1.00 GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, and equipment required to construct water main and necessary appurtenant work as herein specified. The water main and appurtenances shall be installed in the locations as shown on the Plans and shall meet all acceptance tests.

1.02 NOTIFICATION

A. CONTRACTOR shall notify the ENGINEER and the Ann Arbor Township Utilities Department, 24 hours prior to flushing or chlorination of the water main.

B. CONTRACTOR shall schedule bacteriological testing with the ENGINEER 48 hours prior.

C. CONTRACTOR shall notify the ENGINEER and the Ann Arbor Township Utilities Department 48 hours prior to connecting to an existing water main.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings or data sheets for all pipe, manholes, manhole castings, pipe to manhole connections, valves, hydrants and the B-1 Poly Pig. The Contractor shall submit a certification letter for all pipe proposed on the project. The letters shall contain the following: Contractor name, project name, Township name, current date, certification of pipe provided and letterhead of the certifying company.

1.04 TESTING

A. General

1. CONTRACTOR shall furnish all equipment and personnel to conduct system acceptance tests as specified herein. All tests shall be conducted under the supervision of the ENGINEER or Ann Arbor Township personnel. All water mains, branches and valves shall be subject to cleaning with a poly-pig, hydrostatic pressure testing, disinfection and bacteriological testing. No acceptance tests shall be conducted until the water main has been installed and backfilled for not less than 30 days. A copy of all test results shall be furnished to the ENGINEER.

2. Hydrostatic pressure testing must be performed in accordance with ANSI/AWWA C600. Disinfection and bacteriological testing must be performed in accordance with ANSI/AWWA C651.

3. CONTRACTOR shall furnish all material and labor to provide for an acceptable full size blow-off to flush the poly-pigs out of the main at the far end of the project not connected to the existing system.

4. Should the results of any test fail to meet the criteria established in this Specification, the CONTRACTOR shall, at his own expense, locate and repair the rejected section and retest until it is within the specified allowance.

5. Only Ann Arbor Township personnel or the CONTRACTOR under direct supervision of Ann Arbor Township personnel may fill or flush lines.

B. Preparation

1. After the pipe has been laid and backfilled as specified, the CONTRACTOR shall fill the line, or a valve section thereof, to be tested with water in such a manner as to expel all air from the pipe. This may be done through fire hydrants at the high points; or, if no hydrant is available at such point, the CONTRACTOR shall make the taps necessary to accomplish the expulsion of all air. At the close of the test, all taps shall be satisfactorily plugged with brass plugs.

C. Sequence

1. All water mains connected to an existing water system shall be flushed, swabbed, chlorinated and bacteriological tested prior to pressure testing. The sequence for acceptance testing shall be:

   a. Flushing with approved B-1 Poly-Pig
   b. Chlorination
   c. Flushing
   d. Bacteriological Testing
   e. Pressure Testing

2. Where mains can be totally isolated from the existing water system with airgaps, pressure testing shall precede chlorination and bacteriological testing. The sequence for acceptance testing shall be:

   a. Pressure Testing
   b. Connect to System
   c. Flushing with approved B-1 Poly Pig
   d. Chlorination
   e. Flushing
   f. Bacteriological Testing

3. If a hydrostatic pressure test fails, the chlorination and flushing process must be repeated after repairs to the system are completed.

D. Flushing

1. Mains shall be flushed with an approved B-1 Poly Pig and clean potable water until the water runs clear under the supervision of Ann Arbor Township personnel or the ENGINEER. Poly Pig locations shall be chosen by the Township Utility Director. When flushing mains prior to chlorination, all hydrant leads, operating stems and hydrant valve mechanisms shall be removed.

E. Chlorination

1. All new mains and pipe or any existing mains contaminated by the CONTRACTOR shall be chlorinated to a minimum residual chlorine concentration of fifty (50) parts per million with commercial liquid chlorine solution or approved equal. The chlorinated water shall be allowed to stand in the mains for 24 hours. At the end of the 24-hour period, the chlorinated water shall show a free available chlorine residual of not less than twenty-five (25) parts per million. If less than twenty-five (25) parts per million residual is shown at the end of the first 24 hours period, additional chlorine shall be added until a residual of not less than twenty-five (25) parts per million at all parts of the system is shown after a subsequent 24 hour period. The chlorinated water shall then be removed from the mains and disposed of in a location approved by Ann Arbor Township. If an approved location cannot be found, dechlorination may be necessary. The mains shall be flushed with potable water for bacteriological testing.

