SECTION 2 – WATER DISTRIBUTION

GENERAL REQUIREMENTS

The design of water facilities shall comply with the "Recommended Standards for Water Works" (10 States Standards), latest edition.

All materials shall be manufactured in the United States of America wherever available.

Concrete work shall be as Specified in ODOT Item ~~604~~ 499.

All work shall conform with the General Requirements in Section 1 for seeding, restoration, landscaping, etc.

I. MATERIALS

2.1. PIPE AND FITTINGS

A. Requirements - Pipe, fittings and appurtenances shall conform to the latest edition of the referenced Standards.

The manufacturer shall furnish an affidavit indicating that all pipe, fittings and appurtenances have been manufactured and tested in accordance with the requirements of the applicable referenced Standards. A copy of the affidavit, indicating the project on which the material is to be used, shall be forwarded to the City prior to construction.

All pipe, fittings and appurtenances shall be appropriately marked for purposes of identification. The materials and methods of manufacture, and the completed pipes, fittings and appurtenances shall be subject to inspection and rejection at all times. The City shall have the right to make inspections.

B. Ductile Iron Pipe and Fittings - Ductile iron pipe shall be designed in accordance with AWWA C150 and manufactured in accordance with AWWA C151 and shall be Thickness Class 52. If crossing, or within, railroad right-of-ways, Thickness Class 56 shall be used. The pipe shall be of the push-on joint or mechanical joint type, with joints within the lengths noted on the drawings to be restrained type joints. Furnish City with calculations to support lengths of restrained joint pipe to be used at all fittings and valves. Restrained joint lengths shall meet Ductile Iron Pipe Research Association (DIPRA) minimum lengths recommended. All pipe shall be coated with a bituminous material on the exterior and shall be cement mortar lined by the factory in accordance with AWWA C104. Pipe shall be furnished in minimum 18-foot lengths unless otherwise specified.

Fittings shall be of ductile iron, shall conform to AWWA C153, and shall be coated and lined and have joints as specified for the pipe.

Mechanical joints and push-on joints shall be in accordance with AWWA C111, incorporating rubber gaskets.

Restrained push-on joints shall be completely boltless and shall be Clow-McWane Super-Lock, American Flex-Ring, U.S. Pipe TR Flex, or as approved by the City. Restrained mechanical joints shall be of the pipe manufacturer's standard design, or shall be MEGALUG as manufactured by EBAA Iron,

Inc., or equal, of ductile iron and with a working pressure of at least 250-psi and a minimum safety factor of 2:1. All fittings and valves shall have restrained mechanical joints.

Whenever it is necessary to cut the pipe at fittings, valves, specials or elsewhere, the remaining portions may be used where possible to minimize the number of scrap pieces when the project is complete; however, pieces less than 5 feet in length shall not be used. Cut pieces of pipe shall be beveled to manufacturers specifications.

C. Directional Drilled Water Mains, Polyethylene (HDPE) pipe and Ductile Iron Fittings – Polyethylene (HDPE) pipe shall comply with AWWA C906, PE3408, DR11, PC 160; NSF approved for potable water. Ductile iron fittings shall be AWWA C153 with exterior coating of bituminous material. Interior lining per AWWA C104 cement mortar with seal coat; and the use of stainless steel ring stiffeners at all fittings shall be employed. Butt fusion weld joints between plain ends of polyethylene pipe, mechanical for transition between pipe, valves, etc. of differing materials as approved by City.

Install 8-gauge trace wire continuous over top of polyethylene pipe. Permanently affix this trace wire to the HDPE pipe as it is being installed. Allow sufficient slack on both ends of HDPE pipe to extend trace wire into a valve box on each end of the directionally drilled water main. Bring trace wire up into and loop at the top of each valve box. Splicing of wire shall be done using splice caps with waterproof seals. Twisting of wire together is not permitted. Test wire for continuity before and after backfilling. Broken wire to be replaced.

Contractor shall verify that area for trenchless installation is ready to receive work, and excavations, dimensions, and elevations are as indicated on drawings. Contractor accepts full responsibility for Contractor's conclusions relative to the nature and probable difficulties of the work due to underground structures and soil conditions. Beginning of installation means acceptance of existing conditions.

Make butt fusion joints in accordance with pipe manufacturer's and fusion machine manufacturer's instructions. The wall thickness of the adjoining pipes shall have the same DR at the point of fusion.

Directional Drilling shall be accomplished via a drilling rig mounted on a variable but shallow sloped bed which pushes the drill head through the soil along the route of the proposed water main. Stiff rod sections are added to extend the hole. The route/depth is controlled by locating the drill head electronically and rotating the drill head to a position that forces redirection. The hole is kept full with bentonite to prevent collapse and facilitate drawing the pipe back through the hole, connected to the rods.

Install HDPE pipe in the following manner. Provide such means as necessary to facilitate the installation of the pipe and appurtenances in accordance with lines, grades, and locations as shown on the drawings. Drill the drilling rods and head at a downward angle to a minimum depth of 4 feet or as approved by the City and continue to drill horizontally at the specified depth along the proper alignment. When connecting two separate lengths of pipe together, maintain minimum burial depth drilling in a horizontal direction beyond the point at which the existing pipe begins its upward ascent before bringing the drill head to the surface. Attach piping to drill rods per manufacturer’s instructions and then pull the

rods and pipe back through the hole created. After pulling the pipe completely through the created hole with the drilling unit, excavate the location of the connection. Butt fuse the two lengths of pipe together at the point where both pipes are horizontal to the surface.

If obstructions are encountered, back up drilling head and deflect around obstruction. At no time shall a deflection around an object cause the pipe to leave a road right-of-way or easement limits.

Maintain a data sheet for all directionally drilled pipe. The data sheets shall at a minimum contain name of driller, date of work, location of work, footage of drilled pipe, depth of burial, slope of drill head, all updated at 5 foot intervals and comments regarding installation. Perform all required backfill as subsequently specified.

Survey and record on the Record Drawings the water main elevation at intervals of 200 feet or less along the main.

Directionally Drilled HDPE pipe shall only be used as approved by the City. No water service connections shall be permitted on HDPE pipe, unless otherwise permitted by the City.

Directionally drilled PVC pipe will be acceptable on a case-by-case basis, as permitted by the City.

2.2 POLYETHYLENE ENCASEMENT

Contractor and/or developer is responsible for coordinating with the Ductile Iron Pipe Research Association (DIPRA) to test the project site to determine the corrosiveness of the soil and the need for polyethylene encasement. Report shall be submitted to the City for determining the need, if any, to wrap the pipe.

Pipe, fittings and appurtenances shall be field wrapped with a minimum 8-mil thick polyethylene tube meeting the requirements of AWWA C105, as directed by the City. Installation shall be in accordance with Method A and the instructions of the manufacturer. All overlaps and seams shall be completely taped. All rips, punctures and other damage to the polyethylene shall be acceptably repaired. Tape shall be 2-inch wide plastic backed adhesive tape which will bond securely to both metal surfaces and the polyethylene film.

2.3. PIPE INSULATION

Provide minimum 1-inch cellular glass insulation with an aluminum jacket; adequate to prevent freezing at 0 degrees F; suitable for burial. Installation shall be FOAMGLAS by Pittsburgh Corning Corporation or as approved.

Provide insulation in any area where the depth of cover, wether horizontal, at ~~on~~ slopes or vertical, is less than or equal to 3'-6". Install pipe insulation and jacketing per manufacturer's recommendations, and to prevent entry of water between the pipe and insulation.

2.4. PIPELINE MARKERS

Provide pipeline markers for water main installation in railroad or Turnpike right-of-ways or in easements other than maintained residential yards or as required by the City.

In railroad or Turnpike right-of-ways, furnish and install prominent durable, weatherproof signs located over the centerline of the pipe at each right-of-way line, and along the pipeline in the right-of-way

for longitudinal occupancy, or as designated by the right-of-way owner. Signs shall show the name and address of the Owner, contents of the pipe, pressure in pipe, pipe depth below grade at the sign and an emergency telephone number in the event of pipe rupture. The signs shall be acceptable to the railroad company or Ohio Turnpike Commission.

