

SECTION 1  
EXCAVATION AND FILL SPECIFICATIONS

TABLE OF CONTENTS

1.01	DESCRIPTION OF WORK
1.02	MATERIALS
1.02.01	Trench Backfill
1.03	PREPARATION
1.03.01	Clearing and Grubbing
1.03.02	Conflicting Utilities
1.03.03	Signs, Mailboxes and other Movable Surface Features
1.03.04	Property Irons
1.04	EXCAVATION
1.04.01	General
1.04.02	Trenches
1.04.03	Blasting
1.04.04	Length of Open Trench
1.04.05	Damage to Underground Utilities
1.05	BACKFILLING
1.05.01	Pipe Bedding Area
1.05.02	Trench Backfill Area
1.05.03	Structures
1.06	SPECIAL PIPE FOUNDATIONS
1.06.01	Excavation
1.06.02	Backfill
1.07	COMPACTION, TESTING, AND INSPECTION
1.08	SOIL EROSION AND SEDIMENTATION CONTROL
1.09	SURPLUS MATERIALS
1.10	DEWATERING

## SECTION 1

### EXCAVATION AND FILL SPECIFICATIONS

#### 1.01 DESCRIPTION OF WORK

This section includes the work required for trenching, excavating and backfilling, clearing, boring and jacking, special pipe foundations, and special work below grade.

#### 1.02 MATERIALS

##### 1.02.01 Trench Backfill:

- a. Backfill utility trenches with suitable excavated material, if available or granular material as specified.
- b. Suitable excavated material: Native soil excavated from trench free of debris, frozen material, and highly compressible or organic material. Not used under or within 1 on 1 slope of driving surfaces or structures. Placed between the top of the bedding or trench backfill and the bottom of the surface restoration.
- c. Granular material: MDOT 205, and 902 Class II limited to 1-inch maximum size.
- d. Concrete: MDOT P2, S3, or DIVISION 3, CAST-IN-PLACE CONCRETE, if included.

#### 1.03 PREPARATION

##### 1.03.01 Clearing and Grubbing:

- a. Remove trees, clear and grub as indicated on the drawings along pipeline route, or as approved by Engineer.
  1. Wood (4 inches in diameter and larger) from trees removed shall belong to the adjacent property owner unless instructed by the property owner to dispose. Cut the wood in 4-foot lengths and stockpile in location suitable to property owner.
  2. Promptly dispose of brush, wood less than 4 inches in diameter and wood not wanted by property owner.
- b. Save and protect all trees and vegetation not identified to be removed.

- c. Repair or replace trees, shrubs and other vegetation damaged by CONTRACTOR'S operation at no additional cost to OWNER.

1.03.02 Conflicting Utilities:

- a. Before starting excavation, establish location and extent of existing utilities in work area.
- b. Establish potential conflict areas prior to construction.
- c. Excavate and expose existing utilities presenting potential conflict to determine their exact location and elevation.
- d. Provide adequate means of support and protection during operations.
- e. Advise ENGINEER of conflicts and obtain instructions on how to proceed.
- f. Make adjustments in proposed utility location at no additional cost to OWNER.
- g. Make arrangements with owner of existing utility for relocation, if necessary.
- h. Schedule work accordingly.

1.03.03 Signs, Mailboxes and other Movable Surface Features

- a. Witness location prior to removal. Relocate to accessible location and maintain during construction.
- b. Upon completion of construction, replace to original position and condition.
- c. Replace regulatory traffic control signs immediately after utilities are placed and backfilled.

1.03.04 Property Irons

- a. Protect existing property irons at edge of right-of-way. If property iron must be removed for construction, the CONTRACTOR shall have a registered professional surveyor witness the property iron(s) prior to disturbance and replace the existing property iron(s) at the CONTRACTOR'S expense.

1.04 EXCAVATION

1.04.01 General:

- a. Dispose of surplus and unsuitable excavated material.
- b. Remove, salvage and stockpile topsoil on-site in area designated by ENGINEER.

- c. Remove unsuitable material encountered in trench.

1.04.02 Trenches:

- a. Depth: Provide a uniform and continuous bearing and support for proposed utility on solid and undisturbed or compact granular material.
- b. Provide min. 4" clearance around pipe in rock, boulders, and large stones.
- c. Minimum Width: Allow space for jointing and bedding.
- d. Maximum Width: Limitations apply at utility crown.
  - 1. 6 inch through 10-inch diameter: 30 inches.

1.04.02 Blasting:

- a. Obtain and comply with required permits.
- b. Perform only during hours approved by ENGINEER.

1.04.03 Length of Open Trench:

Maximum 200 feet.

1.04.04 Damage to Underground Utilities:

- a. Report all damage to ENGINEER and Utility Owner.
- b. Repair to utility Owners standard.

1.05 BACKFILLING:

1.05.01 General:

Final backfill shall be free of debris, frozen material, and organic material within 2-ft of top of pipe.

1.05.02 Pipe bedding area:

- a. Compact MDOT Class II material to 95% of maximum density.
- b. If highly compressible or organic soils are encountered below the normal trench bottom or a utility structure, ENGINEER may order the removal of this compressible material and replacement with specified material in order to make a suitable foundation for the construction of the utility or utility structure.

1.05.03 Trench Backfill Area:

- a. Under permanent pavement, shoulder areas, and areas within a one on one slope from the shoulder edge:
  - 1. Compact MDOT Class II Granular Material in 9-inch layers to 95% maximum density.
- b. Under nonpermanent pavement:
  - 1. Compact native suitable excavated material in top 4 feet and balance native suitable excavated material or granular material in 9-inch layers to 95% maximum density.
- c. Under unimproved right-of-way areas: Compact suitable excavated material to 85% of maximum density.
- d. Under undercut existing structures: Place concrete.

1.05.04 Structures:

- a. Density requirements: Same as Trenches.
- b. Concrete structure: Place backfill only after 75 percent of concrete design strength has been reached.

1.06 SPECIAL PIPE FOUNDATIONS:

1.06.01 Excavation:

ENGINEER's instructions.

1.06.02 Backfill:

To pavement line with granular material.

1.07 COMPACTION, TESTING AND INSPECTION:

- a. Surplus excavated and unsuitable excavated material becomes the property of the Contractor.
- b. Dispose of surplus excavated or unsuitable excavated materials off-site or on-site in areas designated by ENGINEER.
- c. Performance and test equipment: By ENGINEER or OWNER approved

independent laboratory.

- d. Moisture - Density relationships:
  - 1. AASHTO T99 Method C
- e. Field Density: Either of following:
  - 1. ASTM D-2167 (Rubber Balloon)
  - 2. ASTM D-2922 (Nuclear)
  - 3. AASHTO T191
  - 4. One Point Michigan Cone
- f. Furnish equipment and personnel to provide access to test location and depth. Density tests will be performed at various levels, as determined by ENGINEER, during or after backfilling operation.
- g. Correct any deficiencies resulting from insufficient or improper compaction. Retest if required.