F. Bacteriological Testing

1. The Ann Arbor Township Utilities Department will take bacteriological samples of the water in the mains for analysis at two different times. The first samples will be taken 24 hours after the mains have been satisfactorily chlorinated, flushed and filled with potable water. The second sample will be taken 24 hours later. Each sample will be incubated for 48 hours. No flushing shall be done during or between tests. Two sets of safe consecutive bacteriological samples, collected at least 24 hours apart, must be obtained before placing the water main in service.

2. The CONTRACTOR shall provide a sufficient number of corporation cocks and copper tubing for taking samples. Samples shall not be collected from hoses or fire hydrants.

3. Bacteriological testing must begin on Monday through Wednesday to allow Ann Arbor Township personnel and the testing laboratory a full work week to conduct the testing.

G. Hydrostatic Pressure Testing

1. All water mains shall be subjected to a hydrostatic pressure of 150 psi based on the elevation of the highest point in the system. The main shall be maintained under the test pressure for a minimum continuous period of two (2) hours by pumping potable water into the line at frequent intervals. The volume of water added shall be measured and considered to represent the leakage from the main. No pipeline installed will be accepted until the leakage measured is less than 0.092 gallons per inch diameter of the pipe per 1 hour per 1,000 feet. The CONTRACTOR shall pressure test sections of water main as sections of 2,000 feet or less unless otherwise authorized by the ENGINEER. When permitted to test lengths in excess of 2,000 feet, only the allowable leakage for 2,000 feet will be permitted.

2. In the event that the leakage exceeds the specified amount, the main shall be carefully inspected for leaks and repaired as necessary. Any cracked or defective pipe, fittings, valves or hydrants discovered shall be removed and replaced with sound material and the test repeated to the satisfaction of the ENGINEER and the Ann Arbor Township Utilities Department.

3. If the CONTRACTOR chooses to pressure test against an existing valve he assumes the responsibility of meeting the leakage requirements. The CONTRACTOR may at his discretion provide a physical break and cutting in sleeve for pressure testing.

4. Temporary connections (jumpers) between existing water mains and the newly constructed system for testing purposes, shall include a reduced zone backflow preventer to prevent backflow and possible contamination of the public water.

5. Copper service leads and associated fittings shall be visually observed under line pressure. After service lead installation, the CONTRACTOR shall flush the lead and remove all air. The curb stop shall be closed after flushing and all joints shall be visually observed for leaks by the ENGINEER or Ann Arbor Township personnel. In the case where a service extends beyond the curb stop, the service shall be pinched closed and visually inspected to the end of the service.

2.00 PRODUCTS

A. All products shall be consistent with the current component part submittal sheet posted on the Township website.

2.01 PIPE AND FITTINGS

A. Ductile iron water main pipe shall meet all the requirements of the latest revision of ANSI/AWWA C151/A21.51. Pipe shall be furnished in eighteen-foot or twenty-foot lengths, unless otherwise required. All joints, to include joints for fittings, valves and hydrants, must be of the push on joint type and compatible tyton joint gaskets. Ductile iron pipe must be designed in accordance with the latest revision of ANSI/AWWA C150/A21.50 to meet requirements for Thickness Class 54. Double cement liners.

B. Ductile iron pipe flexible restrained joints approved for use in directional drilling are as follows:

1. Clow Super Lock
2. U.S. Pipe TR Flex

C. Ductile iron pipe and fittings shall be double-cement lined with an approved bituminous seal coat in accordance with ANSI/AWWA C104/A21.4.

D. Ductile iron fittings shall meet all the requirements of the latest revision of ANSI/AWWA C110/A21.10 for full body fittings and ANSI/AWWA C153/A21.53 for compact fittings for a minimum working pressure of 350 psi and be of the push-on joint type. Plugs, where shown on the plans, shall be solid mechanical joint plug type.

E. Restrained mechanical joints of the wedge action type shall use a follower gland and shall include a restraining mechanism which, when activated, impart multiple wedging action against the pipe, increasing its resistance as the pressure increases. Twist off nuts shall be used to insure proper actuating of the restraining device. Restrained mechanical joints for ductile iron pipe shall be EBAA Iron Megalug, Series 1100, or approved equal. Mechanical joints shall be in conformity with the requirements of the latest revision of the ANSI/AWWA C111/A21.11. All bolts and nuts must be type 304 stainless steel and manufactured in the United States.

