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CITY OF FLINT
SPECIAL PROVISION
FOR
WATER MAIN CONSTRUCTION

a. Description. Water main work includes all labor, equipment, and materials necessary to complete the water main, water services, hydrants, and other related construction.

b. Materials. All materials shall be of United States manufacture. The Contractor shall direct all requests for any variances to the Engineer in writing. The manufacturer shall supply a sworn statement (certification) that all pipe, hydrant valves, fittings, gaskets, and all appropriate appurtenances furnished comply with the standards referenced in these specifications. Catalog cuts for all materials to be installed shall be provided to the Engineer for review at the Pre-construction Meeting. No materials shall be installed prior to the approval of the catalog cuts by the Engineer.

1. Ductile Iron Pipe. Ductile iron pipe shall meet or exceed the requirements of ANSI/AWWA C150/A21.50-81 for zinc-coated Thickness Class 52 or 54 and ANSI/NSF Standard 61. Ductile iron pipe shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4. Gaskets for ductile iron pipe shall be push-on type and shall meet ANSI/AWWA C111/A21.11. One gasket per length of pipe shall be furnished. Gaskets shall be compatible with the pipe joint furnished. Gasket lubrication meeting the requirements of ANSI/AWWA C111/A21.11 shall be furnished for each gasket. ALL HYDRANT LEADS SHALL BE DUCTILE IRON PIPE. The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01.

2. Polyethylene Encasement. Ductile iron water main, fittings, and appurtenances and non-copper service connections shall be encased with polyethylene in accordance with ANSI/AWWA C105/A21.5. Encasement material shall be linear low-density polyethylene film with a minimum thickness of 8 millimeters (mil).

3. Polyvinyl Chloride (PVC) Pipe. PVC pipe shall meet the requirements of ANSI/AWWA C900 for Pressure Class 305, DR14 pipe and ANSI/NSF Standards 14 and 61. All PVC pipe shall be stamped “NSF-pw” on the exterior pipe wall. PVC pipe is not allowed where it may be exposed to significant concentrations of pollutants comprised of low molecular weight petroleum products or organic solvents or their vapors. Joints shall be gasket, push-on type. Joints and gaskets shall meet the requirements of ASTM D3139 and ASTM F477. One gasket per length of pipe shall be furnished. Gaskets shall be compatible with the pipe joint furnished. Gasket lubrication shall be furnished for each gasket.

4. High Density Polyethylene (HDPE) –Directional Drilling Only: Pipe shall be manufactured from a PE 3608 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D 3350 with a cell classification of 34564C. Pipe shall have a manufacturing standard of ASTM F 714. Pipe shall be a

minimum of DR 11 (200psi WPR) or Engineer approved replacement. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification form the same raw material.

5. Fittings. All fittings shall be ANSI/AWWA C110/A21.10 or C153/A21.53, mechanical joint type, and be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4.

6. Mechanical Joint Bolts. Mechanical joint bolts (T-bolts) shall be high-strength, low-alloy steel meeting ANSI/AWWA C111/A21.11 requirements.

7. Mechanical Joint Restraints. Mechanical Joint Restraint shall be MJ FIELD LOK® Gasket or devices that consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11. All nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated. The gripping wedges shall have individually actuated wedges with torque limiting twist off nuts. Gland body, wedges, and wedge actuating components shall be ductile iron conforming to ASTM A536.

8. Ductile iron pipe mechanical joint restraints shall have a working pressure rating of 350 psi and be EBAA Iron Megalug Series 1100, Uni-Flange Series UFR 1400, or Engineer approved equal. All nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated.

9. PVC Pipe mechanical joint restraints shall meet the requirements of ASTM F1674 and have a working pressure rating of 200 psi. All nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated. PVC joint restraints shall be EBBA Iron Series 2000PV, Uni-Flange Series UFR 1500-C, or Engineer approved equal.

10. MJ FIELD LOK® Gasket. The restraint system shall be completely integral to the gasket, requiring only standard mechanical joint assembly techniques. All nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated. The restraining system for ductile iron shall be pressure rated to 350 psi. The restraining system for PVC shall be rated at a 2:1 safety factor for the pipe on which it is installed. The restraining system shall be rated in accordance with the performance requirements of ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

11. Pipe Bell Restraints. Ductile iron pipe bell restraint shall be locking gasket or devices that consist of a restraint ring on the spigot joined to a ring behind the bell. The restraint ring shall have individually actuated wedges with torque limiting twist off nuts. Bell restraint rings and wedging components shall be made of ductile iron conforming to ASTM A536. Connecting tie rods shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure of 350 psi. Ductile iron bell restraint shall be the EBAA Iron Series 1700 Megalug restraint harness, Uni-Flange Series UFR 1450, or Engineer approved equal.

12. Locking Gasket. Locking gaskets for ductile iron pipe shall be a boltless, integral restraining system and shall be rated for 350 psi in accordance with the performance requirements of ANSI/AWWA C111/S21.1. Gaskets for TYTON® joints shall be Field Lok 350 manufactured by U.S. Pipe. Gaskets for American, pipe shall be Fast-Grip® manufactured by American Cast Iron Pipe Co.

