Technical Specifications

North 33rd Street
Transmission Main

City of Kalamazoo

2022

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ENGINEERS, LTD.

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TECHNICAL SPECIFICATIONS

APPENDIX

NOTES:
The *City of Kalamazoo - Standard Specifications for Water Main and Service Installation 2021* shall supersede these Technical Specifications where conflicting information occurs.

IF ANY OF THE PAGES LISTED ABOVE ARE NOT INCLUDED IN THESE CONTRACT DOCUMENTS, PLEASE ADVISE.

END OF SECTION

SECTION 01010
DEFINITION OF CONTRACT ITEMS

PART 1 GENERAL

1.01 FOREWORD

A. This Section describes the various Contract Items listed in the Bid.

1.02 WORK INCLUDED

A. Under each Item the Contractor shall furnish all labor, materials, tools, equipment, supplies, maintenance of equipment, heating, lighting and power, insurance and bonds, coordination, and all Work and in accordance with the Specifications Divisions 1 through 16 and the City of Kalamazoo *Standard Specifications for Water Main and Service Installation 2021* necessary to complete the Work in accordance with the obvious or expressed intent of the Contract Documents.

1.03 WORKMANSHIP AND MATERIALS

A. The quality of workmanship and materials entering into any and all of the Items and the Work included shall conform to pertinent sections, paragraphs, sentences, and clauses, both directly and indirectly applicable thereto, contained in the Contract Documents, whether or not direct reference to such occurs under each Item in this Section.

1.04 PAYMENT

A. The lump sum and unit prices stated in the Bid shall be payment in full for the completion of all Work specified and described or required to be included in the Contract, complete, and ready for use.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 SPECIAL PROVISIONS

4.01 CONTRACT ITEMS

A. The contract items are defined on the following pages.

ITEM 1
GENERAL CONDITIONS/MOBILIZATION

1.01 DESCRIPTION

A. This Item is intended to pay non-recurring cost to the Contractor not recovered under other pay Items of the Contract.

B. This Item shall include, but not be limited to, the cost for moving equipment in and out, performance and payment bonds, insurance, permits, utility connection cost, and other expenses associated with preparation for construction in accordance with the requirements of the Contract Documents.

1.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

1.03 DEFINITION OF ITEM

A. Item 1 - Includes General Conditions/Mobilization.

1.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 1.

B. Mobilization for Contractor and any tier of subcontractor(s) shall be considered collectively and shall not exceed 10 percent of the Contract Price.

C. Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup and demobilization. Mobilization does not include items such as contract negotiations and bid preparation.

1.05 PAYMENT

A. General Conditions/Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup and demobilization.

B. The Engineer may reduce the amount to be paid under Item 1 if the percentage requested is not represented by the actual amount performed.

ITEM 2
TRAFFIC CONTROL

2.01 DESCRIPTION

A. Under this Item, the Contractor shall provide, mobilize, and temporarily install all traffic signage and equipment necessary to complete the project as described in the specifications and plans.

B. The Contractor shall provide a traffic control plan and obtain all permits as necessary and required by all local governing agencies with appropriate jurisdiction.

2.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

2.03 DEFINITION OF ITEMS

A. Item 2 –Includes Traffic Control.

2.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 2.

2.05 PAYMENT

A. The lump sum unit price stated in the Bid shall be full compensation for traffic control as required.

ITEM 3
AUDIO/VIDEO RECORDING

3.01 DESCRIPTION

A. Under this item, the Contractor shall produce and deliver to the Owner, color audio-video recordings of existing topography within the zone of influence along all water main and areas of pavement work as specified and directed.

3.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

3.03 DEFINITION OF ITEMS

A. Item 3 – Audio/Video Recording includes audio-video recording of the Zone of Influence (Construction Limits).

3.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 3.

3.05 PAYMENT

A. The lump sum unit price stated in the Bid for Item 3 shall be full compensation for audio-video recording production as specified and required.