F. Push-on joints shall be Tyton joints and shall meet all requirements of ANSI/AWWA C111/A21.11. Fastite joints are not approved. Push-on joints shall consist of a ductile-iron bell provided with a recess to receive a circular molder rubber gasket to effect the joint seal. A rubber gasket and sufficient lubricant to assemble the joint shall be furnished with each joint. The lubricant shall have no deleterious effect upon the color, taste or odor of potable water and shall not be corrosive to either the pipe or gasket. Pipe furnished with push-on type joints shall be equal in strength and leak tightness to pipe furnished with mechanical joints as specified when installed under identical conditions, and shall meet all other requirements of these specifications. In addition to the above requirements, the gasket and lubricant shall conform to the latest revision of ANSI/AWWA C111/A21.11. When it is necessary to utilize a locking mechanism for a push-on joint upstream or downstream of a restrained mechanical joint, field-lok gaskets or equal shall be utilized and shall be used in conformance with DIPRA Standards for restraint distance from a restrained mechanical joint fitting.

G. All pipe and fittings shall be manufactured in the United States of America.

H. The ENGINEER or Ann Arbor Township personnel shall witness the delivery and unloading of all pipe and collect the appropriate manufacturer's certificate of compliance per this Specification.

2.02 VALVES

A. All valves installed under this Specification shall conform to the applicable requirements of ANSI/AWWA C500, C504 and C509 standards governing construction materials and workmanship. Each valve shall carry the name or trademark of the manufacturer. All valves shall have operating nuts that turn to the right (clockwise) to open.

B. Resilient-Seated Gate Valves

1. Resilient seated gate valves shall conform to the applicable requirements of ANSI/AWWA C515. Valves shall have a minimum working pressure of 250 psi. The gate shall be ductile iron encased in a bonded synthetic rubber to form resilient seating surfaces. Stem shall be bronze with a non-rising design and double o-ring packing.

2. Resilient Seated Gate Valves shall be Clow F-6112 or manufactured by East Jordan Iron Works.

C. Tapping Sleeves and Valves

1. Tapping sleeves shall be full length of heavy-duty stainless steel construction designed for use with the type of pipe to be tapped. Tapping sleeve flange and body shall be type 304 stainless steel. Bolts and nuts shall be 304 stainless steel. Gasket shall be full circumferential SBR compounded for water service. Tapping sleeve shall contain a test plug to assure seal prior to tapping. Tapping sleeve shall be JCM Industries 432; Romac Industries SST, Ford FAST, Powerseal 3490AS; Dresser 630 or equal.

2. Tapping valves shall meet the specifications for gate valves except that the valve shall have a flange compatible with the tapping sleeve.

3. The tapping sleeves and valves shall be subjected to a hydrostatic pressure of 200 psi. The sleeves and valves shall be maintained under pressure for a minimum continuous period of 5 minutes by pumping potable water into the sleeve. Upon any visual leakage observed by the ENGINEER, the tapping sleeve and valve shall be removed and replaced, and the test repeated at the CONTRACTOR's expense to the satisfaction of the ENGINEER.

D. Air Release Valves

1. Air release valves when specified shall conform to the requirements of ANSI/AWWA C512 and shall be designed to operate under a maximum operating pressure of 300 psi and capable of venting 200 CFFAS (cubic feet of free air per second). Valves shall be cast iron with bronze internal parts and Type 304SS float.

E. Corporation Stops

1. Corporation stops used for insertion into mains shall be Ford FB600 Ball Corp - AWWA/CC Taper Thread Inlet by Flared Copper Outlet or equal. All stops shall have no-lead brass cast bodies, keys, stem washers and nuts. Inlet threads shall conform to the latest revision of AWWA C800.

F. Valve Boxes

1. Valves boxes shall be 5-1/4" and be of cast-iron construction. They shall be of three-piece, screw-type adjustment design. All valve boxes shall be installed flush with the top of the proposed site grade. Cover shall be designed to be removed easily to provide access to the valve. The base shall not rest upon the valve assembly. Valve boxes shall be Tyler 6860 Item D with number 6 base or Bibby V620-D.

G. Valve Extensions

1. All gate valves with operating nuts at a distance greater than 6.5 feet below ground surface shall be provided with an extension stem. The length of the extension stem shall reach within 6.5 feet of the ground surface. Details of the extension system and method of installation shall be approved by the ENGINEER prior to installation.