13. PVC pipe bell restraint devices shall meet the requirements of ASTM F1674 and consist of split serrated rings to grip behind the pipe bell and on the connecting pipe. The restraint shall be manufactured of ductile iron conforming to ASTM A536. Connecting tie rods shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a minimum working pressure rating of 200 psi. The restraint shall be the EBAA Iron Series 1500, Uni-Flange Series UFR 1390-C, or Engineer approved equal.
14. HDPE Fittings. Butt Fusion Fittings: Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Molded fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the quality control records.
15. Electrofusion Fittings: Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Electrofusion fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.

16. Hydrants. Hydrants shall conform to ANSI/AWWA C502. Hydrants shall be East Jordan BR-250, Mueller Super Centurion or Engineer approved equal with the following:

    A. 5'-6" bury
    B. Open Valve Clockwise
    C. 5-1/4" valve opening
    D. Mechanical joint inlets with accessories
    E. 7/8" square operating nut (top nut)
    F. Nozzle caps shall have 7/8" square nuts
    G. One 4-1/2" pumper nozzle (facing curb or pavement)
    H. Two 2-1/2" hose nozzles
    I. Hose nozzles shall be national standard fire hose coupling thread
    J. Drains shall be open before installation
    K. O-ring seals
    L. *Hydrants shall be painted YELLOW above the ground line
    M. *Hydrant caps shall be color coded per Standard Detail Fire Hydrant Detail
    N. * Hydrant Painting shall be two-part industrial coating system. First coat shall be epoxy primer followed by second coat of poly-urethane, following manufactures suggested application. Primers and paints shall be Sherwin Williams, Pittsburgh Paints, or approved equal.

17. Gate valves. Gate valves shall be resilient wedge valves, mechanical joint on both ends, 2-inch square operating nut, O-ring seals, and **open right**. Valves shall conform to ANSI/AWWA C509 or C515 and be supplied with accessories, nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated. Valves shall be East Jordan Iron Works Flowmaster or Mueller 2361 series. American AVK Series 65 may be used for hydrant leads. Parts shall be approved by Engineer prior to ordering.

18. Tapping Valves. Tapping valves shall be resilient seated gate valves with mechanical joint on one end and flange with alignment ring on the other end. Tapping valves shall accommodate a full-size shell cutter. Valves shall have 2-inch square operation nut, O-ring seals, and **open right**. Valves shall conform to ANSI/AWWA C509 or C515 and

be supplied with accessories, nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated. Valves shall be East Jordan Iron Works Flowmaster, Mueller 2361 series, CLOW R/W, Kennedy Kenseal R/W, US Pipe Metroseal 250 R/W, or American Flow Control Series 2500.

19. Tapping Sleeves. Tapping sleeves, nuts, bolts, and lugs shall be 304 stainless steel or epoxy coated. Lugs shall be of extra-heavy gauge construction, welds must be fully passivated to insure maximum corrosion protection, sleeves shall have full circle virgin SBR or neoprene gasket in accordance with ASTM D2000 with 360 degrees of sealing surface, and flanges shall be recessed for tapping valve alignment. Sleeves shall be Ford FTSS, Powerseal 3490, Smith-Blair 665, , Romac SST III, or JCM 432.

20. Valve Boxes. Valve boxes shall be 5-1/4-inch shaft, screw-type with #6 base. Sleeves shall be Tyler 6860 series, Item D or Bibby 45 to 66 inches extension, or Bingham & Taylor (B&T) Figure No. 4906, size D. Lids shall be marked “WATER.”

21. Gate Wells. Gate well material shall conform to MDOT 2020 Standard Specifications for Construction Section 823.

22. Gate Well Cover. Material for gate well cover shall meet the requirements of AASHTO M306, Class 35B, for manholes, catch basins, inlets, iron steps, and bridge deck drains. Castings must be certified to proof load testing of 50,000 pounds. Coat exposed casting surfaces with matching intersection colored paint. The coating must be smooth, tough, and tenacious when cold and must not scale off, tack, or become brittle.

23. In Line Stops. Temporary line stop type valves: plugging mechanisms used for isolating sections of existing water line. Line is stopped/plugged: when 95 percent or more of pipe’s existing water flow has been stopped. Backfill to grade above pipe left in place. Place and compact backfill in compliance with the Special Provision. Valve materials meeting AWWA Standards C-509 or C515. Valves shall be Hydra-Stop Insta-Valve 250 Patriot, Hydra-Stop IVP250, or approved equal.

24. Service Lines. Water service connections shall be ASTM-B88 Type-K soft temper copper.

25. Corporation Stops. Corporation stops for copper service pipes shall conform to ANSI/AWWA C800 with AWWA corporation stop inlet threads and outlet external threads for use with flared copper pipe (no compression types). Corporation stops shall be Ford Meter Box (F-600-4-NL), or Mueller Company (H-15000). Parts shall be approved by Engineer prior to ordering.

26. Service Saddles: Service saddles for 2 inches and smaller service connections to PVC water pipe shall conform to ANSI/AWWA C800. Saddles shall be cast brass construction with internal threads compatible with AWWA corporation stop inlet threads. O-ring gasket shall be EPDM rubber conforming to ASTM D2000. The saddle shall provide full support around the circumference of the pipe. Service Saddles shall be Ford Meter Box (S90) or Mueller Company (BR2B).

27. Curb Stops (Service Stops). Curb stops for copper service pipe shall conform to ANSI/AWWA C800 with threading for use with flared copper pipe (no compression types). Curb stops shall be Ford Meter Box (Z22-444-NL) or Mueller (B-25204). Parts shall be approved by Engineer prior to ordering.