ITEM 4
CLEARING & GRUBBING

4.01 DESCRIPTION

A. This Item shall include all clearing and grubbing of lands required to complete the Work as specified, shown in the Contract Documents, and as directed by the Engineer. This Work shall include, but not be limited to, the complete removal of all vegetation including plants, shrubs, sod, agricultural crop residue, trimming and cutting of trees with trunk diameter less than 6-inches, removal of tree cuttings and stumps unless otherwise specified, scalping and the removal and disposal of all debris generated by the clearing and grubbing operation as specified and shown on the Drawings.

4.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

4.03 DEFINITION OF ITEMS

A. Item 4 - Clearing and Grubbing, includes the complete removal of all vegetation including plants, shrubs, sod, agricultural crop residue, removal of existing stumps, scalping, and the removal of all debris generated by the clearing and grubbing operation.

1. Tree removal of trees with trunk diameter of 6-inch and less shall be considered part of clearing and grubbing operations.
2. Stump removal of stumps with trunk diameter of 12-inches and less shall be considered part of clearing and grubbing operations.

4.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 4 - Clearing and Grubbing.

4.05 PAYMENT

A. The lump sum unit price stated in the Bid for Item 4 - Clearing and Grubbing shall be made in the amount of a percent of the lump sum Bid price for Item 4 - Clearing and Grubbing consistent with the percentage of Work completed.

ITEMS 5, 6, 7, & 8
TREE REMOVAL AND STUMP REMOVAL

5.01 DESCRIPTION

A. Under this Item, the Contractor shall perform all Work necessary for the removal of trees with trunk diameter 6 inches and greater, removal of tree cuttings and stumps, and the removal and disposal of all debris generated by tree cutting operations as specified and shown on the Drawings.

B. This Item shall include the removal of stumps with trunk diameter greater than 12 inches as specified and shown on the Drawings.

5.02 WORK NOT INCLUDED

A. Any work specifically included under other Bid Items.

5.03 DEFINITION OF ITEMS

A. Item 5 - Tree, Rem, 6-inch to 18-inch, shall be the cutting of trees with trunk diameter 6 inches to 18 inches, removal of tree cuttings and stumps.

B. Item 6 - Tree, Rem, 19-inch to 36-inch, shall be the cutting of trees with trunk diameter 19 inches to 36 inches, removal of tree cuttings and stumps.

C. Item 7 - Tree, Rem, 36-inch and larger, shall be the cutting of trees with trunk diameter larger than 36 inches, removal of tree cuttings and stumps.

D. Item 8 - Stump Removal, shall be the complete removal of existing stumps with diameter 12 inches and larger.

5.04 MEASUREMENT

A. The quantities to be paid for under Items 5, 6, & 7 - Tree Removal shall be measured by the quantity of trees with trunk of specified diameter measured 4 feet above ground height removed.

B. The quantity to be paid for under Item 8 - Stump Removal shall be measured by the quantity of stumps with specified diameter removed.

5.05 PAYMENT

A. The unit price stated in the bid for Item 5 - Tree, Rem, 6-inch to 18-inch shall be full compensation for each tree removed and disposed of as specified and required.

B. The unit price stated in the bid for Item 6 - Tree, Rem, 19-inch to 36-inch shall be full compensation for each tree removed and disposed of as specified and required.

C. The unit price stated in the bid for Item 7 - Tree, Rem, 36-inch and larger shall be full compensation for each tree removed and disposed of as specified and required.

D. The unit price stated in the bid for Item 8 - Stump Removal shall be full compensation for each stump removed and disposed of as specified and required.

ITEM 9
CURB REMOVAL

9.01 DESCRIPTION

A. Under this item, the Contractor shall remove curb and gutter.

9.02 WORK NOT INCLUDED

A. Curbs and gutters damaged or destroyed beyond the specified limits shall be replaced at the Contractor's expense.

B. Any Work specifically included under other Bid Items.

9.03 DEFINITION OF ITEMS

A. Item 9 – Curb Removal, includes curb and gutter removal.

9.04 MEASURMENT

A. Quantities to be paid for under this item shall be the actual linear footage quantity removed, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer, in which case measurement will be made to the authorized limits.