In easements other than railroad or Turnpike right-of-way, furnish and install prominent, durable weatherproof signs located over the centerline at each end of the easement and along the pipeline in the easement. Signs shall have the word WATER permanently imprinted on them, and shall be Carsonite Utility Markers as manufactured by ~~AMETEK~~ Carsonite Compsites, or as approved; and shall comply with APWA/ULCC color coding for utility locating.

Signs shall be located at each right-of-way line, at beginning of easements, at each valve location and at 500 foot intervals along the pipeline outside the public right-of-way, or such shorter interval to allow sight distance between two consecutive marker signs.

2.5 STEEL ENCASEMENT PIPE

Where shown, the pipe shall be installed within welded steel encasement pipe. The encasement pipe shall meet the requirements of ASTM A139, Grade B, ~~and shall be bituminous coated on the outside. Any coating applied in the field shall be applied a minimum of 48 hours prior to installation.~~ The encasement pipe diameter shall be four inches larger than the diameter of the pipe bell, rounded up to the next nominal pipe size. The minimum wall thickness of the encasement pipe shall be 0.375-inches and is based on steel pipe having a minimum tensile strength of 60,000 psi and a minimum yield strength of 35,000 psi. The wall thickness shall be adjusted as necessary for other grades of pipe. All joints shall be fully welded on the circumference.

The encasement pipe shall be installed by boring and jacking and in such a manner so as to allow the pipe to be laid at the grade shown. This shall include both horizontal and vertical control methods as approved by the City Engineer. Control methods shall permit location of and realignment of the cutting heads at all times during installation. Boring and jacking operations shall be continuous. The pipe shall be blocked in place within the encasement pipe to prevent shifting or flotation. The ends of the encasement pipe shall be blocked up in such a way as to prevent the entrance of foreign material, but allowing leakage to pass in the event of same within the encasement pipe. See Figure 2.5.1.

Blocking shall be accomplished using wood blocks or approved casing chocks. Wood blocking shall be as shown on the drawings. Wood blocks shall be of hardwood lumber. Banding straps for holding the wood blocks in place shall be of stainless steel. Casing chocks shall be of polyethylene or stainless steel with a liner and UHMW polymer plastic runners, shall be as manufactured by Power Seal Pipeline Products Corporation, Cascade Waterworks Manufacturing Company, Advance Products & Systems, Inc., or equal, and shall be installed in accordance with the manufacturer's instructions. Blocking shall be notched to secure banding to blocking without slipping off. Two sets of blocks or chocks shall be used per pipe segment. See Figure 2.5.2.

The annular space between the encasement pipe and the carrier pipe shall be filled with either sand, blown in, or grout.

The Owner will secure all necessary permits for boring pipe, but the Contractor shall pay the cost of all necessary inspection, insurance, etc. No work shall begin until a permit, if required, has been issued. The City shall either secure upfront the cost of all necessary inspections, insurances, etc., or shall withhold monies due to Contractor for same until satisfactory proof is received from Contractor that all costs have been paid. The Contractor shall be responsible for meeting the requirements of the governing authority, which may include approval of equipment to be used, for installation of the encasement pipe and for providing same with the required notification prior to the start of such work. The City shall not be responsible for any additional cost to the Contractor as the result of the Contractor's failure to meet any of the governing authorities requirements.

Steel encasement pipe in and across railroad right-of-ways shall meet the requirements of the railroad company. Steel encasement pipe in and across Turnpike right-of-ways shall meet the requirements of the Ohio Turnpike Commission.

2.6 GATE VALVES

Valves 12-inches in diameter and smaller shall be gate valves. Gate valves shall be iron-body, resilient-seated gate valves meeting the requirements of AWWA C-515. Valves shall be designed for a working water pressure of 200 psi, shall be of the non-rising stem type with standard AWWA nut, and shall open by turning to the left (counterclockwise). Stem seals shall consist of at least two O-rings. Ends shall be mechanical joint.

Gate valves shall be as manufactured by American ~~Darling~~ Flow Control or Mueller, and shall match those existing in the system. The manufacturer shall furnish an affidavit indicating that all tests and provisions of the applicable standard have been met.

Each gate valve shall be complete with a valve box as subsequently specified in Item 2.11. Valves shall be set plumb with the valve box accurately centered over the valve. If required, operators shall be provided with extension stems such that the operating nut is located approximately 4'-0" below grade. Extension stems shall be centered in the valve boxes by approved stem guides.

2.7 TAPPING SLEEVES AND VALVES

A. Requirements - When an existing main into which a connection is to be made cannot be shut down or taken out of service, the connection shall be made with a tapping sleeve and valve. The installation shall be made by personnel skilled and experienced in the making of pressure taps. The Contractor shall exercise care in the selection and adjustment of drilling equipment as well as in the installation, inspection and cutting procedures.

Prior to ordering the tapping sleeve assembly, the Contractor shall expose a section of the existing main and verify the circumference of the pipe.

The Contractor shall be responsible for inspection, proper assembly, alignment and fitting of the tapping sleeve and tapping valve to the main. In the event of any mismatch of purchased materials, it shall be the Contractor's responsibility to refit them in the field or to make the necessary arrangements with the manufacturer for factory refit.

The severed section of water main shall be removed through the tapping valve and given to the Engineering Department as proof of satisfactory execution of the operation. The City may retain the coupon for such analysis or tests as are necessary to evaluate the condition of the existing water main.

Other requirements for installation of the tapping sleeve and valve shall be as subsequently specified in Item 2.26 – Connections to Mains.

B. Tapping Sleeves – Tapping sleeves and bolts shall be of stainless steel. Gaskets shall extend the entire interior length of the sleeve to form watertight joints when the side bolts are tightened in accordance with the manufacturer's instructions. Branch flange shall have a female face to accommodate the male face of the tapping valve. Tapping sleeves shall be as manufactured by Romac Industries, or equal. Tapping sleeves shall be tested to 200 psi.

C. Tapping Valves – Tapping valves shall be gate valves as previously specified in Item 2.6 except as modified by the following:

The waterway shall accommodate full size cutters. One end shall be flanged to match the tapping sleeve outlet. The valve outlet shall be mechanical joint in compliance with AWWA C111.

Each tapping valve shall be complete with a valve box as subsequently specified in Item 2.11. Valves shall be set plumb with the valve box accurately centered over the valve. If required, operators shall be provided with extension stems such that the operating nut is located approximately 4'-0" below grade. Extension stems shall be centered in the valve boxes by approved stem guides.

2.8 INSERTION VALVES

Insertion Valves shall be used as directed by the Engineering Department. Insertion valves shall ~~be QuikValve~~ as manufactured by Romac Industries or approved equal.

The valve insert shall be a ductile iron casting coated with SBR rubber, compounded for water service, with a durometer of 55 Shore A; and which seats on the inside diameter of the sleeve, neck and lower half of the water main. The neck shall be manufactured to precision tolerances that assure proper alignment, support and seating of the valve insert.

The bolts and nuts shall be type 304 stainless steel, including washers. Gaskets shall be manufactured of SBR rubber, compounded for potable water service per ASTM D2000 with a durometer of 70 Shore A; providing a positive 360 degree seal. The armors shall be heavy gauge, type 304 stainless steel, armor plates to bridge the gap between the sleeve halves.

2.9 BUTTERFLY VALVES

Valves 14-inch diameter and larger shall be a butterfly valve. Butterfly valves shall be the tight closing rubber seat type, shall be designed specifically for buried service, and shall meet the requirements of AWWA C504, Class 150B. Valves shall be bubble tight at rated pressure with flow in either direction, and shall be suitable for applications involving throttling service and/or frequent operation, and for applications involving operation after long periods of idleness. Shafts shall be of stainless steel. Ends shall be mechanical joint. Valves shall open by turning left (counterclockwise), and shall be equipped with a fully gasketed and grease packed, watertight, self-locking operator having standard AWWA operating nut and mechanical stop limiting devices.