28. Service Boxes (Curb Stop Boxes). Curb boxes shall be screw-type 2-1/2-inch shaft, extension 41 to 64 inches, Tyler 6500 series, Item 95E, or Bibby 95E. Lids shall be marked "WATER." Parts shall be approved by Engineer prior to ordering.

29. Cast Couplings. Cast coupling shall be Romac Alpha, Smith-Blair Rockwell 441, Power Seal System 3500 series, Dresser Style 253, or Dresser Hymax.

c. Construction. Ductile iron water main pipe shall be installed in accordance with ANSI/AWWA C600, "Installation of Ductile Iron Water Mains and Their Appurtenances." PVC water main pipe shall be installed in accordance with ANSI/AWWA C605, "Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water". Additional requirements are as indicated on the construction drawings and standard details, and as specified herein.

30. During installation process the City of Flint will require a City of Flint Water Services Staff employee to visually observe all water main installation.

31. Laying Pipe. Pipe shall be laid to line and grade and shall have bearing over its entire length except at joints where joint holes shall be of such size as to give adequate room for working. Depth of excavation shall be such as to give between five feet and six feet of cover over the pipe. The bottom of the trench shall be excavated to the required grade so that the pipe shall have a full four inches of bedding. Where pipe is being laid in future streets, the depth of excavation shall be sufficient to provide a minimum of 5-1/2 feet of cover below established grades as indicated on the drawings.

32. Water main trenches shall follow MDOT Standard Plans Details R-83-C, Utility Trenches. Exceptions will be concrete encased pipe Trenches, see note 10 below.

33. Temporary Plugs. Plugs with watertight seals shall be installed to keep water, sand, mud, animals, etc. out of newly installed water pipe. A plug shall be placed into the open end of each pipe section as well as Tees and Bends as they are installed into the trench and shall remain in place until immediately before the next section of pipe is connected to it. Non-pressure plugs with rubber gaskets shall be as manufactured by Plug-It Products, Taylor Made Plastics, or another plug acceptable to the Engineer.

34. Isolation. The new water main shall be kept isolated from the active distribution system using a physical separation (see standard detail drawing) until satisfactory bacteriological testing has been completed and the disinfectant water flushed out. Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include an appropriate cross-connection control device consistent with the degree of hazard and shall be disconnected (physically separated) from the new main during the hydrostatic pressure test. It will be necessary to re-establish the

temporary connection after the completion of the hydrostatic pressure test to flush out the disinfectant water before final connection of the new main to the distribution system.

35. Insulation. Where water and sewer are approximately the same elevation, the water shall pass over the sewer where possible. If in going over sewers, the minimum required cover cannot be maintained, 2-inch x 4-foot x 8-foot Styrofoam insulation shall be used. The inspector will provide needed instructions. Cost of insulation and installation shall be included in cost of water main installation.

36. Separation of water mains and storm and sanitary sewers shall meet Michigan Department of Public Health recommendations as outlined in the Recommended Standards for Water Works.

    A. Parallel Installation. Water main shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

    B. Crossings. Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required. Where vertical separation cannot be achieved contractor shall encase water main in concrete for 3 feet beyond the limits where vertical separation between water main and other utility is less than 18 inches.

    C. Exception. The reviewing authority must specifically approve any variance from the above requirements when it is impossible to obtain the specified separation distances. Where sewers are being installed and these requirements cannot be met, the sewer materials shall be water pipe or equivalent and shall be pressure tested to insure water tightness.

    D. Force Mains. There shall be at least a 10-foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18-inch vertical separation of crossings as required above.

    E. Sewer Manholes. No water pipe shall pass through or come in contact with any part of a sewer manhole.

37. Joints. Push-on joints shall be used and installed in strict accordance with the manufacturer’s specifications.

38. Mechanical Restraints for 12-inch and Smaller Pipe. All tees, bends, dead ends, reducers, valves and hydrant watch valves, and hydrants for water main 12 inches and smaller are to

be restrained by mechanical joint retainer glands, bell restraint harnesses, or locking gaskets. Restrained lengths shall be a minimum of 2 pipe lengths on either end of all appurtenances including connection to HDPE directional drill piping. Other methods of restraint shall be only as authorized by the Engineer and may include the following:

A. Thrust blocks (poured against undisturbed earth with concrete. No precast blocks).

B. Tie rod joint restraints using Duc-lugs or 3/4-inch Corten Steel Anchor Eyebolts. Two restraints per joint are required for 4-inch through 8-inch pipe. Four restraints per joint are required for 10- and 12-inch pipe.

39. Thrust Blocks for Pipe Larger than 12 inches. All tees, bends, and dead ends for water main larger than 12 inches are to be restrained by thrust blocks. Thrust blocks shall be concrete (no precast) having a compressive strength of 3,000 psi at 28 days, placed between the pipe and undisturbed earth of the trench wall. Exposed bolts and/or flanges shall not be covered with concrete. Concrete shall extend from the bottom of the trench to the top of the pipe within the limits of laying length of the fitting. Thrust block dimensions shall be as specified on the Standard Water drawings.
40. Concrete Encasement of pipe. Where called for on plans encasement shall be concrete (no precast) having a compressive strength of 3,000 psi at 28 days, placed 6 inches thick around the proposed pipe and extend 3 feet beyond the edges of the existing pipe being crossed.
41. Polyethylene Encasement of Ductile Iron Pipe. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material, but is not intended to be a completely airtight or watertight enclosure. All lumps of clay, mud, cinders, etc., on the pipe surface shall be removed before installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or embedment material from becoming trapped between the pipe and the polyethylene. The polyethylene film shall be fitted to the contour of the pipe to affect a snug, but not tight, encasement with minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaced, bolted joints or fittings, to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape, string, or any other material capable of holding the polyethylene encasement in place until backfilling operations are complete. For installations below the water table, both ends of the polyethylene tube shall be sealed as thoroughly as possible with adhesive tape at the joint overlap. Installation of polyethylene encasement shall be in accordance with ANSI/AWWA C105, Method A, and as described below unless otherwise authorized by the Engineer.

