

## **SECTION 333400 – PUBLIC SANITARY UTILITY SEWERAGE Force Mains**

### **Scope:**

The Contractor shall provide all labor, equipment and materials to install force mains using high density polyethylene (HDPE), polyvinyl chloride (PVC), or ductile iron (DI) pipe for the collection of sanitary sewage from lift stations in accordance with these specifications.

### **Submittals:**

- A. The Contractor will submit complete product data from named vendor on all products proposed for use in the project.
- B. Results from recording of each fuse on HDPE pipe will be submitted to the Owner as part of the installation record.
- C. Contractor will submit a proposed method for pigging or cleaning lines for approval by the Owner after installation.
- D. Contractor shall provide proof of qualification for all labor involved in fusing of HDPE pipe. Proof of qualification shall be written confirmation of training by a manufacturer involved in the manufacture of HDPE pipe for more than two years. Only individuals with such qualifications will be allowed to perform fusing operations.
- E. Contractor shall submit proposed pressure testing methodology for review by the Owner prior to initiating any final pressure testing of pipe.

### **Products:**

This section of the specification details the requirements for pressurized sanitary sewer force mains and related accessories. Unless noted otherwise, force mains will be constructed of high density polyethylene pipe (HDPE), polyvinyl chloride (PVC), or Class 350 Ductile Iron Pipe (DIP) meeting the requirements in this section. All pipe and fittings must be manufactured in the United States of America.

- A. **High Density Polyethylene Pipe (HDPE):** The Contractor shall furnish High Density Polyethylene Pipe and Fittings conforming to ANSI/AWWA Standard C 906-90 and ASTM D3350-02. The pipe shall be PE 3408 with an SDR of 11 or less as directed by the owner and be rated for a pressure of 160 psi or more. All HDPE force main piping shall be DIPS sizing unless approved and /or called out differently on the contract drawings. The carbon black content shall measure 2% to 3% by weight when tested according to ANSI/ASTM D 1603 or ASTM D4211. The pipe shall be provided in ductile iron pipe sizes. The pipe shall be produced by Rinker, J-M PE Corporation, or equal. Pipe shall be “prisma” coated with a green exterior color or the pipe shall have a green stripe impregnated into the wall of the pipe to make it easily identifiable when excavated. The manufacturer shall have an ISO 9001 listing covering the HDPE manufacturing facility as well as the corporate office. The Owner at no additional cost may require quality audits. All pipe will be provided in standard straight lengths. No coiled pipe will be accepted for installation on the project. **All pipe and fittings must be manufactured in the United States of America.**
  - (1) **Quality and Inspection:** All pipe shall be smooth on both the interior and exterior surfaces; be free of noticeable imperfections such as cracks, blisters, or kinks in the pipe. The Owner, if Owner so chooses, shall be able to inspect the pipe at the pipe plant, trench, and other various storage sites. Based on these observations the Owner will have the right to reject any and all piping not conforming to these stated requirements, independent of laboratory tests. Field repair of any damaged piping

shall not be permitted. The Owner reserves the right to require the removal of fused connections for destructive testing to verify the integrity of fused joints, etc.

- (2) Experience of Manufacturer: The pipe manufacturer shall provide evidence, if requested by the Owner, of having provided quality pipe and joints that have shown satisfactory results in service for a period of no less than five years. Evidence of completion of projects of similar size and timing for HDPE pipe will also be provided upon Owner request. All pipe within any given phase shall be from the same manufacturer.
- (3) Fittings: The fittings shall meet all of the requirements of the pipe to which they are to be fused. They shall be homogeneous throughout and essentially uniform in color, opacity, density and other properties. Fittings should also be free of such defects as cuts, cracks, or holes. Fabricated fittings will not be allowed where molded or machined fittings are available. All fittings will be manufactured in accordance with AWWA C906 with a minimum pressure class equal to that of the pipe.
- (4) Markings: Markings shall be legible during usual handling of the pipe and be applied in a manner that will not damage the pipe. The following markings shall be provided as shown below:
  - a. Nominal size and OD base
  - b. Standard material code designation
  - c. Dimension ratio
  - d. Pressure class
  - e. AWWA designation for this standard (AWWA C 906-90)
  - f. Manufacturers production code
  - g. Material test category of pipe
  - h. NSF 61 approved

