

SECTION 02731

CLEANING AND TELEVISIONING SANITARY SEWERS

PART 1 – GENERAL

1.01 SUMMARY:

- A. This Section includes work required for the cleaning and televising (video inspection) of sanitary sewers.
- B. Castings must be set to the established gravel grade.
- C. Notification: The Township Inspector or Township Engineer shall be provided notice and allowed three (3) work days to complete major inspections.

1.02 RELATED SECTIONS:

- A. Section 02730 – Sanitary Sewers.

1.03 SUBMITTALS:

- A. Submit the following to Allendale Charter Township Department of Public Works after completion of the sewer cleaning and televising:
 - 1. One copy of a bound written report of the video inspection including the following information:
 - a. Specific details as to the internal condition of the sewer and manholes televised noting location and condition of any broken or crushed pipe, obstructions, defective joints, misalignment in line and grade, infiltration, service laterals, manhole flow channels, etc. per N.A.S.S.C.O. requirements for MACP/PACP grading.
 - b. Length of sewer section, size, pipe material, manhole identification numbers and/or plan stationing, street name, etc.
 - 2. Original of the inspection video to Allendale DPU on a USB drive in protective case and labeled. A MDB file must be included.
 - 3. A read-only program shall be provided for Allendale DPU use.

1.04 JOB CONDITIONS:

- A. Maintain existing sanitary sewer system operational, if applicable.

PART 2 – PRODUCTS

2.01 EQUIPMENT:

- A. Sewer Cleaning Equipment:
 - 1. Shall be capable of removing all dirt, grease, rocks and other deleterious materials without causing damage to the sewer pipe
 - 2. Must be high velocity water-jetting, vacuum
 - 3. Necessary pulleys and supports shall be installed in manholes so as not to restrict the cleaning operation or damage existing manholes.
 - 4. Shall be capable of cleaning sewer lengths of up to 800 feet with vehicular access to one manhole only.

- B. Video Camera:
1. Camera operator to be PACP certified.
 2. Shall be specifically designed and constructed for the required video inspection and shall be capable of operating under 100% humidity conditions.
 3. Shall have "pan / tilt and rotate" capabilities for viewing into lateral connections and manholes.
 4. Shall be capable of producing quality color picture.
 5. Shall record video continuously for each sewer section from manhole to manhole. The recording speed and electronics shall be equal to that which can be played back on standardized equipment in the electronics industry.

PART 3 – EXECUTION

3.01 PREPARATION:

- A. Sewer and Manhole Cleaning:
1. Clean sewer mains, laterals and manholes until they are completely free of debris prior to televising (video inspection).
 2. High velocity water-jetting of all debris to downstream manholes.
 3. Remove all sludge, dirt, sand, rocks, grease and other solid or semisolid material resulting from the cleaning operation at downstream manholes. Passing material from manhole section to manhole section will not be permitted.
 4. Properly dispose of removed material.
 5. If sewer televising indicates that the sewers, laterals and manholes have not been **completely** cleaned free of debris, the sewers, laterals and manholes shall be re-cleaned and re-televised at no additional cost to the Township.

3.02 PERFORMANCE:

- A. Televising (video inspection):
1. Flush sewer with flow of water from upstream end immediately prior to televising. Minimum five (5) gallons of water to be used.
 2. Move camera through sewer in either direction at a moderate and uniform rate (30 to 40 feet per minute) per N.A.S.S.C.O specifications for P.A.C.P inspection, stopping when necessary to allow examination and documentation of the sewer's condition and all points of infiltration, cracked or crushed pipe, defective joints, misalignment of line and grade, service laterals, and other points of interest noted during the inspection.
 3. Use the "pan / tilt / rotate" features to inspect all service laterals, defective joints and manholes.
 4. If the camera encounters a vertical dip in the sewer line, the amount of vertical dip shall be estimated in inches.
 5. Note distances from a manhole to the various points of interest. The accuracy of the distance measurements shall be verified and certified to within 0.1 feet.

3.03 ACCEPTANCE:

- A. Deliver completed product as outlined in paragraph 1.03 SUBMITTALS for review by the Township and Township Engineer.
- B. If repairs are necessary to correct deficiencies found during the video inspection, the section repaired shall be re-televised for acceptance. This review will be performed at no charge. Any subsequent reviews will be charged to the developer.
- C. Repairs causing disturbance to pipe bedding or backfill will require an additional mandatory 30-day waiting period prior to televising. As such, the contractor will be required to test and inspect the repaired sewer in accordance with SP02730 SANITARY SEWERS - 3.03 TESTING AND INSPECTION.

END OF SECTION

SECTION 02732

SANITARY FORCE MAINS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes work required for sanitary force mains, structures and appurtenant work.

1.02 REFERENCES:

- A. ASTM - American Society Testing Materials, latest edition.
- B. ANSI - American National Standards Institute, latest edition.

1.03 SUBMITTALS:

- A. Submit the following for review by TOWNSHIP or TOWNSHIP's ENGINEER:
 - 1. Product data on Isolation Valves and Air Release Valves.
 - 2. Proposed equipment and method for Pressure and Leakage testing
 - 3. Details for connection to sanitary sewer system.
 - 4. Submittals must be approved by ACT DPU prior to construction.
- B. Report witness measurements on fittings.
 - 1. Provide measurements from two permanent fixtures such as building corners, power poles and trees 8-inch diameter and larger.
- C. Provide certification on pipe and fittings indicating conformance to specifications prior to installation.
- D. Submittal of drawings of record plans to:
 - 1. Provide the Township Hall two (2) printed sets and one (1) electronic file
 - 2. Provide the Township Engineer (1) one electronic file with as-constructed dimensions and witnesses.
 - 3. Provide Township Utilities Superintendent (1) one electronic file

1.04 JOB CONDITIONS:

- A. Clean up promptly following pipe installation and within maximum of 600 feet behind pipe laying operation. Cleanup includes backfill and rough grading.
- B. Installation not allowed when air temperature is 25 degrees or colder (F), or when determined too cold by Township field inspector.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Cement Lining: ANSI A21.4 Standard thickness for ductile iron pipe and fittings.

2.02 PIPE:

- A. Ductile Iron: ANSI A21.50 and ANSI A21.51; Class 52.

2.03 JOINTS:

- A. Ductile Iron Pipe and Fittings:
 - 1. Mechanical: ANSI A21.11.
 - 2. Push-on: ANSI A21.11.
 - 3. Electrical Continuity: Provide bronze wedges (3 per joint), or thermite welded sockets and cables.

2.04 FITTINGS:

- A. Ductile Iron: ANSI A21.10, ANSI 21.53, Class 54, 250 psi working pressure through 12-inch and 150 psi greater than 12-inch.

2.05 VALVES (Open Right):

- A. Gate: AWWA C515, double disc, non-rising stem, fully bronze mounted and roller and gear operator over 16 inches.
- B. Plug: ANSI B16.1, Clow Corporation F-5410, or equal.
- C. Air release: APCO 400 or Val-Matic 48 BWA.
- D. Boxes: Three (3) section cast iron with lid marked SEWER.
 - 1. Upper section: Screw on adjoining center section and full diameter throughout. Place geotextile fabric around threaded joint of risers, if used.
 - 2. Center section: Minimum 5-inch inside diameter.
 - 3. Base section: Fit over valve bonnet and shaped round for valves through 10-inch and oval for 12-inch and over. Place geotextile fabric around valve bonnet.

2.06 AIR RELEASE VALVE AND CLEANOUT CHAMBERS:

- A. Chambers shall be precast or cast-in-place concrete.
- B. Precast Units: ASTM C478 and ASTM C76, Class III.
 - 1. Joints: Cement mortar, preformed bituminous rope or "O"-ring gaskets.
 - 2. Pipe Opening: Pipe diameter plus 6-inch, maximum.
- C. Concrete: 4000 psi 28 day, 4-inch maximum slump.
- D. Concrete Brick: ASTM C55, Grade N-1 (For repair of existing brick structures only).
- E. Grade Rings: ASTM C478.
- F. Mortar: ASTM C270, 1-part Portland cement, 1-part lime and 3-parts sand by volume.
- G. Chamber Steps:
 - 1. Plastic with $\frac{3}{8}$ -inch steel reinforcement.
 - 2. Dimensions: 10-inch deep by 10-inch wide, 5-inch tread depth.
- H. Chamber Casting: East Jordan 1040 A cover – two (2) hole cover with the words "ALLENDAL AREA SANITARY SEWER" and East Jordan 1045 Z1 frame.

- I. Piping: Coal tar epoxy coating required.

2.07 MISCELLANEOUS:

- A. Tie Rods and Clamps: Clow Corporation or Traverse City Iron Works.
- B. Polyethylene Encasement:
 - 1. Material: ASTM D1248 Polyethylene, Type I, Class C, 8 mils thick.
 - 2. Closing tape: 2-inch wide Poly Ken #900 or Scotchwrap #50.
- C. Mechanical Joint Restraint: Megalug by EBBA Iron Sales, Inc.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Alignment and Grade:
 - 1. Deviations: Notify OWNER's ENGINEER and obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on the plans.
 - a. Verify location and depth of existing utilities in advance of construction and provide adjustments in alignment and grade of force main.
 - b. Depth of pipe: Minimum cover over pipe below finished grade shall be 5 feet.
 - 2. High points in pipe line: Locate at air release valves.
 - 3. Install pipe to elevations and grades when indicated on drawings.
 - 4. Measure pipe inverts prior to setting cones, for as-built drawings.
- B. Bedding:
 - 1. Method: See Article 3.04 SCHEDULES.
 - 2. Provide bedding area backfill in accordance with MDOT Standard Plan No. R-83B.
 - 3. Provide continuous bearing by supporting entire length of pipe barrel evenly.
- C. Cleaning Pipe and Fittings:
 - 1. General: Provide interior free of foreign material and joint surfaces free of lumps and blisters.
- D. Termination:
 - 1. Forcemains shall terminate at the bottom of a manhole 0.1 foot above outlet invert.
 - 2. The alignment of forcemain discharge must be within 30 degrees of straight through (i.e. 12 o'clock to 6 o'clock position).
 - 3. Manhole flow channels shall be constructed to crown of downstream outlet.

3.02 INSTALLATION:

- A. Laying pipe:
 - 1. Place pipe length and bedding as a unit in a frost free, dry trench.
 - 2. Special supports and saddles: See Article 3.04 SCHEDULES.
 - 3. Joint deflection shall be as recommended by pipe manufacturer.
- B. Cutting Pipe:
 - 1. Ductile iron: Power saw.

C. Jointing:

1. Mechanical:
 - a. Lubricate with manufacturer specified material.
 - b. Tighten bolts evenly to manufacturer specifications.
2. Push-on:
 - a. Lubricate as recommended by manufacturer.
 - b. Shape beveling as recommended by manufacturer.

D. Setting Valves and Fittings:

1. General: See Article 3.04 SCHEDULES.
2. Valves: Plumb.
3. Valve boxes:
 - a. Base section: Center and plumb over operating nut and 2 inches above bonnet joint.
 - b. Upper section: Set cover flush with finished grade.
 - c. Witnesses: Provide two (2) measurements to permanent surface features.

E. Cleanout and Air Release Valve Chambers:

1. General: See Article 3.04 SCHEDULES:
2. Base Bedding: Provide 4-inch pea stone with full and even bearing in impervious soils or wet conditions. Otherwise provide on undisturbed, frost-free, dry subgrade.
3. Precast: Fill joint space completely and trowel.
4. Provide casting setting as follows:
 - a. Existing pavement: Finished grade.
 - b. Gravel road: 6 inches below.
 - c. Unpaved areas: Finished grade.

F. Pipe Joint Restraint:

1. Provide mechanical joint restraint for the minimum lengths shown in joint restraint detail (i.e. Schedule 3.06.A.4)

* The length of restrained pipe required shown in the joint restraint detail is based on trench backfill being compacted to 95% of the maximum density according to the Modified Proctor Method. The joint restraint detail does not consider polyethylene wrapped pipe. If the pipe is wrapped with polyethylene, a greater length of restrained pipe will be required. Unless otherwise specified, a multiplier of 1.5 shall be used to determine the required length when the pipe is wrapped with polyethylene.

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

- a. Tees: Pipe restraint length shown in the joint restraint detail shall be provided in the branch direction. Also, the minimum length of pipe restraint in the straight through (run) direction shall be 10 feet on both sides of the tee.
- b. Bends: Pipe restraint length shown in the joint restraint detail shall be provided on both sides of the bend.
- c. Dead End: Pipe restraint length shown in the joint restraint detail shall be provided back from the dead-end plug.
- d. See 3.06 SCHEDULES for a detail illustrating the joint restraint requirements.
- e. All joints shall be restrained for pipe within casings.
- f. All joints between bends on water main offsets shall be restrained.

G. Reaction Backing (allowed only where restrained joints cannot be used and when approved by ENGINEER):

1. Placement:

- a. Place concrete manhole block next to pipe and concrete reaction backing behind. Megalugs and fitting bolts shall not be covered with concrete.