A. Cut polyethylene tube to a length approximately two feet longer than the pipe section. Slip the tube around the pipe, centering it to provide a one-foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube. After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure it in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width at the top of the pipe to make a snug, but not tight, fit along the barrel of the

pipe, securing the fold at the quarter points. Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired as described herein. Proceed with installation of the next section of pipe in the same manner.

B. Pipe-shaped Appurtenances. Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

C. Odd-shaped Appurtenances. When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in a tube, wrap with a flat sheet of split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges together, folding over twice and taping down. Handle width and overlaps at joints as described above. Tape polyethylene securely in place at valve stem and other penetrations.

D. Repairs. Repair any cuts, tears, punctures, or damage to the polyethylene with adhesive tape or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area and secured in place.

E. Openings in Encasement. Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an x-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape. Service taps may also be made directly through the polyethylene with any resulting damaged areas being repaired as described above.

F. Junctions Between Wrapped and Unwrapped Pipe. Where polyethylene wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least three feet. Secure the end with circumferential turns of tape.

G. Service lines of dissimilar metals shall be wrapped with polyethylene or a suitable dielectric tape for a minimum clear distance of three feet away from the ductile iron pipe.

H. Exercise care to prevent damage to the polyethylene wrapping when placing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, or other material that could damage polyethylene.

42. Fire Hydrants. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb, with the pumper nozzle facing the curb, except that the hydrants having two-hose nozzles 90 degrees shall be set with each nozzle facing the curb at an angle of 45 degrees.

A. Set to Grade. Hydrants shall be set to the established grade, with the center of the lowest nozzle at least 18 inches above the ground. The lowest nozzle shall be installed away from the curb line at a sufficient distance to avoid damage from or to vehicles. Traffic model hydrants shall be installed so that the breakaway flange is not less than two inches nor more than six inches above the established grade. Any fittings used to set the hydrant to grade shall be included in the unit price bid for hydrant installation.

B. Hydrant Valve. Each hydrant shall be connected to the main with a six-inch diameter branch controlled by an independent valve, unless otherwise specified. The valve shall be restrained to allow shutoff when the hydrant is to be removed.

C. Drainage. When a hydrant is set, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least six inches above the drain port opening in the hydrant and to a distance of one foot around the elbow. Where ground water rises above the drain port or when the hydrant is located in contaminated soils or when the hydrant is located within ten feet of a sanitary or storm sewer main, the drain port shall be plugged.

D. Backfill. All backfill within the influence of the road shall be Michigan Department of Transportation (MDOT) Class II, compacted to 95% maximum density in accordance with Standard Detail SD-7W.

43. Valve and Fitting Installation.

A. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure containing bolting and test plugs, cleanness of valve ports, and especially seating surfaces, handling damage, and cracks. Defective valves shall be marked and held for disposition as required. All bolts and nuts, with the exception of seat adjusting bolts or screws in butterfly valves, shall be checked for proper tightness. Seat adjusting bolts in butterfly valves shall be adjusted only on the recommendation from the manufacturer.

B. Placement. Valves, fittings, plugs, and caps shall be set and joined at the pipe according to ANSI/AWWA C600 or ANSI/AWWA C605, as applicable. Valves connecting to PVC pipe and all valves 12 inches or larger shall be provided with special support, such as crushed stone, concrete pads, or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.

C. Drainage Branches and Blowoffs. Mains shall be drained through drainage branches or blowoffs. Drainage branches, blowoffs, and appurtenances shall be provided with control valves and shall be located and installed as indicated on the drawings. Drainage branches or blowoffs shall not be directly connected to any storm or sanitary sewer, submerged in any stream, or be installed in any manner that will permit a back siphonage into the distribution system.

D. Vents. Air-release of vacuum vents shall be provided at high points in the line and in areas of potential negative pressure. The air release or vacuum vents shall not be connected to any storm or sanitary sewer, and they shall be protected from freezing.

~~E. Valve Box. A valve box shall be provided for every valve that has no gearing or operating mechanism, or in which the gearing or operating mechanism is fully protected with a gear case. The valve box shall not transmit shock or stress to the valve. The valve box shall be centered over the operating nut of the valve with the box cover flush with the surface of the finished area or another level as specified.~~

F. Curb Stop Box. Brick will be placed under curb stop box. 1 ½ " PVC pipe will be used to hold curb box in place while being backfilled.

G. Gate Well. A vault designed to prevent settling on the pipe shall be provided for every valve that has exposed gearing or operating mechanisms. The operating nut shall be readily accessible for operation through the opening in the valve vault. The opening shall be set flush with the surface of the finished pavement, or another level as specified. Vaults shall be constructed to permit minor valve repairs and to protect the valve and pipe from impact where they pass through the vault walls.