H. Post Indicators and Valves

1. Post indicators, when specified, shall be Clow series 2945A with aluminum plates indicating OPEN and SHUT. Post indicators shall open left. Post indicator valves shall be Clow model F-6112. All valves shall open left. Post indicators and their corresponding valves must be made by the same manufacturer. Bollards must be placed to protect post indicators, except as specified by the ENGINEER.

2.03 GATEWELLS

A. Gatewells shall conform to the latest revision of ASTM C478 for Precast Reinforced Concrete Manhole Sections. Section joints shall be rubber gasketed and shall conform to ASTM C990. Cone sections shall be eccentric, with an offset step configuration.

B. All gatewell components shall have the name of the manufacturer stenciled on the inside. The lettering shall be a minimum of 4-inches high.

C. Gatewells constructed over an existing water main shall have a doghouse mudded to an 8-inch thick cookie. All other gatewells shall have precast integral base sections.

D. Mortar for masonry or plastering outside of gatewells shall be made of one part of Portland Cement to two parts fine aggregate. Mortar materials and mixing shall correspond, in general, to those for concrete. All openings in gate wells shall be made water tight with Kor-N-Seal flexible rubber boots.

E. Gatewell steps shall be reinforced polypropylene coated steel. They shall be M.A. Industries models PS1-PF or PS1-B, or approved equal. The top step shall be no more than 18-inches from the top of the cover.

2.04 GATEWELL FRAMES AND COVERS

A. Gatewell frames and covers shall weigh not less than 350 lbs. Each frame and cover shall have machined bearing surfaces and shall be suitable notched for convenient removal of the cover.

B. Covers shall be a EJ Type A cover. Each cover shall have the letters "WATER" cast integrally into the cover. Frames shall be EJ Model 3024 SELFLEVEL assembly product number 00302403 for asphalt, EJ 3025ZPT SELFLEVEL assembly product number 00302514A01 for concrete or EJ Model 1040Z for green belt areas.

C. All frames and covers shall be coated at the place of manufacturer with coal tar pitch varnish or other asphaltum coating approved by the ENGINEER.

2.05 GATEWELL CONNECTIONS

B. Water pipe to gate well connections shall be through a watertight flexible pipe-to-manhole connector, which shall be securely clamped into a core-drilled port. Pipe ports shall be core-drilled at the point of manufacturer and shall be accurately located within 1/2-inch of the proposed water main centerline. Flexible pipe-to-manhole connectors shall meet the requirements of ASTM C923 and shall be Kor-N-Seal, or equal. All non-rubber components including wedges, bands and pipe clamps shall be stainless steel.

2.06 GATEWELL ADJUSTMENTS

A. All final grade adjustment of gatewell cover and frame assemblies shall be completed utilizing crumb rubber recycled from old tires and RFL coated fiber INFRA-RISER rubber composite circular adjustment rings as manufactured by EJ, or approved equal. Brick adjustments are not acceptable.

B. Each adjustment ring shall be sealed using a continuous strip of 5/16" - 3/8" thick polyurethane joint sealant/adhesive on the surface of the rubber composite adjustment rings.

C. All castings and adjustment rings shall be securely fastened to the cone of the structure with four 3/8-inch threaded rods. The rods shall be galvanized or stainless steel anchored to the structure with Redhead Trubolt concrete anchors, or equal. Stainless steel or galvanized nuts and washers shall be used to attach the casting.

D. All castings and adjustment rings shall be sealed to the structure with an external Infi-Shield Uni-Band seal manufactured by Sealing Systems, Inc., or approved equal. The seal shall be continuous bands, made of high quality Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall have a 2-inch wide mastic strip on the top and bottom of the band. The mastic shall be non-hardening butyl rubber sealant, with a minimum thickness of 3/16-inch, and shall seal to the cone of the gatewell and over the lip of the casting.

E. When the depth of the gate well requires an adjustment greater than the maximum allowed, the CONTRACTOR shall provide additional pre-cast gate well barrel sections required to maintain acceptable chimney heights.

2.07 HYDRANTS

A. Fire hydrants shall comply with the latest revision of ANSI/AWWA C502. Hydrants shall be compression type, opening against the pressure and closing with the pressure. Hydrants shall be designed for 250 psi working pressure and tested to 500 psi.

B. Hydrants shall be EJ WaterMaster 5BR-250 with the following features: a 6-inch Tyton joint connection; two 2-1/2" NST hose nozzels; one 5" Storz nozzel; 1-3/8" pentagon operating and cap nuts; open left (counter clockwise); breakaway traffic flange; no barrel drain, painted red finish and all stainless steel bolts.