**B. Polyvinyl Chloride Pipe (PVC):** Polyvinyl chloride pipe shall conform to requirements of AWWA C900 or AWWA C905, as amended to date; with a standard dimension ration DR 18 or less as directed by the owner (and approved by the owner's engineer) and be rated for a pressure of 150 psi or less depending on the design of the specific application. All PVC force main piping shall be sized in cast iron equivalent outside diameter for each nominal pipe size unless approved and /or called out differently on the contract drawings. Integral wall-thickened and sleeve-reinforced bell-type pipe ends designed for joint assembly using elastomeric seals shall be measured in accordance to ASTM D 2122 as amended to date. Pipe shall be furnished in standard 20 ft. laying lengths.

- (1) Quality and Inspection: All pipe shall be smooth on both the interior and exterior surfaces; be free of noticeable imperfections such as cracks, blisters, or kinks in the pipe. The Owner, if Owner so chooses, shall be able to inspect the pipe at the pipe plant, trench, and other various storage sites. Based on these observations the Owner will have the right to reject any and all piping not conforming to these stated requirements, independent of laboratory tests. Field repair of any damaged piping shall not be permitted.
- (2) Experience of Manufacturer: The pipe manufacturer shall provide evidence, if requested by the Owner, of having provided quality pipe and joints that have shown satisfactory results in service for a period of no less than five years. Evidence of completion of projects of similar size and timing for PVC pipe will also be provided upon Owner request. All pipe within any given phase shall be from the same manufacturer and factory.

- (3) **Fittings:** The fittings shall meet all of the requirements of the pipe to which they are to be connected. They shall be homogeneous throughout and essentially uniform in color, opacity, density and other properties. Fittings should also be free of such defects as cuts, cracks, or holes. Fabricated fittings will not be allowed where molded or machined fittings are available. All fittings will be manufactured in accordance with AWWA C900 or C905 with a minimum pressure class equal to that of the pipe.
  - (4) **Markings:** Pipe and couplings shall bear identification markings in accordance with AWWA C900, as amended to date, that will remain legible during normal handling, storage and installation and which have been applied in a manner that will not reduce the strength of the pipe or coupling or otherwise damage them.
  - (5) **Certification:** The manufacturer shall furnish the Owner with certified reports stating that inspection and specified tests have been made and that the results thereof comply with the applicable AWWA and ANSI Specifications.
- C. Ductile Iron Pipe (DIP):** Pipe shall be centrifugally cast and shall conform to ANSI Specification A 21.51 (AWWA C 110) as amended to date, with mechanical or push-on joints and laying lengths of at least 18 feet. Pipe sizes 4” through 12” shall be standard pressure Class 350, and pipe sizes greater than 12” shall be pressure Class 250 unless otherwise indicated herein or on the Drawings.
- (1) **Fittings:** Fittings shall be cast from ductile iron and shall conform to ANSI Specifications A 21.10 (AWWA C 110) as amended to date. All fittings shall have standard mechanical or push-on joints. Fittings for size 4-inch through 12-inch shall be Class 350 for Ductile Iron. Fittings for size 14-inch through 48-inch shall be Class 250 for Ductile Iron. Gray Iron will not be permissible unless otherwise specified or shown on the Drawings.
  - (2) **Lining and Coating:** Pipe and fittings shall be cement-lined (standard thickness) inside and bituminous coated outside, in accordance with the applicable provisions of ANSI Specification A 21.4 (AWWA C 104) and, ANSI A 21.51 (AWWA C 151), as amended to date. The inside cement lining shall be treated with a bituminous seal coat.
  - (3) **Protective Lining for Ductile Iron pipe and fittings:** Pipe and fittings as indicated on the plans shall be lined with Protecto 401 ceramic epoxy or approved equal. The epoxy shall be applied at an application facility without any asphalt, cement lining, or any other lining on the interior surface. The lining shall be applied by a certified firm with a successful history of applying linings to the interior of ductile iron pipe and fittings. Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, ect. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded during loading. Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from the excavator bucket or banging with heavy hammers.
  - (4) **Weights and Marking:** Weights of pipe and fittings shall conform strictly to the requirements of ANSI Specifications. The class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each joint of pipe and each fitting after the exterior coating has hardened.
  - (5) **Certification:** The manufacturer of iron pipe and fittings shall furnish the Owner with a certified report stating that inspection and specified tests have been made and that the results thereof comply with the applicable ANSI Specifications for each.
  - (6) **Quality and Inspection:** Latitudes in workmanship and finish allowed by ASTM notwithstanding, all pipe shall have smooth exterior and interior surfaces; be first