H. Plugs and Caps. All dead ends on new mains shall be closed with plugs or caps that are suitably restrained to prevent blowing off under test pressure. If a blowoff valve precedes the plug or cap, it too shall be restrained against blowing off. All dead ends shall be equipped with suitable blowoff or venting devices.

44. Backfilling. After the water line has been properly positioned for grade and horizontal alignment, the trench shall be backfilled in accordance with the following described methods.

A. Pipe Bedding and Initial Backfill. Pipe bedding and initial backfill shall be performed to properly set the pipe. Bedding shall conform to details indicated on the drawings and as specified herein. Pipe laid in sandy soils will be bedded with hauled-in Class IIIA granular material or approved on-site material. Pipe laid in a rocky, dry trench will be bedded with Class IIIA granular material. Use coarse aggregate 6A as directed by the Engineer for bedding pipe in unstable soil conditions. The Engineer reserves the right to use alternate pipe bedding.

B. Initial backfill to twelve inches above the pipe shall be with Class IIIA granular material or approved onsite material. The Contractor shall take all necessary actions and precautions to ensure that initial backfill is properly placed around the pipe, especially from the spring line of the pipe to the bottom of the trench. This shall be accomplished to the satisfaction of the Engineer. Initial backfill shall be compacted to a minimum of 90% of the maximum unit weight.

C. Final Backfilling. After proper pipe bedding and initial backfill, the Contractor shall begin final backfill operations. Backfill shall be accomplished by placing layers, 12 inches maximum of the appropriate backfill material in the excavation and compacting.

Trenches under road surfaces, pavement, curb, driveway, sidewalk, and within their zone of influence shall be backfilled with Class II granular material. Compaction shall be by the controlled-density method or other effective means and shall be a minimum of 95% of the maximum unit weight. Other trenches may be backfilled with suitable onsite material and compacted to a minimum of 90% of its unit weight.

Wherever utilities cross the trench, the backfill material shall be thoroughly compacted for the full depth beneath such pipe and a stone-free sand cushion tamped under and around the pipe a minimum of 12 inches measured in any direction.

Stones exceeding six inches in diameter, logs, stumps, and other debris shall not be allowed in the backfill material in the roadway or within six inches of the pipe. Muck or other unstable organic soils which may be encountered in excavation shall be hauled and disposed of and the Contractor shall furnish sufficient approved material to complete the backfill as required.

D. Granular Material. Granular material which is encountered in the excavated material may be used for the required MDOT Class II granular material if approved by the Engineer. The use of such material shall not be allowed without prior approval of the Engineer.

45. Damaged Materials. Any pipe, manholes, valves boxes, stop boxes, or structures which are damaged during construction shall be replaced by the Contractor at no expense to the Owner.

46. Salvaged Materials. Old fire hydrants and selected large valves shall be removed as part of the work that will not be reused and shall remain City property and be set aside for pickup by the City of Flint Water Department. The Contractor shall exercise caution during removal to avoid damage to the valves or hydrant and remove the head, barrel, and foot piece intact in one piece.

47. Connecting to Existing Water Lines. The Contractor shall make connections to existing water lines as indicated on construction drawings. All new water system mains shall be constructed, backfilled, pressure tested, chlorinated, and approved by the Engineer, and water tests shall be taken and approved for potable use by the Michigan Department of Environmental Quality or the City of Flint Water Department prior to connecting the new system mains to existing water distribution mains. Temporary connections for filling, chlorinating, and testing new mains shall be as specified herein and shown on the drawings.

48. Notification Prior to Shutting Off Water. Where water main construction under this contract requires shutting off water supply in existing mains supplying residents, the Contractor shall provide advance notice to the Owner and to all residents who will be affected. Residents and businesses shall be notified at least 24 hours prior to shutting off the water supply. Facilities with critical water needs may require more advance notice. Water supply shall not be shut off until approved by the Engineer. If faulty valves or other unforeseen conditions require expanding the area of shut off, the shut off shall be delayed until proper notification is provided. Delays will not be cause for extra compensation to the Contractor. Water supply shut off shall be limited to a period of not longer than four hours between 8 a.m. and 6 p.m. and this period shall be selected for the time of day which will least affect the residents and businesses. Other restrictions may be specified elsewhere in the contract documents. The Contractor shall be required to maintain an adequate water supply at all times (except as described above for brief periods) to all residents adjacent to the project and change over to new mains or services shall be coordinated to eliminate any long periods for residents without water.

49. Filling New Water Main. Provision shall be made to fill the main at a proper rate of approximately one foot per second. Air shall be bled off the water main prior to testing. Unless approved otherwise, this will require one-inch corporations and bypass at main line valves. Tap and materials required to install one-inch corporations shall be included in the cost of construction.

A. The Contractor shall pay the City of Flint for all water used during construction, including water main breaks and water necessary for testing, cleaning, and chlorinating water mains. The actual volume of water used shall be determined by the City. The rate of pay for all water used shall be at the current rate per 100 gallons.

B. The water necessary to fill the volume of the water main at the completion of the project shall be paid by the city.

50. Service Connections. Minimum size shall be one inch. Water service connections shall be constructed with a minimum of five feet cover, at right angles to water main between main and curb stop, and as close as possible to the existing service that is being replaced. Where obstructions (e.g., trees) make open cut installation impractical or when directed by the Engineer, the service shall be installed by boring.