C. Copperhead Industries Cobra T2 test station Model No. T1-B-FLPKG-5/8 shall be installed on the bottom flange of the fire hydrant. The Copperhead Industries Cobra T2 test station shall be blue of color.

D. Fire hydrant extensions shall be manufactured by the hydrant manufacturer for use with the model hydrant being installed.

E. Hydrants adjacent to truck routes on commercial developments shall be protected by bollards.

2.08 SERVICE LEADS

A. Pipe for service leads 1-inch to 2-inch shall be soft annealed Type K copper. Service leads 4-inch to 8-inch shall be Class 54 Ductile Iron, Double cement lined.

B. Curb Stops

1. Curb stops used for service connections shall be ball valve type. All parts shall be cast from no-lead brass. Both the inlet and outlet connections shall be of the compression type to receive copper service pipe. Curb stops shall be consistent with the most current shop drawing checklist posted on the Township website.

C. Curb Boxes

1. Curb boxes used for service connections shall be the "Minneapolis" style. All curb boxes shall be a three piece assembly of polyurethane and PVC construction. The three sections will consist of a polyurethane base, a PVC extention pipe, and a polyerethane upper sleeve. The extension pipe shall be 1½-inch diameter Schedule 80 PVC 6-feet long which is permanently fixed to the base. The upper sleeve shall be polyurethane and will telescope onto the extension pipe and provide at least 12-inches of adjustment to allow the cap to be flush with the final grade. The upper sleeve will have a polyurethane cap with magnet. All boxes shall include a self centering stainless steel operating rod within 3 feet of the surface. The curb boxes will be manufactured by Argonics, Inc or an approved equal. Each service box shall also include a polyurethane service rod support to keep the rod centered in the extension pipe. The minimum bury shall be 5'-0" (60") and the maximum 6' (72"). Curb boxes shall be consistent with the most current shop drawing checklist posted on the Township website.

D. Couplings

1. Couplings used for service connections shall be located outside the pavement and more than 10 feet from any building wherever possible. They shall have a three part union and for 1" or 1 1/2" couplings, both connections shall be of the flare type to receive copper service pipe. For 2" couplings, both connections shall be of the compression type.

2. All service connections between two copper service pipes (two-inch or less in diameter) located under the pavement or within 10 feet of a building shall be connected using wrought copper, solder-sweat type couplings conforming to ASME B16.18 or ASME B16.22. Fittings shall bear made in USA labels. Joining of copper piping shall be a solder-sweat connection using lead free Stilfos. The use of 95-5, Tin-Antimony or equivalent solders will not be allowed.

2.09 TRACER WIRE

A. Tracer wire to be used on open cut pipe shall be Copperhead Industries 12 AWG copper clad steel with blue 30 mil HDPE insulation. Connections and all required two-way splicing shall be made using Copperhead Industries Locking Connector Product No. LSC123DB. For three-way splicing use Product No. 3WB-01. Magnesium grounding anode rods shall be installed at the beginning and end of the water main installation, every 2500 feet and at all dead ends such as Hydrants, Post Indicator Valves and commercial service leads.

B. Tracer wire to be used on directional drill pipe shall be Copperhead Industries SoloShot Xtreme with blue 50 mil insulation, 4700 lb break load, Product No. PBX-50B-LLS. Connections shall be made using Copperhead Industries Product No. SC-PB-01.

2.10 POLYETHYLENE ENCASEMENT

A. All ductile iron pipe and fittings must be V-Bio polyethylene encased. In addition, the initial 24-inches of copper service lead must be encased from the corporation stop. Polyethylene encasement must be manufactured in accordance with the requirements of the latest revision of ANSI/AWWA C105/A21.5.

B. V-Bio polyethylene encasement shall be white color consisting of three layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness of not less than eight mils. The LLDPE film shall feature an inside surface that is infused with a proprietary blend of an anti-microbial biocide to mitigate microbiologically influenced corrosion (MIC) and a volatile corrosion inhibitor (VCI) to control galvanic corrosion..

2.11 BOLLARDS

A. Bollards shall be 4-inch diameter galvanized schedule 40 steel posts 36 to 48 inches high with minimum depth of 24 inches. The posts shall be set in and filled with 3000 psi concrete. Bollards protecting hydrants and PIVs shall be painted red.

3.00 EXECUTION

3.01 EXCAVATION AND BACKFILL

A. All excavation and backfill shall conform to the Earthwork specification.

3.02 BEDDING

A. Ductile iron pipes shall be fully enclosed in polywrap and laid on a compacted sand cushion, 4 inches thick. Sand shall conform to fine aggregate 2NS as defined in 2003 MDOT, Section 902.