2. Bearing area: Provide the following square feet of concrete against trench wall in sand:

Pipe Size	Tees Plugs	Hydrants 90° Els	Wyes 45° Els	22½° Els	11¼° Els
4"	2	1	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
12"	9	11	6	3	2
16"	13	20	10	6	3

3. Other Soil Conditions:

- (a) Cement sand or hardpan - Multiply above by 0.5
(b) Gravel - Multiply above by 0.7
(c) Hard dry clay - Multiply above by 0.7
(d) Soft clay - Multiply above by 2.0
(e) Muck - secure all fittings with Megalug retainer glands or tie rod clamps and concrete reaction backing the same as listed for sand conditions. Install as required by SECTION 02220 - EXCAVATING, BACKFILLING AND COMPACTING.

H. Polyethylene Encasement:

1. In corrosive soils: Install over ductile iron pipe and tape seams in accordance with AWWA C-105.

3.03 TESTING AND INSPECTION:

A. General:

1. Observation: By TOWNSHIP or TOWNSHIP's ENGINEER.
2. Completion: Before connection to lift station.
3. Notification: Pretest and arrange for inspection and test.
4. Equipment and assistance: Provide.
5. Required water: By TOWNSHIP where available from municipal system.

B. Electrical Continuity: Test ductile iron pipe for continuity and repair breaks.

C. Pressure:

1. Conditions: Air or air-water methods of applying pressure prohibited.
2. Range: 100 to 110 psi at lowest elevation.
3. Duration: 1 hour and until completion of inspection.
4. Procedure: Fill system slowly, expel air through air release valve connection at high points and apply pressure. Install air release valve after test.
5. Inspection: Examine line and appurtenances for leaks and movement.
6. Corrections: Repair defects, visible leaks and repeat test until acceptable.

D. Leakage:

1. Condition: Following pressure test.
2. Average pressure: Within pressure test range.
3. Duration: two (2) hours.
4. Filling: As in pressure test.
5. Supplying make-up water: Measurable source.
6. Leakage: Quantity of water supplied to maintain test pressure.
7. Allowable: Less than:

$$L = \frac{ND \times \text{Square root of } P}{3700}, \text{ where}$$

L = leakage (gallons per hour)

N = number of joints

D = nominal pipe diameter (inches)

P = average test pressure (pounds per square inch gauge)

Note: Formula equals 0.8 gallon per hour per mile per inch diameter at 100 psi for 18-foot lengths.

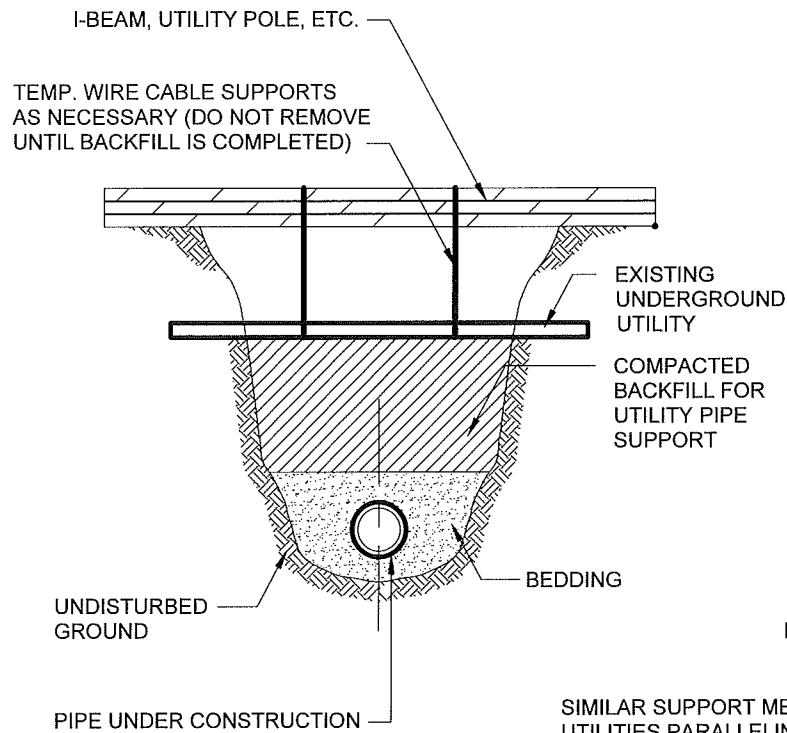
8. Correction: Repair defects and repeat test until acceptable.

3.04 SCHEDULES:

A. Standard Details:

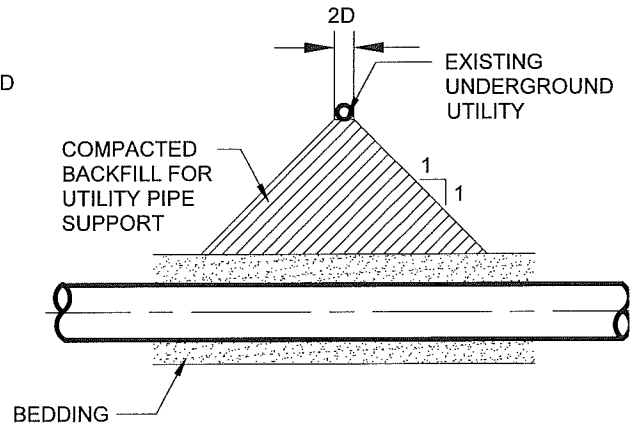
1. Special supports for underground utilities / pipe saddles
2. Methods of bedding pipe
3. Standard air release valve chamber
4. Joint Restraint Requirements
5. Drop connection detail
6. Force main discharge detail

END OF SECTION



SECTION

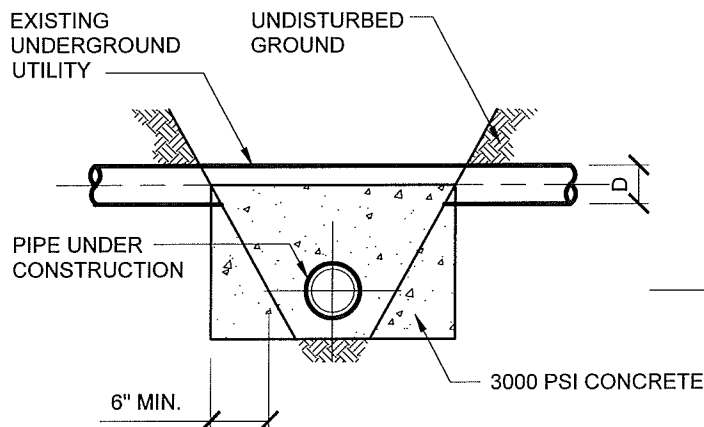
NOTE: MAINTAIN EXISTING
COATING ON UTILITY



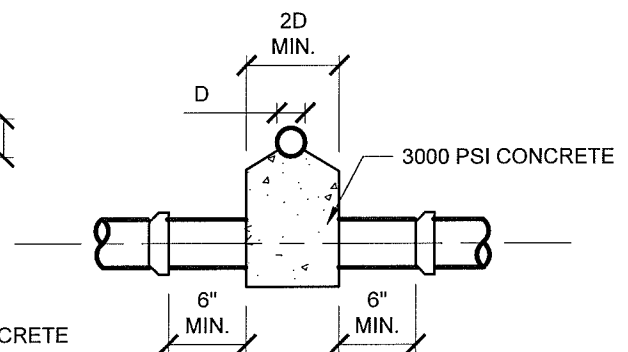
ELEVATION

SIMILAR SUPPORT METHODS APPLY TO
UTILITIES PARALLELING AND ABOVE
THE PIPE UNDER CONSTRUCTION

SPECIAL SUPPORTS FOR UNDERGROUND UTILITIES



SECTION

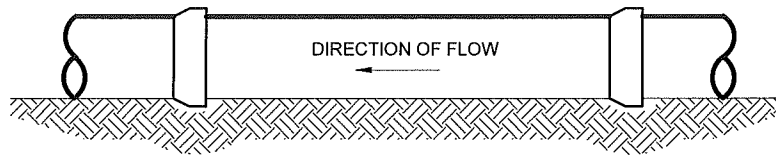


ELEVATION

NOTE:

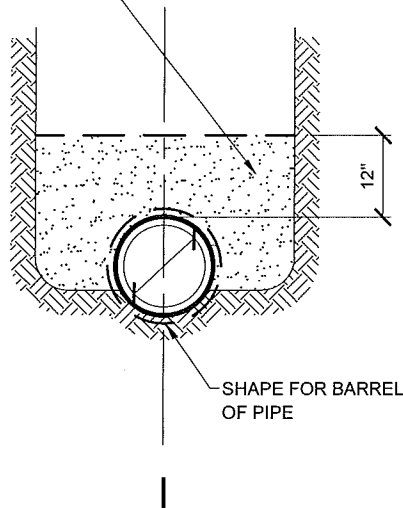
1. PIPE SADDLE IS NOT REQUIRED FOR PLASTIC,
STEEL, LEAD OR COPPER PIPE 2" OR SMALLER.

PIPE SADDLES



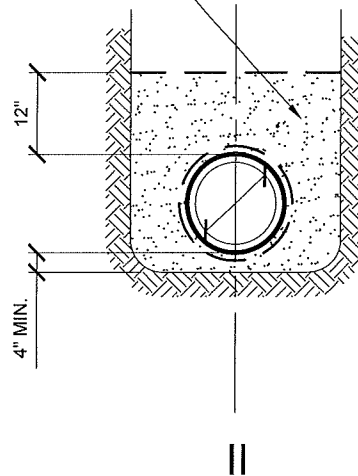
EXCAVATION FOR BELLS

GRANULAR BACKFILL
COMPACTED



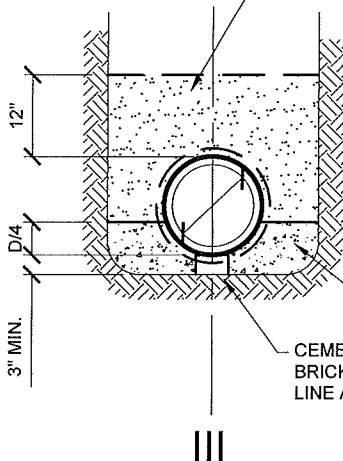
SHAPE FOR BARREL
OF PIPE

GRANULAR BACKFILL
COMPACTED



4" MIN.

APPROVED BACKFILL PLACED AND
COMPACTED A MINIMUM OF 24 HOURS
AFTER PLACING CONCRETE



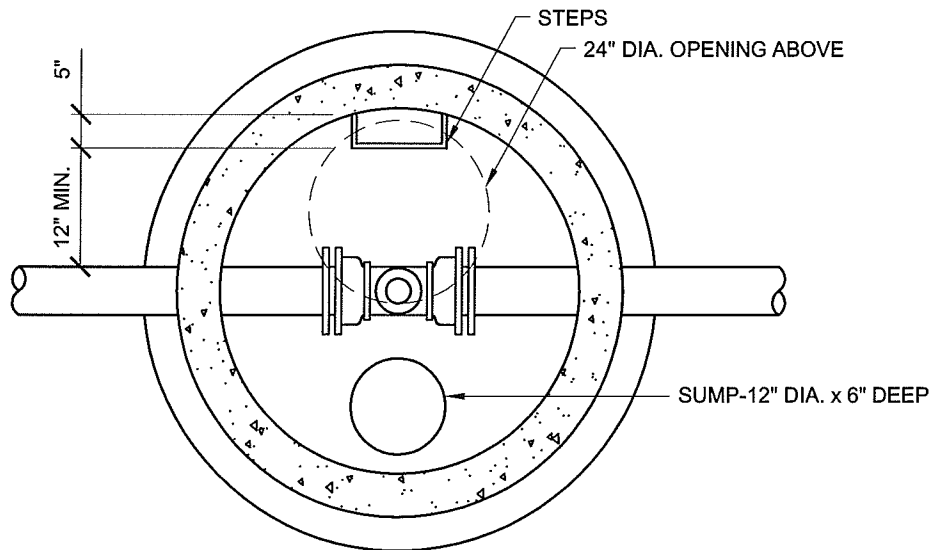
3000 PSI CONCRETE CRADLE

CEMENT BLOCK OR
BRICK TO PRESERVE
LINE AND GRADE.