A. Service Taps. Service taps should be located at ten o'clock or two o'clock on the circumference of the pipe. Service taps on ductile iron pipe may be screwed directly into the tapped and threaded main without any additional appurtenances.

B. All service taps on PVC pipe shall utilize a tapping saddle (NO DIRECT TAPS). The equipment and procedures specified in ANSI/AWWA C605 for saddle tapping shall be followed.

C. Service Taps in Polyethylene Encasement. Service taps may be accomplished by making an x-shaped cut in the polyethylene encasement and temporarily folding back the film. After the tap has been completed, cuts in the polyethylene and any other areas of damage to the film shall be repaired with tape as described in ANSI/AWWA C105/A21.5. Direct service taps may also be made through the polyethylene, with any resulting damaged areas being repaired as described previously. The preferred method of making direct service taps consists of applying two or three wraps of polyethylene adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted. After the direct tap is completed, the entire circumferential area should be closely inspected for damage and repaired if needed.

A. Disinfecting Service. Prior to connecting customer's service line to curb stop, the service in the street right-of-way shall be flushed and filled with a 200 miligrams/liter (mg/L) (200 parts per million (ppm)) minimum chlorine solution. Solution shall stand for a minimum of one hour after which time the service shall be flushed free of chlorine solution. A sample will then be taken by the Water Department after which the curb stop shall be installed, if not already in place, and the customer's service shall be reinstated.

B. Backfill. The service shall be bedded with Class IIIA granular material and backfilled with Class II granular material or approved onsite material. Backfill under road surfaces, curb, driveways, or sidewalk or within their zone of influence shall be compacted to 95% of the maximum unit weight. Other trenches shall be backfilled with suitable onsite material and compacted to a minimum of 90% of its maximum unit weight.

51. Hydrostatic Testing. Hydrostatic testing shall be performed in accordance with ANSI/AWWA C600 (Ductile Iron pipe) or ANSI/AWWA C605 (PVC pipe), and as specified herein.

A. Test Restrictions. Test pressure shall not be less than 150 psi at the highest point along the test section. Test pressure shall not exceed pipe or thrust-restraint design pressures. The hydrostatic test shall be of at least a two-hour duration. Test pressure shall not vary by more than ±5 psi for the duration of the test. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. The test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if desired. The test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves, or butterfly valves.

B. Pressurization. After the pipe has been laid, all newly-laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 150 psi at the point of testing for a minimum of 4 hours. Each valve section of pipe shall be slowly filled with water, and the specified test pressure shall be applied using a pump connected to the pipe. Valves shall not be operated in either the opened or the closed direction at differential pressures above the rated pressure. The system should be allowed to stabilize at the test pressure before conducting the hydrostatic test.

C. Air Removal. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at these points to expel air as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and the pipe plugged or left in place as required.

D. Examination. Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with reliable material, and the test shall be repeated until satisfactory results are obtained.

E. Testing Allowance Defined. Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly-laid pipe or any valved section thereof to maintain pressure within five psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Testing pressure shall not be measured by a drop in pressure in a test section over a period of time.

A. Testing Allowance. No pipe installation will be accepted if the amount of makeup water is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

L=testing allowance (makeup water), in gallons per hour
S=length of pipe section tested, in feet
D=nominal diameter of the pipe, in inches
P=average test pressure during the hydrostatic test, in pounds per square inch (gauge)

F. Hydrants in Test Section. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

B. Acceptance. Acceptance shall be determined on the basis of testing allowance. If any test of laid pipe discloses a testing allowance greater than that specified, repairs or replacements shall be accomplished. After this work has been done, the tests shall be repeated. Final acceptance of the lines will not be made until satisfactory tests are obtained.

52. Disinfection and Testing of Water Main. Water mains shall be disinfected and pass bacteriological test prior to hydrostatic testing. All pressure testing and disinfection of water mains shall be in accordance with these specifications and shall be included in the cost of construction. It shall be the contractor's responsibility to determine all procedures and costs for coordination with all city departments for water main disinfection and include all costs and time in their bid and progress schedule.

The effectiveness of disinfection depends, in large measure, on maintaining clean pipes and avoiding major contamination during construction. Therefore, it is strongly recommended that sanitary practices be used for handling and installing pipe, valves, fittings, and accessories.

The interiors of pipes, fittings, and valves shall be protected from contamination. Pipe delivered for construction shall be strung to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day’s work or for other reasons, such as rest breaks or meal periods. Rodent proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

A. The Flint Water Department will disinfect the water main and appurtenances using the continuous feed method outlined in ANSI/AWWA C651. Either calcium hypochlorite (HTH) containing 65% available chlorine by weight or liquid sodium hypochlorite containing approximately 10% available chlorine, conforming with ANSI/AWWA B300, will be used for disinfection.

B. The Contractor shall provide all hoses and personnel needed to flush the mains in a manner that is safe and will not damage adjacent property. The Contractor shall not operate any existing valve. Water Department personnel will control water flow with assistance from the Contractor. It shall be the contractor's responsibility to determine all procedures and costs for coordination with all city departments for water main disinfection and flushing and include all costs and time in their bid and progress schedule.

C. Disinfectant Procedures.

(1) Place four ounces minimum (1/2 cup) of HTH granules in each length of pipe as it is installed (optional).