Butterfly valve shall be as manufactured by DeZurik, or ~~Henry~~ Pratt Co.(Mueller). The manufacturer shall furnish an affidavit indicating that all tests and provisions of AWWA C504 have been met.

Butterfly valves with mechanical joints shall be complete with a long, solid mechanical joint cast iron sleeve and a cast iron filler piece. Installation shall be such that the sleeve can be slid over the pipe within the manhole and the filler piece and pipe removed to permit removal of the valve without disturbing the manhole.

Each butterfly valve shall be complete with a manhole as subsequently specified in Item 2.12. Valves in manholes shall be installed as shown in plan on Figure 2.9.1 and in Section on Figure 2.9.2, and shall be complete with a handwheel, an extension stem and guides.

2.10 AIR RELEASE VALVES

Air release valves shall be installed at high points in the main, or as directed by the City, to permit the release of air when the main is being filled and during service by manually opening the valve. The valve shall be a 2-inch diameter, ball valve, as subsequently specified in Item 2.17. The valve shall be screw connected into a tapped blind flange on an appropriate fitting in the main with the required lengths of stainless steel pipe and fittings installed so as to permit use without entering the manhole. Stainless steel pipe shall be provided with a hose bibb to permit connection of hose to allow ease of use.

Each air release valve shall be complete with a manhole as subsequently specified in Item 2.12. See Figure 2.10.1.

2.11 VALVE BOXES

Valve boxes shall be constructed of cast iron, shall be coated, shall be of the three piece screw type, shall have a 5-1/4 inch shaft, and shall be provided with a heavy, neat-fitting cover having the word "WATER" cast on the top. The base of the valve box shall cover the entire bonnet section of the valve. The three piece valve box shall have sufficient length, such that when installed, the top of the cover shall be flush with the surrounding surface with each section properly engaged. Valve boxes shall be as manufactured by Bibby St. Croix or an approved equal.

Valve boxes shall be installed with a Class QC concrete collar, see Figure 2.11.1, or as directed by the City. Valve boxes in concrete pavements or sidewalks shall have expansion joint material around that portion of the box in the concrete. The concrete collar shall terminate three inches below final grade.

After installation, valve boxes shall be checked to ensure the box is not filled with stones, dirt, debris or backfill material and that the operating nut is centered to allow operation of the valve.

2.12 MANHOLES

Manholes shall be constructed with approved precast concrete pipe sections, and shall have a minimum inside diameter of four feet. Walls shall rest on an ODOT Class QC reinforced concrete foundation. The pipe sections shall be set in a full bed of, and all joints shall be filled with, mortar composed of one part, by volume, Portland cement and two parts clean hard sand. Where the pipe passes through the manhole walls, provide minimum 1/2-inch thick watertight Kor-N-Seal or A-Lok gasket or equal around the pipe. Foundations shall be complete with sumps, supports and blocking as shown.

See Figure 2.9.1. for butterfly valve and manhole details, Figure 2.10.1 for air release valve and manhole details, and Figure 2.13.1 for blowoff chamber details.

All manholes shall be provided with a removable top slab constructed of Class QC reinforced concrete. The top slab shall have 2 inch diameter lifting holes, filled with mastic to prevent the entry of dirt, or approved lifting rings, and a cast iron manhole frame and cover. The manhole frame and cover shall be heavy duty gray iron castings conforming to ASTM A48, with a minimum weight of 375 pounds, and shall be East Jordan (EJ) 1040 or equal. Frame shall have a height of 7 inches and a clear opening of 24 inches. Covers shall be solid and shall have the word 'WATER" cast in the top. Both the underside of the cover and the upper surface of the ledge upon which it rests shall be machined. Castings shall be cleaned and coated with asphalt bitumastic paint prior to installation, and after installation the top of the cover and the top of the frame shall be given one coat of asphalt bitumastic paint.

The top of the frame and cover shall be flush with the surrounding surface. The frame shall set in a full leveling bed of mortar on the top slab. Any elevation adjustment up to a maximum height of 12-inches shall be accomplished using precast adjusting rings or red non-porous sewer brick set in mortar. Bituminous material shall be placed on both sides of any and all adjustment rings and a minimum 1/2-inch thick waterproof mortar shall be placed on both sides of any and all red non-porous sewer brick set in mortar. Mortar shall use Type M cement with waterproofing additive.

Steps shall be provided in the chamber. Steps shall meet the requirements of ASTM C478 and shall be of reinforced polypropylene. Steps shall consist of a 1/2-inch steel reinforcing rod encapsulated in a copolymer polypropylene plastic and shall incorporate a notched tread ridge and retainer lugs on each side of the tread ridge. The steel rod shall be continuous through the entire length of legs and tread. Steps of the press fit type driven into the concrete wall shall have a pullout resistance of not less than 1,500 pound per leg, as evidenced by test data.

2.13 BLOWOFF CHAMBER

Blowoff chambers shall be used where sediment blowoff is required due to a low point in the water main. The blowoff chamber shall be of materials and construction as previously specified in Item 2.12 for manholes, except the top shall be a precast eccentric dome section. See Figure 2.13.1.

Inlet piping into the blowoff chamber to connection with the plug valve shall be ductile iron anchoring pipe as subsequently specified in Paragraph 2.15.D.

The 6-inch plug valve shall be a rubber faced, semi-steel plug valve as manufactured by DeZurik. Plug valve shall be provided with flanged joint ends, and shall be complete with a blind flange, bronze extension stem, stem guides, and operating wrench.

2.14 FLUSHING ASSEMBLIES

Flushing assemblies shall be used at the end of water mains where a hydrant is not located within 100 lineal feet. Each flushing assembly shall be a post or flush style, 2-1/8-inch fire hydrant, dry barrel type, meeting the requirements of AWWA C502, complete with one 2-1/2-inch hose nozzle with NST threads. Each flushing assembly shall be complete with anchored piping, watch valve and valve box. Flush type fire hydrants shall be provided with a cast iron flush box with non-locking lid. Operating nuts

shall be standard AWWA hydrant type operating nuts. See Figure 2.14.1 for a post type flushing assembly and Figure 2.14.2 for a flush-type flushing assembly.

Watch valves shall be gate valves as previously specified in Item 2.6. Valve boxes shall be as previously specified in Item 2.11. Provide ODOT #6 stone as shown. City shall approve style of flushing assembly and shall further determine if a main line gate valve prior to the flushing assembly will be required.

2.15. FIRE HYDRANTS

A. Assemblies - Fire hydrants shall be complete assemblies of the types shown in the details on the drawings, each including fire hydrant, watch valve and valve box, piping (mainline tee, and anchoring pipe and fittings as required), and appurtenances. (See Figures 2.15.1, 2.15.2, 2.15.3 and 2.15.4.) Installation shall be as specified in Item 2.20.

B. Fire Hydrants - Fire hydrants shall be of the compression type, opening against and closing with the water pressure in the main, and shall meet the requirements of AWWA C502. Hydrants shall have a 5-1/4 inch valve opening, two 2-1/2 inch hose nozzles NST; and one 4-1/2-inch Mack National Threads pumper nozzle, and shall open by turning to the left (counterclockwise). Hydrants shall be traffic models with frangible barrel section and stem coupling, shall be furnished with a positive operating drain valve and installed with the valve open, and shall be designed so that when properly operated, water hammer will be prevented. Hydrants shall be suitable for setting in trenches of the depths and in the locations shown, and shall be furnished with a 6 inch mechanical joint base. The Contractor shall be responsible for determining hydrant depth of bury based on the locations shown. The breakaway flange shall be set at 3-inches above to 3-inches below finished grade. Each hydrant if necessitated by field conditions, shall be provided with an offset grade adjusting fitting, as manufactured by Grade-Lok or equal. Distance from road to hydrant shall be 3 to 8 feet with curb and 5 to 8 feet with ditch and hydrant approach. Hydrants shall be located at intersections and at 300 to 350 foot intervals, and be located such that the hydrant is on the property line of adjacent parcels. Hydrants shall be painted color as designated by the City, and hydrant caps shall be removed and nozzles greased (lubricated) prior to acceptance.