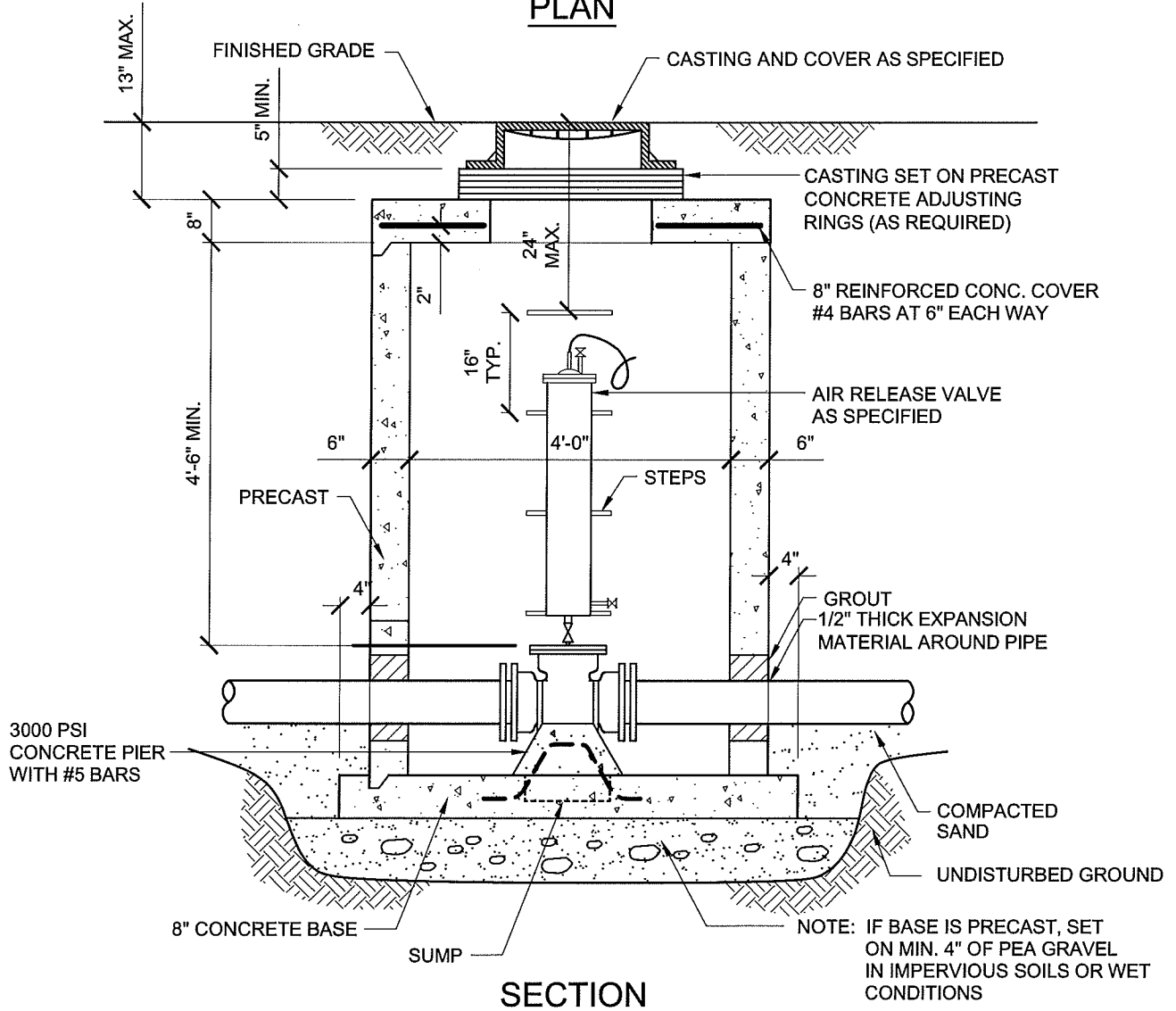
NOTES:

1. METHOD I: IN AREAS OF UNCONSOLIDATED SOILS
(SAND, GRAVEL, ETC.)
2. METHOD II: IN AREAS OF CONSOLIDATED SOILS
(CLAY, HARDPAN, ROCK, ETC.)
3. METHOD III: IN AREAS INDICATED
ON DRAWINGS

METHODS OF BEDDING PIPE

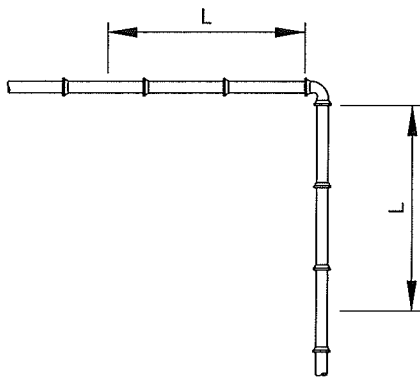


PLAN

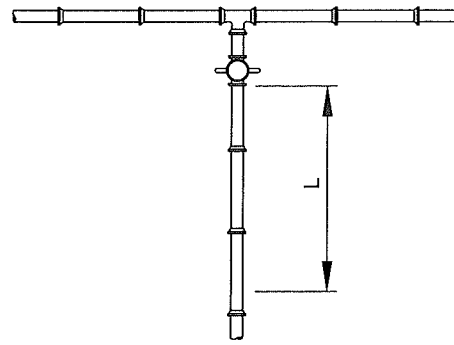


SECTION

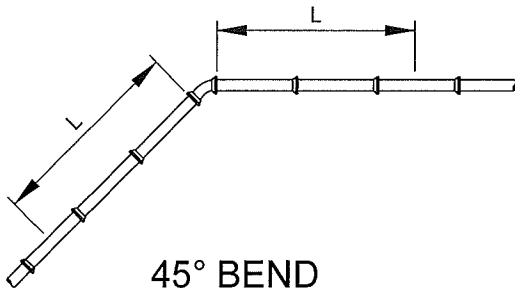
STANDARD AIR RELEASE VALVE CHAMBER



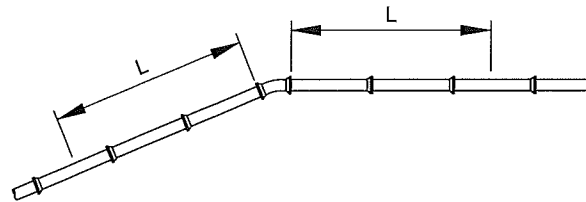
90° BEND



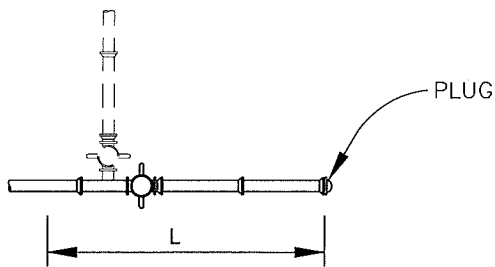
TEE



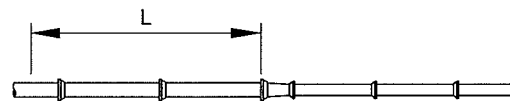
45° BEND



22 1/2° BEND OR LESS



DEAD END



REDUCERS

"L" = MINIMUM LENGTH OF MECHANICAL JOINT
RESTRAINT SHOWN IN TABLE

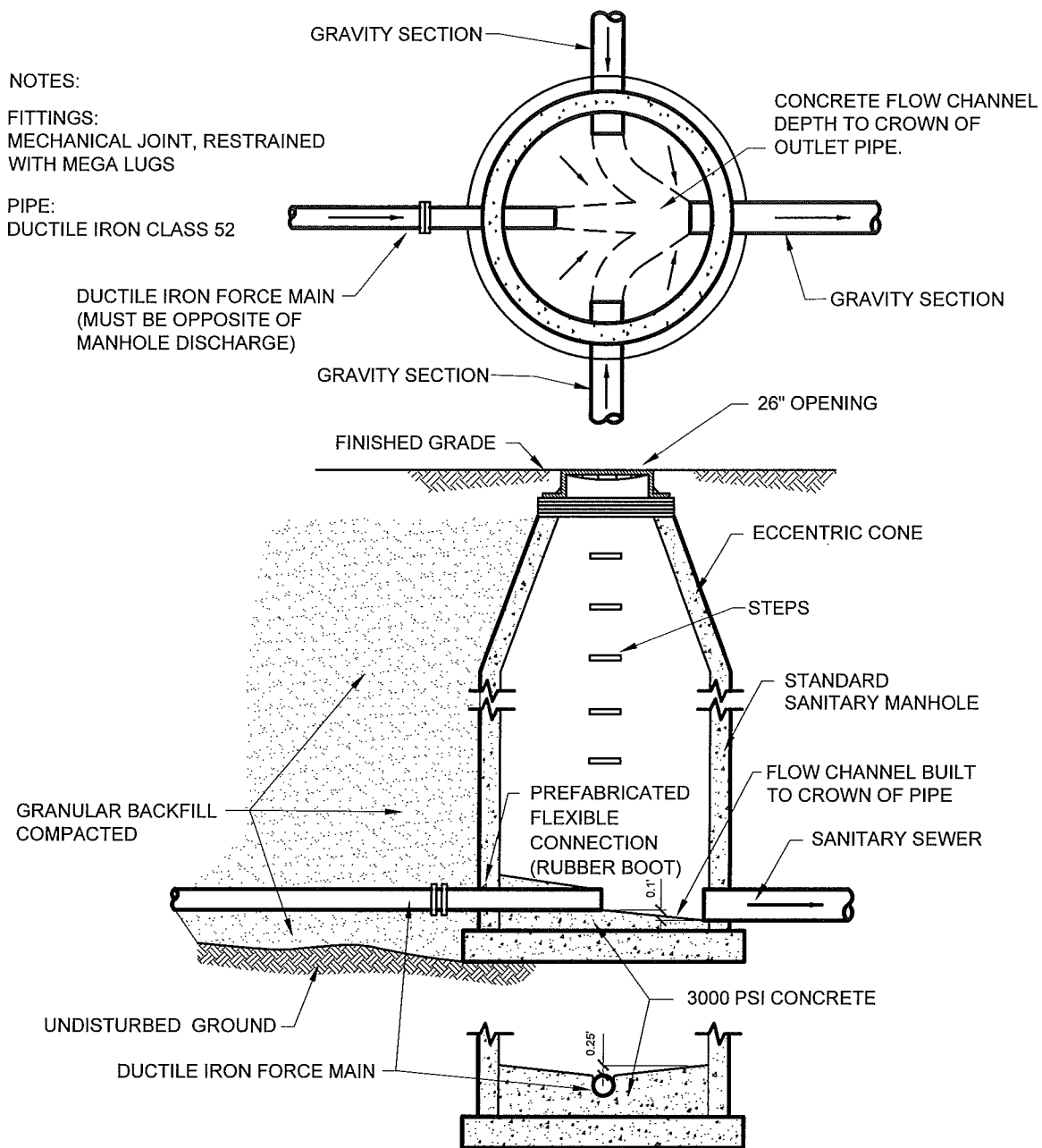
PIPE RESTRAINT LENGTH (L) REQUIRED, FEET*							
Pipe Dia.	Tees, 90° Bends	45° Bends	22-1/2° Bends	11-1/4° Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110

* AND ** - SEE PARAGRAPH 3.02H OF SPECIFICATION SECTION 02660
***VERTICAL BENDS REQUIRE 50% OF ADDITIONAL RESTRAINT.

JOINT RESTRAINT REQUIREMENTS



SECTION



FORCE MAIN DISCHARGE DETAIL

SECTION 02740

HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required to install a carrier or casing pipe under an obstacle using the method commonly known as directional drilling to the grades and alignments shown on the Drawings, where approved by the TOWNSHIP and TOWNSHIP ENGINEER.

1.02 REFERENCES:

- A. ASTM - American Society of Testing Materials, *Latest Edition*.
- B. PPI - Plastics Pipe Institute
- C. AWWA - American Water Works Association
- D. ANSI - American National Standards Institute

1.03 JOB CONDITIONS:

- A. A. MDOT Right-of-Way: Comply with MDOT "Provisions for Jack Construction (1998)" for permitting, installing and inspecting jacked-in-place and directional-drilled pipe within MDOT right-of-way.
- B. Other Jurisdictions: Comply with all permit requirements.
- C. Critical Crossings: Critical crossings, such as surface water crossings, require valve chambers on each side of the crossing so that the section of piping may be isolated. The valve chambers shall include corporation stops on each side of the valve for purposes of future chlorination, sampling, and leak testing.

1.04 GENERAL REQUIREMENTS:

- A. The CONTRACTOR shall be responsible for the method of construction, the stability and accuracy of the drilled and reamed hole and pits constructed, and all costs for damages resulting from any failure thereof. The CONTRACTOR shall be solely responsible for the safety of the pits and related structures and personnel engaged in underground construction throughout the duration of the work.
- B. The CONTRACTOR's methods and schedule shall consider the overall project requirements and anticipated subsurface soils and groundwater conditions. The CONTRACTOR's selection of inadequate, inappropriate or inefficient equipment and methods will not be cause for adjustments to the contract price or contract time.
- C. The general dimensions, arrangement and details for the drilled hole and pits to be constructed shall be as needed to complete the required work.

- D. Methods of excavation, equipment and procedures for the directional drilling operation and pits shall be selected by the CONTRACTOR to provide adequate working space and clearances for the work to be performed.
- E. Pit excavation methods, groundwater control and pit support techniques shall be selected by the CONTRACTOR.

