true location of existing piping to which connections are to be made, and location of other facilities which could be disturbed during earthwork operations, or which may be affected by CONTRACTOR'S Work in any way.

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- c. Conform to applicable requirements of Division 1 pertaining to cutting and patching, and connections to existing facilities.

2. Taking Existing Pipelines Out of Service:

- a. Do not take pipelines out of service unless specifically noted on the Drawings, or approved by SD1.

3. Work on Existing Pipelines:

- a. Cut or tap pipes as shown or required with machines specifically designed for this work.

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b. Install temporary plugs to prevent entry of mud, dirt, water and debris.

c. Provide all necessary adapters, fittings, pipe and appurtenances required to complete the Work.

K. Install service laterals per SD1's standard details and per the requirements specified in this specification,.

L. Bedding and backfilling of pipeline trenches shall be in accordance with the

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requirements set forth in Section 02220 and as shown on SD1's trench compaction detail.

- M. Before final acceptance, the CONTRACTOR will be required to level all trenches or to bring the trench up to grade. The CONTRACTOR shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

### 3.3 DUCTILE IRON PIPE INSTALLATION REQUIREMENTS

- A. Jointing Pipe:

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1. Ductile Iron Mechanical Joint Pipe:

- a. Wipe clean the socket, plain end and adjacent areas immediately before making joint. Make certain that cut ends are tapered and sharp edges are filed off smooth.
  
- b. Lubricate the plain ends and gasket with soapy water or an approved pipe lubricant, in accordance with AWWA C111, just prior to slipping the gasket onto the plain end of the joint assembly.
  
- c. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.

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- d. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.
  
- e. Push gland toward socket and center it around pipe with the gland lip against the gasket.
  
- f. Insert bolts and hand tighten nuts.
  
- g. Make deflection after joint assembly, if required, but prior to tightening bolts. Alternately tighten bolts 180 degrees apart to seat the gasket evenly. The bolt torque shall be as follows:

Pipe Size	Bolt Size	Range of Torque
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<u>(inches)</u>	<u>(inches)</u>	<u>(ft-lbs)</u>
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120
42-48	1-1/4	120-150

2. Ductile Iron Push-On Joint Pipe:

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- a. Prior to assembling the joints, the last 8 inches of the exterior surface of the spigot and the interior surface of the bell shall be thoroughly cleaned and all mud, debris, etc. removed and joint recesses wiped clean.
  
- b. Rubber gaskets shall be wiped clean and flexed until resilient. Refer to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.
  
- c. Insert gasket into joint recess and smooth out the entire circumference of the gasket to remove bulges and to prevent interference with the proper entry of the spigot of the entering pipe.
  
- d. Immediately prior to joint assembly, apply a thin film of approved lubricant to the surface of the gasket which will come in contact with the entering spigot end of pipe. CONTRACTOR may, at his option, apply a thin film of lubricant to the outside of the spigot of the entering pipe.

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- e. For assembly, center spigot in the pipe bell and push pipe forward until it just makes contact with the rubber gasket. After gasket is compressed and before pipe is pushed or pulled all the way home, carefully check the gasket for proper position around the full circumference of the joint. Final assembly shall be made by forcing the spigot end of the entering pipe past the rubber gasket until it makes contact with the base of the bell. When more than a reasonable amount of force is required to assemble the joint, the spigot end of the pipe shall be removed to verify the proper positioning of the rubber gasket. Gaskets which have been scoured or otherwise damaged shall not be used.
  
- f. Maintain an adequate supply of gaskets and joint lubricant at the site at all times when pipe jointing operations are in progress.

3. Proprietary Joints:

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- a. Pipe which utilizes proprietary joints such as Fastite, by American Cast Iron Pipe Company, Tyton by U.S. Pipe Incorporated, restrained joints, or other such joints shall be installed in strict accordance with the manufacturer's instructions.

B. Polyethylene Tube Wrap Installation

The polyethylene tube wrap shall be installed on ductile iron pipe in accordance with AWWA C105 and the following:

1. Pick up the pipe by a crane at the side of the trench using either a sling or pipe tongs, and raise the pipe about three feet off the ground. Slip a section of the polyethylene tubing over the spigot end of the pipe and bunch up, accordion

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fashion, between the end of the pipe and the sling. The tubing should be cut to a length approximately 4 feet longer than the length of the pipe.