(2) Fill the main and appurtenances, including hydrants, with water from the distribution system through corporations at a rate of approximately one foot per second as follows:

Nominal Pipe Size	
Size (inches)	Rate (gallons per minute)
6	80
8	160
12	360
16	640

Note: The existing distribution system shall be protected from backflow caused by hydrostatic pressure tests and disinfection procedures. The Contractor shall commence filling the main before 9 a.m.

(3) Allow a minimum of two hours contact time with the HTH in the new main (if Step A is used).

(4) With assistance from the Water Department, flush the main at a minimum velocity of 2.5 feet per second.

(5) Chlorinate the main and appurtenances, including hydrants, using the “continuous feed method” as follows:

(a) Water from the existing distribution system or other approved source shall be made to flow at a constant metered rate into the new main at a point not more than 10 feet downstream from the beginning of the new main.

(b) Water entering the main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 50 mg/L (50 ppm) free chlorine. Chlorine concentration will be measured by the Water Department at regular intervals using appropriate chlorine test kits or other approved method to ensure even distribution throughout the main.

(c) The chlorinated water shall be retained in the main for at least 24 hours during which time valves and hydrants shall be operated to ensure disinfection at the end of this 24-hour period.

(d) The treated water in all portions of the main after the 24-hour period shall have a residual of not less than 10 mg/L (10ppm) free chlorine.

D. Bacteriological Samples. After the satisfactory chlorination of the mains has been completed as described above, the chlorinated water flushed out and the mains filled with potable water, the Water Department will take for analysis two consecutive bacteriological samples of the water in the mains, 24 hours apart.

E. If the analysis of the samples shows the water to be non-potable as a result of unsatisfactory disinfection of the mains, the mains shall be re-chlorinated at the Contractor's expense until satisfactory samples are obtained.

53. Final Connections to Existing Mains**.** Water mains and appurtenances must be completely installed, flushed, disinfected, and have satisfactory bacteriological sample results received before permanent connections are made to the active distribution system. Sanitary construction practices shall be followed during installation of the final connection so that there is no contamination of the new or existing water main with foreign material or groundwater.

A. Disinfection of Fittings and Pipe Used for Connection. The new pipe, fittings, and valves required for the connections may be spray-disinfected or swabbed with a minimum of 1% to 5% solution of chlorine just prior to being installed if the total length of the connection from the end of a new main to the existing main is equal to or less than 18 feet. If the length is greater than 18 feet, the pipe required for the connection must be set up above ground, disinfected and bacteriological samples taken as described in the disinfection section above. After satisfactory bacteriological sample results have been received for the "pre-disinfected" pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time the satisfactory bacteriological sample results are received and the time that the connection piping is installed, the ends of the piping must be sealed with plastic wrap, watertight plugs, or caps.

B. Flushing. To assure complete removal of foreign materials that might have entered the main during the course of the installation, the new water main shall be thoroughly flushed following connection to the existing system or any other procedure that exposes new components to external sources of contamination. This is in addition to flushing required under "Disinfection and Testing of Water Main." With assistance from the Water Department, flushing shall be done following connection to the existing water system, but before any service connections are made. The new water main shall be flushed again after all final tie-ins are completed. The Contractor shall coordinate flushing operations by submitting a support request to the Water Department at least one working day in advance. If no fire hydrants or other convenient outlets for flushing are available, the Contractor shall install temporary hydrants for flushing at no additional cost.

Whenever practical, initial connection to the existing system shall be to a larger main so that desired flushing velocity can be achieved. All valves and hydrants shall be fully opened and closed under water pressure to ensure proper operations during flushing and to dislodge foreign material.

Flush new mains, hydrant leads, and service connections to fire system risers thoroughly before connection is made to system piping. Flushing shall be of sufficient magnitude and duration to flush all foreign material out of the lines, valves, and hydrants. The flushing velocity shall be a minimum of 3.0 feet per second (5 feet per second preferred) for non-fire protection lines. Where the main supplies a fire protection system, the velocity shall meet the NFPA 24 requirement of 10 feet per second. The flow required to produce a velocity of 10 feet per second in various pipe sizes is as follows:

Nominal Pipe Size Inches (in)	Gallons per Minute (gpm)
6	880
8	1560
10	2240
12	3520

Direct flushing water away from traffic, pedestrians, and private property. Prevent erosion damage to streets, lawns, and yards by the use of tarpaulins and lead-off discharge devices.

54. Disinfection When Cutting into or Repairing Existing Mains. The following procedures apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to the completion of bacteriological testing in order to minimize the time customers are without water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water may present little danger of contamination and, therefore, may not require disinfection.

G. Trench Treatment. When an existing main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from this pollution. Tablets have the advantage in this situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

H. Swabbing with Hypochlorite Solution. The interior of all pipes and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1%, NSF AWWA C651 approved, hypochlorite solution before they are installed.

I. Flushing. Thorough flushing is the most practical means of removing contamination introduced during repairs. If the valve and hydrant locations permit, flushing toward the work location from both directions is recommended until discolored water is eliminated. Highly concentrated chlorine water shall be discharged to the sanitary sewer.