1.05 CONTRACTOR QUALIFICATIONS:

- A. The CONTRACTOR who will complete the work contained in this Section must be experienced in the type of work specified in this Section and must have successfully completed similar projects within the last three years.
- B. Personnel that will perform the work must be trained and experienced in the fabrication and installation of the materials and equipment, as well as being knowledgeable of the design and the reviewed shop drawings.
- C. At the ENGINEER's request, the CONTRACTOR responsible for the completion of the work contained in this Section shall submit a list of jobs successfully completed within the last three years. Information on each job must include the following:
 - 1. Date of Project
 - 2. Location
 - 3. Length of Directional Drill
 - 4. Size and Material of Pipe
 - 5. General CONTRACTOR's name, contact and phone number.
 - 6. OWNER's name, contact and phone number.
 - 7. Other information relevant to the successful completion of the project.

1.06 SAFETY:

- A. The CONTRACTOR shall become familiar with, and shall at all times conform to, all applicable codes, ordinances and laws in relation to the work required.
- B. Directional drilling equipment machine safety requirements shall include a common grounding system to prevent electrical shock in the event of a high voltage underground cable strike. The grounding system shall connect all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats and any other interconnected equipment to a common ground. The drill shall be equipped with an "electrical strike" audible and visual warning system that shall notify the system operators of an electrical strike.
- C. Operators of the drill shall wear electrical shock protection equipment and operate from common grounding mats as required.

1.07 SUBMITTALS:

- A. Proposed drill profile data including the minimum information listed below:
 - 1. Entrance angle
 - 2. Exit angle
 - 3. Minimum radius of curvature
 - 4. Depth of pipe every 50 feet
 - 5. Pilot hole diameter
 - 6. Back ream hole diameter
 - 7. Wet or dry pullback
 - 8. Estimated maximum pullback force
- B. Polyethylene pipe data including, but not limited to, the following:
 - 1. Manufacturer's brochures and catalog sheets
 - 2. Dimensions
 - a. Inside diameter
 - b. Outside diameter
 - c. Standard dimension ratio
 - d. Yield stress
- C. HDPE to DI connection:
 - 1. Manufacturer
 - 2. Product data sheet
 - 3. Dimension drawing
 - 4. Installation instructions
- D. Drilling Fluid:
 - 1. Bentonite (or alternate):
 - a. Product manufacturer
 - b. Product data sheet
 - c. Mixing instructions
 - 2. Polymer:
 - a. Product manufacturer
 - b. Product data sheet
 - c. Mixing instructions
 - d. Material safety data sheet (MSDS)
- E. Drill Path Documentation upon completion: See Article 3.07.
- F. Contractor corrective action plan as noted in Section 02740.1, Paragraph 5.

1.08 DELIVERY, STORAGE AND HANDLING:

- A. Handle and store materials in a manner that will prevent:
 - 1. Deterioration or damage
 - 2. Contamination with foreign matter
 - 3. Damage by weather or elements
- B. After the pipe is fused together and before it is pulled through the drilled hole, the CONTRACTOR shall be responsible to provide vehicular and emergency access to all properties affected by the fused pipeline. The CONTRACTOR shall be responsible to repair all damage to existing surface and site improvements damaged by the fused pipeline.

1.09 UTILITY PROTECTION:

- A. All underground utilities shown on the drawings are shown according to the best available information. It is the CONTRACTOR's responsibility to verify the location of all existing utilities prior to working in the area.
- B. All utilities are to remain in service and shall be protected by the CONTRACTOR from any damage as a result of his operations.
- C. Where utilities are encountered and not shown on the drawings, the CONTRACTOR shall report them to the OWNER before proceeding with the work.
- D. All utilities damaged by the CONTRACTOR's activities shall be repaired or replaced by the CONTRACTOR without preventable delay. All costs to repair the utility including, but not limited to, materials, labor, inspection, testing and temporary service shall be borne by the CONTRACTOR with no cost to the OWNER.
- E. All utilities in close proximity to the drill pilot bore, back ream or product pipe installation must be exposed in accordance with all codes, ordinances and regulations to ensure, by visual inspection, that the CONTRACTOR's work has not caused any damage to the utility or to the CONTRACTOR's work and adequate clearance between the utility and the CONTRACTOR's work is maintained.

1.10 APPLICABLE REGULATIONS:

- A. All work covered by this Section shall be performed in accordance with all applicable federal, state and local laws, regulations, codes and ordinances which pertain to such work, as well as the supplemental regulations contained in these specifications. If a conflict exists between any laws, regulations, codes or ordinances, the most stringent shall govern.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. PIPE:

- 1. Water main pipe material shall be high density polyethylene (HDPE) constructed of PE 3408 resin with an SDR of 11 or less and conform to AWWA Standard C-906. In addition, all materials must be listed and approved for use with potable water under ANSI/NSF Standards 14 and 61 (Standard 14 meets the requirements of Standard 61). The Exterior wall of all HDPE pipe proposed for potable use must also bear NSF and AWWA C-906 identification. The pipe shall conform to DIPS (Ductile Iron Pipe Size) size and be appropriately striped as water main (blue).
- 2. Sanitary force main pipe material shall be high density polyethylene (HDPE) made from a high density, high molecular weight resin classified as a Type III, Grade P34, Class C, Category 5 by ASTM D1248. Cell Classification by ASTM D3350 shall be 345434C, and rated 3408 by the Plastics Pipe Institute, a Division of the Society of the Plastics Industry, Inc.
- 3. The pipe shall have the minimum or maximum inside diameter (ID) and standard dimension ratio (SDR) as indicated on the plans. The rated working pressure (psi) shall be as indicated on the plans.

4. The CONTRACTOR is responsible for calculating loads placed on the pipe during its installation based on the CONTRACTOR's chosen means and methods of construction. It is the CONTRACTOR's responsibility to ensure the pipe will withstand all loadings placed on it during installation. If the pipe with dimensions given above will not withstand the installation loads, it is the CONTRACTOR's responsibility to size the pipe to withstand the installation loads.
5. Manufacturers:
 - a. Phillips Driscopipe, Inc.
 - b. Chevron Chemical Company (Plexco)
 - c. or Engineer approved equal

B. DRILLING FLUIDS:

1. The CONTRACTOR must use a high-quality Bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Oil-based drilling fluids or fluids containing additives that can contaminate the soil or ground water will not be considered acceptable substitutes. Composition of the drilling fluid must comply with all federal, state and local environmental regulations.
2. Polymer used as lubrication in the drilling fluid is acceptable, if desired.
3. Drilling fluids must be mixed with water that is free from significant solids and contamination. Potable water is acceptable. River water is acceptable provided no organic matter or soil particulates are mixed into the drilling fluid. It is the CONTRACTOR's responsibility to apply for and obtain any necessary permits for the procurement of drilling fluid water. It is also the CONTRACTOR's responsibility to pay permit application fees, metering charges or any other costs associated with drilling fluid mixing water.

C. HDPE TO DUCTILE IRON CONNECTION:

1. The connection from the HDPE pipe to DI shall be manufactured by the pipe manufacturer. It shall be made of HDPE and connect to the DI pipe with a standard rubber gasket and a mechanical joint gland.
2. Additional restraint shall be provided on each side of the connection point in the form of an HDPE anchor ring encased in concrete or other methods as approved by TOWNSHIP ENGINEER. All proposed connection and restraint details shall be included on the plans.
3. Connections shall not be made for a period of 24 hours after the pipe has been installed to allow the pipe to approach an equilibrium temperature with it's surrounding environment.
4. The HDPE pipe shall be properly aligned at all connections.

D. TRACER WIRE:

1. Provide minimum copper 6 gauge.

PART 3 - EXECUTION

3.01 ALIGNMENT AND PROFILE OPTIONS:

- A. Alignment and profile shown on the drawings.
- B. An alternate alignment and profile developed by the CONTRACTOR with the following requirements:
 1. Alignment must be within easement(s) and right-of-way.
 2. Clearance between utilities is maintained.

3. 15-foot minimum vertical distance between the drill path and the bottom of a river to prevent drilling fluid breakout.
4. Changes from the approved plans shall be applied by the Township DPU or Township Engineer.

3.02 PIPE FUSION:

- A. All pipe shall be joined with the "butt fusion" method in accordance with the pipe manufacturers recommendations. Socket fusion, extrusion welding, hot gas welding and mechanical connections are not acceptable.
- B. Butt fusion joining shall produce a joint of equal or greater tensile strength than the strength of the pipe.

3.03 DRILL ENTRANCE AND EXIT PITS:

- A. The CONTRACTOR is responsible for the design and construction of the drill entrance and exit pits. Supports may be required to maintain safe working conditions. Ensure stability of the pit, minimize loosening, and minimize soil deterioration and disturbance of the surrounding ground.
- B. Entrance and exit pits must be contained in the easement(s) and right-of way.
- C. Drill entrance and exit pits must be maintained at minimum size to allow only the minimum amount of drilling fluid storage prior to transfer to mud recycling or processing system or for removal from the site.
- D. Drilling fluid will not be allowed to freely flow on the site or around the entrance or exit pits. Fluid spilled must be removed as soon as possible and the ground restored to original condition.
- E. Pits must be shored to OSHA standard if workers are required to enter the pits for any reason.

3.04 DRILL ENTRANCE AND EXIT ANGLES:

- A. Entrance and exit angles of the drill can be whatever the CONTRACTOR desires such that the elevation profile maintains adequate ground cover to ensure no drilling fluid breakout occurs and that ground exit occurs within the designated easement(s) or right-of-way. The CONTRACTOR is responsible for ensuring that entrance and exit angles ensure pullback forces do not exceed 5% strain on the polyethylene pipe.

3.05 GUIDANCE SYSTEM:

- A. The guidance system must have the capability of measuring inclination, roll and azimuth. The guidance system must have an independent means to ensure the accuracy of the installation. The CONTRACTOR will 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 guidance system must meet the following specifications:

Inclination:	Range	-90° to +90°
	Accuracy	0.2°
Azimuth:	Range	0° to 360°
	Accuracy	0.5°
Roll:	Range	0° to 360°
	Accuracy	0.2°

3.06 PILOT HOLE TOLERANCES:

- A. The pilot hole shall be drilled along the agreed-to alignment and profile with the following tolerances:
 - 1. Vertical
 - a. Plus 4 feet (deeper or additional ground cover).
 - b. Minus 1 foot (shallower or reduced ground cover).
 - 2. Horizontal:
 - a. Plus or minus 2.5 feet
 - 3. Curve radius:
 - a. Curve radius shall not exceed the pipe manufacturer's recommendations.

3.07 DRILL PATH DOCUMENTATION:

- A. The CONTRACTOR is responsible for maintaining drilling logs that provide drill path data every 25 feet along the drill path. Information logged every 25 feet will, at a minimum, include the following:
 - 1. Pilot hole:
 - a. Distance out or station
 - b. Depth below a known ground surface elevation
 - c. Plus or minus (left or right) of alignment
 - d. Torque
 - e. Drill fluid flow rate
 - f. Time
 - 2. Back ream:
 - a. Distance out or station
 - b. Pull back force
 - c. Torque
 - d. Drill fluid flow rate
 - e. Time

3.08 PIPE GOUGING:

- A. The CONTRACTOR shall take every precaution to prevent gouging of the pipe prior to and during pipeline installation.
- B. It is expected some pipe gouging will occur during pullback. However, the constructed pipeline shall not have any gouges that are deeper than 10% of the pipe wall thickness. Pipe that has gouges greater than 10% of the pipe wall thickness will not be accepted.

3.09 INSTALLING PRODUCT PIPE:

- B. After the pilot hole is completed, 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.
- C. Reaming diameter will not exceed 1.4 times the diameter of the product pipe being installed.
- D. Allow sufficient length of product pipe to extend past the termination point to allow connections to adjacent pipe sections or gate valves. Pulled pipes will be allowed 24 hours of stabilization prior to making tie-ins. The length of extra product pipe will be at the CONTRACTOR'S discretion.
- E. Install an AWWA C153-11 Mechanical Joint Adaptor, per the manufacturer's requirements, when connecting the pipe to a valve or hydrant.

3.10 YIELD STRESS:

- A. The yield stress shall be calculated from the HDPE material submitted and the cross-sectional area of the pipe. The result will be the force at which the HDPE pipe will yield.
- B. The pullback force will be monitored throughout the pullback. At no time shall the equipment be operated to produce a pullback force that exceeds 75% of the yield force.

3.11 CLEANUP:

- A. All excavated soil, soil cuttings and drilling fluid shall be the property of the CONTRACTOR. All material shall be disposed of in accordance with all laws, regulations, codes, ordinance and these specifications.
- B. Immediately upon completion of the work in this section, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.
- C. If a drilling fluid breakout should occur, the area shall be cleaned immediately and the surface washed and returned to original condition by Contractor.
- D. Every precaution shall be implemented to prevent a drilling fluid breakout in the river. It is the CONTRACTOR's responsibility to conduct construction activities to prevent this occurrence. However, if a drilling fluid breakout occurs in the river, it is the CONTRACTOR's responsibility to clean up any resultant contamination. The CONTRACTOR is also responsible for any damage to property or the environment due to such a breakout.