Fire hydrants shall be Mueller Centurian A423 or American ~~Darling~~ Flow Control B84B. The manufacturer shall furnish an affidavit indicating that all tests and provisions of AWWA C502 have been met. The Contractor shall verify that the hydrant pumper nozzle, operating nut, outlet nozzle cap nuts and hose threads conform to those in the system before the new hydrants are shipped. Hydrant exterior above ground level, in addition to finishing as required by AWWA C502, shall be field painted with two coats of paint as required by the City after backfilling is complete. Backfill around base of hydrant shall be No. 57, washed gravel. No limestone shall be permitted to come in contact with the hydrant or asssembly.

C. Watch Valves and Valve Boxes - Watch valves and valve boxes shall be gate valves and valve boxes as previously specified in Items 2.6 and 2.11, with the valves to have ends suitable for receiving the spigot end of 6 inch anchoring pipe.

D. Piping - Piping shall be Class 52 ductile iron anchor pipe and fittings designed in accordance with AWWA C150 and manufactured in accordance with AWWA C151. All pipe and fitting shall be coated with a bituminous material on the outside and shall be cement mortar lined in accordance with AWWA C104. Mainline tees shall conform to the requirements of AWWA C153. The branch shall be standard mechanical joint for connecting to anchoring pipe and fittings, and shall be of the mechanical joint anchoring type when connecting to a watch valve.

Anchoring pipe shall be of the plain end mechanical joint type incorporating an integral cast shoulder and follower gland, and shall be as manufactured by Clow Corporation, American Cast Iron Pipe Company, United States Pipe and Foundry Company, or equal.

E. Hydrant Approaches - Hydrant Approaches shall be provided where a ditch line exists between the edge of pavement and a fire hydrant. This will permit ease of access to the hydrant. All earthwork for hydrant approaches shall be in accordance with all applicable requirements of ODOT Item 203. Pipe culverts shall be reinforced concrete pipe meeting the requirements of ASTM C76 - Class IV with rubber O-ring joints and ODOT Item 706.02. Contractor shall provide calculations to City supporting size of pipe culvert proposed. When proposed pipe abuts existing pipe, furnish and install a 1-foot wide by 6-inch thick concrete collar encasement. All pipe shall be bedded to 12 inches over the top of the pipe with Class B bedding, and the remainder of the trench backfilled as specified in Item 2.25. (See Figure 2.15.5.) Fill material shall be select excess excavated material. All approaches and all fill and other earth areas disturbed by the Contractor's operations shall be seeded as previously specified in Section 1.

F. Fire Department Connection – Private fire suppression systems shall be provided with a fire department connection assembly as shown on Figure 2.15.6. This assembly shall be tied into the fire suppression system from within the building and extend to outside the building to the location as determined by the City Fire Department.

2.16 BACKFLOW PREVENTION DEVICES, ENCLOSURES AND THERMAL EXPANSION CONTROL

A. General – Backflow prevention devices shall be provided for, but not limited to, the following circumstances: all commercial and industrial buildings, fire lines, in-ground irrigation systems, swimming pools, properties with auxiliary water supply (wells), and other circumstances as determined by the City and/or City Ordinance and associated rules and regulations for Backflow Prevention, latest edition. The City shall review and approve all drawings for backflow prevention. Backflow prevention devices, except for fire suppression systems and in-ground irrigation systems, shall be a minimum of a testable, reduced pressure principle assembly (ASSE 1013 or ASSE 1047). Fire suppression systems shall be provided with a minimum of a testable, double check backflow assembly (ASSE 1015 or ASSE 1048) provided no other hazard or condition exists requiring the use of a different backflow device. In-ground irrigation systems shall be provided with either a testable reduced pressure principle assembly (ASSE 1013) or a testable, Pressure Vacuum Breaker (ASSE 1020). All backflow prevention devices must be protected from freezing if applicable in the following ways: installed in a

heated buidling or approved heated enclosure, any backflow device that is not in service during freezing weather may be protected by completely removing any moisture from the device or by removing the device completely from the system and stored in a heated location. Backflow prevention devices and enclosures shall be installed downstream of the meter and shall remain the property of the property owner for maintenance and operation requirements.

B. Approved Backflow Prevention Assembly – Approved backflow prevention assemblies shall be included on the Ohio EPA list of approved backflow prevention devices, latest edition, ~~on file with the City.~~ Or approved by the City.

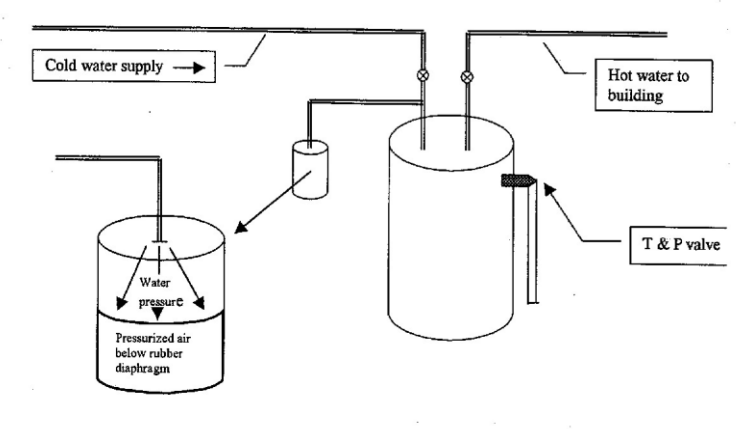
C. Backflow Prevention Device Installation - All backflow assemblies shall be installed in such a manner so to be readily accessible for inspection, testing, and maintenance. Test cocks cannot face towards a wall or otherwise be obstructed. All backflow assemblies shall be installed "in line" and must not be smaller than the water meter supply line. All backflow assemblies shall be inspected and tested at the time of installation by a State of Ohio certified backflow tester, with the results being recorded on a City-provided test form and forwarded to the address on the form.

1. Pressure Vacuum Breaker Installed As Follows:
    a. Shall be installed at least 12 inches above all downstream piping and the highest outlet or flood level rim, of the fixture(s) being supplied.
    b. Shall be installed in a vertical position with adequate space to facilitate maintenance and testing.
    c. Shall be installed in an area where water spillage from the air inlet valve is not objectionable to the consumer.
    d. Shut-off valves may be installed on the downstream side of pressure vacuum breakers.
2. Double Check Valve Assembly Installed As Follows:
    a. Double check valve assemblies shall be installed in a horizontal position unless specified otherwise by the manufacturer and approved by the City.
    b. Installation above ground level is preferred. Where above ground installations are not reasonbly practical, a pit or vault may be used.
3. Reduced Pressure Principle Assembly Installed As Follows:
    a. Reduced pressure principle backflow prevention devices shall be installed above ground level or floor level, whichever is higher, if installed in an area prone to flooding.
    b. Reduced pressure principle backflow prevention devices shall be installed in a horizontal position unless specified otherwise by the manufacturer and approved by the City.
    c. Installed so that there is no visible discharge from the relief valve port.
    d. Installed with a drain to receive spillage from the relief valve port if the device is located within a building. The relief valve port, if piped to a drain, must

include an approved air gap separation at the discharge opening of the relief valve port.

e. The installation of this device in a vault or pit is prohibited.

D. Thermal Expansion Control – Per the Ohio Basic Building Code, where a backflow prevention device is installed on a water supply system utilizing storage water heating equipment such that thermal expansion causes an increase in pressure, a thermal expansion tank for controlling pressure shall be installed. The expansion tank shall be installed in the cold water service piping on the supply side of the hot water heater prior to any control valves. The size of the expansion tank is based upon the size of the hot water heater and may be determined by referring to the manufacturer recommendations.



E. Backflow Prevention Device Enclosure – The enclosure, depending on location, may be an existing or new building which is heated; and which meets the requirements of the Architectural Review Board (if new) and other building ordinances. If an exisitng building is not appropriate, a heated enclosure shall be provided including electrical power for heat, per the manufacturer's recommendations, based on size of backflow prevention device. The heated enclosure shall comply with ASSE-1060 Performance Requirements for Outdoor Enclosures for Backflow Prevention Assemblies.