2. Lower the pipe into the trench, seat the spigot end in the bell of the adjacent installed pipe and then lower the pipe to the trench bottom. A shallow bell hole shall be provided in the trench bottom to facilitate the wrapping of the joint.
  
3. Make up the pipe joint in the normal fashion.
  
4. Remove the sling from the center of the pipe and hook into the bell cavity and raise the bell end 3 or 4 inches to permit the polyethylene tubing to be slipped along the full length of the barrel. Enough of the tubing should be left bunched up, accordion fashion, at each end of the pipe to overlap the adjoining pipe approximately 2 feet.
  
5. To make the overlap joint, pull the tubing over the bell of the pipe, fold around the adjacent spigot and wrap with approximately three (3) circumferential turns of the 2-inch wide plastic adhesive tape to seal the tubing to the pipe.

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6. The tubing on the adjacent pipe shall then be pulled over the first wrap on the pipe bell and sealed in place behind the bell using approximately three circumferential turns of the 2-inch plastic adhesive tape.
  
7. The resulting wrap on the barrel of the pipe will be loose, and it should be pulled snugly around the barrel of the pipe and the excess material folded over at the top, and held in place by means of 6-inch strips of the 2-inch wide plastic adhesive tape at intervals of approximately 3 feet along the pipe barrel.
  
8. Fittings, valves, hydrants, etc., shall be hand wrapped, using polyethylene film that is held in place with the plastic adhesive tape.
  - a. Bends, reducers, and offsets can be wrapped with the polyethylene tubing in the same manner as pipe.
  
  - b. Valves can be wrapped by bringing the tube wrap on the adjacent pipe over the bells or flanges of the valve and sealing with a flat sheet of

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the polyethylene passed under the valve bottom and brought up around the body to the stem and fastened in place with the adhesive tape.

- c. Hydrants can be wrapped with polyethylene tubing slipped over the hydrant to encase the hydrant from the lead-in valve to the ground level of the hydrant. To provide drainage of the hydrant, it is necessary to cut a small hole in the film and insert a short pipe nipple to drain the water to the soil outside the film wrap.
  
- d. All fittings that require concrete backing should be completely wrapped prior to pouring the concrete backing block.

### 3.4 HDPE INSTALLATION REQUIREMENTS

#### A. Pipe Joining

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1. Joints between plain end pipes and fittings shall be made by butt fusion, and joints between the main and saddle branch fittings shall be made using saddle fusion using only procedures that are recommended by the pipe and fittings manufacturer.
  
2. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets, of like outside diameter and wall thickness (SDR or DR). Butt fusion jointing between like diameters, but unlike wall thickness, shall not be permitted. Transitions between unlike wall thicknesses shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means.
  
3. Heat-joining of HDPE pipe shall conform to applicable portions of AWWA C-906.
  
4. HDPE pipe and fittings shall be joined together or to other materials by means of flanged connections (flange adapters and back-up rings) or mechanical couplings designed for joining HDPE pipe or for joining HDPE pipe to another material. Mechanical couplings shall be fully pressure-rated and fully

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thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins. External joint restraints shall be used in lieu of fully restrained mechanical couplings.

## B. Installation

1. Installation shall be in accordance with ASTM D 2321, manufacturer's recommendations, and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.
2. Mechanical joints and flange connections shall be installed in accordance with the manufacturer's recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flanged bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the manufacturer. At least one (1) hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the manufacturer. The

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final tightening torque shall be 100 ft.-lbs. or as recommended by the manufacturer.

3. Pipe shall be laid on grade and on a stable foundation in accordance with Section 02220.
4. When lifting with slings, only wide fabric choker slings shall be used to lift, move, or lower pipe and fittings. Wire rope or chain shall not be used.
5. CONTRACTOR shall be liable to correct any pipe installed off line or grade (whether by horizontal directional drilling or other means).