quality, be free from cracks, blisters, and other imperfections, and be true to theoretical shapes and forms throughout each length. Pipe shall be subject to inspection by the Owner at the pipe plant, trench, and other points of delivery for the purpose of culling and rejecting pipe, independent of laboratory tests, which does not conform to the requirements of this Section. Pipe which does not conform will be so marked by the Owner, and shall not be used in the work. On-the-job repairing of rejected pipe will not be permitted.

- (7) **Experience of Manufacturer:** The pipe manufacturer shall submit evidence, if requested by the Owner, of having consistently produced pipe and joints of the quality specified herein, and which have exhibited satisfactory performance results in service over a period of not fewer than five years. The pipe manufacturer and the pipe manufacturing process shall be subject to approval by the Owner.
- D. **Locating Wire & Detector Tape:** The Contractor will supply all locating wire and detector tape. Locating wire shall be 8 gage, coated wire. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with AWWA color codes with the following legends: Sewer Systems, Safety Precaution Green, "Caution Sewer Line Buried Below". Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 2-inches when buried less than 10-inches below surface and 3-inches when buried greater than 10-inches. Tape shall be Lineguard Type II Detectable, Allen Systems Detectatape, or equal. Locating wire and Detector Tape are required for the entire length of all HDPE and PVC force mains. For DIP force mains no locating wire is required however detector tape is still required for the entire length of the force main.
- E. **Couplings for HDPE**
- (1) **Electrofusion Couplings:** For HDPE force mains electrofusion couplings and saddles will not be used on this Project without written approval of Owner.
  - (2) **Aqua Grip Couplings:** As manufactured by Mueller Company are acceptable for use at locations that are approved by the owner.
- F. **Flange Assemblies:** For HDPE force mains flange assemblies shall consist of a metal back-up flange or ring and a polyethylene flange adapter. The back-up flange shall be slipped over the pipe profile flange adapter and then be fused into the plain end pipe.
- G. **Mechanical Joint:** All mechanical joints must be restrained. For HDPE force mains mechanical joints are to be made with stiffeners which are inserted into the HDPE pipe. Stiffener manufacturer's directions shall be followed when installing stiffeners and mechanical joints. Stiffeners shall be Romac Industries 501-H & RC501-H or equal. The mechanical joints shall then be restrained using mechanical joint adapters manufactured by Performance Pipe, or equal. For PVC and DIP force mains mechanical joints are to be made with retainer glands such as EBAA Iron's MEGALUG or US Pipe's Field LOK gasket kits. In addition for PVC and DIP force mains, additional joints on both sides of fittings shall be restrained according to the chart included in the drawings or as directed by the owner/engineer to avoid joint separation due to pipe movement.
- H. **Vacuum Breaker / Air Relief Valve:** A combination air relief and vacuum breaker valve shall be installed at high points and grade changes within the force main piping as specified on the plans. The valve shall be as manufactured by Cla-Val, Model Number 36WW22 or Val-matic model number 802A. The valve shall be mounted in the vertical position on the top of the pipeline with an isolation valve installed below each valve to allow for maintenance of the valve. The valve shall be installed in a vault or manhole which has adequate drainage and venting.
- I. **Plug Valves:** Plug valves shall be used on sewage, and shall be furnished complete with operators and accessories shown on the Drawings or specified or both. Valves shall be of the

eccentric, non-lubricated resilient seat type, designed for sewage at 125 psi working pressure and shall have mechanical joint ends. The valve body shall be semi-steel conforming to ASTM A 126, Class B. Seats shall have a welded-in or cast overlay of not less than 90% pure nickel on all surfaces which will contact the rubber seating area. Upper and lower plug stem bushings shall be of stainless steel and permanently lubricated. Valves shall be manufactured by DeZurik, Clow or equal. Extension stems shall extend from the valves to the connections with the operators. Operators for buried valves shall have extension stems, 2-inch square operating nuts and valve boxes. Extension stems shall be furnished for all buried valves to bring the 2-inch square AWWA operating nut within six inches of the top of the valve box. Operating nuts shall have an arrow cast on the top indicating the direction for opening the valve. Valve boxes shall be two piece, with covers. Covers shall be cast with the word "SEWER" on the top of the cover. The bottom part of the valve box may be 6-inch cast iron pipe. The top part shall be of the sliding type sized to fit over the 6-inch pipe and be 36-inches in length. Valve boxes and covers shall be constructed of cast iron. The 6-inch pipe shall extend not less than 18-inches into the sliding top. All valve boxes shall be bushed and furnished with extension stem.