B. 2NS sand bedding material shall be placed (refer to bedding detail on sheet W-01) around and above the main to a height of 12 inches above the main. The sand bedding shall be compacted to not less than 95 percent of the maximum unit density as determined at optimum moisture content.

3.03 PIPE INSTALLATION

A. The installation of ductile iron water main must conform to the requirements of ANSI/AWWA C600.

B. Any pipe damaged in transport or handling shall be rejected and removed from the site of the work.

C. Before lowering in the trench, and while suspended, each pipe and fitting shall be inspected for defects. Defective, damaged or unsound pipe shall immediately be removed from the construction site. The interior and exterior of each pipe shall be inspected for cleanness and cleared of all dirt and foreign matter before being lowered into the trench.

D. In handling and placing ductile iron pipe and fittings, no metal shall be used in contact with the inside of the pipe to fit or support the pipe. The pipe shall be moved only through the use of belt slings or automatic release type pipe tongs. Care shall be taken not to injure the pipe or pipe coating, and no damaged or imperfect pipe shall be used in the work except that minor damage to pipe coating may be repaired subject to the review of the ENGINEER.

E. Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying. After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the adjacent pipe; the pipe shoved into position and brought to a true alignment. It will then be secured with sand backfill tamped under and on each side of the pipe, except at bell holes. No earth or other foreign matter shall be allowed to enter the joint space.

F. A minimum of 18-inches vertical clearance shall be provided between the water main and any existing underground facility, unless otherwise approved by the ENGINEER. Whenever a main is installed under any existing utility line such as gas, buried electric power, telephone line, sewer or water, provisions shall be made to properly support or distribute any concentrated load to avoid settlement and possible failure of either main. Such provisions shall consist of concrete bedding of the main, complete concrete encasement, or some other method as shown on the plans.

G. Water mains shall be installed at least 10 feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge.

H. In assembly of push-on type joints, the bell socket recess and the gasket shall be wiped clean and the gasket placed properly in position. A thin film of lubricant shall then be applied to the surface of the gasket to come into contact with the entering pipe. The plain end of the entering pipe shall be cleaned and then entered and forced home to the base of the socket.

I. Where necessary to cut pipe, cutting shall be done with approved tools and cut ends of pipe shall be square and regular. Cutting shall be done in a manner to avoid damage to lining and coating. Minor damage may be repaired subject to review of the ENGINEER.

J. To prevent trench water from entering the pipe, joints, which for any reason may not be completed as the pipe is laid, shall be thoroughly packed with approved material, in a manner to make them watertight. Open ends of fittings shall be tightly closed with approved plugs and well packed, as shall the end of the last pipe laid whenever work is not in progress.

K. Each pipe shall be laid accurately to the line and grade shown on the Plans. Wherever deflections at joints are required either in the horizontal or vertical plane, the deflection at any bell and spigot joint shall not exceed that which will cause the spigot end of pipe to be away from home in the bell of the adjacent pipe a distance of 1/4 inch at the point of greatest opening. In no case shall joint deflection exceed the manufacturer's recommended maximum deflection.

L. The deflection at any mechanical joint shall not exceed three-quarters of the maximum deflection recommended by the manufacturer or 3 degrees, whichever is more conservative of the joint used.

M. Pipe shall be laid at depths to provide minimum cover of 5'-6" over the top of the pipe unless otherwise noted on the Drawings or elsewhere in these specifications. The CONTRACTOR shall not be entitled to any additional compensation because depth is more than specified at certain locations or due to clearances at manholes, or due to unforeseen obstacles, or occasioned in order to avoid undue changes in grade.

N. Hydrants shall be provided at dead-end water mains where specified by the ENGINEER.

3.04 DIRECTIONAL DRILLING

A. The drilling equipment shall have a minimum rating of pullback, torque and mud flow which is capable of installing ductile iron pipe of proposed diameter and length. The number of access pits shall be kept to a minimum. Submit the drilling equipment data to the ENGINEER for review.

B. The guidance system shall have the capability of measuring inclination, roll and azimuth. The guidance system shall have an independent means to ensure the accuracy of the installation. The CONTRACTOR shall demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance system will be capable of generating a plot of the borehole survey for the purpose of an as-built Drawing. The CONTRACTOR shall also prepare to provide alternative methods such as gyroscoping, ground penetrating radar or "intelligent" pigs to determine the as-built position.