9.05 PAYMENT

A. The unit price stated in the Bid for Item 9 shall be for each linear foot of curb and gutter removed within the prescribed limits as specified, so measured.

ITEMS 10, 11, & 12
CURB & GUTTER

10.01 DESCRIPTION

A. Under this Item, the Contractor shall construct concrete curb and gutter.

10.02 WORK NOT INCLUDED

A. Curb and gutter damaged or destroyed beyond the specified limits shall be replaced at the Contractor's expense.

B. Any Work specifically included under other Bid Items.

10.03 DEFINITION OF ITEMS

A. Item 10 - Includes construction of MDOT B2 Curb and Gutter.

B. Item 11 - Includes construction of MDOT D2 Curb and Gutter.

C. Item 12 - Includes construction of MDOT F4 Curb and Gutter.

10.04 MEASUREMENT

A. Quantities to be paid for under Items 10, 11, & 12 shall be the actual quantity constructed, measured in place by linear length at the back of the curb, within the limits as scheduled and shown on the Drawings, unless otherwise authorized by the Engineer, in which case measurement will be made to the authorized limits.

10.05 PAYMENT

A. The unit price stated in the bid for Item 10 shall be full compensation for each linear foot of MDOT B2 Curb and Gutter installed in accordance with the Specifications and Drawings.

B. The unit price stated in the bid for Item 11 shall be full compensation for each linear foot of MDOT D2 Curb and Gutter installed in accordance with the Specifications and Drawings.

C. The unit price stated in the bid for Item 12 shall be full compensation for each linear foot of MDOT F4 Curb and Gutter installed in accordance with the Specifications and Drawings.

ITEM 13
PAVEMENT REMOVAL

13.01 DESCRIPTION

A. Under this Item, the Contractor shall remove pavement, including the aggregate base as scheduled, shown on the Drawings, and specified herein.

13.02 WORK NOT INCLUDED

A. Pavement removal required beyond specified construction limits and items included for payment under other items.

B. Pavement and curb and gutters damaged or destroyed beyond specified pay limits shall be replaced at the Contractor's expense.

C. Any work specifically included under other Bid Items.

13.03 DEFINITION OF ITEMS

A. Item 13 - Pavt, Rem, Mod includes complete pavement removal including the aggregate base.

13.04 MEASUREMENT

A. Quantities to be paid for under this item shall be the actual square yardage quantity removed, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer, in which case measurement will be made to the authorized limits.

13.05 PAYMENT

A. The unit price stated in the Bid for Item 13 shall be full compensation for each square yard of pavement removed within the prescribed limits as specified, so measured.

ITEMS 14, 15, 16, & 17
DRIVEWAY REMOVAL

14.01 DESCRIPTION

A. Under these Items the Contractor shall remove driveways including bituminous pavement, concrete pavement, and gravel, and the aggregate base as scheduled, shown on the Drawings, and specified herein.

B. Brick paver driveways shall be removed and salvaged for reuse as shown on the Drawings and specified herein.

14.02 WORK NOT INCLUDED

A. Driveway removal required beyond specified construction limits and items included for payment under other items.

B. Pavement and curb and gutters damaged or destroyed beyond specified pay limits shall be replaced at the Contractor's expense.

C. Any work specifically included under other Bid Items.

14.03 DEFINITION OF ITEMS

A. Item 14 - Driveway, Rem, Bit includes complete pavement removal of bituminous driveways, including the aggregate base.

B. Item 15 - Driveway, Rem, Gravel includes complete removal of gravel driveways.

C. Item 16 - Driveway, Rem, Conc includes complete removal of concrete driveways, including the aggregate base.

D. Item 17 - Driveway, Rem, Brick includes complete removal and salvage of bricks for reuse and the removal of the aggregate base.