3.12 HYDROSTATIC TESTING:

- A. The pipe shall be hydrostatically tested before being connected to other piping systems. The pipe shall be tested independently of other hydrostatic tests.
- B. Hydrostatic testing will consist of filling the constructed pipeline with water taking care to bleed off trapped air. The CONTRACTOR shall pressurize the pipe to 150 psi for a minimum of 4 hours to give the pipe time to expand. During this initial 4 hours, make-up water shall be added as-needed to maintain the pressure within 5 psi of the specified pressure. At the end of the first 4 hours, the pipe shall be pressurized to the specified

pressure and the test commences. The pipeline shall be maintained under the test pressure for a continuous period of between 1 and 3 hours, as determined by the TOWNSHIP ENGINEER, by pumping water into the line at frequent intervals. The volume of water so added to maintain pressure within 5 psi of the specified pressure shall be measured and considered to represent the "leakage" from the line during the interval.

The allowable "leakage" for the pipeline shall not exceed the allowances given in the following table.

Nominal Pipe Size (In)	Allowable "Leakage" (Gal/100' of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

It is understood that the pipe will continue to expand after the initial 4 hours under pressure and throughout the 1 to 3-hour test period. The allowable "leakage" presented in the table above accounts for this expansion and no additional allowable "leakage" will be considered.

- C. Under no circumstances shall the total time under the specified test pressure exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., the test shall be terminated and the pipeline shall be de-pressurized and permitted to "relax" for a minimum of 8 hours prior to the next testing sequences.
- D. If there are no visual leaks or significant pressure drops during the final test period, and the measured "leakage" is less than allowable, the pipeline passes the hydrostatic test.
- E. In the event that the "leakage", as determined by the ENGINEER, exceeds the specified allowable, the CONTRACTOR shall be responsible to repair or replace the pipeline until the pipeline passes the hydrostatic test, as determined by the ENGINEER.

3.13 TRACER WIRE:

- A. Tracer wire shall be installed with the directionally drilled pipe.

3.14 SCHEDULES:

- A. Horizontal Directional Drilling Plan for Preventing and Controlling the Loss of Drilling Mud (3 sheets).
- B. Joint Adapter Detail (1 sheet).
- C. HDPE to DIP Connection Detail (1 sheet).

END OF SECTION

SECTION 02740.1

HORIZONTAL DIRECTIONAL DRILL PLAN FOR PREVENTING LOSS OF DRILLING MUD

1.0 INTRODUCTION

- A. This directional drill contingency plan provides specific procedures and steps to prevent and/or to contain inadvertent releases of drilling mud (also referred to as frac-outs) for waterbodies that are crossed using horizontal directional drilling (HDD) techniques.

2.0 HORIZONTAL DIRECTIONAL DRILLING PROCESS

- A. Installation of a pipeline by HDD is generally accomplished in three stages. The first stage consists of directionally drilling a small-diameter pilot hole along a pre-determined path. The second stage enlarges this pilot hole to a diameter that will accommodate the pipeline. Numerous "reaming" passes will be necessary with each pass enlarging the diameter of the pilot hole incrementally. The third stage involves pulling the pipeline through the enlarged hole.

During the drilling of the pilot hole, directional control is achieved by using a non-rotating drill string with an asymmetrical leading edge. The asymmetry of the leading edge creates a steering bias, which allows the operator to control the direction of the drill bit. The actual path of the pilot hole is monitored during drilling by taking periodic readings of the inclination and azimuth. These readings are used to calculate the horizontal and vertical coordinates along the pilot holes relative to the initial entry point on the surface.

Once the pilot hole is complete, it is enlarged using reaming tools that are often custom-made for a particular diameter of pipe or type of soil. The reamers are typically attached to the drill string at the exit point and are rotated and drawn to the drilling rig, thus enlarging the pilot hole with each pass. Pipe installation is accomplished by attaching a prefabricated pull section behind a reaming assembly at the exit point and pulling the entire assembly back to the drilling rig.

- B. Ideally, horizontal directional drilling involves no disturbance to the bed or banks of a stream or wetland. However, it is possible that geologic irregularities could be encountered during drilling, and drilling could fail. This plan describes the potential for failure of horizontal directional drilling, the contingency methods that would be implemented in the event of inadvertent release of drilling fluids to water or land, and drill hole abandonment procedures.

The feasibility of the horizontal directional drill method primarily depends on the local geologic setting, as well as site topography and other surface features. For example, horizontal directional drilling may not be feasible in areas of glacial till or outwash interspersed with boulders and cobbles, highly fractured bedrock, or non-cohesive coarse sands and gravels. These formations increase the likelihood that drilling could fail due to refusal of the drill bit, continuous loss of drilling fluid through fractures or weak areas in the ground, or collapse of the bore hole in non-cohesive, unstable substrate.

Fortunately, surface characteristics at the proposed Project drill sites are generally favorable for HDD.

Also, subsurface geotechnical investigations indicate that conditions are favorable for horizontal directional drilling.

3.0 MONITORING PROCEDURES

- A. The Project Engineer and construction personnel will continuously monitor operations during drilling activities.
 - 1. Visual inspection along the drill path, including monitoring the water body for evidence of a release.
 - 2. Continuous examination of drilling fluid pressures and returns flows.

4.0 NOTIFICATION PROCEDURES

- A. If in the course of an inspection an inadvertent release is discovered, steps will be taken by construction personnel to contain the release as described in Section 5.0, Corrective Action and Cleanup.
- B. If monitoring indicates an in-stream release, the Project Engineer will immediately notify the appropriate Federal and State agencies as soon as possible by telephone and/or facsimile of an in-stream release event, detailing the nature of the release and corrective actions being taken. The notified agencies will determine whether additional measures need to be implemented.
- C. If a release occurs that may migrate downstream and affect water quality, downstream water users will be contacted.

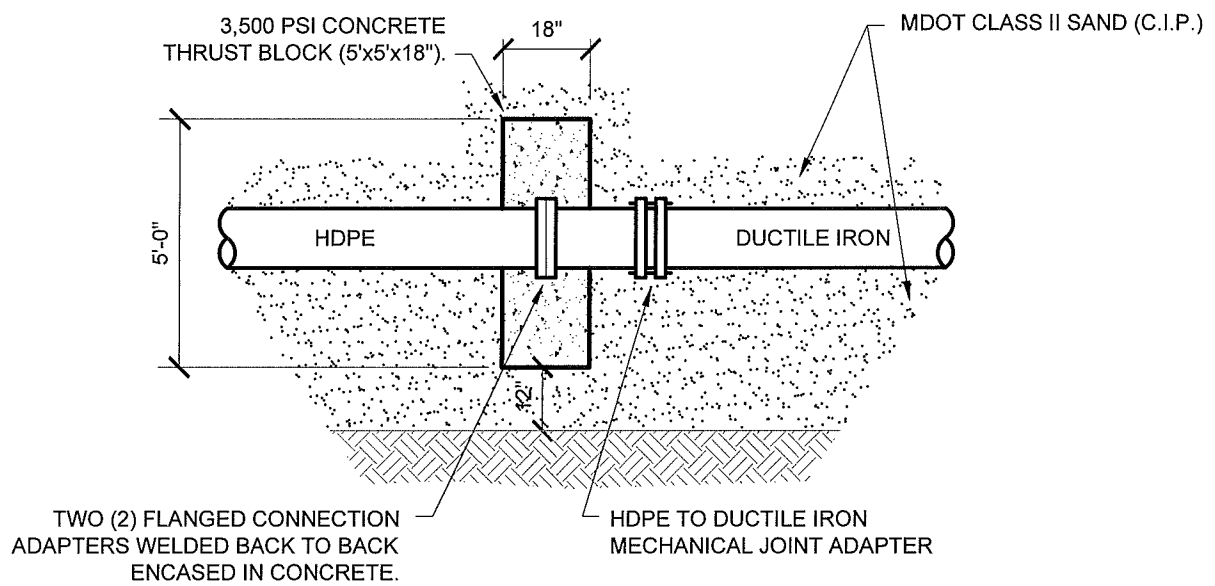
5.0 CORRECTIVE ACTION AND CLEANUP

- A. By monitoring drilling operations continuously, it is intended to correct problems before they occur. In addition, containment equipment including earth-moving equipment, portable pumps, hand tools, sand, hay bales, silt fence, lumber, and a suction dredge will be readily available at the drill site. If a release does occur, the following measures will be implemented to stop or minimize the release and to clean it up.
 - 1. The drilling contractor will decide what modifications to make to the drilling technique or composition of drilling fluid (e.g., thickening of fluid by increasing bentonite content) to reduce or stop minor losses of drilling fluid.
 - 2. If a minor bore path void is encountered during drilling, making a slight change in the direction of the bore path may avoid loss of circulation.
 - 3. If the bore head becomes lodged resulting in loss of drilling pressure, the borehole may be sized by moving the bore head back and forth to dislodge the stuck materials.
 - 4. If necessary, drilling operations will be reduced to assess the extent of the release and to implement other possible corrective actions.
 - 5. If public health and safety are threatened, drilling fluid circulation pumps will be turned off. This measure will be taken as a last resort because it increases the potential for drill hole collapse resulting from loss of down-hole pressure.
 - 6. If a land release is detected, the drilling crew will take immediate corrective action to contain the release and to prevent migration off site.
 - 7. The contractor will construct pits and berms around the borehole entry point to contain inadvertent releases onto the ground.
 - 8. Any drilling mud released into the pits will be pumped by contractor personnel into a mud-processing unit for recycling of drilling fluid and separation of cuttings.
 - 9. Additional berms will be constructed around the bore pit as directed by the Project Engineer to prevent release materials from flowing into the water body.

10. If the amount of an on-land release does not allow practical collection, the affected area will be diluted with fresh water and allowed to dry. Steps will be taken (such as berm, silt fence, and/or hay bale installation) to prevent silt-laden water from flowing into the water body.
11. If hand tools cannot contain a small on-land release, small collection sumps (less than 5 cubic yards) may be constructed to pump the released material into the mud processing system.
12. Contractor HDD crews will immediately implement non-mechanized measures to contain the spread of drilling fluids, including the installation of hay bales or silt fence.
13. Sump pumps or vacuum trucks will be used to remove and dispose of any drilling fluids.

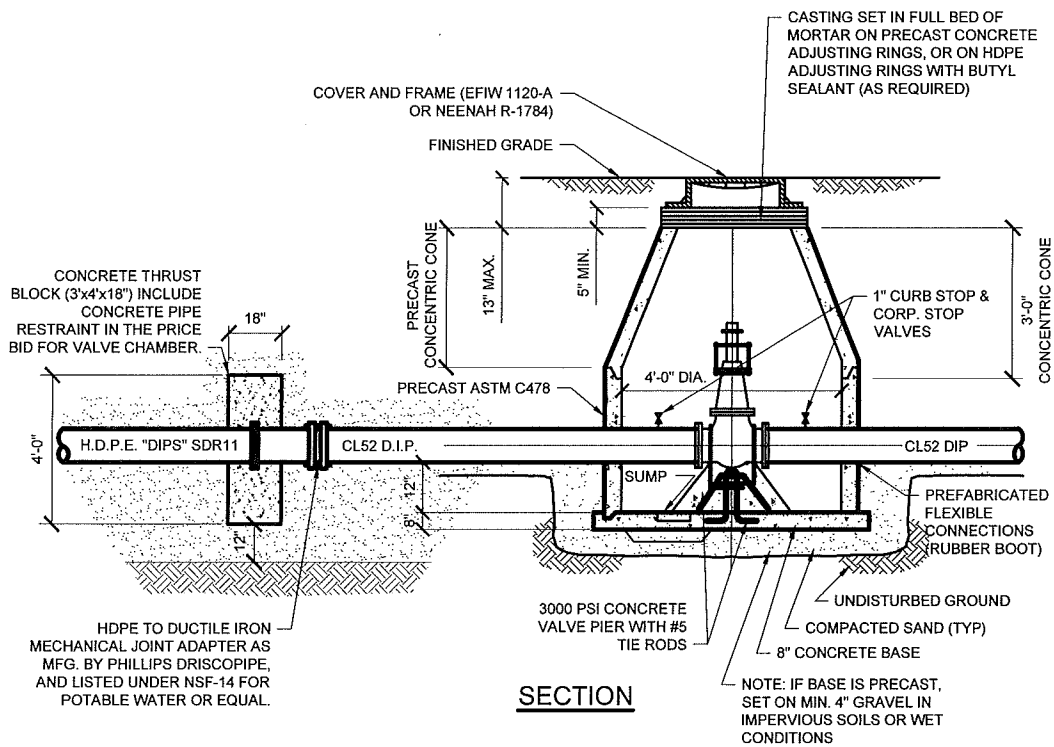
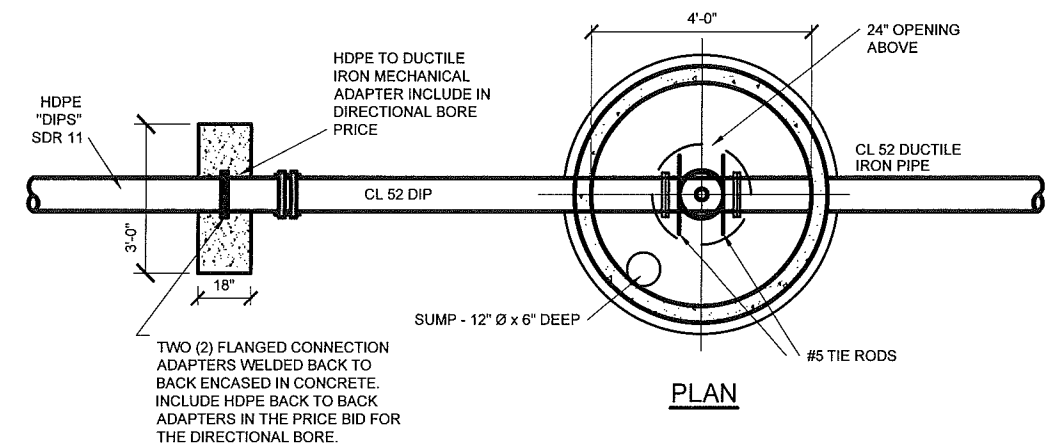
6.0 ABANDONMENT