- J. **Manhole Protection:** Manholes where force mains are connected must be protected using a manhole liner equal to Spectrashield Liner Systems.
- K. **Manhole Frame and Covers:** Manhole frames and covers shall be "Heavy Duty" and constructed in accordance with ASTM A 48 Class 30. The frame weight shall be 190 pounds and the cover weight shall be 130 pounds. The frame pattern shall be V-1480-10 and the cover pattern shall be V-1480-1 as manufactured by Vulcan Foundry Corp, or equal. The covers for the manholes shall be cast with the word "SEWER" on the face.

#### **Implementation:**

- A. **Unloading:** Equipment and facilities for unloading, hauling, distributing and storing materials shall be furnished by the Contractor and shall at all times be available for use in unloading materials. Delays in unloading railroad cars, unloading trucks, or hauling from freight terminal that incur demurrage, truck waiting charges or terminal charges shall be at the expense of the Contractor.
- B. **Handling:** Pipe, fittings and other material shall be carefully handled so as to prevent breaking and/or damage. Pipe may be unloaded individually by hand but shall not be unloaded by rolling or dropping off of trucks or cars. Preferred unloading is in units using mechanical equipment, such as forklifts, cherry pickers or front end loaders with forks. If forklift equipment is not available units may be unloaded with use of spreader bar on top and nylon straps looped under the unit.
- C. **Distributing:** Materials shall be distributed and placed so as to least interfere with traffic. No street or roadway may be closed without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for protection of traffic along highways, streets, and roadways upon which material is disturbed. No distributed material shall be placed in drainage ditches.
- D. **Storage:** All pipe, fittings and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas; except that, with permission, he may make reasonable use of the Owner's storage yards.
- E. **Joining Methods for HDPE Pipe:** The pipe and fittings shall be joined by butt or saddle fusion, mechanical joint adapters, or by flange connections in accordance with manufacturer's recommendations. All joints shall be fused, not including connections to existing utilities, unless otherwise shown on Drawings or requested by the Owner.

- (1). Fusion: The pipe shall be joined by heat fusion of the ends. Prior to fusion the pipe shall be clean and the ends shall be cut square. Fusion system operators shall be trained in the use of the equipment by the pipe supplier or manufacturer of the fusing machine and be experienced in the operation of the equipment. All fuses shall be recorded, the recording of the information must be provided to the Owner, and the recorded information must meet the standard requirements of the pipe manufacturer. All fusions failing to meet these requirements shall be removed and refused.
- (2). Flange: A flange assembly consists of a metal back-up flange or ring and a polyethylene flange adapter. The back-up flange is slipped over the pipe profile and the stub-end, or flange adapter, is then fused into the plain end pipe.
- (3). Payment for HDPE pipe shall be made from the start of the pipeline to the termination point along the top of the pipe.
- (4). Connection to Ductile Iron Pipe or Valves: Connections to ductile iron pipe and valves shall be by mechanical joints or flanges. All connections to ductile iron pipe or valves must be restrained.
  - a. Restrained Mechanical Joints: Restrained mechanical joints shall be made using mechanical joint adapters and shall incorporate a factory installed stiffener manufactured by Rinker, J-M PE Corporation Pipe, or equal.
  - b. Flange: Flange connections shall be as described above in E (2).
  - c. Aqua Grip connections as described in Products Section E (2).

F. **Installation of Locating Wire and Detector Tape:** The Contractor shall be required to install locator wire along the entire section of HDPE or PVC pipeline and along all HDPE or PVC service connections. The locator wire shall be installed simultaneously with the piping. Detector tape shall be installed by the Contractor once backfill has been placed and compacted to at least 12 inches above the top of the pipe and not more than 18 inches above the top of the pipe for all HDPE and DIP force mains. Wire shall be properly spliced at each end connection and each service connection. Care should be taken to adequately wrap and protect wire at all splice locations. No bare wire shall be accepted. There will be no additional pay item for this work; it should be included in the Unit Price for installing HDPE or PVC pipelines and DIP pipelines.