1.08 SOIL EROSION AND SEDIMENTATION CONTROL:

Follow Kent County Standards

1.09 SURPLUS MATERIALS:

- a. Surplus excavated and unsuitable excavated material becomes the property of the Contractor.
- b. Dispose of surplus excavated or unsuitable excavated materials off-site or on-site in areas designated by Engineer.

1.10 DEWATERING:

- a. Remove water entering excavation as required to maintain dry trench.
- b. Provide dry excavations until utility has been placed and backfill is completed.
- c. Provide and maintain slopes, crowns, ditches and ponds to insure satisfactory surface drainage at all times.
- d. Sedimentation control required at discharge.
- e. Treat contaminants if present.

SECTION 2

WATERMAIN SPECIFICATIONS

TABLE OF CONTENTS

2.01	DESCRIPTION OF WORK
2.02	MATERIALS
2.02.01	Water Pipe and Fittings
2.02.02	Gate Valves
2.02.03	Hydrants
2.02.04	Cast Iron Valve Boxes
2.02.05	Water Services
2.03	HANDLING OF MATERIALS
2.04	INSPECTION OF MATERIALS BY CONTRACTOR
2.05	PIPE LAYING
2.05.01	Alignment and Grade
2.05.02	Inspection Before Installation
2.05.03	Manner and Handling Materials
2.05.04	Pipe Kept Clean
2.05.05	Placing
2.05.06	Cutting Pipe
2.06	PIPE JOINTS
2.06.01	General
2.06.02	Mechanical Joints
2.06.03	Push-on Joints
2.07	SETTING OF VALVES, FITTINGS AND HYDRANTS
2.07.01	General Requirements for Valves and Fittings
2.07.02	Setting Valve Boxes
2.07.03	Setting Hydrants
2.08	ANCHORAGE
2.08.01	General
2.08.02	Hydrants
2.08.03	Plugs, Tees and Bends

- 2.09 WATER SERVICES
  - 2.09.01 General
  - 2.09.02 Location
  - 2.09.03 Tapping and Main
  - 2.09.04 Length and Depth
  - 2.09.05 Setting Curb Boxes
  
- 2.10 OPERATING VALVES AND INTERRUPTION OF SERVICE
  
- 2.11 WATER FOR FLUSHING
  
- 2.12 LEAKAGE TESTS
  
- 2.13 CHLORINATING
  
- 2.14 MEASUREMENT AND PAYMENT
  - 2.14.01 General
  - 2.14.02 Water Pipe
  - 2.14.03 Fittings
  - 2.14.04 A "Cut-in"
  - 2.14.05 Valves
  - 2.14.06 Valve Boxes
  - 2.14.07 Hydrants
  - 2.14.08 Anchorage
  - 2.14.09 Water Services
  - 2.14.10 Special Items



## SECTION 2

### WATERMAIN SPECIFICATIONS

#### 2.01 DESCRIPTION OF WORK

The work shall consist of constructing watermains of the specified size or sizes in a trench, and shall include the construction and/or installation of all appurtenances thereto as shown on the Plans and as described in these Specifications.

Excavating, trenching and backfilling shall be as specified in Section 1.

#### 2.02 MATERIALS

All materials furnished by the Contractor shall conform to the Specifications which follow. Where reference specifications are used, they shall be considered as referring to the current edition of the latest issue.

The Contractor shall furnish in triplicate, certification by the manufacturer of water pipe, valves, hydrants and other materials, that these materials meet the requirements of the appropriate tests for the kind and class of material as required in these Specifications or shown on the Plans.

Certifications of conformance shall be submitted and shall be approved by the Township Engineer before these materials are used in the proposed construction.

##### 2.02.01 Water Pipe and Fittings

- a. General. Unless otherwise specified, all water pipe and fittings shall be ductile iron, Class 53, meeting the requirements specified herein, **and all watermain materials coming in contact with potable water shall meet NSF/ANSI Standard 61.**
- b. Ductile Iron Pipe. All ductile iron pipe shall conform to the requirements of ANSI Specifications A 21.51 (AWWA C151). The thickness for the various sizes of pipe shall be as designated in the following table. The class shown shall meet the requirements of ANSI Specifications A 21.50 (AWWA C150) except that the minimum wall thickness shall be Class 53.

c. Ball Joint Pipe (River Crossing Pipe). Where ball joint pipe is specified or indicated in the Plans, the pipe shall be Clow Ductile Iron Ball Joint River-Crossing Pipe or approved equal. Joints shall be of an approved type which shall provide 15 degrees deflection at each joint with no reduction in the pipe waterway. All or a portion of the pipe shall be furnished in short lengths when necessary to provide the required curvature.

d. Fittings. All tees, bends and other fittings shall conform to the requirements of ANSI Specification A 21.10 (AWWA C110) for the same or greater working pressure as the pipe. Fittings for cast iron pipe may be cast iron or ductile iron. Where ductile iron pipe is specified, all fittings shall be ductile iron.

Mega-lug joint retainer glands may be used in lieu of restrained joint pipe where restraint is required. Mega-lugs shall be manufactured by EBAA Iron Inc. or approved equal.

e. Plugs for dead ends shall be Clow Push-on Restrained Plugs F-1159 or approved equal for push-on joint pipe, and shall be Clow F-1035 or approved equal for mechanical joint pipe.

All plugs shall be inserted in the bell end of the pipe.

f. Special Fittings or other appurtenances may be required or desirable in certain instances. The Contractor shall review the use of such items with the Township Engineer before they are ordered. In no case shall materials other than those specifically covered by the Specifications be utilized or installed without prior approval of the Township Engineer.

g. Joints. Unless otherwise specified, all pipe joints shall be rubber gasket joints conforming to the requirements of the ANSI Specification A 21.11 (AWWA C111) for bolted mechanical joints or push-on joints. Joints on fittings shall be bolted mechanical joints.

h. Cement Mortar Lining. All pipe and fittings shall be cement lined in accordance with the requirements of ANSI Specification A 21.4 (AWWA C104) for standard cement lining.

i. Polyethylene Wrap. When pipe is required to include polyethylene wrap, it shall conform to AWWA C105.

#### 2.02.02

Gate Valves. All gate valves shall be reduced wall, resilient seated gate valves with non-rising stems conforming to the requirements in AWWA Specification C515. Unless otherwise specified, valve ends shall be mechanical joint. Gate valves shall be as manufactured by East Jordan Iron Works, Inc. or American Flow Control.

Direction of opening and the design of the operating nut shall conform to the practice in the water system where the valve is installed. The valve shall open by turning the

operating nut clockwise (to the right) and the operating nut shall be the standard two-inch square nut.

- 2.02.03 Butterfly Valves – This specification covers tight shut off butterfly valves for water system distribution valves, 16” and larger, shall be designed for direct bury and operated through a standard valve box. Butterfly valves shall be Pratt Ground-Hog or approved equal.

Valves furnished under this specification shall conform to ANSI/AWWA C504, except as herein modified. Unless otherwise noted on the Drawings, these valves shall be the same nominal size as the watermain.

Valves shall be Class 150-B and have mechanical or restrained joint ends in accordance with ANSI/AWWA C110.