A. Bacteriological Samples. Bacteriological samples shall be taken after repairs are completed to provide a record for determining the effectiveness of the procedure. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If positive bacteriological samples are recorded, the situation shall be evaluated by the Water Department to determine corrective action. Daily sampling shall be continued until two consecutive negative samples are recorded.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price for the following pay items:

Pay Item	**Pay Unit**
Water Main, ____ inch, Open Cut	Foot
Water Main Bedding and Backfill, SD-7W	Foot
Gate Valve, ____ inch	Each
Gate Valve and Box, 6 inch	Each
Hydrant Assembly, SD-1W	Each
Water Main, _____ inch, Cut and Plug	Each
Water Main, Connect New ____ inch to Existing ____ inch	Each
Water Service, __ inch	Foot
Gate Well, ___inch dia	Each
Gate Well, Cover	Each
Water Main, ___ inch Rem	Foot
Hydrant, Rem	Each
Water Main, Abandon, Flowable Fill	Cubic Yards
Gate Well, Abandon	Each

Water Main, Open Cut of the size, class, and trench detail specified, will be measured in place by length in feet, from center to center of crosses, tees, and bends, including fittings. Payment includes providing and installing the specified pipe, bedding, and initial backfill material to one foot above the pipe.

Payment also includes polyethylene encasement (for Ductile Iron), concrete encasement, gaskets, restraints, and other materials required for proper installation. When required, payment includes providing and installing Styrofoam insulation. Payment also includes excavation, trenching, coffer dams, de-watering, placing and removing temporary sheeting and bracing, support and protection for existing utilities, backfilling with approved onsite granular material, compaction, disposal of surplus earth removal, tree root protection, abandoning old water main, removal of gate wells as required on the drawings, temporary road or trench surface as directed by the Engineer, removal of temporary surfaces, all work and materials required for the necessary disinfection and testing, and all other work required for a complete job.

All additional work necessary for the completion of this work but not specifically listed as a pay item will be deemed included in one or more of the contract items listed in the proposal.

Water Main Bedding and Backfill, SD-7W will be measured by length in feet along the water main. Payment for Water Main Bedding and Backfill, SD-7W includes disposal of unsuitable material and furnishing Class II granular material for backfill from one foot above the pipe to the pavement base or finished grade. Where onsite backfill material is used in backfilling the water main, the payment will be reduced in proportion to the amount of onsite backfill material actually used.

Gate Valve, _ inch of the size specified includes providing and installing the valve, retaining glands if needed. excavation and backfill with Class II sand or approved onsite material and any other materials needed to properly install specified items.

Gate Valve and Box, 6 inch includes providing and installing the valve, retaining glands if needed, cast iron valve box with lid marked “WATER”, excavation and backfill with Class II sand or approved onsite material and any other materials needed to properly install specified items. Where required by paving operations, payment shall include temporary lowering. (Note: Payment for Gate Box, Adjust, Case 1 will be made for gate boxes lowered for paving.)

Hydrant Assembly, SD-1W includes providing and installing fire hydrant, 6-inch ductile iron hydrant lead, polyethylene encasement, 6-inch valve, cast iron valve box, retainer glands, coarse gravel or crushed stone mixed with coarse sand for drainage, excavation, and backfill with Class II sand or approved onsite material.

Water Main, Cut and Plug includes providing and installing plug or cap, polyethylene encasement, retainer glands, and any other materials needed to properly install specified items. Payment includes the removal of any valves, valve boxes, or valve manholes rendered unnecessary, bulkheading abandoned pipe with concrete and excavation and backfill with Class II sand or approved onsite material.

Water Main, Connect New ___ inch to Existing ___ inch includes providing and installing bends, couplings, retainer glands, and any other materials needed to properly make the connection. Pay item includes coordination deemed necessary by the Engineer with the City and adjacent property owners. Payment includes the removal of any valves, valve boxes, or valve manholes rendered unnecessary by the new connection, bulkheading abandoned pipes with concrete and excavation and backfill with Class II sand or approved onsite material. Water main will be paid separately as measured between the connection point to the existing main and the center of the new main. Water valves will also be paid separately.

Water Service, _ inch of the size specified includes providing and installing copper pipe, corporation stop and tap saddle, curb stop, stop box, excavation, and backfill with Class II sand or approved onsite material, and any other fittings required to connect new service to existing pipe in parkway. This pay item will include connecting the new service to main and to the existing service line to building and disconnecting old service from main.

Gate Well, _ inch dia. of the size specified includes the cost of concrete footing and up to 10 feet of structure depth. Refer to MDOT 2020 Standard Specifications for Construction Section 823.

Gate Well Cover as detailed on Sheet 3 of the plans, including embossing required by the City of Flint.

Water Main, _ inch, Rem includes the removal and disposal of old water mains, any valves, valve boxes, or valve manholes rendered unnecessary and as required on the drawings. Payment also includes saw cutting, excavation to the depth required, de-watering, support and protection for existing utilities, tree root protection, disposal of unsuitable material, furnishing Class II granular material for backfill to the pavement base or finished grade, and compaction. Where onsite backfill material is used in backfilling the water main, removal will be reduced in proportion to the amount of onsite backfill material actually used.

Hydrant, Rem includes removing the existing hydrant lead, valve, and hydrant assembly as indicated on drawings and setting the hydrant aside (undamaged and in one piece) for retrieval by the Water Department. The work includes bulkhead of the existing lead and backfill with specified material.

Gate Well, Abandon includes removing the top three feet of the existing structure and casting from the site as well as filling the remainder of the structure with Class II sand including compaction. This item includes all sawcutting and demolition necessary to remove the top three feet of the structure.