G. **Backfill and Bedding of HDPE:** Bedding for this material shall be as called for by ASTM D 2774 - 94. The trench width will vary depending on depth and the type of soil present. The bed width should allow for adequate compaction around the pipe. The excavated material, if it is free of rock and well broken up by the digging machine, may provide a suitable bedding material. Maximum particle size of Class I or Class II materials used for bedding, haunching, or initial backfill should be kept to ½" for smaller pipe (<8") and a maximum size of 1" aggregate for pipe diameters greater than 8". The trench bottom should be relatively smooth and free of rock. Objects that may cause point loading on the pipe should be removed and the trench bottom padded using 4-6 inches of tamped bedding. If an unstable soil condition exists, the trench bottom shall be undercut and filled to proper trench depth with a selected material. Contractor will install pipe in accordance with ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pipe, AWWA C906-90 (as amended), and the manufacturer's recommendations. Pipe shall not be installed in water or wet mucky soils, on rock or stony soil. When these conditions exist, Contractor shall remove the objectionable material to a depth of 6" below the pipes final grade and install crushed stone or other approved bedding materials. No extra payment will be made for bedding, the cost therefore to be included in the prices bid for sewers.

- (1). **Depth of Bedding:** Trench shall be undercut to allow for a minimum of six inches (6") of bedding material. After joint assembly, Bedding material shall be placed under and up to the spring line of the pipe for the entire length of pipe and compacted. Compaction to the spring line of the pipe shall be of the same material used in the bedding. Selected backfill shall then be carried to a point twelve inches (12") above the top of pipe, using hand tools for tamping. The remaining backfill shall be as specified in "Selected Backfill" and "General Backfill" paragraphs of these specifications. Pipe shall have at least thirty-six inches (36") of cover before wheel loading and at least forty eight inches (48") of cover before using heavy duty tamping equipment such as a hydrohammer.
  - (2). **Trench Width:** The maximum clear trench width at the top of the pipe shall not exceed a width equal to the nominal pipe diameter plus eighteen inches (18"). If this width is exceeded or the pipe is installed in a compacted embankment, pipe embedment shall be compacted to the trench walls.
- H. Backfill and Bedding of PVC:** Bedding for this material shall be as called for by ASTM D 2774 - 94. The trench width will vary depending on depth and the type of soil present. The bed width should allow for adequate compaction around the pipe. The excavated material, if it is free of rock and well broken up by the digging machine, may provide a suitable bedding material. Maximum particle size of Class I or Class II materials used for bedding, haunching, or initial backfill should be kept to ½" for smaller pipe (<8") and a maximum size of 1" aggregate for pipe diameters greater than 8". The trench bottom should be relatively smooth and free of rock. Objects that may cause point loading on the pipe should be removed and the trench bottom padded using 4-6 inches of tamped bedding. If an unstable soil condition exists, the trench bottom shall be undercut and filled to proper trench depth with a selected material. Contractor will install pipe in accordance with ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pipe, AWWA C605-05 Underground Installation of PVC Pressure Pipe and Fittings (as amended), and the manufacturer's recommendations. Pipe shall not be installed in water or wet mucky soils, on rock or stony soil. When these conditions exist, Contractor shall remove the objectionable material to a depth of 6" below the pipes final grade and install crushed stone or other approved bedding materials. No extra payment will be made for bedding, the cost therefore to be included in the prices bid for sewers.
- (1). **Depth of Bedding:** Trench shall be undercut to allow for a minimum of six inches (6") of bedding material. After joint assembly, Bedding material shall be placed under and up to the spring line of the pipe for the entire length of pipe and compacted. Compaction to the spring line of the pipe shall be of the same material used in the bedding. Selected backfill shall then be carried to a point twelve inches (12") above the top of pipe, using hand tools for tamping. The remaining backfill shall be as specified in "Selected Backfill" and "General Backfill" paragraphs of these specifications. Pipe shall have at least thirty-six inches (36") of cover before wheel loading and at least forty eight inches (48") of cover before using heavy duty tamping equipment such as a hydrohammer.
  - (2). **Trench Width:** The maximum clear trench width at the top of the pipe shall not exceed a width equal to the nominal pipe diameter plus eighteen inches (18"). If this width is exceeded or the pipe is installed in a compacted embankment, pipe embedment shall be compacted to the trench walls.
- I. Cold (Field) Bending for HDPE or PVC:** Contractor shall not bend the pipe to fit a trench more than that allowed by the pipe manufacturer.
- J. Installation of HDPE by Pulling In:** Contractor will submit to Owner maximum proposed pull in length for the pressure class and diameter pipe proposed to be pulled into an open