14.04 MEASUREMENT

A. Quantities to be paid for under these items shall be the actual square yardage quantity removed, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer, in which case measurement will be made to the authorized limits.

14.05 PAYMENT

A. The unit price stated in the Bid for Item 14 shall be full compensation for each square yard of bituminous driveway removed within the prescribed limits as specified, so measured.

B. The unit price stated in the Bid for Item 15 shall be full compensation for each square yard of gravel driveway removed within the prescribed limits as specified, so measured.

C. The unit price stated in the Bid for Item 16 shall be full compensation for each square yard of concrete driveway removed within the prescribed limits as specified, so measured.

D. The unit price stated in the Bid for Item 17 shall be full compensation for each square yard of brick driveway removed and salvaged within the prescribed limits as specified, so measured.

ITEM 18
WETLAND UNDERCUTTING

18.01 DESCRIPTION

A. Under this item, the Contractor shall remove excess unsuitable soils in wetland areas beyond ordinary limits for water main trench excavation in order to construct required embankment.

18.02 WORK NOT INCLUDED

A. Trench excavation to ordinary depths for water main shall be included under other Bid Items.

B. Excavation beyond the limits shown on the drawings or not otherwise authorized by the engineer shall be considered unauthorized excavation and shall be at the Contractor's expense.

C. Any Work specifically included under other Bid Items.

18.03 DEFINITION OF ITEMS

A. Item 18 – Wetland Undercutting includes removal of excess wetland soils in order to install water main embankment.

18.04 MEASUREMENT

A. The quantity to be paid under Item 18 shall be full compensation for each cubic yard of wetland undercutting performed in accordance with the Specifications and Drawings.

18.05 PAYMENT

A. The unit price stated in the Bid for Item 18 shall be full compensation for each cubic yard of wetland undercutting, as specified and required.

ITEM 19
WETLAND AGGREGATE EMBANKMENT

19.01 DESCRIPTION

A. Under this Item, the Contractor shall construct an aggregate riprap embankment on compacted subgrade surface approved by the Engineer. This Item includes providing, hauling, placing, compacting, and shaping the material to construct the embankment, as well as backfilling with in situ soils.

19.02 WORK NOT INCLUDED

A. Embankment constructed beyond specified construction limits with approval from the Engineer and items included for payment under other Items.

19.03 DEFINITION OF ITEMS

A. Item 19 - Wetland Aggregate Embankment.

19.04 MEASURMENT

A. Quantities to be paid for under this Item shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer, in which case measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:

1. Depth - As specified, scheduled, or ordered.
2. Length - The actual length ordered.
3. Width - The actual width ordered.

19.05 PAYMENT

A. The unit price stated in the Bid for Item 19 shall be full compensation for each cubic yard of wetland aggregate embankment placed within the prescribed limits as specified, so measured.

ITEM 20
SUBBASE, CIP 24" MDOT CLASS III

20.01 DESCRIPTION

A. Under this Item, the Contractor shall construct a granular subbase on a surface approved by the Engineer and according to RCKC standards. This Item includes providing, hauling, placing, compacting, and shaping the material.

20.02 WORK NOT INCLUDED

A. Subbase required beyond specified construction limits and items included for payment under other Items.

20.03 DEFINITION OF ITEMS

A. Item 20 - Includes Subbase, CIP 24" MDOT Class III.

20.04 MEASURMENT

A. Quantities to be paid for under this Item shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer, in which case measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:

1. Depth - As specified, scheduled, or ordered.
2. Length - The actual length ordered.
3. Width - The actual width ordered.

20.05 PAYMENT

A. The unit price stated in the Bid for Item 20 shall be full compensation for each square yard of Subbase, CIP 24" MDOT Class III placed within the prescribed limits as specified, so measured.

ITEM 21
AGGREGATE BASE, 8", MDOT 22A

21.01 DESCRIPTION

A. Under this Item, the Contractor shall construct aggregate base for new pavement as scheduled, shown on the Drawings and specified herein.