- 2.02.04 Hydrants. All hydrants shall conform to the requirements of AWWA C502 for post-type hydrants with compression type shut-off. Unless otherwise specified, all hydrants shall be furnished as East Jordan Iron Work, (EJIW) Traffic Model 5-BR.

Nominal Valve Opening	5 ¼ inch diameter
Inlet Connection	6 inch mechanical joint
Bury Length – Measured	
From bottom of connecting pipe to ground line	5.5 feet
Hose Nozzle	2-2 ½ inch hose nozzles
Pumper Nozzle	1-4 inch pumper nozzle
Pumper Nozzle Converter	5-inch Storz x 4-inch NH/NST Female

Hydrants shall be painted red, and shall open by turning counter clockwise with the standard 1 ½ inch pentagon nut. Nozzle threads shall be National Standard ANSI B26. Pumper nozzle shall be equipped with low profile 5-inch Storz hydrant converter fitting as listed above. Converter and cap shall be of hard anodized aluminum construction. Safety chain and 5” Storz security lock shall be installed on pumper nozzle blind cap.

- 2.02.05 Cast Iron Valve Boxes shall be EJIW Model 95E or approved equal. The cover shall be marked with the word “WATER.” The base section shall be the proper size to fit over the bonnet of the valve on which the box is set. The valve box shall be a minimum of 5 inches diameter and shall be sufficient length to extend from the bonnet of the valve to the established final grade of the pavement or ground surface. The valve box shall be approved by the Township Engineer before installation.

- 2.02.06 Water Services. Materials for water services shall be as follows:

Copper Water Pipe shall be Type K conforming to ASTM B 88 with 1” minimum diameter.

Corporation Stops shall be 1" McDonald 4701-22-Mac-PAX 1½" and 2" shall be the Ball Valve type. McDonald Model 47-1 BT or approved equal-compression fitting with Mueller thread.

Curb stops valves shall be ball valve type McDonald Model 6100-22 or approved equal compression fitting. 1½" and 2" valves shall have base enlarger, East Jordan Model 95B or approved equal.

Curb boxes shall be an approved standard cast iron extension service box having a minimum diameter of 2½ inches and having a lid held in place by a brass bolt. The lids of all boxes shall be marked with the word "WATER".

2.03 HANDLING OF MATERIALS

The Contractor shall use care and proper equipment during the unloading and distribution of watermain materials on the job site to insure the materials are not damaged.

Pipe and/or fittings shall not be rolled or skidded off the truck beds against previously unloaded materials.

2.04 INSPECTION OF MATERIALS BY CONTRACTOR

It shall be the responsibility of the Contractor to inspect all materials for cracks, flaws or other defects before they are incorporated into the work. Any materials found to be defective or damaged, shall be promptly removed from the job site.

2.05 PIPE LAYING

2.05.01 References. All pipe installed in accordance with AWWA C600-99.

2.05.02 Alignment and Grade. The watermain shall be laid true to the alignment and grades shown on the Plans with fittings, valves and hydrants at the required locations. Unless otherwise specified or required the pipe shall be laid with the center 5 feet 9 inches below the street grade.

2.05.03 Separation. Horizontal separation of 10 feet and Vertical separation of 18 inches from outside face of water main pipe to outside face of sewer pipe (sanitary and storm sewer).

2.05.04 Bedding. When excavated material is found to include ashes, cinders, refuse, organic material, or other unsuitable material, this material shall be removed to a minimum of at least 6 inches below the bottom of the pipe, and replaced with clean, stable backfill material installed in accordance with Excavation and Fill section of the Specifications and AWWA C600-99.

2.05.05 Inspection Before Installation. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged, or unsound pipe shall be rejected. Furthermore, all pipes, fittings and special

castings shall be carefully examined for defects and no pipe, fitting or special casting shall be laid which is known to be defective. If any such pipe, fitting or special casting shall be discovered to be defective after being laid, it shall be removed and replaced with sound pipe, sound fitting or a sound casting by the Contactor at the Contractor's expense.

2.05.06 Manner of Handling Materials. Proper implements, tools and facilities satisfactory to the Township Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into trench piece by means of derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

2.05.07 Pipe Kept Clean. All dirt or other foreign matter shall be removed from inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.

Whenever work is stopped for the day, a standard plug shall be securely placed in the end of the pipe. No tools or other articles shall be stored in the pipe at anytime.

2.05.08 Placing. The pipe shall be placed on the prepared subgrade and held firmly in place during subsequent pipe jointing and embedment operations. As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe pushed home and brought to the correct line and grade. Care shall be exercised to prevent joints from opening up as successive length of pipe is placed. The Contractor shall take the necessary precautions when using a trench box to prevent joint separation when the box is pulled ahead.

Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying, and for lines on an appreciable slope, bells shall, at the direction of the Township Engineer, face upgrade.

2.05.09 Cutting Pipe. The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

When machine cutting is not available for cutting pipe 20 inches in diameter or larger, the electric-arc cutting method, using a carbon or steel rod, will be permitted. Only qualified and experienced workmen shall be used on this work.

Flame cutting of pipe by means of an oxyacetylene torch shall not be permitted.

## 2.06 PIPE JOINTS

2.06.01 General. Unless otherwise specified or required, joints may be mechanical joints or push-on joints at the option of the Contractor.

Pipe joints shall be made in strict accordance with the pipe manufacturer's recommendations unless otherwise specified herein. All lubricants, gaskets and other materials required to make the joints, shall be furnished by the pipe manufacturer.

2.06.02

Mechanical Joints.

- a. Cleaning and Assembly of Joint. The last 8 inches outside of spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter from the joints, and then painted with a clean soapy solution from a sterile container made by dissolving one-half cup granulated soap in one gallon of water. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge toward the gland. If an approved pipe lubricant is used instead of the soapy water solution, then the lubricant must meet ANSI/AWWA C111/A21.11 requirements.
- b. Bolting of Joint. The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and nuts screwed tightly with the fingers. All nuts shall be tightened with a suitable (preferably torque-limiting) wrench. The torque for various size of bolts shall be as follows:

<u>Size</u> <u>in.</u>	<u>Range of Torque</u> <u>ft.-lb.</u>
5/8	40-60
3/4	60-90
1	70-100
1-1/4	90-120

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

- c. Permissible Deflection at Joints. Whenever, in the opinion of the Township Engineer, it is necessary or desirable to deflect mechanical joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the following maximum limits:

TABLE I

Maximum Deflection Full Length Pipe – Mechanical Joint Pipe					
Size of Pipe In.	Deflection Angle Deg.–Min.	Maximum Deflection Inches		Approx. Radius of Curve Produced by Succession of Joints Feet	
		18-ft Length	20-ft. Length	18-ft Length	20-ft. Length
4	8-18	31	35	125	140
6	8-07	27	30	145	160
8	5-21	20	22	195	220
10	5-21	20	22	195	220
12	5-21	20	22	195	220
14	3-35	13-1/2	15	285	320
16	3-35	13-1/2	15	285	320

2.06.03 Slip Joint Pipe

- a. Cleaning and Assembly of Joints. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

A thin film gasket lubricant shall be applied to either the inside surface of the gasket, the spigot end of the pipe or both. Gasket lubricant shall be as supplied by the pipe manufacturer and approved by the Township Engineer.