trench. Pull in lengths will not exceed the maximum lengths recommended by the manufacturer for the class and diameter pipe. Final tie-ins should be made one day after pulling in to allow the pipe to recover from the stress of the pulling.

- K. **Installation of DIP Pipe:** Contractor shall install ductile iron pipe in accordance with manufacturer's instructions and AWWA C600-99 as amended.
- (1) Pipe, fittings, valves and hydrants shall be lowered into the trench in a careful manner using slings and ropes as necessary to avoid damage to the force main or the protective coatings of the piping. Pipe shall in no cases be dropped into the trench.
  - (2) All lumps, blisters, and excess coatings shall be removed from the socket and the plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry to ensure the removal of all dirt, sand, grit and other foreign materials prior to laying the pipe. No pipe containing dirt, debris or other foreign materials shall be laid.
  - (3) As each pipe length is laid, the Contractor shall assemble the joint and bring the pipe to proper grade and alignment. Pipe shall be secured in place with the proper backfill.
  - (4) Contractor shall not deflect any joint more than the maximum deflection recommended by the manufacturer. Contractor shall maintain a transit on site to check that deflections allowances are not exceeded.
  - (5) Joints shall be push-on, mechanical or flange and shall be assembled in accordance with manufacturer's instructions.
  - (6) Cutting of pipe: Cut ductile iron pipe using an abrasive wheel saw. Remove all burrs and smooth end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, and accessories in the correct locations.
  - (7) Quality and Inspection: All pipes shall be smooth on both the interior and exterior surfaces; be free of noticeable imperfections such as cracks, blisters, or kinks in the pipe. The Owner, if he so chooses, shall be able to inspect the pipe at the trench and other various storage sites. Based on these observations the Owner will have the right to reject any and all piping not conforming to these stated requirements, independent of laboratory tests. Field repair of any damaged piping shall not be permitted.
- L. **Bedding of Ductile Iron Pipe:** All pipes shall be laid on foundations prepared in accordance with the following specifications. Bedding for all pipe shall be in accordance with ASTM D 2321 and AWWA C151/A21.51, as amended to date, the manufacturer's recommendations and these Specifications. Only Class III, IV, and V bedding are allowed for ductile iron pipe as shown in the drawings and specified unless otherwise approved by the owner.
- (1) Depth of Bedding: Trench shall be undercut to allow for a minimum of six inches (6") of bedding material. After joint assembly, Bedding material shall be placed under and up to the spring line of the pipe for the entire length of pipe and compacted. Compaction to the spring line of the pipe shall be of the same material used in the bedding. Selected backfill shall then be carried to a point twelve inches (12") above the top of pipe, using hand tools for tamping. The remaining backfill shall be as specified in "Selected Backfill" and "General Backfill" paragraphs of these specifications. Pipe shall have at least thirty-six inches (36") of cover before



wheel loading and at least forty eight inches (48") of cover before using heavy duty tamping equipment such as a hydrohammer.