B. No additional payment will be made for the following:

1. Aggregate used for adjusting roadway shoulders and driveways to match new roadway surfaces.
2. Machine grading
    a. Machine grading shall be incidental to this item.

21.02 WORK NOT INCLUDED

A. Aggregate required beyond specified construction limits and items included for payment under other Items.

21.03 DEFINITION OF ITEMS

A. Item 21 - Includes Aggregate Base, 8 inch, MDOT 22A.

21.04 MEASURMENT

A. Quantities to be paid for under this Item shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:

1. Depth - As specified, scheduled, or ordered.
2. Length - The actual length ordered.
3. Width - The actual width ordered.

21.05 PAYMENT

A. The unit price stated in the Bid for Item 21 shall be full compensation for each square yard of aggregate base placed within the prescribed limits as specified, so measured.

ITEMS 22, 23, & 24
HMA MDOT 13A

22.01 DESCRIPTION

A. Under Items 22, 23, & 24 the Contractor shall construct pavement courses as scheduled, shown on the Drawings and specified herein.

B. Under Item 24, the Contractor shall adjust existing structure castings as required to set flush with new grades and casting adjustments shall be incidental to this Item.

22.02 WORK NOT INCLUDED

A. Pavement replacement required beyond specified construction limits and items included for payment under other Items.

B. Pavement damaged or destroyed beyond specified pay limits shall be replaced at the Contractor's expense.

C. No additional payment will be made for the following:

1. Asphalt surface course used for adjusting driveways to match new roadway surfaces.

22.03 DEFINITION OF ITEMS

A. Item 22 - Includes HMA MDOT 13A - 2” Base Course.

B. Item 23 - Includes HMA MDOT 13A - 2” Leveling Course.

C. Item 24 - Includes HMA MDOT 13A - 2" Wearing Course.

22.04 MEASURMENT

A. Quantities to be paid for under Items 22, 23, & 24 shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:

1. Depth - As specified, scheduled, or ordered.
2. Length - The actual length ordered.
3. Width - The actual width ordered.

22.05 PAYMENT

A. The unit prices stated in the Bid for Items 22, 23, & 24 shall be full compensation for each ton of pavement placed within the prescribed limits as specified, so measured.

ITEM 25
CONCRETE DRIVEWAY REPLACEMENT

25.01 DESCRIPTION

A. Under this Item, the Contractor shall place 6-inch thick concrete pavement and 4-inch aggregate base to replace existing driveways as required, as scheduled, shown on the Drawings and specified herein.

25.02 WORK NOT INCLUDED

A. Pavement replacement required beyond specified construction limits and items included for payment under other Items.

B. Pavement damaged or destroyed beyond specified pay limits shall be replaced at the Contractor's expense.

25.03 DEFINITION OF ITEMS

A. Item 25 - Includes Concrete Driveway Replacement.

25.04 MEASUREMENT

A. Quantities to be paid for under this Item shall be the actual quantity constructed, measured in place within the limits as scheduled and shown on the Drawings, unless

otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits.

25.05 PAYMENT

A. The unit price stated in the Bid for Item 25 shall be full compensation for each square yard of concrete placed within the prescribed limits as specified, so measured.

ITEM 26
SAWCUTTING

26.01 DESCRIPTION

A. Under this Item, the Contractor shall perform all sawcutting of pavement as necessary to facilitate pavement removal and provide a clean edge adjacent to pavement scheduled to remain.

26.02 WORK NOT INCLUDED

A. Sawcutting performed beyond specified construction limits and items included for payment under other items.

B. Pavement replacement required beyond specified construction limits.

C. Pavement and curb and gutters damaged or destroyed beyond specified pay limits shall be replaced at the Contractor's expense.

26.03 DEFINITION OF ITEMS

A. Item 26 – Includes Sawcutting.

26.04 MEASUREMENT

A. Quantities to be paid for under this item shall be the actual linear footage quantity of sawcutting, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits.