The spigot end of the pipe shall be entered into the socket with care to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type of tool or device approved by the Township Engineer. Pipe that is not furnished with a deep mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field-but pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured. Assembly instructions are available from the pipe manufacturer and shall be closely followed.

- b. Permissible Deflection at Joints. Whenever, in the opinion of the Township Engineer, it is necessary or desirable to deflect slip joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the following maximum limits:

TABLE II

Maximum Deflection Full Length Pipe – Slip Joint Pipe					
Size of Pipe In.	Deflection Angle Deg.	Maximum Deflection Inches		Approx. Radius of Curve Produced by Succession of Joints Feet	
		18-ft Length	20-ft. Length	18-ft Length	20-ft. Length
4	5	19	21	205	230
6	5	19	21	205	230
8	5	19	21	205	230
10	5	19	21	205	230
12	5	19	21	205	230
14	3	11	12	340	380
16	3	11	12	340	380

Insofar as possible, the Contractor shall do the work in the locations shown on the drawings, with minor adjustments allowable if approved by the Engineer. Deflections in pipes and fittings shall be made with sufficient number of joints being deflected to allow for clearance of underground structures. The maximum deflection permissible shall be limited to that allowed in the deflection tables.

2.06.04 Electrical Thawing Devices

- a. General. A device to provide electrical conductivity from one pipe length to another shall be furnished on all new watermain and also on all cut-ins to existing watermain. Thawing devices shall be capable of carrying a minimum of 500 amperes to current through the pipe joint without damage to the gasket in the joint.
- b. Serrated Silicon Bronze Wedges. Serrated wedges can be used with push-on joints only 2 per joint for 3” through 12” pipe; four for larger diameter pipe. Each wedge shall be driven into the opening between the plain end and the bell until snug. When four wedges are used they shall be inserted side by side in pairs.
- c. Conductive Push-On Gaskets. Gaskets having metal contact strips which are molded or inserted into the gasket may be used in lieu of wedges in push-on joints.
- d. Cable or Strip Conductor. May be used for all types of joints. Conductor shall be sufficiently flexible to withstand minor ground and pipe movement. When it is necessary to bond conductor strips to cut lengths of pipe in the field, the strips shall be welded to the pipe by exothermic welding.
- e. Payment. Furnish and placing electrical thawing devices will not be paid for separately but shall be considered incidental to furnishing and laying the pipe.



2.07            SETTING OF VALVES, FITTINGS AND HYDRANTS

2.07.01        General Requirements for Valves and Fittings. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified for cleaning, laying and jointing pipe.

Each valve shall be cleaned and tested for operation before it is installed. Valves and curb stops shall be set with stems plumb and at the exact locations shown on the Plans or as directed by the Township Engineer.

2.07.02        Setting Valve Boxes. Cast iron valve boxes shall be firmly supported and maintained plumb over the operating nut of the valve with the box cover flush with the finished grade. The valve box shall be supported so no shock or stress is transmitted to the valve. After box is set to grade, there shall be a minimum of two complete revolutions of the threaded portion of the box remaining on the unit.

2.07.03        Setting Hydrants

a. General. Hydrants shall be set at a minimum of 2 feet 6-inches between hydrant and hydrant valve. The grade line of the hydrant shall be at the proposed finished grade unless otherwise directed by the Township Engineer. Adjustments to the proposed grade shall be made with approved hydrant extensions installed on a standard 6-foot hydrant.

b. Position of Nozzles. All hydrants shall stand plumb and shall have their nozzles parallel with (or at right angles to) the curb, with the pumper nozzle point normal to the curb. Hydrants having hose nozzles at an angle of 45 degrees shall be set normal to the curb. The nozzles shall be at the height indicated by the manufacturer, but not less than 18 inches above the established curb grade, or as directed by the Township Engineer.

c. Stone shall be placed around every hole for drainage (7 cubic feet pea stone). **Hydrant weep holes should remain open to allow drainage into the stone after use. However, in certain conditions the hydrant weep holes should be plugged. Those conditions include areas with poor draining soils, areas with a high water table, or areas with known or suspected groundwater contamination.**

2.08            ANCHORAGE

2.08.01        General. On all watermain work all hydrants, bends, tees, plugs and other fittings shall be securely blocked against the trench bottom and walls by the use of megalugs, restraining glands or restrained joints, concrete thrust blocks or other supports, the size and shape of the thrust block or other support shall be as shown in the Standard Details or on the Plans, or as approved by the Township Engineer according to the laying conditions encountered.

Joint restraining glands shall be an acceptable means of joint restraint. Glands shall be mega-lug as manufactured by EBAA Iron, Inc. or approved equal.

Approval of anchorage by the Township Engineer shall not relieve the Contractor from his responsibility for the adequacy of the anchorage.

Where joints are to be restrained with mechanical devices (glands, restrained joint), all joints shall be restrained in accordance with design methods recommended by the Ductile Iron Pipe Research Association (DIPRA).

Acceptable restraint lengths for common pipe sizes and fittings are outlined in the following table:

TABLE III  
PIPE RESTRAINT LENGTH REQUIRED, FEET

Pipe Diameter	Tees, 90° Bends	45° Bends	22- 1/2° Bends	11- 1/4° Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110

\*\* If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.

**NOTE:** The length of restrained pipe required as shown in Table III is based on trench backfill being compacted to 95% of the maximum unit weight as measured by the modified Proctor, AASHTO T-180. If the pipe is to be wrapped in polyethylene, the length of restrained pipe required will be as shown on the drawings or in the special specifications. Table III does not consider polyethylene wrapped pipe.

2.08.02 Hydrants. The bowl of each hydrant shall be solidly braced against unexcavated earth at the end of the trench with stone slabs or concrete backing, or shall be tied to the pipe with rods or clamps, or restrained with mega-lugs as shown on the Plans or as directed by the Township Engineer. All blocking shall be installed in a manner which leaves the drain hole unobstructed.

2.08.03 Plugs, Tees and Bends. On all watermains, all tees, plugs and bends shall be securely restrained in accordance with Table III.

2.09 WATER SERVICES

2.09.01 General. The contractor shall install water services when specified or when directed by the Engineer. Water services shall include the connection to the watermain, the curb stop and box and the water service piping.

Installation of water services shall meet the general requirements specified for watermains. All services shall be inspected by the Township Engineer before the trench is backfilled.

2.09.02 Location. The locations of water services shown on the Plans are approximate. These locations may be adjusted where necessary to best serve the various properties. Exact locations will be determined by the Township Engineer before the services are installed and prior to tapping the main.

2.09.03 Tapping the Main. Unless otherwise specified, all work of tapping the watermain shall be performed by the Contractor using an approved tapping machine.

The Contractor shall keep an accurate record of measurements from the nearest valve or hydrant to each corporation or other connection to the main. These measurements shall be recorded on an as-built plan to be furnished by the Contractor to the Owner before final payment will be made to the Contractor.