New heated enclosures shall be either a box style, as manufactured by Hydrocowl, Inc. or Hot-Box or a Hot-Rok style as manufactured by Hot-Box. Both styles shall fully enclose the backflow preventer assembly, valves, handwheels and stems, and be constructed on an ODOT Class QC concrete pad, as recommended by the manufacturer. The heating and electrical requirements shall comply with manufacturer's recommendations. See Figure 2.16.1.

2.17 BACTERIA SAMPLING AND FLUSHING ASSEMBLIES

Sampling and flushing assemblies will be installed as a minimum every 1,200 l.f. of water main or as directed by the City. A corporation cock will be installed in the main with a bacteria sampling and flushing assembly at each sampling location. A curb stop or ball valve can be used in the portion of the

assembly that is above ground to facilitate the sampling procedure. At least 18 inches of smooth copper tube must extend beyond the valve (located above ground) and be bent in a downward arc. Additional length shall be provided to prevent flooding, to go into storm conveyance system, etc. Contractor shall be responsible for controlling direction of flow to proper drainage location to prevent flooding. Once installed, Contractor shall not be permitted to operate or otherwise tamper with bacteria sampling and flushing assemblies without approval from the City. The bacteria sampling and flushing assembly shall not be removed until the Contractor has received written notice that the main has passed all bacteriological tests per AWWA C651-92; Section 7.3 and Ohio EPA requirements. See Figure 2.17.1.

Materials for bacteria sampling and flushing assemblies shall be as specified in Item 2.18, with the exception that a ball valve may be substituted for the curb stop. The ball valve shall be bronze, two piece body, chrome plated, brass ball, teflon seats and stuffing box ring, with lever handle and balancing stops, solder or threaded ends with union; and shall be model ~~S-216 as manufactured by Stockholm~~; Model #S-587-70 or T-587-70 as manufactured by Nibco.

See Section III – Testing for additional testing requirements.

2.18. SERVICE CONNECTIONS AND METERS

A. Service Connections – Service connections shall be 1 inch for residential services up to the road right-of-way (See Figure 2.18.1.) and from the right-of-way to the meter setting. Locations of service connections, when shown on the drawings, are approximate only. Final locations will be established at the time of construction by the City or a representative of the Owner of the property being served. Service connections shall be installed prior to the new mains being tested and disinfected and placed in service. For service connections greater than 2-inch diameter, see Figure 2.18.2.

Service connections shall include the furnishing and installation of tapping saddle, corporation stop, curb stop and box, and service pipe and fittings as required. Materials shall meet all applicable requirements of AWWA C800. Work shall be in accordance with all applicable requirements previously specified in this Item.

Tapping saddles shall be used on services greater than 1-inch and shall be of bronze or brass, with silicon bronze screws, shall be designed for use with the type of pipe on which they are installed, and shall accept the subsequently specified corporation stops. Minimum quality shall be Epoxy Coated saddle with double stainless steel straps and bolts. Tapping saddles shall incorporate an "0" ring seal or gasket which shall effect a positive hydraulic seal. Installation shall be in strict accordance with the manufacturer's instructions.

Corporation stops shall be of the best quality bronze or brass, ball valve, and shall be a teflon coated ball valve and shall be complete with required coupling and accessories for connection to type of service pipe provided. Corporation stops shall be subjected to an air test at the factory, and shall be as manufactured by AY McDonald, Model No. ~~4731~~ 4701-B; Mueller, Model No. ~~15000~~ B2500; Ford Meter Box Co., Model FB800-X-NL, or as approved.

Curb stops shall be of the best quality brass or bronze, and shall be a teflon coated ball valve complete with connections for the type of service pipe provided from the main and for the type of service

pipe required to the building being served. Curb boxes shall be of steel and cast iron and shall be Bibby St. Croix Model 94E Arch Base, or as approved. Concrete blocking shall be provided under each curb box.

Service pipe shall be of Type K copper tube meeting the requirements of ASTM B88, and shall be soft tempered when installed in open trenches and hard tempered when installed by pushing. Flare type unions shall be used with the copper tube. Each service connection two inch diameter and smaller shall be provided with a tail piece of copper as shown in Figure 2.18.1.

Pipe shall be installed under street and highway pavements by pushing or boring, with no excavation closer than 5 feet to the edge of the pavement. In addition, no joints shall be permitted within these limits. When boring under pavement, if the opening exceeds by 2 inches the outside diameter of the pipe installed, the opening around the pipe shall be filled with grout.

B. Water Meters – Water meters shall be magnetic drive, with a scancode remote read, i.e. residential, commercial and industrial. They shall read in cubic feet, set with valves before and after the meter. Water meter setting shall be approved by the City. All ¾" and 1" diameter water meter installations require copper horns obtained from the City. Installation of water meters, settings and remote meter wire is the responsibility of the contractor.

Water meters greater than 1" diameter shall be rigid plumbed. These meters shall have by-pass piping with a lockable valve installed on the by-pass. Only Teflon tape shall be used on fittings and threads located on the supply side of water meters.

Water meters 2" diameter and smaller shall be obtained from the City. Water meters greater than 2" diameter shall be compound meters with strainer, unless otherwise approved by the City. Water meters shall be horizontally mounted approximately 30-42" above the floor and must be accessible and protected from damage, especially freezing.

The owner/contractor shall install a remote water meter wire from the proposed water meter location to the vicinity of the proposed electric meter base location. The remote meter wire shall terminate outside the structure in the vicinity of the proposed electric meter location and allow at least a two feet pigtail at each end. The remote shall be set in the immediate vicinity of where the remote wire exits the structure. The remote meter wire shall be single stranded, thermo-coated, 18 gauge wire with three conductors. The owner/contractor shall contact the Hudson Public Power or the electric utility in that area to determine the exact location of the electric meter base location. This requirement shall apply to all residential, commercial and industrial connections.

Per the Ohio Basic Building Code, where the water pressure within any building exceeds 80 psi, a water pressure reducing valve or regulator shall be installed immediately after the water meter to reduce the pressure to a maximum of 80 psi within the building.

2.19 BEDDING AND BACKFILL

A. Bedding – Pipe embedment shall be sand meeting the requirements of ODOT Item 703.06, from 4-inches below the pipe barrel to 12-inches above the pipe barrel.

Concrete encasement shall be ODOT Class QC concrete.

B. Granular Backfill – The granular backfill shall meet the requirements of ODOT Item 304 crushed limestone or controlled density backfill in accordance with fig. 2.25.1.

Trenches within railroad right-of-way, except for longitudinal occupancy, shall be backfilled with crushed stone with a top size of the aggregate to be a maximum of two inches and to have no more than 5% passing the number of 200 sieve. The gradation of the material is to be such that a dense stable mass is produced.

C. Control Density Fill (CDF) – Control Density Fill (CDF) shall be ODOT Item 613, Type 1 low strength mortar, except no fly ash permitted. The design mix used shall be approved by the City, and shall have a maximum design strength of ~~100~~ 50 psf.

II. INSTALLATION

2.20 PIPE LAYING AND HYDRANT INSTALLATION

Pipe sections shall be strung along the route of the mains within the right-of-way or easement so as to interfere least with pedestrian and vehicular traffic and to protect the pipe as fully as possible. Care shall be taken at all times in handling the pipe so as not to damage it in any way and at no time shall other pipes or material be placed in the pipes.

The use of equipment with metal tracks or treads will not be permitted on paved surfaces which will not be removed during trenching operations without some type of pavement protection such as matting or rubber tracks. Heavy equipment shall not be driven over streets, but shall be moved by trailer.

The mains shall be laid in the locations and at the grades shown on the drawings, except as specifically permitted by the City in order to avoid existing or proposed utility lines or any other obstructions encountered in the progress of the work; to secure a more readily accessible position for trenching; or to facilitate the location of various appurtenances of the main. Deflection of pipe joints shall be in strict accordance with the pipe manufacturer's instructions.