3.5 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE INSTALLATION REQUIREMENTS

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A. Push-on Joints

1. Bevel all field-cut pipe, remove all burrs and provide a reference mark the correct distance from the pipe end.
2. Clean the pipe end and the bell thoroughly before making the joint. Insert the O-ring gasket, making certain it is properly oriented. Lubricate the spigot well with an approved lubricant; do not lubricate the bell or O-ring. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell.

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3.6 FIBERGLASS PIPE INSTALLATION REQUIREMENTS

A. Pipe Handling: Use textile slings, other suitable materials or a forklift. Use of chains or cables is not permitted.

B. Jointing:

1. Clean ends of pipe and coupling components.

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2. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer.
  
3. Use suitable equipment and end protection to push or pull the pipes together.
  
4. Do not exceed forces recommended by the manufacturer for coupling pipe.
  
5. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

### 3.7 SANITARY SEWER TESTING REQUIREMENTS

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A. General:

1. Test all piping.
2. All piping shall be tested prior to post-construction CCTV operations.
3. Notify SD1 at least 48 hours in advance of testing.
4. Conduct all tests in the presence of SD1.

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5. Remove or protect any pipeline-mounted devices which may be damaged by the test pressure.
  
6. Provide all apparatus and services required for testing, including but not limited to, the following:
  - a. Test pumps, bypass pumps, hoses, calibrated gauges, meters, test containers, valves and fittings.
  
  - b. Temporary bulkheads, bracing, blocking and thrust restraints.
  
7. Provide air if an air test is required and power if pumping is required.

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8. CONTRACTOR shall provide fluid required for testing.

B. Force Mains Test Schedule:

1. The required hydrostatic test pressures shall be as specified by the Design ENGINEER and approved by SD1.
  
2. Unless otherwise specified, the required hydrostatic test pressures are at the lowest elevation of the pipeline.

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C. Pressure Test Procedure for Force Mains:

1. Complete backfill and compaction of entire pipe before testing, unless otherwise required or approved by ENGINEER.
2. Fill section to be tested slowly with water and expel all air. Install corporation cocks, if necessary, to remove all air.
3. Apply specified test pressure for two hours and observe pressure gage. Check carefully for leaks while test pressure is being maintained.
4. A successful test shall be defined as zero drop in the specified test pressure during the two hour testing period.

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D. Displacement of Pipe

1. The sewer pipe sections may be checked by SD1 to determine if any displacement of the pipe sections from alignment and grade have occurred as each portion of the sewer is completed between manhole locations. When the test is required by SD1, it shall be as follows:
  - a. Flashing a light beam by means of a strong flashlight or reflecting sunlight through the portion of the sewer between manhole locations or by utilizing a laser beam.
  - b. When viewed from the opposite end of the portion of the sewer from the light location, the light beam should be full throughout the

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sections, but not less than two-thirds full under any circumstances. There shall be no "dips" in the grade of the pipe invert.

- c. If the pipe sections show any misalignment, displacement or any other defects in the sections or joints, the CONTRACTOR shall remedy the defect to the satisfaction of SD1.
  
- d. This test may be done after the pipe sections have been laid, the joints completed and the bedding completed to twelve (12) inches above the pipe sections, or after completion of the sewer and all backfilling has been undertaken or both.

E. Deflection of Pipe

- 1. A deflection test shall be performed on all gravity sanitary sewers using flexible pipe. The test shall be conducted after the final backfill has been in place at least thirty (30) days. No pipe shall exceed a deflection of five percent

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(5%). The deflection test is to be run by using a rigid mandrel, or equal means approved by SD1, and shall have a diameter equal to ninety-five percent (95%) of the inside diameter of the pipe, including the pipe manufacturer's tolerances. The test shall be performed without mechanical pulling devices. All tests must be witnessed and approved by a representative of SD1.

F. Air Test for Gravity Sewers 42" and Smaller

1. The CONTRACTOR shall test the tightness of the pipe sections, joints and appurtenances of all gravity sewers by means of the low pressure air test.
  
2. No tests shall be made until the backfill is consolidated over the pipe and all service lines in the section to be tested have been connected and plugged.
  