C. The entry angle of the pilot hole and the boring process shall maintain a curvature that does not exceed the allowable bending radius of the ductile iron pipe.

D. The CONTRACTOR shall follow the pipeline alignment as proposed on the Drawings. If adjustments are required, the CONTRACTOR shall notify the ENGINEER for approval prior to making the adjustments.

E. In the event of difficulties during boring operations requiring the complete withdrawal from the tunnel, the CONTRACTOR shall be allowed to withdraw, abandon the tunnel and begin a second attempt at a location approved by the ENGINEER, or at the option of the CONTRACTOR and with the approval of the ENGINEER, the CONTRACTOR may excavate at the point of the difficulty and install the water main by open cut method.

F. After the pilot hole is completed, the CONTRACTOR shall install a swivel to the reamer and commence pullback operations. Pre-reaming of the tunnel may be necessary and is at the option of the CONTRACTOR.

G. Reaming diameter shall not exceed 1.4 times the diameter of the pipe being installed. When the reamer exceeds the pipe diameter plus 3", a flowable fill or suitable grout shall be pumped into the void between the pipe and drill hole displacing the drilling fluid. The flowable fill or suitable grout material and method of placement shall be approved by the ENGINEER prior to installation of pipeline.

H. Drilling Fluid shall be introduced into the bore hole during the pilot hole and pre-reaming operations. For longer pull back operations that may take place over multiple days, weep hole rods shall be provided to introduce drilling fluid during the pipe pullback operation. The ratio of bentonite to water shall be as outlined by the manufacturer of the bentonite, dependant on existing soil conditions that are encountered on-site. Adjustments to the ratio of bentonite and water shall only be allowed upon approval of the ENGINEER.

I. Disposal of excess drilling fluid and spoils shall be the responsibility of the CONTRACTOR who must comply with all relevant regulations, right-of-way, work space and permit agreements. Excess drilling fluid and spoils shall be disposed at an approved location. Excess drilling fluid and spoils shall be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils shall not be discharged into sanitary sewers or storm drain systems, or waterways. Drilling fluid returns (caused by fracturing or formations) at locations other than the entry and exit points shall be minimized. The CONTRACTOR shall immediately clean up any drilling fluid that surface through fracturing.

3.05 GATE VALVES AND WELLS

A. All pre-cast section joints and lift holes shall be pointed and plugged, inside and outside, with mortar.

B. Gate valves shall be of the size and installed at the location as shown on the plans. They shall be set square with the line of the main, and unless otherwise directed by the Township ENGINEER, all gate valves shall be set with stems plumb. At each side of gate valve, the CONTRACTOR shall furnish and install a 1-inch corporation stop on the main as shown on the Standard Details.

C. All gate valves with operating nuts at a distance greater than 6.5 feet below ground surface shall be provided with an extension stem.

3.06 HYDRANTS

A. Fire hydrants shall be constructed in accordance with the details shown on the plans. Finish grade level to center of nozzle caps shall measure between 24 and 30 inches. A maximum of one hydrant barrel extension and one operating stem extension may be used to ensure the safety flange is located at or above surface grade. Under no conditions shall extended hydrant have more than one coupling in the operating stem. Pumper connections shall be aligned toward the street or as directed by the Utility Director. All grade, facing, and vertical alignment adjustment of hydrants shall be completed prior to pressure testing and charging of the hydrants.

B. Fire hydrants shall be installed with barrel carefully plumbed, braced and backfilled so it remains plumb. Concrete thrust blocks shall be placed behind the hydrant, tee, and every bend. Backfilling around fire hydrants shall be carefully tamped sand in 12-inch layers from the centerline of the lead main to a height of 1-foot below finished grade.

C. Copperhead Industries Cobra T2 test station Model No. T1-B-FLPKG-5/8 shall be installed on the bottom flange of the fire hydrant. The Copperhead Industries Cobra T2 test station shall be blue of color. Flange connector to hydrant shall be red, test station shall be blue, pipe from test station shall be a minimum of 18" long and shall be Schedule 80 PVC pipe.

D. Fire hydrant and gate valve shall be set apart 24 inches. Gate valves and valve box shall be as specified under the valve paragraphs of this specification.