2.09.04 Length and Depth. All water services shall be laid at a minimum depth of 5 feet 9 inches from the finished grade and at right angles to the street line and shall extend to a point ten feet outside the street right-of-way (property line) unless otherwise directed. No payment will be made for pipe laid beyond this point unless specifically ordered by the Township Engineer.

2.09.05 Setting Curb Boxes. Curb boxes shall be set plumb over the curb stop and shall be firmly supported without transmitting load or stress to the stop. When set to grade, there shall be a minimum of two complete revolutions of the barrel remaining on the threaded portion of the unit.

After backfilling is completed, all curb boxes shall be adjusted to finished grade and each curb stop shall be tested by operating with a standard curb wrench.

The location of all curb boxes shall be marked with a 2" x 2" wood marker until the as-built locations have been recorded and checked by the Township Engineer.

## 2.10 OPERATING VALVES AND INTERRUPTION OF SERVICE

Only Water Department personnel are authorized to open or close valves on mains in service in conjunction with the Contractor's work. The contractor shall make the necessary arrangements with the Water Department for opening and closing valves which shall be subject to such limitations on the time and location of shut-off as requirements of the water system shall impose.

The Contractor shall not operate any valve in any watermain in service, except that in case of emergency the Contractor shall, with the approval and under the direction of the Township Engineer, operate such valves as directed to relieve the emergency. In case of emergency shut-off, the Contractor shall immediately notify the Fire Department and consumers affected, of the time and probable duration of each shut-off.

2.11 WATER FOR FLUSHING

Water for flushing new mains will be provided by the Water Department at the closest hydrant or main in the existing system at no cost to the Contractor. However, if water is wasted unnecessarily or if additional flushing is required, as when rechlorination is necessary, the Contractor may be charged for such excessive amounts of water used.

The Contractor shall make the necessary connections from the existing system for filling and/or flushing the new mains.

2.12 LEAKAGE TESTS

All tests will be made by the Contractor using his own equipment, operators, and supervision, under the direction of the Township Engineer. The length of a section to be tested shall be as directed by the Township Engineer. Tests shall not be made against an existing valve. **All watermain leakage/pressure testing procedures must be in accordance to AWWA Standard C-600, as amended in 2005 which contain stricter allowable leakage requirements.**

The watermain shall be completely filled with water from the water supply and the main shall be subject to an initial hydrostatic test pressure of 160 pounds per square inch at the point of lowest elevation, and an average pressure of 150 pounds per square inch shall be maintained for at least two hours and for such longer time as the Township Engineer may require.

While the test pressure is being maintained, the leakage shall be measured by a method by the Township Engineer. Leakage is defined as the quantity of water to be supplied into the newly laid pipe necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled.

The test shall be repeated as necessary to maintain the test pressure for one hour. In all cases, the pressure shall be restored to 150 pounds at the end of the two hour period. The loss shall not exceed the allowances in the current AWWA C600 formula for the size of pipe and number of joints. No pipe installation will be accepted if the amount of makeup water is greater than that determined by the AWWA C600 Section 5.2.1.6 Testing allowance loss formula:

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

Where:

$L$  = testing allowance (makeup water), in gallons per hour

$S$  = length of pipe tested, in feet

$D$  = nominal diameter of the pipe, in inches

$P$  = average test pressure during the hydrostatic test, in pounds per square inch (gage)

Defects in the pipeline which cause leakage in excess of the maximum allowable leakage, shall be promptly corrected by the Contractor at no cost to the Owner and the main shall be retested until a satisfactory leakage test has been made. All work required for testing the watermains shall be considered incidental to laying the pipe and no specific payment will be made there for.

2.13 DISINFECTION

2.13.01 Methods. All new mains or sections thereof shall be disinfected by the Contractor, using his own chlorinating equipment and operators, under the supervision and direction of the Township Engineer in accordance with AWWA C651 Section 4.4 Methods of Chlorination, Tablet Method and Continuous-Feed Method. The tablet method gives an average chlorine dose of approximately 25 mg/L; the continuous-feed method gives a 24-hour chlorine residual of not less than 10 mg/L.

After the leakage test has been satisfactorily completed, the pipe shall then be thoroughly cleaned by flushing and refilling for chlorinating. The chlorinating solution shall then be pumped into the section of the main to be disinfected and shall be left in the main for a period of at least 24 hours. Following this period, the main shall be thoroughly flushed by the Contractor and samples will be taken by the Township Engineer for bacteriological analysis by the EGLE Environment, Great Lakes, and Energy, or State certified private laboratory. The Contractor shall not backfill the portion of the trench where the taps for chlorinating are located until the results of the bacteriological tests are satisfactory. The cost of this work shall be included in the price bid for laying water pipe.

All pipe and fittings that are used for final hook up to the existing system and have not been subjected to the chlorination test shall be cleaned of all dust, dirt, and other deposits and then carefully swabbed with a chlorine solution containing a minimum of fifty parts per million of chlorine immediately before installation.

2.13.02 Final Flushing. Clearing main of potentially heavily chlorinated water in accordance with AWWA C651 Section 4.5 Final Flushing. Heavily chlorinated water shall be flushed from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use.

2.13.03 Bacteriological Tests. After flushing and before new watermain is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 ft. of the new watermain, plus one set from the end of the line and at least one set from each branch. All Bacteriological Tests in accordance with AWWA C651 Section 5.1 Bacteriological Tests.

2.14 MEASUREMENT AND PAYMENT

2.14.01 General. All proposed construction shall be measured for payment by the Township Engineer in accordance with the items listed in the Proposal.

The unit price bid for each Proposal item shall be payment in full for completing the work, ready for use as specified.

Any materials which may be furnished and/or installed for the convenience of the Contractor, such as extra sleeves, appurtenances for testing and similar items, will not be considered for payment whether or not the proposal contains a like item for material used.

2.14.02 Water Pipe will be measured in linear feet in place, from end to end of the line of pipe, including the lengths of fittings, valves and joints.

2.14.03 Fittings such as bends, tees, crosses, plugs, reducers and sleeves, will be measured as single units, each and will be defined according to the diameter of the pipe on which each is installed.

2.14.04 A "Cut-in" will be measured as a single group of two or more fittings, or fittings and valves, installed in an existing main as described in the Proposal Items and/or as shown on Plans, and will defined according to the diameter of the larger pipe in each.

2.14.05 Valves will be measured as single units, each, and will be defined according to the size of the valve.

2.14.06 Valve Boxes will not be measured separately but shall be included in the prices bid for furnishing and placing valves and/or curb stops.

2.14.07 Hydrants will be measured in single units each including hydrant extensions to finished grade unless specific items have been provided in the Proposal for hydrant extensions.

2.14.08 Anchorage. Thrust blocks and other anchorage for fittings and hydrants shall be incidental to installing the watermain unless specified items have been provided in the Proposal in which case anchorage will be measured in the units specified in the Proposal.

2.14.09 Water Services.

- a. Water service pipe will be measured in linear feet in place from the centerline of the watermain to the end of the service.
- b. Corporation cocks will be measured in single units, each according to the diameter of the water service piping.
- c. Curb stops will be measured in single units, each, according to the diameter of the water service piping.