3. The low pressure air test shall be conducted in accordance with procedures outlined in UNIBELL Specification UNI B-6. If the section of sewer being

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tested is below the elevation of ground water in the trench, the test pressure shall be 0.5 psi for each foot of ground water above the invert of the pipe.

4. All tests must be witnessed and approved by a representative of SD1.
  
5. Any leaks determined from the air test shall be fixed by the CONTRACTOR using an SD1 approved method.
  
6. The minimum air test pressure for all gravity sewers shall be 4 psi.

G. Individual Pipe Joint Testing for Gravity Sewers 48" and Greater.

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1. The CONTRACTOR shall test each individual joint of the gravity sewers using the following procedure:
  - a. Center the joint tester over the joint. Using the manufacturers approved testing apparatus and other recommendations, Inflate the outer element filling the center of the joint tester cavity with water or air, dependent upon test used, until it flows evenly from the bleed off valve, which removes air from the outer cavity. The bleed off valve shall be located at the top of the joint tester assembly. Close the bleed –off valve and pressurize the cavity to 3.5 to 5.5 psig depending on groundwater back pressure. Allow pressure to stabilize for 10 to 15 seconds and turn off pressure source. If pressure holds or drops less than 1 psi for 1 minute the joint is acceptable. The pressure gage used shall read in one (1) psi increments.

### 3.8 STORM SEWER TESTING REQUIREMENTS

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C. Displacement: Storm sewer pipe sections may be checked by SD1 to determine if any displacement of the pipe sections from alignment and grade has occurred as each portion of the sewer is completed between structure locations. When the test is performed, it shall be as follows:

1. Flashing a light beam by means of a strong flashlight or reflecting sunlight through the portion of the sewer between structure locations or by utilizing a laser beam.
  
2. When viewed from the opposite end of the portion of the sewer from the light location, the light beam should be full throughout the sections, but not less than two-thirds full under any circumstances. There shall be no "dips" in the grade of the pipe invert.
  
3. If the pipe sections show any misalignment, displacement or any other defects

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in the sections or joints, the CONTRACTOR shall remedy the defect, at the CONTRACTOR'S sole cost, to the satisfaction of SD1.

3.9 REPAIR OF FAILED PIPE SECTIONS

- A. If a pipe section failed testing as outlined in Paragraphs 3.7 & 3.8 herein. Contractor shall repair the failed pipe sections as follows:
  - 1. Contact SD1 24 hours prior to making any repairs to failed pipe sections. SD1 shall be present during the entire duration of time repairs are being made to failed sections of pipe.

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2. The CONTRACTOR shall remove and replace, at no extra cost to SD1 all sections of pipe which fail any of the tests specified in this section in accordance with the following procedures:

a. Excavate failed sections of pipe in accordance with Section 02220.

b. Cut out and/or remove failed sections and relay new pipe beginning at nearest joint.

c. Close pipe with pipe coupling per manufacturer's recommendation and approval of SD1.

3. The CONTRACTOR shall provide all material, labor, and equipment necessary to remove and replace the failed pipe section.

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4. Retest the replaced sewer sections to meet the applicable requirements listed in Paragraphs 3.7 & 3.8 herein.

3.10 PIPE ABANDONMENT

- A. Pipe abandonment in non-paved roadway:

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1. Pipe abandonment under non-paved roadways shall be as outlined in SD1 Standard Detail No. 107 (SD-107). Ends of pipe shall be filled with minimum of 1' of concrete.

B. Pipe abandonment in paved roadway:

1. Pipe abandonment under paved roadways shall consist of completely filling the designated pipes with controlled density fill (CDF), grout or other approved materials. Appreciable deposits of debris shall be removed from other pipes prior to placement of CDF, grout or other approved materials. Pipes under roadways shall be filled completely

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- C. On Pipe abandonment in for manholes that remain, re-work bench to eliminate invert.

### 3.11 CLEANING FOR SEWERS

- A. Cleaning:

1. Thoroughly clean all piping and flush in a manner approved by ENGINEER, prior to placing in service.

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3.12 CLEAN-UP

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- A. Upon completion of the 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. Refer to Section 02900, Landscaping, for restoration.

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++ END OF SECTION ++

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