E. Hydrant leads shall have a minimum of 5.5 feet of cover in all areas, including crossings through ditch sections.

F. CONTRACTOR shall place burlap sack or equivalent material over the hydrant nozzles after installation.

3.07 TRACER WIRE

A. Tracer wire shall be installed along the top of all water mains. For directional drilling, the tracer wire shall be pulled in place with the pipe. For open cut construction, the tracer wire shall be installed at a height of not more than 6 inches above the centerline of the main line pipe or service leads. Wire shall be extended to all hydrants, blow-offs, dead ends, service leads and post indicator valves. Tracer wire shall be brought to grade, and terminated using one of the methods described below.

B. When tracer wire is to be run along short offsets (less than 20 feet), a loop of wire shall be utilized to loop to the end of the offset, bring the loop to grade and terminate it in an approved manner. For service leads and offsets of more than 20 feet in length, or installed by directional drilling method, a splice may be utilized to make the connection at the main. The tracer wire shall then be installed and terminated in an approved manner.

C. Tracer wire terminations shall be made by one of the following methods:

1. Tracer wire shall be terminated at hydrants using a Copperhead Industries T2 test station Model No. T1-B-FLPKG-5/8 blue, flange connector red.

2. Terminations at valve/curb boxes, post indicators, valves and blow-offs shall be snake skin blue, made with 2 wraps of wire at grade around the box or pipe, leaving excess material for future trimming following landscaping.

3. Gatewell terminations shall be made by running the tracer wire through the pipe opening in the wall, down to and across the floor to the steps, up the wall and secure to the top step leaving Snakeskin termination accessible at the casting. Wire shall be run through the gatewell such that it does not create a hazard.

4. Terminations at existing water mains without tracer wire shall be made at the nearest hydrant or gate well as outlined above. If no hydrant or gatewell is available, an upper section of valve box shall be installed with the tracer wire stubbed up inside

D. When connections are made to existing water mains which do not have tracer wire, the following method most applicable to field conditions shall be used.

1. When connection is made at/near a valve or gatewell, the connection shall be made in the same manner as the termination at said structures in Item C(2) above.

2. When connection takes place in a gatewell, the same procedure shall be used as in termination at a gatewell (see Item C(3) above).

3. If no valve or hydrant is available, the upper section only of a valve box shall be set with the tracer wire stubbed up inside.

3.08 POLYETHYLENE ENCASEMENT

A. The V-Bio polyethylene encasement must be installed in accordance with the specifications and requirements of ANSI/AWWA C105/A21.5. For open cut applications a single wrap is required, and for directional drill applications a double wrap is required.

B. The polyethylene encasement must be taped and overlapped 12" at pipe joints and must be taped in a spiral configuration along the length of the pipe.

3.09 CONNECTION TO EXISTING MAINS

A. All valves shall be operated by the Ann Arbor Township Utilities Department.

B. When making a dry connection to an existing main, the existing main to which a connection is to be made shall be isolated by the closing of the necessary existing valves, and the water from the existing main shall then be pumped out or removed by other means so the connection may be made in the dry. No water may re-enter the main throughout this process. After the connection has been acceptably made, the portion of the new line to the nearest valve shall be satisfactorily tested and disinfected, along with the drained portion of the existing water main, before the isolated existing main is placed back in service, except as the ENGINEER may otherwise direct. In as much as residents served by this isolated main will be temporarily out of water during this period, the work shall be executed as rapidly as possible, and the time of, and the procedure in, making such connections shall be subject to the review of the ENGINEER. Such work may be required to be done at night in order to minimize inconvenience of water users. The CONTRACTOR shall not be entitled to any additional compensation because of night work or other special requirements in work under this section.

C. The CONTRACTOR shall make particular effort, prior to bidding, to ascertain whether or not valves in the existing mains to be connected to the new mains are so located as to provide isolation. If valves are not found to be adequate, then the CONTRACTOR shall utilize other means to make the connections with a minimum of interruption to service.

D. When making a wet tap connection to an existing main, a tapping sleeve designed for the type of pipe being tapped shall be utilized and the tap shall be made in accordance with the manufacturer of the tapping equipment.

E. Wherever adapters are required to properly connect the pipe with existing pipe or other material or manufacturer, the nominal I.D. of adapters shall be the same size as the nominal diameter of pipe connected thereto. Adapters shall also be furnished and used as required by the manufacturer for connection to fittings.

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Legend

Notes

Revision	By	Appd.	YY.MM.DD
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Permit-Seal

Client/Project
ANN ARBOR TOWNSHIP

Standard Specifications and Details

Title
WATER MAIN SPECIFICATIONS

Project No.

Scale
NOT TO SCALE

Drawing No. W-02

Sheet 1 of 1

Revision 0