When abrupt changes in the grade of the main are necessary to avoid existing utilities or other obstructions, suitable fittings, usually 1/8 bends, shall be used so as to secure an easy flow of liquid and to provide sufficient cover below same unless otherwise specified or noted on the drawings. Pipe shall be so located to maintain a minimum clearance of 18 inches in all directions with respect to other utilities to allow for taps to be inserted. Care shall be taken to avoid high and low points in the mains. Dead-end stub may be terminated with a restrained valve (for further use) as determined by the City.

Pipe shall be laid at a minimum 10-foot horizontal distance from sewers and manholes and at a minimum 18 inches vertical distance from sewers at their crossing, both as measured between the outside of the pipe walls. At crossings, one full length of water main pipe shall be installed centered on the pipe being crossed so both joints will be as far from the sewer as possible.

With push-on joints, the surfaces to be in contact with the rubber gasket shall be wiped clean and dry just prior to making the joint and, when making the joint, a lubricant shall be used in accordance with the manufacturer’s recommendations. With mechanical joints, the surfaces to be in contact with the rubber gasket shall be brushed with soapy water to remove all sand and grit just prior to making the joint.

The Contractor is responsible for disinfection of the water main in accordance with AWWA C651-92, as subsequently specified in Item 2.28. The Contractor shall follow AWWA C651-~~92~~14 ~~Section 4~~ - Preventive and Corrective Measures during Construction. All pipes shall be thoroughly cleaned inside and outside before being lowered into the trench; shall be kept clean during and after laying; and the end of the pipe shall be sealed with a watertight plug when pipe laying is stopped for any reason. If, in the opinion of the Engineer, the pipe contains dirt that will not be removed during subsequent flushing operations, the interior of the pipe shall be cleaned and swabbed, as necessary, with a 1% chlorine solution (10,000 mg/l) prepared by mixing one pound of high-test calcium hypochlorite (65-70% CL) and 8 gallons of water.

Hydrants shall be set plumb and to the grade of the curb, street, alley, highway or right-of-way as approved by the City. The breakaway flange shall be within three inches of finished grade, either existing for developed streets or proposed grade for proposed streets. Any readjustment of the grade will require readjustment of the fire hydrant as noted above. Pumper nozzle shall always be set toward the middle line of the street, highway or right-of-way prior to final acceptance of the project. Prior to the water main being placed into service, the Contractor shall either turn pumper nozzle away from the middle line of the street or provide plastic bags, as approved by the City, to cover each hydrant.

The hydrant base and watch valve shall each rest on approved concrete blocking. Excavation for hydrants shall first be backfilled with ODOT #~~6 aggregate~~ 57 washed gravel (no limestone) for a minimum depth of two feet. Remainder of excavation shall be backfilled as specified for trenches.

Should it be necessary, as determined by the City to set a fire hydrant at a greater depth of bury as a result of changing hydrant location from that shown, elevation adjustment shall be accomplished by furnishing and installing the fire hydrant manufacturer's standard barrel and stem extensions or grade adjustment offset.

2.21 TRENCHES

Except where otherwise specifically required or permitted by the City, the mains shall be laid in open trench excavated to a depth sufficient to provide not less than 4 feet of vertical cover over the top of the pipe barrel and to provide not less than 4 inches of bedding below the outside bottom of the pipe barrel to 12 inches above the pipe barrel. No blocking shall be permitted under the water main. However, pipes shall be installed at a greater depth when shown on the drawings; when necessary to pass under other utilities or obstructions; or where necessary to prevent high points in the main. In addition to the minimum vertical cover, where any pipes parallel roadside ditches or streams, a lateral cover shall be provided at least equal to the specified vertical cover.

Prior to trenching, in lawn areas and in fields used for farming, both as determined by the City, all topsoil shall be removed and stockpiled for replacement during backfilling.

The width of the trench shall not be more than 24 inches greater than the outside diameter of the pipe, except at joints, where sufficient space shall be provided for properly making the joints without raising the length of pipe above the solid bottom of the trench. Care shall be taken to detect and remove stones and debris in the bottom of the trench which would damage the pipe or be detrimental to the

proper bedding of the pipe, with removal to be for a depth of at least 6 inches below the bottom of the pipe and replaced with bedding material.

Trenches in rock shall be excavated to a depth of 6 inches below the outside bottom of the pipe barrel and bell when the pipe is laid on its final grade and the pipe shall then be laid on a cushioning layer of bedding material as specified and provided by the Contractor. Rock excavation shall be in accordance with the requirements subsequently specified in Item 2.27.

Prior to open trenches entering the paved limits of a street, alley, driveway, sidewalks, or parking area, the pavement shall be neatly cut for its full depth, removed, and disposed of off the Project site. Street and road crossings shall be constructed in accordance with the requirements specified in Section 7 – Roadway.

Trench excavation shall include the removal of such other existing facilities noted to be removed.

Trenches shall be kept free of water during pipe laying and jointing. When water exists in the trenches at the time of pipe laying, the Contractor shall dewater the trench at his expense.

2.22 PROTECTION OF EXISTING UTILITIES

Existing underground utilities along the route of construction, as shown on the drawings or marked at the time of construction by the utility owner, shall be uncovered by the Contractor and their elevations determined at least 200 feet in advance of pipe installation. Contractors shall contact OUPS 48 hours prior to any excavation work.

All underground utilities, when encountered, shall be adequately supported, shored up or otherwise protected whenever exposed in the excavation. Timber supports shall be a minimum of 6 inches square. Supports shall extend into undisturbed earth a minimum of 12 inches each side of the trench and the pipe, conduit, etc., banded or tied to the bridging for its full length. Where bridging cannot be supported by a firm foundation, the Contractor shall provide vertical support for the bridging, including any lateral bracing necessary to provide a firm and substantial support. Supports and bracing shall be of native hardwood and shall be furnished and installed by the Contractor. (See Figure 2.22.1.)

Above ground (aerial) utilities, including power, telephone and cable television, shall remain in service at all times. Any anticipated disruption of service shall be with the full knowledge of the utility company and required advance notice to the affected users by the Contractor. Removal of guy wires and holding of poles shall be done as required to complete the work, shall be as agreed upon by the utility company and the Contractor with no additional cost to the City.

Arbitrary disruption of underground and aerial utility services will not be permitted.

2.23 TRENCH PROTECTION

Where necessary to prevent caving of the trench and other excavation, and for protection of workmen and nearby structures, trench protection shall be provided per OSHA standards by and at the expense of the Contractor. ~~Trench protection shall be by trench box, wood sheeting and bracing or such other methods as determined by the Contractor. Contractor shall have a competent person on site to determine the appropriate method for the conditions.~~

~~Wood sheeting and bracing shall be of sound lumber suitable for the purpose intended and shall be so arranged as to support the trench walls and existing structures and utilities. Sheeting left in place shall be cut off not less than 18 inches below ground surface.~~

~~Sheeting and bracing not required to be left in place may be removed at the discretion and responsibility of the Contractor after backfill has been placed and compacted to a level at least two feet above the top of the pipe. In no case shall sheeting be pulled in increments exceeding three to four feet in order to avoid the danger of breaking the pipe due to the weight of the backfill. Upon removal of sheeting and bracing, voids left due to such removal shall immediately be filled and the backfill recompacted.~~

~~Where it is necessary to drive sheeting below the centerline of the pipe, it shall be driven below the bottom of the pipe as determined by the City, and that sheeting below a point two feet above the top of the pipe shall be left in place.~~

2.24 PIPE EMBEDMENT

After the pipe has been laid and the joints made, the full length of each pipe shall be thoroughly bedded. The material shall be placed in layers not exceeding 6 inches in thickness, loose measurement, and securely compacted by hand or mechanical tamping to not less than 98% of maximum density as determined in accordance with ASTM D1557 (Modified Proctor) while taking care not to displace or damage the pipe or joints.

An exception shall be made where concrete encasement is noted on the drawings. Concrete encasement shall be square in cross section, shall have a minimum thickness of 6 inches at pipe bells, and shall be of the length noted. (See Figure 2.24.1.)