- A. If corrective actions do not prevent or control releases from occurring into the water body, the HDD Contractor may opt to re-drill the hole along a different alignment or suspend the Project altogether. In either case, the following procedures will be implemented to abandon the drill hole.
 1. The method for sealing the abandoned drill hole is to pump thickened drilling fluid into the hole as the drill assembly is extracted, and using cement grout to make a cap.
 2. Closer to the surface of the hole(s) (within approximately 10 feet of the surface), a soil cap will be installed by filling with soil extracted during construction of the pit and berms.
 3. The bore hole entry location will be graded by the contractor to its original grade and condition after the drill hole has been abandoned.



HDPE TO DUCTILE IRON MECHANICAL JOINT ADAPTER DETAIL

NOT TO SCALE



HDPE TO DIP CONNECTION

SECTION 02800

SURFACE PROTECTION AND RESTORATION

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required for protection and restoration of surface features such as site improvements and all trees, shrubs, lawns and other landscape features.
- B. Definition of Site Improvements: Fences, retaining walls, parking appurtenances, playing fields and equipment, sheds, mail boxes, lawn sprinkling systems, landscaping, yard lights and yard accessories.

1.02 REFERENCES:

- A. MDOT - Michigan Department of Transportation, *"Standard Specifications for Construction", Current Edition.*

1.03 JOB REQUIREMENTS:

- A. Lawn Areas Disturbed by Construction Operation shall be as follows:
 - 1. Restoration: Fine grade to 4 inches below finish elevations. Remove all stones and debris greater than 1-inch diameter. Place 4 inches of new topsoil, and heavy duty hydroseed and mulch.
 - 2. Install mulch blanket as directed.
- B. Scheduling:
 - 1. Restoration of lawns and other surface features: Promptly following curb and gutter, site improvements and paving.
 - 2. Restoration of site improvements: Promptly following utility installation.
 - 3. Clean up: Promptly following restoration.
- C. Seasonal Limitations: MDOT 816.03.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Trees, shrubs and Plants: MDOT 917.
- B. Topsoil: MDOT 917.
- C. Chemical Fertilizer: MDOT 917. Phosphorus not allowed.
- D. Grass Seed: MDOT 917.12.
 - 1. Lawns: Mixture THM.
 - 2. Other areas: Mixture THV.
- E. Sod: MDOT 917.13.
- F. Mulch Blanket: Excelsior or straw mulch blanket, MDOT 917.15, anchored in place only with wood stakes.

- G. Site Improvements: Provide materials equal to or better than those that existed prior to start of construction whether shown or not shown on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Inspection: Approval required.

3.02 TREES AND SHRUBS:

- A. Protection: All items not indicated for removal.
- B. Damaged branches: Trim and seal within fifteen (15) days.
- C. Replacement: MDOT 815. Place mulching around tree with diameter one foot greater than ball diameter.
- D. Maintain a clear space of ten feet (10') around all existing and proposed fire hydrants.

3.03 TOPSOIL:

- A. Place new topsoil in preparation of seeding or sodding. Remove all stones and debris larger than 1-inch diameter.
- B. Construction methods: MDOT 816.03.

3.04 SEEDING:

- A. Construction methods: MDOT 816.03 except with the following rates:
1. Topsoil: 4 inches of new topsoil.
 2. Heavy duty hydroseed.
 3. Heavy duty hydromulch.

3.05 SODDING:

- A. Construction Methods: MDOT 816.03 with 4-inch topsoil.

3.06 SITE IMPROVEMENTS:

- A. Protection: All items not indicated for removal.
- B. Restoration: Approval required.

3.07 SURFACE RESTORATION:

- A. Seed: Backfill with site soil, place new topsoil, fine grade, remove stones larger than 1 inch, clay lumps, wood, debris and other extraneous materials, provide hydraulic seeding.
- B. Sod: Grade backfill to smooth subgrade, place and fine grade new topsoil, place Class A sod, fertilizer, water and roll into new topsoil.

SECTION 13425

PEDESTRIAN BRIDGE

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. This Section includes the design, furnishing, erection, testing and placing in service of a pedestrian bridge intended to carry pedestrian and bicycle traffic.

1.02 REFERENCES:

A. General:

1. Bridge shall be designed, fabricated and constructed in accordance with the AASHTO Guide Specifications for Pedestrian Bridges and the AASHTO Guide Specifications for Highway Bridges where applicable.

B. The work of this Section shall comply with the following references:

1. AASHTO HB-17– Standard Specification for Highway Bridges, Latest Edition
2. AASHTO GSDPB – LRFD Guide Specifications for Design of Pedestrian Bridges, Latest Edition
3. AASHTO GSDFPB – Guide Specifications for Design of FRP Pedestrian Bridges, Latest Edition
4. Michigan Building Code, Latest Edition
5. AWS D1.1 – Structural Welding Code, Latest Edition
6. AWS D1.5 – Bridge Welding Code, Latest Edition
7. ACI 318 – Building Code and Commentary, Latest Edition
8. AISC – Manual of Steel Construction, Latest Edition
9. AITC TCM–Timber Construction Manual, Latest Edition
10. NDS – National Design Standard for Wood Construction, Latest Edition
11. ASCE 7 – Minimum Design Loads for Buildings and other Structures, Latest Edition
12. PCI - Pre-stressed Concrete Institute:
 - a) MNL-116 - Manual for Quality Control for Plants and Production of Precast Pre-stressed Concrete Products.
 - b) MNL-127 - Recommended Practice for Erection of Precast Concrete.
13. ASTM Standard Specifications:
 - a) A 185 - Steel Welded Wire Fabric. Plain, for Concrete Reinforcement.
 - b) A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - c) C 33 - Concrete Aggregates.
 - d) C 150 - Portland Cement.
 - e) A123 - Standard Specifications for Zinc (hot dip galvanizing) coatings on iron and steel products.

1.03 SUBMITTALS:

A. Signed and sealed design calculations, specifications, plans and detail drawings.

1. Prepared by a Professional Engineer registered in Michigan.
2. Submit for:
 - a. Foundation
 - b. Bridge Structure
 - c. Bridge Railings
3. Obtain ENGINEER's review prior to proceeding with fabrication and construction.

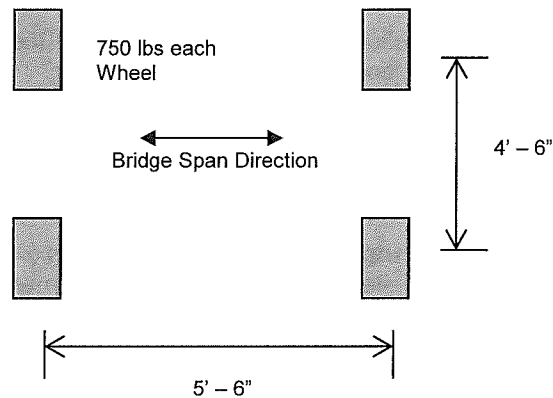
- B. Welder's qualifications and certification.
- C. Structural steel certified steel mill test reports and certification.
- D. Concrete reinforcing steel certified mill steel test report.
- E. Concrete mix design.
- F. Concrete reinforcing steel schedule and layout drawing.
- G. Precast Concrete test reports
- H. Prestressing strand certifications.
- I. Soils report for foundation design.

1.04 GUARANTEE:

- A. Bridge Contractor shall guarantee the structure against any defects in materials or workmanship for a period of one year from the date of completion. If any defect is discovered and reported to the Contractor during the guarantee period, the Contractor shall make the necessary repairs without charge to the owner.

1.06 DESIGN REQUIREMENTS:

- A. Design Loads:
 - 1. Dead load: Structure load including decking
 - 2. Live load: 85 pounds per square foot uniformly distributed. Reductions in live load will be allowed for contributory area exceeding 400 square feet in accordance with the AASHTO Specification. In no case shall the live load be less than 65 pounds per square foot.
 - 3. Snow load: Calculated per ASCE 7 acting in combination with the live load
 - 4. Wind load: Calculated per AASHTO Specification
 - 5. Concentrated load: The bridge structure shall be designed for each of the following point load conditions:
 - 6. A concentrated load of 1000 pounds placed on any area 2 feet x 2 feet square.
 - 7. A 3000 pound 4-wheel vehicle as shown in the following diagram placed on the structure to provide the most critical loading.



8. Construction loads: All other associated loads experienced during construction such as equipment, workers, steel rigging and erecting methods.

B. Hydraulic Capacity:

1. For bridges over water the clear opening of the structure shall be designed to pass the 100 yr storm with a minimum of one foot of freeboard to the low beam elevation.
2. The span of the structure shall be set to clear the channel and to minimize scour of the abutments and footings. Where scour counter measures are required, such as sheet piling or rip rap shall be utilized.

C. Abutments:

1. The bridge abutments shall be constructed using cast in place steel reinforced concrete.

D. Foundation:

1. Design the foundation based on the results of a soil investigation report and foundation recommendations provided by geotechnical engineer registered in the State of Michigan.

E. Railings:

1. Railings shall be designed to resist a 50 lb/ft linear load applied to any member in from any direction and a nonconcurrent 200 lb point load applied in any direction to the top of the rail.
2. Railing posts shall be spaced at a maximum of 5'-0" on center.

F. Structure Dimensions:

1. The Minimum clear width for the structure as measured from face of curb to face of curb shall be 8 feet.
2. The bridge shall be cambered for dead load of the bridge and 1% of the span length. The camber shall not exceed the maximum grades specified for ADA compliance.

G. Deflection:

1. The vertical deflection of the main span due to the pedestrian load shall not exceed 1/500 of the span length.
2. The horizontal deflection of the main span shall not exceed 1/500 of the span under an 85-mph wind load.

1.07 PERMITS:

- A. The CONTRACTOR shall obtain all permits required for the structure including but not limited to the MDEQ Inland Lakes and Streams Army Corps of Engineers Joint Permit, SESC permit and applicable County Road Commission and Drain Commission permits.

PART 2 - PRODUCTS

2.01 BRIDGE:

A. Foundation:

1. Foundation shall consist of reinforced concrete spread footings or piles as recommended in the soil's investigation report.
2. Foundation concrete shall have a minimum 3500 psi compressive strength.

B. Abutments:

1. Abutments shall be constructed of reinforced cast in place concrete with minimum 3500 psi compressive strength.

C. Bearings:

1. The proposed bridge shall include bearing devices designed for the rotational movements of the bridge due to dead and live loads as well as the anticipated thermal expansion and contraction movements of the structure.
2. Anchor rods shall be provided at the bearing points of the bridge to resist the design reactions at the bearing points.

2.02 ATTACHMENTS:

A. Safety Railings:

1. Vertical safety rails or pickets shall be placed on the structure to a minimum height above the deck surface of 54 inches. The pickets shall be placed as to prevent a 4-inch diameter sphere from passing through the railing.
2. Railings shall extend off of the structure where required for approach slopes in excess of 1 on 3 or where required for fall protection from vertical drops.

B. Handrail:

1. The bridge shall have a handrail on each side of the structure meeting ADA requirements.

C. Rubrail:

1. The bridge design shall include a 6-inch-high rubrail located along each side of the structure at deck level. The rubrail shall be designed and located to protect the structure and handrails during snowplowing operations.
2. The design of the rubrail and placement shall not impede stormwater runoff from the structure.

D. Paint:

1. Steel structures shall be constructed with unpainted weathering steel with a minimum corrosion index of 6.0, determined in accordance with ASTM G101.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Coordinate Site access and staging area with ENGINEER prior to mobilization.