- (2) Trench Width: The maximum clear trench width at the top of the pipe shall not exceed a width equal to the nominal pipe diameter plus eighteen inches (18"). If this width is exceeded or the pipe is installed in a compacted embankment, pipe embedment shall be compacted to the trench walls.
  - (3) Trench Depths: Maximum depth of backfill over ductile iron pipe shall be in accordance with manufacturer's recommendations and in any case shall not exceed 30 feet when Class I bedding and compaction to 95% of maximum dry density is achieved.
- M. **Installation by Horizontal Boring or Directional Drilling:** This work shall be done in accordance with **Section 330523 Trenchless Utility Installation**. Contractor shall install pipe under creeks and county Roads using horizontal boring or directional drilling when directed by Owner. Casing pipe will be installed for all creek and road crossings. The pipeline shall then be installed directly into the casing without centering spacers. At casing exit or entry points, pipe should be wrapped with an elastomeric sheet material.
- N. **Protection of Pipe Openings:** During installation, the Contractor will ensure that pipe ends that have not been fused will be protected against dirt, debris, animals, and other foreign materials. Plastic caps held in place with duct tape or other methods as approved by the Owner may be used.
- O. **Blocking and Restraining:** Contractor shall fully restrain the pipe through the use of fully restrained joints by means of butt fusion, M-J adapters, or flange adapters. Do not use thrust blocks with HDPE pipe installations. Thrust blocks will be used with DIP force mains.
- P. **Cleaning:** Before acceptance of any line, the line must be clean. If the Contractor fails to close the pipe or debris is found to be in the line, the Contractor shall clean the line by pigging or other suitable means at the Contractor's expense. The Contractor shall be prepared to pig all lines installed within this project in order to remove the HDPE pipe shavings, etc. The successful bidder must propose a method of pigging the lines for approval by the owner before proceeding with any pigging operations. This request must be submitted in writing and shall be approved in writing by the Owner prior to line purging.
- Q. **Testing:** Testing of HDPE, PVC and DIP installations will include destructive testing as well as final pressure and leakage testing to ensure no leaks are present in the line.
- (1) At the direction of the Owner, Contractor will perform destructive strap testing on selected HDPE fuses to determine if the fuses meet with manufacturer's requirements. Pipe used in this testing will not be installed in the Project.
  - (2) The hydrostatic pressure and leakage testing of the sanitary sewer force main shall be performed in accordance with AWWA C906 for HDPE, AWWA C605 for PVC, AWWA C600 for DIP, and the manufacturer's recommendations. Contractor will submit a test protocol that has been approved by the pipe manufacturer in writing to the Owner for approval prior to implementing any testing.
  - (3) All sanitary sewer force main(s) shall be hydrostatically tested with potable water at least 1.5 times the shutoff head of the connected pump(s) or 150 pounds per square inch (psi), which ever is greater. The pressure measurement shall be made from the lowest elevation of the sanitary sewer force main section being tested. The test pressure shall not exceed the pipe or valve rated pressures.
  - (4) Pressure Test: The hydrostatic pressure test duration shall be 24 hours (uninterrupted) with a maximum pressure loss of 20 psi.

- (5) Leakage Test: Immediately following the 24 hour pressure test, the contractor shall pump the force main back to the original test pressure and conduct the hydrostatic leakage test with a duration of 2 hours (uninterrupted). Allowable leakage in gallons per hour per 1000 feet of pipeline shall not exceed  $0.045 D$  ( $D$  is the nominal pipe diameter in inches). Minimum test period shall be two (2) hours; however, if additional testing is required, such additional testing shall be performed by the Contractor.
- (6) The Contractor shall remove all debris, soil and rocks from the sanitary sewer force main(s) prior to the hydrostatic test.
- (7) The Contractor shall provide the water for the hydrostatic test and shall be responsible for hauling water. If water is to be used from a fire hydrant, the Contractor shall familiarize himself with Chatsworth Water Works Commission's Backflow Prevention Program and obtain a fire hydrant meter and follow all rental rules and regulations. The existing water system shall be protected from cross-connection at all times.
- (8) The Contractor shall furnish all equipment and labor required, including necessary piping/hoses, injection booster pump, test pressure gauge, water source for testing the sanitary sewer force main(s) with a measuring meter and stopwatch. The measuring meter dial shall be in 0.10 gallons increments. The test pressure gauge shall have a minimum range of 0-150 psi and the pressure gauge figure intervals shall be a maximum of 2 psi increments. The Contractor shall install a test corporation at the location determined by the Engineer and Owner. The Contractor shall be responsible for any holes excavated and/or left open for hydrostatic testing purposes. The hydrostatic test shall be performed by the Contractor and witnessed by the Engineer and Owner. The Contractor shall furnish hydrostatic test reports of the sanitary sewer force main to the Engineer and Owner.
- (9) The cost of the hydrostatic test including test corporation, filling water and the hydrostatic test shall be included in the unit cost of the force main installation. No separate payment nor extra work shall be requested by the contractor for these activities.

**END OF SECTION**