2.25 BACKFILLING

Backfill shall include the material placed above the pipe embedment material previously specified. No heavy or large quantities of backfill material shall be placed over the pipe until backfilling has progressed to a depth of at least 3 feet over the top of the pipe barrel. All backfill material shall be carefully placed so as not to damage the joints or displace the pipe. Backfilling shall immediately follow trenching and pipe laying operations to reduce the possibility of damage to pavements and utilities.

Trenches within existing and proposed stoned streets, alleys, driveways, stoned parking areas and concrete or brick sidewalks shall be backfilled with granular material. The material shall be placed and compacted to not less than 100% of maximum density as determined in accordance with ASTM D1557 (Modified Proctor). Contractor shall provide Certified Proctor test from limestone supplier with the shop drawings, prior to stone being delivered to the project site.

Where mains are installed along existing and proposed paved or stoned streets, alleys, driveways and parking areas, the specified compacted granular material shall also be provided for backfilling any portion of the trenches falling within that area below a line drawn at 45 degrees to the horizontal from the surface at the edge of the pavement or back of curb and above the horizontal plane of the pipe embedment material. (See Figure 2.25.1.)

For trenches within existing or proposed paved streets, alleys, driveways and paved parking areas a controlled density fill (CDF) shall be provided or backfill as approved by the City. The mix shall

be placed in a usable fluid form and in uniform vertical lifts. Design, finishing and protection of the material shall be recommended by the manufacturer for the application. Quality control test procedures of the manufacturer shall include ASTM C138 - Test for Unit Weight, and ASTM C39 - Test for Compressive Strength. No compaction is required for C.D.F.

Trenches where water mains are installed longitudinal to the railroad tracks shall be backfilled per railroad requirements, latest revisions. The backfill material shall be placed in loose six inch lifts and compacted to at least 95% of its maximum density with a moisture content that is not more than 1% greater than or 2% less than the optimum moisture as determined in accordance with current ASTM Designation D - 1557 (Modified Proctor). When the backfill material is within three feet of the subgrade elevation (the interface of the ballast and the subsoil), a compaction of at least 98% will be required. Compaction test results confirming compliance must be provided to railroad company's Engineer by the Contractor.

The City may require Contractor to check compaction of the backfill at no cost to City at any time.

Where trenches are backfilled with granular material, the Contractor shall remove excess excavated material. Any excess excavated spoil shall be removed to an approved dump site.

In all paved streets and highways, immediately upon completion of other backfilling operations and prior to the end of work for that day, a temporary pavement as specified in Section 7 - Roadway shall be provided and shall remain in place and be properly maintained until such time as the permanent pavements are placed. Permanent pavements shall be placed within two weeks after completion of tests and acceptance of each section of the water main.

For backfilling the remainder of the trenches, as much of the excavated material as possible shall be replaced until backfilling has progressed to a depth of at least 3 feet over the top of the pipe barrel. The material shall be finely divided free of stones 3 inches or greater in any dimension, boulders, organic material or other harmful debris, and shall be placed in 6 inch layers, loose measurement, and compacted by mechanical tamping.

Also, immediately upon completion of other backfilling operations and prior to the end of work for that day, a temporary sidewalk shall be provided, and shall remain in place and be properly maintained until such time as the permanent sidewalk is placed. The temporary sidewalk shall consist of a minimum of 1-1/2 inches of the specified compacted granular backfill material placed to the same width as the original sidewalk, and shall be furnished, placed and maintained by and at the expense of the Contractor. The temporary sidewalk shall be reshaped and regraded prior to the installation of permanent sidewalk.

After backfilling, along weed or unsodded areas the material shall be graded to conform to the original ground profile. In lawn areas and in fields used for farming, all topsoil removed and stockpiled prior to trenching shall be replaced and graded to conform to the original ground profile. In lawns and other areas where grass exists, as determined by the Owner or the City, the area shall be graded and made ready for seeding as specified in Section 1. In lawn areas, if the existing replaced topsoil does not provide the required 4-inch minimum depth as specified in Section 1, the Contractor shall provide additional topsoil at his expense.

The Contractor shall be required to regrade and reshape all road shoulders and all ditches or swales from existing high points to existing drainage structures or other outlets along the proposed improvement. The Contractor and the City shall mutually agree and establish all ditch grades to be restored prior to construction. Ditches, which are reshaped, shall have reasonable side slopes. Vertical or steep slopes will not be permitted.

2.26 CONNECTIONS TO MAINS

New mains shall be connected to existing mains using proper fittings. Connections shall be made in a manner acceptable to the City. All connections to AC pipe shall be via pad adaptors. AC pipe shall not be cut with a saw. All cuts shall be accomplished by snap cut. No cut-ins or connections to existing mains shall be made unless at least 48 hours notice of such cut-ins or connections is given to the City. All such work shall be planned so as to reduce the number of shut-offs.

Two days prior to shutting valves on existing lines, the Contractor shall notify in writing all affected property Owners and the City of such shut off. The shut off time shall be kept to a minimum and shall be made at off-peak hours or on weekends.

The operation of all existing valves shall be accomplished by a representative of the Water Resources Department. The Contractor shall not operate existing valves.

The City assumes no responsibility for any delay occasioned by special requirements or conditions which must be met in making connections.

Extreme care shall be taken in making such connections to prevent contamination of the existing mains. Before making cut-ins or connections to existing mains, all fittings, valves and pipe shall be washed with clean water and then disinfected by washing with a chlorine solution having a residual chlorine strength of not less than 50 ppm.

Plugs removed from existing mains that are not damaged may be reused within the Project, and those remaining after completion of construction shall remain the property of the City.

2.27 ROCK EXCAVATION

A. General – The term "rock excavation" shall include the removal of such material as cannot be broken and removed by ordinary excavating equipment. The definition of ordinary excavating equipment does not include rippers or power operated jack hammers. Disintegrated, weathered, rotten and loose rock particles capable of removal by ordinary methods are not included within the scope of rock excavation.

B. Excavation - Excavation shall be carried to a sufficient depth to provide for a cushioning layer of bedding material as previously specified in Item 2.21. Width of trench shall be not more than previously specified for the respective type of pipe.

Excavation for structures shall extend to a plane 4 inches below the underside of the concrete foundations and be confined to limits two feet beyond the outside of such foundations.

C. Disposal of Rock - Except under special permission from the Engineer, rock removed by excavation shall not be used for backfill, but shall be disposed of by the Contractor off the

Project site. Necessary bedding and backfill for trenches and other excavations in rock excavation shall be approved by the City.

D. Method - Where rock is encountered which cannot be removed by ordinary excavating methods, rock excavation, unless otherwise specified, may be accomplished by the use of explosives, subject to compliance with all Federal, State and Local laws and the following requirements:

1) All required permits shall be secured by the Contractor well in advance of such operations.

2) The transporting, handling and firing of explosives shall be performed by someone thoroughly familiar, experienced and, if applicable, licensed in this type of work, preferably a representative of the manufacturer of the explosives to be used.

3) Prior to removing rock in any area, the type of explosives to be used, the number, depth and loading of holes to be detonated at any one time; and any special precautions to be observed shall be determined at a conference between representatives of the Owner, the City, the Contractor, the Contractors Insurance Company and the person directly responsible for detonation. The procedure thereafter followed in that area shall conform to the decisions reached; subject to any modifications which may be required because of unsatisfactory or unsafe results or the procedure agreed upon.

4) Suitable timber mats or other coverings shall be provided to confine all materials lifted by blasting within the limits of the excavation.

5) All public and private utility companies having facilities in the vicinity shall be notified by the Contractor of the location and time of contemplated detonation in sufficient time to allow them to protect their facilities. Likewise, where operations are to be carried on in any location where traffic on streets or highways may be affected, proper notice shall be given the local Police Department.

6) For purpose of protecting the general public, the Contractor and the Owner, the utmost cooperation will be required between the Contractor and all other interested parties. All safety precautions shall be strictly enforced.