2.14.10 Special Items will be measured in the units indicated in the list of Proposal Items.

HYDROSTATIC WATER PIPELINE TEST REPORT

Date \_\_\_\_\_ Tester \_\_\_\_\_

Project Name \_\_\_\_\_

Location \_\_\_\_\_

Pipe Diameter \_\_\_\_\_ Pipe Length \_\_\_\_\_ Pipe Material \_\_\_\_\_

Allowable Leakage (for two-hour test period) \_\_\_\_\_

Test Start Time \_\_\_\_\_ Test End Time \_\_\_\_\_

Test Pressure Used \_\_\_\_\_ Leakage Recorded \_\_\_\_\_

Test Analysis (U-unsatisfactory S-satisfactory) \_\_\_\_\_



SECTION 3  
SANITARY SEWER SPECIFICATIONS

TABLE OF CONTENTS

3.01	DESCRIPTION OF WORK
3.02	MATERIALS
3.02.01	Pipe
3.02.02	Manholes
3.03	PREPARATION
3.03.01	Alignment and Grade
3.03.02	Bedding
3.04	PIPE LAYING
3.04.01	General
3.04.02	Laying Pipe
3.04.03	Jointing
3.04.04	Manholes
3.04.05	Connections
3.04.06	Service Lines (laterals)
3.05	TESTING AND INSPECTION
3.05.01	General
3.05.02	Line and Grade
3.05.03	Plastic Pipe Deformation
3.05.04	Leakage Testing
3.05.05	Infiltration Test (water)
3.05.06	Exfiltration Test (water)
3.05.07	Exfiltration (air)
3.06	ADJUST AND CLEAN
3.06.01	General
3.06.02	Exfiltration Air Test Table
3.07	TELEVISIONING SEWER PIPE

SECTION 3

SANITARY SEWER SPECIFICATIONS

3.01 DESCRIPTION OF WORK

This section includes the work required for sanitary sewer pipe, structures, and appurtenant work.

Excavating, trenching and backfilling shall be as specified in Section 1.

3.02 MATERIALS

All materials furnished by the Contractor shall conform to the Specifications which follow. Where reference specifications are used, they shall be considered as referring to the current edition of the latest issue.

The Contractor shall furnish in triplicate, certification by the manufacturer of sanitary pipe, manholes, and other materials, that these materials meet the requirements of the appropriate tests for the kind and class of material as required in these Specifications or shown on the Plans.

Certifications of conformance shall be submitted and shall be approved by the Township Engineer before these materials are used in the proposed construction.

3.02.01 Pipe

- a. General. Unless otherwise specified, all sewer pipe shall be PVC SDR35/26.
- b. Classification Table.

<u>Size</u>	<u>Depth (ft)</u>	<u>Type</u>	<u>Standard</u>
Plastic Pipe (PVC) 8" – 15"	< 12'	SDR 35	ASTM D3034
Plastic Pipe (PVC) 8" – 15"	> 12'	SDR 26	ASTM D3034
Joints	All	SDR35/26	ASTM D3212

- c. Service Pipe (laterals). Provide minimum 6-inch, same classification as mainline pipe.
- d. Plastic Pipe. Provide seating marks where couplings are used for jointing.
  - 1. Joints. Provide rubber "o" ring.
- e. Joint Repair or Connecting to Existing Sewer Pipe of Different Material. Provide Manhole.

f. Joint Materials. Provide joint materials as Indicated for the Following Pipes:

1. Plastic (PVC): Joints shall meet ASTM D3212.

### 3.02.02 Manholes

a. Manhole units. Shall be precast units.

b. Precast Units. ASTM C478 Modified for “o” ring gaskets.

1. Pipe Openings: Provide flexible, watertight rubber boot using mechanically compressed flexible joint re-seal, link-seal, Pressure Wedge II, Kor-N-Seal, or equal. Conform to ASTM C923.

c. Grade Rings. ASTM C478. Note: Ladtech HDPE adjusting rings are a suitable alternate.

d. Mortar. ASTM C270: 1 part Portland cement, 1 part lime and 3 parts sand by volume.

e. Manhole Steps.

1. Plastic with 3/8-inch steel rod reinforcement.

2. Dimensions: 10-inch wide, 5-inch tread depth, 12-inch maximum spacing.

f. Flow Channels. Shall be made to conform as closely as possible to the shape and slope of the connecting sewers. Flow channel walls shall be formed to the full height of the crown of the outlet sewer.

g. Benches. Shall be provided on each side of the flow channels when the pipe diameter(s) are less than the manhole diameter. Benches shall be sloped no less than ½ inch per foot. No lateral sewer, service connection, or drop pipe shall discharge onto the bench.

h. Manhole Castings. Shall have 24-inch opening with solid covers, watertight frame gasket. East Jordan 1040 Type A – 2-hole cover; with letter S.

i. Bituminous Waterproofing. ASTM D449.

j. Joint Waterproofing. CRETEX, INFi-Shield exterior joint wrap or approved equal. Apply to joints and casting/chimney/adjustment rings.

## 3.03 PREPARATION

### 3.03.01 Alignment and Grade.

a. Deviations. Notify ENGINEER and obtain instructions to proceed where there is a grade discrepancy or an obstruction not shown on the plans.

b. Laser Beam Control.

1. Use for all sewer less than 24" in diameter.
2. Check grade: at set up point, 25 feet, 50 feet, 100 feet and 200-foot points thereafter to the next set-up point.
3. Projector advancement: Reset at each manhole.

3.03.02 Bedding.

- a. Method: ASTM 2321.
- b. Provide bedding area and full trench backfill with MDOT class II granular material.
- c. Provide continuous bearing by supporting entire length of pipe barrel evenly.

3.04 PIPE LAYING

3.04.01 General.

Pipe installation shall be in accordance with ASTM 2321.

3.04.02 Laying Pipe.

- a. Direction shall be upstream with spigot or tongue end downstream and bell end upstream.
- b. Joints shall be smooth and clean.
- c. Place pipe length and bedding as a unit in a frost free, dry trench.

3.04.03 Jointing.

- a. Provide solvents, adhesives and lubricants as furnished by Manufacturer.
- b. Gasket position: Confirm that the gasket is in place and that the joint is properly made.

3.04.04 Manholes.

- a. General: ASTM C478.
- b. Base Bedding: Provide 4" pea stone with full and even bearing in impervious soils or wet conditions. Otherwise provide on undisturbed frost-free dry subgrade.
- c. Fill joint space completely and trowel between sections of precast units.
- d. Grout annular space between manhole wall and flow channel and pipe.

- e. Provide casting grade setting as follows:
  - 1. Existing pavement: Finished grade.
  - 2. Gravel or lawn grade: 4 inches below.
  - 3. Unpaved areas: Finished grade.
- f. Provide waterproofing on ASTM C478 manholes:
  - 1. Bituminous: Apply 1 gallon per 100 s.f. to outside free of holidays and open pin holes.
- g. Provide flexible seal on all joints including: chimney, casting, adjustment rings, and each barrel section joint for entire manhole. Surface preparation required to install seal material shall be in accordance with the manufacturer's instructions.