3.02 ERECTION:

- A. Erect in accordance with bridge manufacturer's Shop Drawings and these Specifications.
- B. Remove all lifting lugs and other devices used for the purpose of bridge erection.

END OF SECTION

Sewer/Water Utility - Trace Wire Specification

Materials

General

All trace wire and trace wire products shall be domestically manufactured in the U.S.A.

All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Trace wire

- **Open Trench** - Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Directional Drilling/Boring** - Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Trace wire – Pipe Bursting/Slip Lining** - Trace wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

Connectors

- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
- **Direct bury wire connectors** – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- Non locking friction fit, twist on or taped connectors are prohibited.

Termination/Access

- All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
- A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
- All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
- Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

Sewer/Water Utility - Trace Wire Specification

- **Service Laterals on public property** - Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
- **Service Laterals on private property** - Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.
- **Hydrants** – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable)
- **Long-runs, in excess of 500 linear feet without service laterals or hydrants** - Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked.

Grounding

- Trace wire must be properly grounded at all dead ends/stubs
- Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
- When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
- When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

Installation

General

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

Sewer/Water Utility - Trace Wire Specification

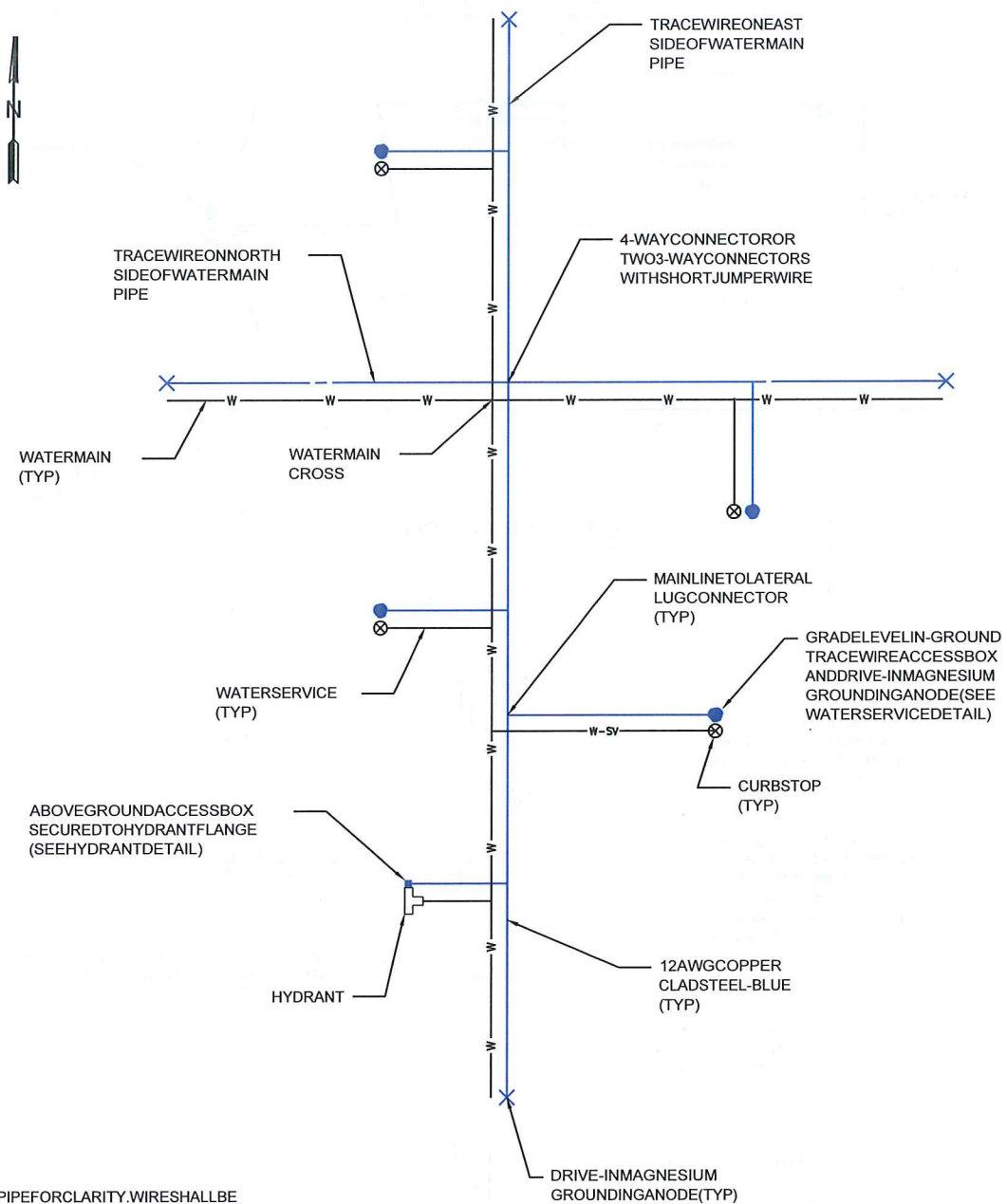
- Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
- Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.
- Trace wire must be properly grounded as specified.
- Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)
- At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)
- Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.
- All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.
- In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

Sanitary Sewer System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.
- Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right of way.

Water System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.
- Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right of way.
- Above-ground tracer wire access boxes will be installed on all fire hydrants.
- All conductive and non-conductive service lines shall include tracer wire.




NOTES:
 1. WIRES SHOWN AWAY FROM PIPE FOR CLARITY. WIRES SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRES SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

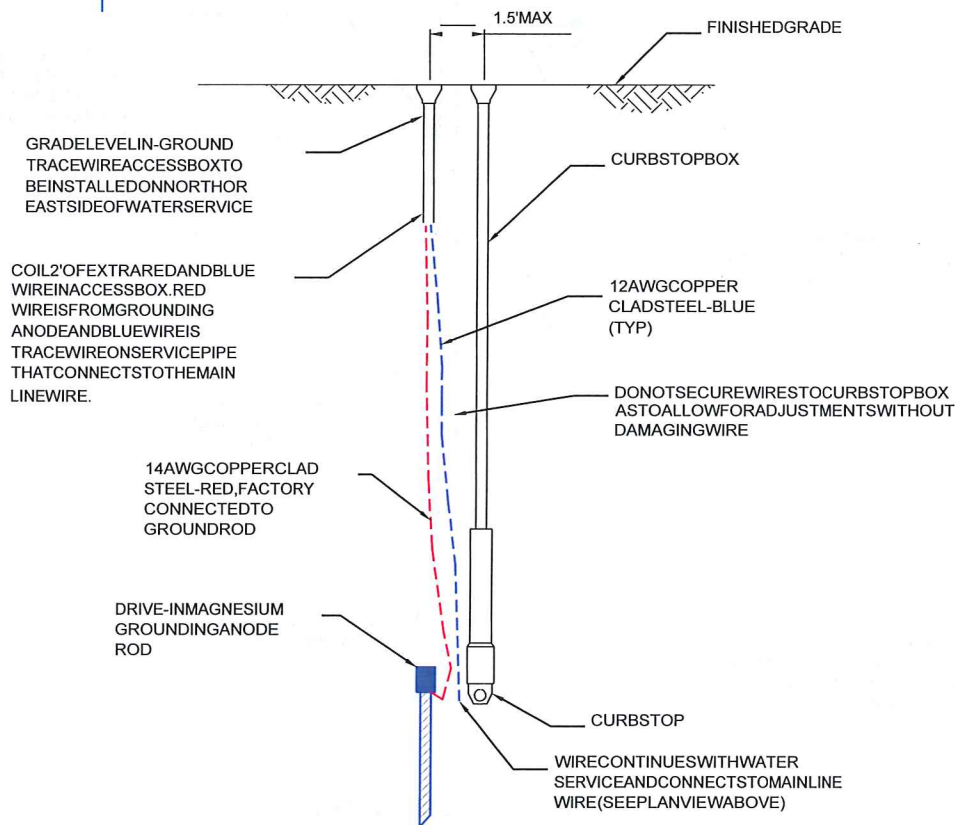
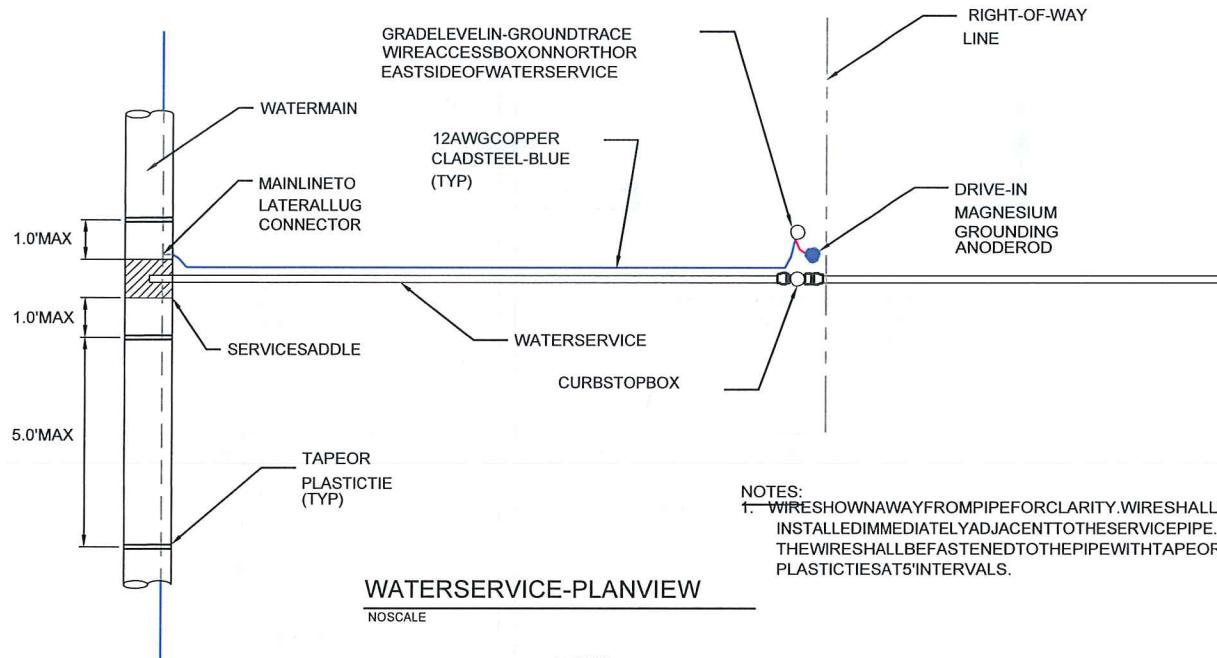
TRACE WIRE PLAN (WATER)
 NOSCALE

MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACE WIRE
SAMPLE WATER PLAN

May 28, 2014

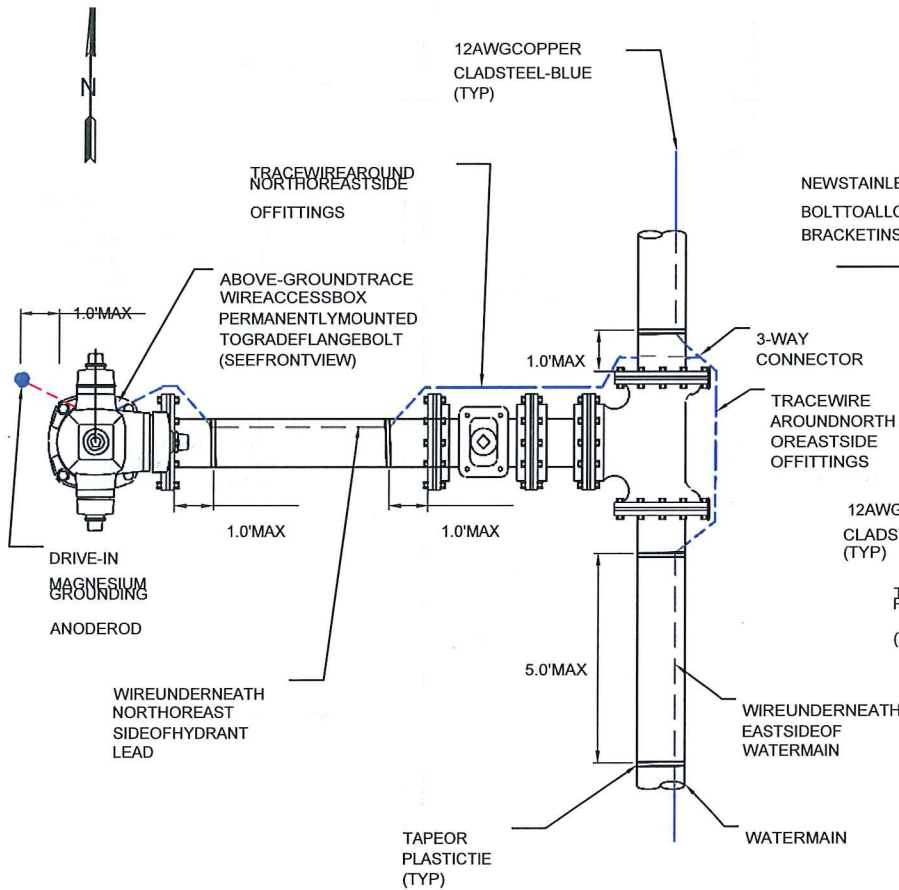




MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

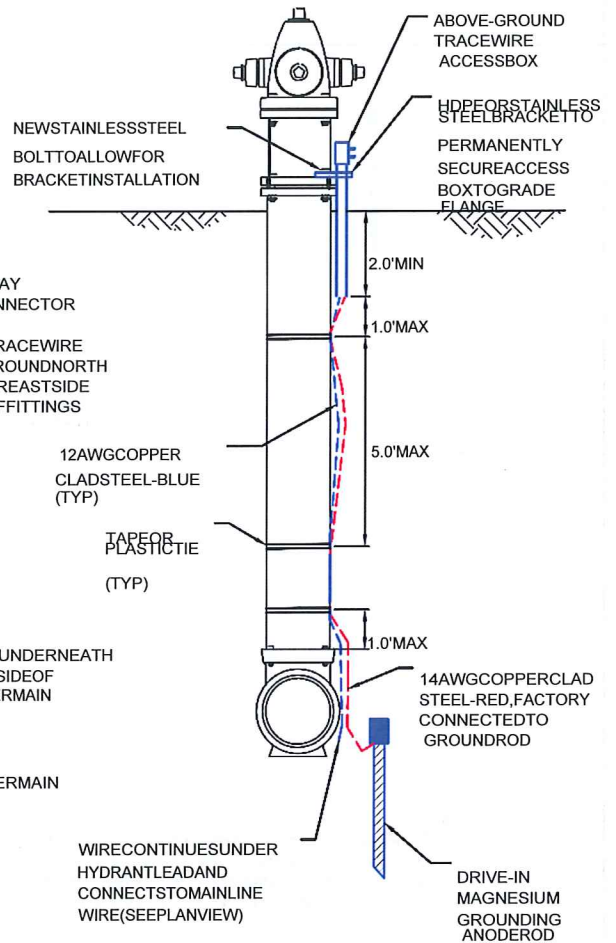
TRACE WIRE
WATER SERVICE DETAIL

May 28, 2014



HYDRANT-PLAN VIEW

NO SCALE



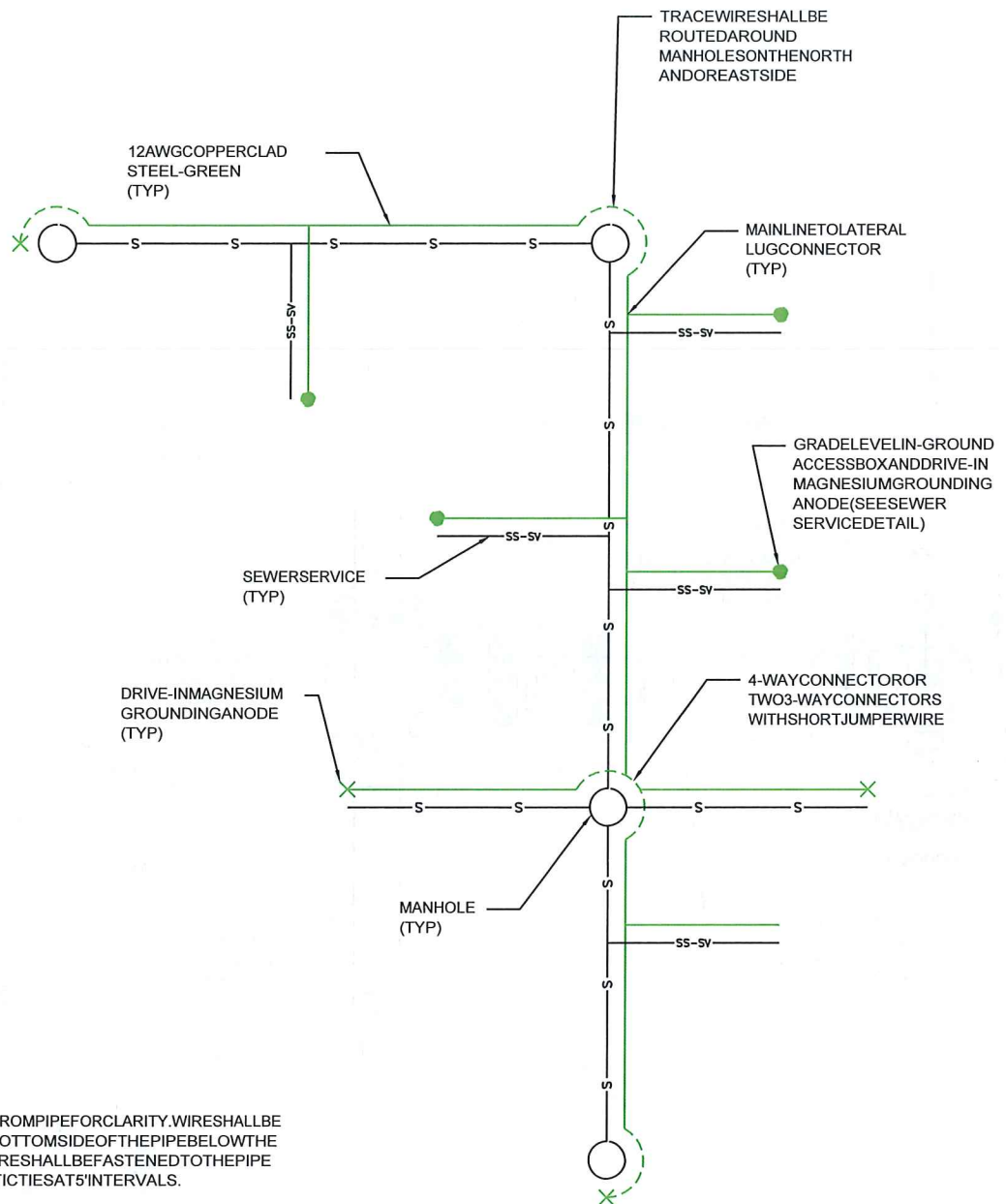
HYDRANT-SECTION VIEW

NO SCALE



MICHIGAN
RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACEWIRE
HYDRANT DETAIL



NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRINGLINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

TRACE WIRE PLAN (SEWER)

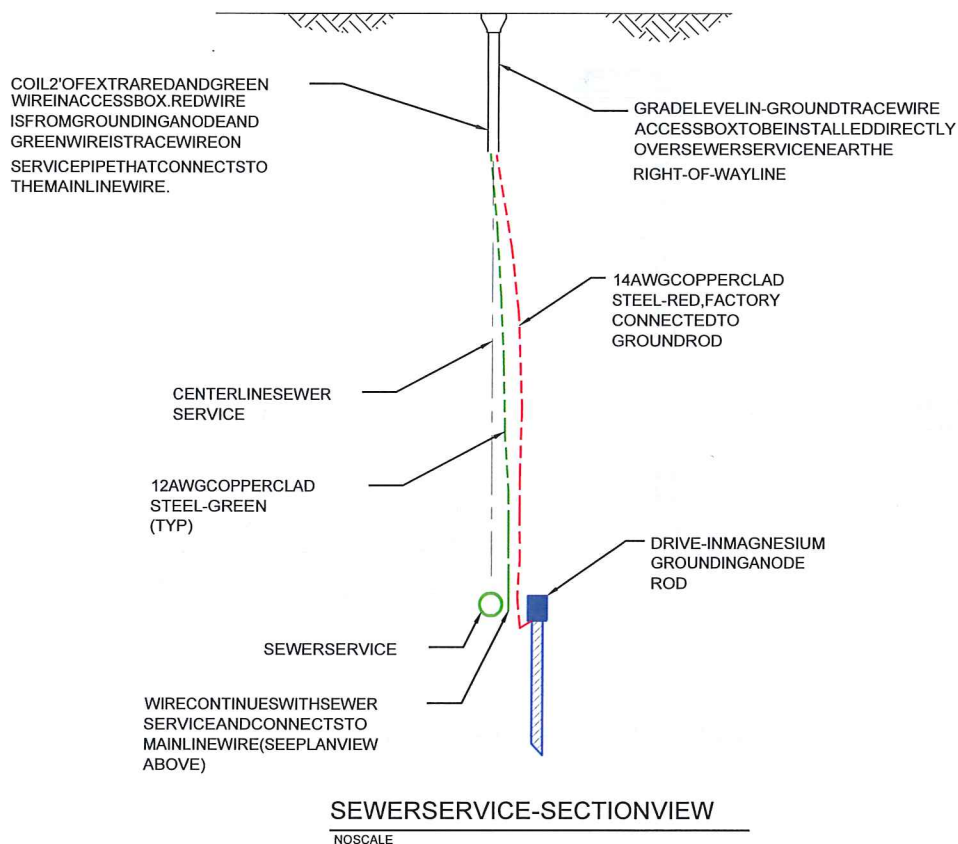
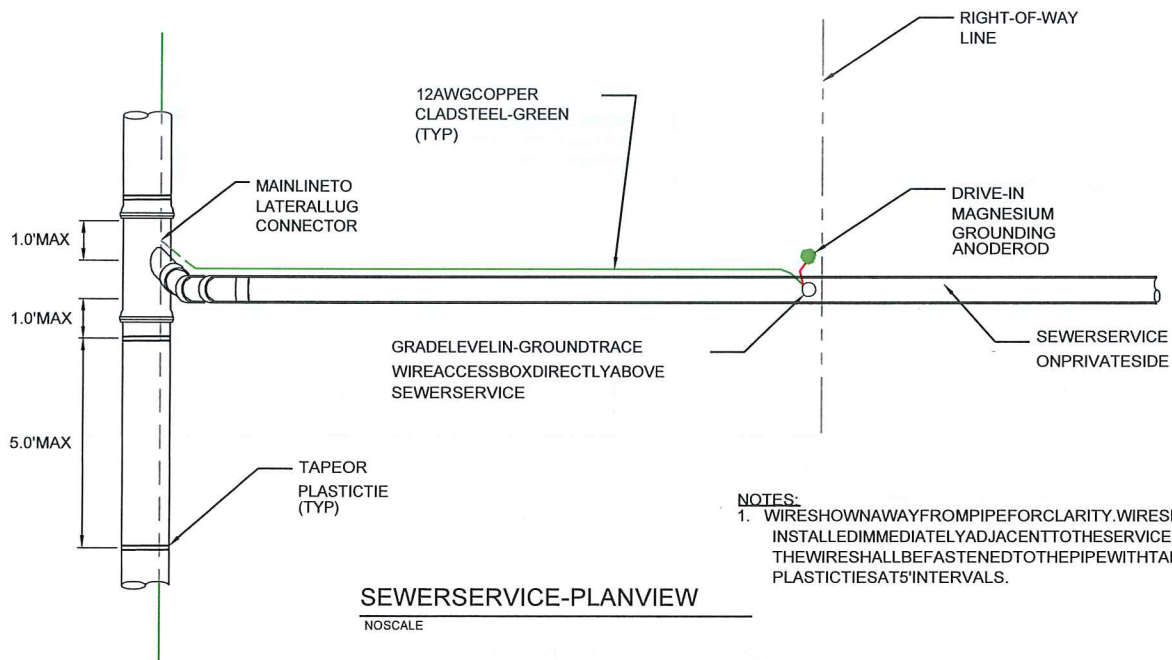
NOSCALE



MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACE WIRE
SAMPLE SEWER PLAN

May 28, 2014



MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACEWIRE
SEWER SERVICE DETAIL

May 28, 2014

MAINLINETOGROUNDING
ANODELUGCONNECTOR

14AWGCOPPERCLAD
STEEL-RED,FACTORY
CONNECTEDTO
GROUNDROD

DRIVE-INMAGNESIUM
GROUNDINGANODE
ROD

TRACEWIRESHALLBE
ROUTEDAROUND
MANHOLESINTHENORTH
ANDOREASTSIDE



TAPEOR
PLASTICTIE
(TYP)

12AWGCOPPER
CLADSTEEL-GREEN
(TYP)

5.0'MAX

1.0'MAX

SEWERMANHOLE-PLANVIEW

NOSCALE

MAINLINETOMAGNESIUM
GROUNDINGANODELUG
CONNECTOR

DRIVE-INMAGNESIUM
GROUNDINGANODE
ROD

TAPEOR
PLASTICTIE
(TYP)

12AWGCOPPER
CLADSTEEL-GREEN
(TYP)

5.0'MAX

1.0'MAX

SEWERMANHOLE-SECTIONVIEW

NOSCALE

MICHIGAN RURAL WATER ASSOCIATION
STANDARDDETAIL



TRACEWIRE
SEWERMANHOLEDETAIL

May28,2014