7) Should permit limitations or the nearness of existing structures and utilities prohibit the use of explosives, rock excavation shall be performed by an approved alternate method.

8) Seismographic monitoring, pre-blasting and post-blasting inspections shall be performed on those structures nearby to avoid fraudulent damage claims.

E. Damage to Existing Facilities - The Contractor shall be responsible for all damage to existing structures, piping, sewers, drains, cables, conduits, equipment and appurtenances resulting from his rock excavation operations, and shall repair same to the satisfaction of the Owner and the City.

III. TESTING

2.28. DISINFECTION

As previously specified, all pipe interiors shall be cleaned before laying and shall be kept clean thereafter. After a main has been completed it shall be disinfected in accordance with AWWA C651-~~92~~14, "Disinfecting Water Mains", using the tablet or continuous feed method and the following:

For the tablet method, an average chlorine dose of 25 mg/l shall be provided by placing calcium hypochlorite granules in the main as it is being installed. Granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 feet intervals in the following quantities, based on pipe diameter:

PIPE DIAMETER (inches)	CALCIUM HYPOCHLORIDE GRANULES (ounces)
4	0.5
6	1.0
8	2.0
10	3.0
12	4.0
16 and larger	8.0

When installation of the pipe is complete, the main shall be filled with potable water at a rate such that water within the main will flow at a velocity no greater than 1 fps. Precautions shall be taken to assure that air pockets are eliminated. The water shall remain in the pipe for at least 24 hours, except if the water temperature is less than 41˚F, the water shall remain in the pipe for at least 48 hours.

For the continuous feed method, the main shall be flushed as thorough as possible with the water pressure and outlets available and all air exhausted. If no hydrant is installed at the end of the main, a tap large enough to develop a velocity in the main of at least 2.5 fps shall be provided by the Contractor. Disinfection can be accomplished by injecting a 1% chlorine solution (10,000 mg/1), prepared by mixing one pound of calcium hypochlorite (approximately 65% available chlorine by weight) and 8 gallons of water, into the main at a point not more than 10 feet downstream from the beginning of the new main. Potable water for the injector for delivering the 1% chlorine solution shall be pumped from a cleaned and sterilized container. Water from the existing distribution system or other approved potable water source shall be controlled so as to flow slowly into the new main during chlorine application, with the rate of chlorine application in such proportion to the rate of water entering the main that the solution of clean water and chlorine in the main will have not less than 25 mg/l free chlorine. The solution shall remain in

the main for 24 hours, during which time all valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24 hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine.

During initial installation, a sufficient number of bacteria sampling and flushing assemblies shall be installed to conform with AWWA C651-~~92~~14~~; Section 7.1 specifications~~. Specifically, at least one set of samples shall be collected from every 1,200 ft. of the new water main, plus one set from the end of the main and at least one set from each branch.

When the water main is ready for filling, the Contractor will notify the resident project representative (RPR) to have the water main filled by the City. The request must be made a minimum of 48 hours (2 working days) in advance. The RPR will contact the City. The City will begin filling the water main within 48 hours (2 working days) of receiving notification. This procedure shall be followed when the water main is ready for flushing.

The main shall be flushed according to AWWA C651-~~92~~14~~; Section 6~~, until the Total Chlorine Residual is at 2.0 mg/l or less at each sampling point. Chlorine Residual testing will be performed by the City.

The bleeder valve(s) and main valve supplying the section under test shall be closed, except during freezing weather, until the bacteriological sampling procedure commences.

Once construction of the water main has been completed, the Contractor shall locate and stake all main line and hydrant valve boxes. All valve boxes shall be made readily accessible. The Contractor shall provide personnel to assist with the filling and flushing of the water main(s). Filling and flushing of the water mains(s) shall be the responsibility of the City. Once the water main(s) have been filled with water, no one other than the City of Hudson authorized personnel shall operate any bacteria sampling and flushing assemblies, valves or hydrants.

Air shall be exhausted at fire hydrants, and 1 inch corporation stops for mains less than 12-inch diameter, and 2-inch corporation stops for mains 12-inch diameter and larger, inserted at the extremities and high points of the main to be used for bacteria sampling and flushing assemblies. The Contractor shall provide all corporation stops required for exhausting air, for samples for testing for chlorine residual, and for chlorine solution injection. In all cases, tests for chlorine residual will be performed by the City.

During all flushing and disinfection operations, existing valves shall be manipulated so that strong chlorine solution in the main being treated will not flow back into the line supplying the water, and new valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

Bacteriological samples shall not be taken for testing until the main has been subjected to a successful pressure and leakage test.

Disinfection is a responsibility of the Contractor, who shall provide all materials, labor and equipment and, in addition, pay for the total volume of water used and dispose of all heavily chlorinated water as approved by the City.

2.29 PRESSURE AND LEAKAGE TEST

After the main has been disinfected and flushed out, the main and all service connections shall be subjected to a pressure and leakage test, after 24-hour waiting period, in accordance with AWWA C600-93 and the following:

The main shall be isolated from adjacent main and pressure shall be applied by pumping clean water from a sterilized container into the main via 1 inch corporation stops. The test pressure shall be 150 pounds per square inch (psi), unless valves in the existing mains are involved within section of new main being tested, in which case the test pressure shall be 100 psi; and shall not vary by more than +5 psi. Pressure testing shall include testing all service connections up to and including the curb stops.

The pressure test shall be started in an afternoon and the pressure shall be on for 18 hours, and then, the test pressure shall be maintained for an additional two hours by pumping water from the container. At the end of the two hour period, the water used shall be measured and the loss by leakage shall not exceed that as determined by the following formula:

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

in which L is the allowable leakage in gallons per hour; S is the length of pipe tested in feet; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr./in. of nominal valve size shall be allowed.

When hydrants are in the test section, the test shall be made against the closed hydrant valves.

Pressure testing at each side of the intermediate valves shall be done at this time by shutting each valve and exhausting the pressure on one side and then applying the test pressure of 150 psi or more to the main on the opposite side of the valve for approximately 10 minutes as determined by the City. This procedure shall be repeated for each intermediate valve.

If the main and valves do not pass the leakage test, the leak or leaks shall be located and repaired and the testing procedure repeated by and at the expense of the Contractor. All visible leaks shall be repaired regardless of the amount of leakage.

Pressure and leakage testing is a responsibility of the Contractor, who shall provide all materials, labor and equipment and, in addition, pay for the total volume of water used.

2.30. BACTERIOLOGICAL TESTS

After main has been disinfected and tested, and before it is placed in service, bacteriological tests shall be performed in accordance with ~~Section 7 of~~ AWWA C651-~~92~~14, and the following:

Samples will be collected by a representative of the Water Resources Department and bacteriological tests performed. Samples shall not be taken by the Contractor. At least two samples taken at 24 hour intervals shall show the water to be safe. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. Samples shall only be collected at times and days as determined by the City. ~~NO~~

~~SAMPLES SHALL BE COLLECTED PRIOR TO THE CITY RECEIVING RECORD DRAWINGS FOR THE WATER MAIN IMPROVEMENTS.~~

Before a sample is taken, the water shall be allowed to flow from the sampling point for at least one minute. The outlet shall be thoroughly flamed in order to kill all bacteria. Nothing should be allowed to touch the lip or top of the sample bottle while the sample is being taken. No hose or fire hydrant shall be used in the collection of samples.

If bacteriological tests show the water to be safe, the main may be placed in service, only after receiving a written confirmation from the City. Upon receipt of written confirmation that the main has been placed in service, the Contractor shall immediately remove all “bacteria sampling and flushing assemblies”. The Contractor shall then either turn hydrants to face the proper direction, or remove bags from the hydrants designating that the water mains and hydrants are approved for City use. If bacteriological tests show the water to be unsafe, the main shall be completely disinfected again at the expense of the Contractor.

The Contractor shall be responsible for all costs of bacteriological tests.

2.31 COMPLETION OF TESTS

When all tests on the water main have been successfully completed, the main will be placed in service by the Owner and no further work on the main or its valves will be permitted without full knowledge of the work by the City.