3.04.05 Connections.

- a. Connect to existing sanitary manhole by core drilling a flexible manhole connection meeting ASTM C923 to receive an opening adequate to insert pipe and secure circumference of pipe with non-shrink cement mortar.
  - 1. Relay and repoint loose blocks and bricks on existing block and brick structures. Re-channel flowlines and benches with concrete.
  - 2. System carrying wastewater: by-pass pumping as necessary to complete work.
- b. Future Sanitary Sewer: Provide the following:
  - 1. Plug: Pipe 4 inch through 21 inch with standard disc.
  - 2. Bulkhead: Pipe 24 inch and larger with brick and mortar and ½ inch plaster coat outside.
    - i. 24 inch – 36 inch: 4 inch thick
    - ii. 42 inch – 60 inch: 8 inch thick

3.04.06 Service Lines (laterals).

- a. Align at right angles to street or easement line.
- b. Grade: Provide at uniform rate from connection or main riser to the property or easement line, minimum 1/8 inch per foot. (1%)
- c. Provide minimum depth at street right-of-way line, property line, or easement line as follows:

1. Standard house with basement: 12 feet below first floor elevation.
  2. Tri-level house: 4 feet below basement floor elevation.
  3. House with walkout basement: 5 feet below basement floor elevation.
  4. Commercial and industrial buildings, schools, churches: As determined in field by ENGINEER.
  5. The above depths govern, except that the minimum depth at the right-of-way line or property line shall be 10 feet below street or easement centerline grade unless otherwise permitted by ENGINEER. Property line riser excluded from this requirement.
- d. Connection fitting:
1. Locate as directed by ENGINEER in field.
  2. 45 degrees or 60 degrees Wyes: Provide on all pipe except concrete pipe.
  3. Tees: Allowed only on reinforced concrete pipe.
- e. Main riser will be allowed where cover exceeds 13 feet at mainline, and meets R.O.W. requirements.
- f. Plugging: Provide standard plugs or caps securely blocked.
- g. Markers: Provide 1/2" steel rod, extended from lateral invert to 4 inches below grade.
- h. Witnesses: Report the following to the ENGINEER:
1. Wyes and Tee: Measurement to nearest downstream manhole.
  2. Markers: 3 measurements to permanent surface features.

### 3.05 TESTING AND INSPECTION:

#### 3.05.01 General.

- a. Supervision: By ENGINEER.
- b. Testing: Perform upon completion and before connecting to active system.
- c. Leakage tests: Provide promptly following installation of sewer pipe including services, and keep within maximum 1200 feet behind pipe laying operation.
- d. Notification: Clean, pretest and arrange with ENGINEER for final inspection and test.

- e. Provide necessary equipment, manpower and assistance.

3.05.02 Line and Grade.

Allowable drift between structures from proposed alignment will be as follows:

- a. Line:
  - 1. Thru 36 inch: 0.20 foot.
  - 2. Over 36 inch: 0.40 foot.
- b. Grade:
  - 1. Thru 36 inch: 0.02 foot.
  - 2. Over 36 inch: 0.05 foot.

3.05.03 Plastic Pipe Deformation:

- a. All flexible pipe shall be tested for deflection.
- b. Pipe deflection shall be limited to 5 percent of the inside pipe diameter. If deflection exceeds 5 percent, the pipe shall be excavated and replaced or corrected. No vibratory re-rounding of pipe is allowed.
- c. Pull GO, NO-GO type gauge through pipe.
- d. Schedule: Conduct after final backfill has been in place a minimum of thirty (30) days, and after shutdown of dewatering operation.

3.05.04 Leakage Testing:

- a. Acceptable leakage will be as follows:
  - 1. Water: Less than 100 gallons per inch of pipe diameter per mile of pipe per 24 hours. (Test permitted only when service laterals are not present, and approved by ENGINEER).
  - 2. Air: Holding time not less than that listed in table.
- b. Correction: Repair defects and repeat test until acceptable.
  - 1. Method of repairing defects shall be approved by ENGINEER.

3.05.05 Infiltration Test (water):

- a. Conditions: Minimum groundwater depth 2 feet above high point of system under test.

b. Procedure:

1. Install and maintain "V" notch weir at low end of system under test.
2. Leakage: Quantity of water measured by "V" notch weir.

3.05.06 Exfiltration Test (water):

a. Conditions: Determine groundwater elevation.

b. Procedure:

1. Fill System minimum 2 feet above high point of system or 2 feet above groundwater, whichever is higher.
2. Leakage: Quantity of water required to maintain constant level.

3.05.07 Exfiltration (air):

a. Condition: Determine groundwater elevation.

b. Procedure: Fill system to a minimum of 4 psig plus the additional pressure created by the presence of groundwater, e.g. 4 feet average depth of groundwater requires the addition of 1.73 psig to 5.73 psig. Hold test for required time with pressure dropping to no less than 3.5 psig.

c. Air Exfiltration Tests shall be done in accordance with ASTM F1417.

3.06 ADJUST AND CLEAN:

3.06.01 General:

Keep pipe and structures clean as work progresses.

3.06.02 Exfiltration Air Test Table.

3.07 TELEVISIONING SEWER PIPE:

A NAASCO Certified sewer televising contractor shall televise and record sewer upon completion of testing prior to acceptance. Four copies of the video shall be provided to the Engineer/Owner on cassette discs or thumb/USB flash drives prior to final payment and acceptance.



EXFILTRATION AIR TEST

TIME REQUIRED FOR LOSS OF PRESSURE FROM 3.5 PSIG TO 2.5 PSIG FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015 (CU. FT./MIN. /SQ. FT. OF INTERNAL SURFACE AREA)

Pipe Diameter (in.)	Minimum time (min:sec.)	Length for Minimum Time (ft.)	Time for Longer length (sec.)	Specification Time for Length (L) Shown (min:sec)								
				100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft	
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24	
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	

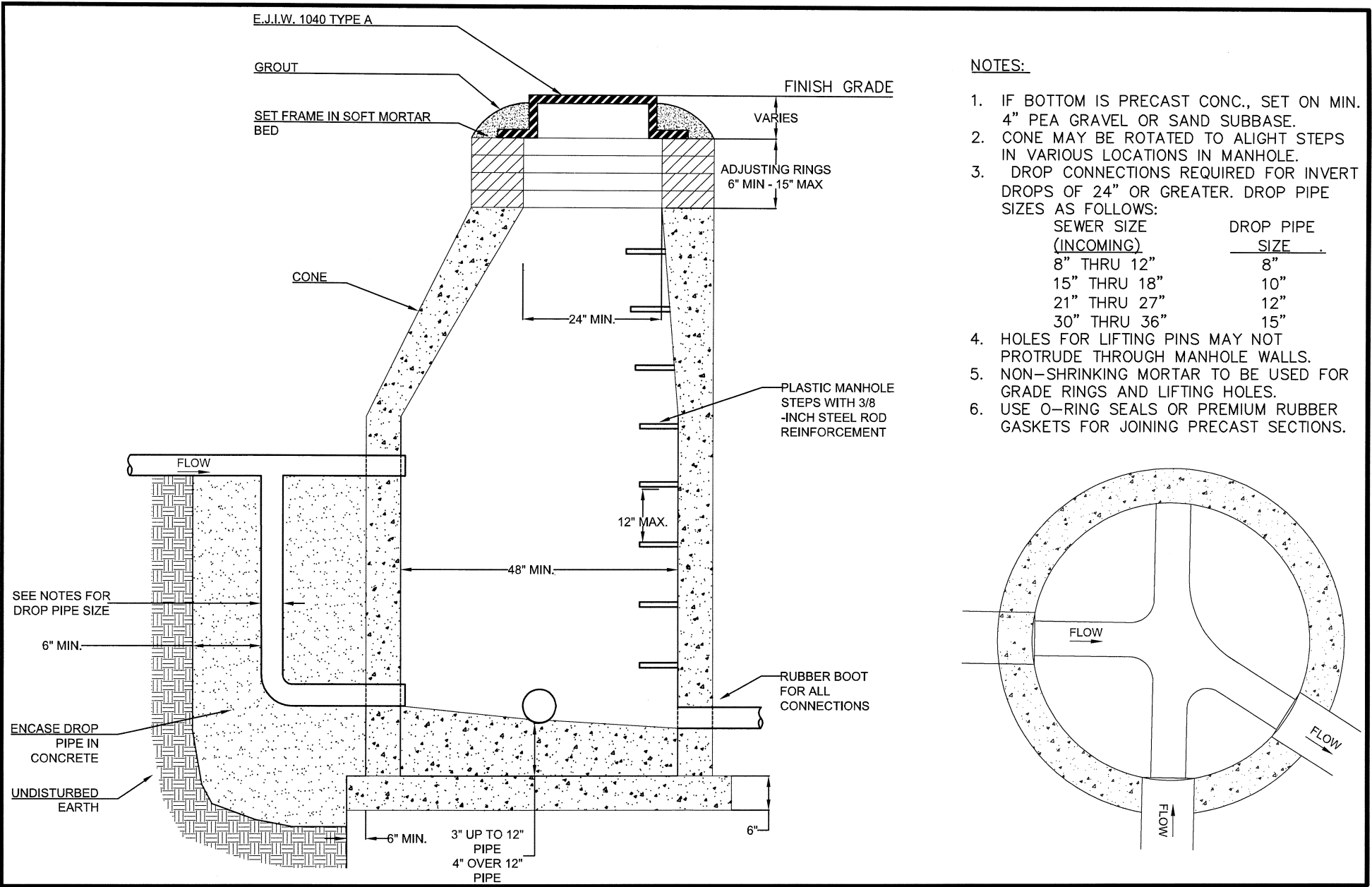
Notes:

1. When 2 or more sizes of pipe are involved, the time shall be computed by using the lengths involved.
2. Air Exfiltration Tests shall be done in accordance with ASTM F1417.

PROJECT \_\_\_\_\_  
 DATE \_\_\_\_\_

INSPECTOR \_\_\_\_\_

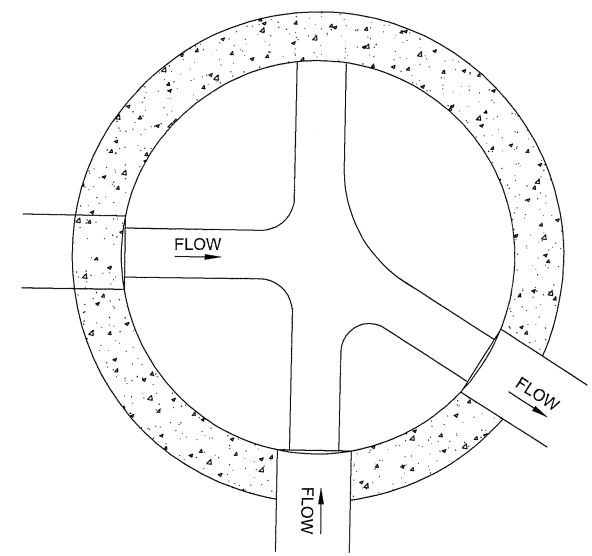
LOCATION	PIPE SIZE & LENGTH	PIPE SIZE & LENGTH	REQUIRED TEXT TIME	REQUIRED PSI	PASS	FAIL	GO-NO-GO	PASS	FAIL



**NOTES:**

1. IF BOTTOM IS PRECAST CONC., SET ON MIN. 4" PEA GRAVEL OR SAND SUBBASE.
2. CONE MAY BE ROTATED TO ALIGHT STEPS IN VARIOUS LOCATIONS IN MANHOLE.
3. DROP CONNECTIONS REQUIRED FOR INVERT DROPS OF 24" OR GREATER. DROP PIPE SIZES AS FOLLOWS:
 

SEWER SIZE (INCOMING)	DROP PIPE SIZE
8" THRU 12"	8"
15" THRU 18"	10"
21" THRU 27"	12"
30" THRU 36"	15"
4. HOLES FOR LIFTING PINS MAY NOT PROTRUDE THROUGH MANHOLE WALLS.
5. NON-SHRINKING MORTAR TO BE USED FOR GRADE RINGS AND LIFTING HOLES.
6. USE O-RING SEALS OR PREMIUM RUBBER GASKETS FOR JOINING PRECAST SECTIONS.



DESIGNED BY	SKS	DATE	10/2019
DRAWN BY	JRT	DATE	10/2019
CHECKED BY	SKS	DATE	10/2019
FILE		EDIT	
SCALE	N.T.S.		
DRAWING	N.T.S.		
PROJECT	NA		

**STANDARD DETAIL  
MANHOLE DROP CONNECTION DETAIL**

---

**FIGURE 1 - STANDARD MANHOLE DETAIL**

**INFRASTRUCTURE  
ALTERNATIVES, INC.**

CLEAN WATER SOLUTIONS

7888 Childsdale Ave. NE | Rockford, MI 49341 | Phone 616.866.1600 | iaiwater.com

FIGURE NO. 1

**CERTIFICATION**  
**STANDARD SPECIFICATIONS**  
**FOR**  
**LOWELL CHARTER TOWNSHIP**

**WATERMAIN AND SANITARY SEWER**

I hereby certify that the foregoing Watermain and Sanitary Sewer standard specifications (Sections 1,2,3) for Lowell Charter Township was adopted October 21, 2019 at a regular meeting of the Township Board.

Board Members Present: Hale, Burt, Benedict, Anderson, Blough, Thompson, Vanderziel

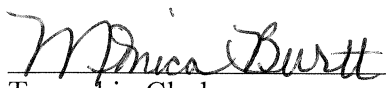
Board Members Absent: None

It was moved by Board Member Thompson and supported by Board Member Anderson to adopt the Water Main and Sanitary Sewer standard specification (Sections 1,2,3).

Board Members Voting Yes: Hale, Burt, Benedict, Anderson, Blough, Thompson, Vanderziel

Board Members Voting No: None

The specifications were declared adopted by Lowell Township Board on October 21, 2019.

  
\_\_\_\_\_  
Township Clerk  
*Lowell Charter Township, Michigan*