26.05 PAYMENT

A. The unit price stated in the Bid for Item 26 shall be for each linear foot of sawcutting within the prescribed limits as specified, so measured.

ITEMS 27-33
STORM SEWER/CULVERTS

27.01 DESCRIPTION

A. Under these Items, the Contractor shall furnish and perform all Work necessary for the removal and installation of storm sewers/culverts as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications and the MDOT Specifications for Construction 2012.

B. These Items shall include all Work to remove and install the storm sewer/culverts, including but not limited to the following: excavation, hauling excess spoil material from Site, backfill, compaction, bedding, pipe materials, fittings, connections to existing culverts, installation of catch basins, and related Work such as performing material testing, unless included under other items.

C. Temporary supporting existing utilities, locating of existing utilities, and exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer/culvert construction, is included under these Items.

D. No additional compensation shall be considered for sewers/culverts installed within 2 feet of the elevation shown on the Drawings.

27.02 WORK NOT INCLUDED

A. Pavement replacement within the Contract limits is included under other Items.

B. Damage to existing utilities shall be the responsibility of the Contractor.

C. Replacement of existing manholes or catch basins removed or damaged for Contractor convenience of construction and which were not planned to be removed, shall be done at the Contractor's expense.

D. The furnishing and placing of special backfill in areas specified under Section 02200 is included under other Items.

27.03 DEFINITION OF ITEMS

A. Item 27 - Includes Remove 12” Storm Culvert.

B. Item 28 - Includes 12” HDPE Flared End Section.

C. Item 29 - Includes 18” RCP Flared End Section.

D. Item 30 - Includes 12” HDPE Storm Culvert.

E. Item 31 - Includes 12” CMP Culvert Extension.

F. Item 32 - Includes 18” RCP Culvert Extension.

G. Item 33 - Includes 2’ Dia. Catch Basin.

27.04 MEASURMENT

A. The quantity to be paid under Item 27 shall be the measured quantity of each linear foot of 12-inch storm culvert removed as specified, shown on the drawings, and so measured.

B. The quantity to be paid under Item 28 shall be the measured quantity for each 12-inch HDPE flared end section installed as specified, shown on the drawings, and so measured.

C. The quantity to be paid under Item 29 shall be the measured quantity for each 18-inch RCP flared end section installed as specified, shown on the drawings, and so measured.

D. The quantity to be paid under Item 30 shall be the measured quantity of each linear foot of 12-inch HDPE storm culvert installed as specified, shown on the drawings, and so measured.

E. The quantity to be paid under Item 31 shall be the measured quantity of each linear foot of 12-inch CMP culvert extension installed as specified, shown on the drawings, and so measured.

F. The quantity to be paid under Item 32 shall be the measured quantity of each linear foot of 18-inch RCP culvert extension installed as specified, shown on the drawings, and so measured.

G. The quantity to be paid under Item 33 shall be the measured quantity for each 2-foot diameter catch basin installed as specified, shown on the drawings, and so measured.

27.05 PAYMENT

A. The unit price stated in the Bid for Item 27 shall be full compensation for each linear foot of 12-inch storm culvert removed as specified and so measured.

B. The unit price stated in the Bid for Item 28 shall be full compensation for each 12-inch HDPE flared end section installed as specified and so measured.

C. The unit price stated in the Bid for Item 29 shall be full compensation for each 18-inch RCP flared end section installed as specified and so measured.

D. The unit price stated in the Bid for Item 30 shall be full compensation for each linear foot of 12-inch HDPE storm culvert installed as specified and so measured.

E. The unit price stated in the Bid for Item 31 shall be full compensation for each linear foot of 12-inch CMP culvert extension installed as specified and so measured.

F. The unit price stated in the Bid for Item 32 shall be full compensation for each linear foot of 18-inch RCP culvert extension installed as specified and so measured.

G. The unit price stated in the Bid for Item 33 shall be full compensation for each 2-foot diameter catch basin installed as specified and so measured.

ITEM 34
AIR RELEASE MANHOLES

34.01 DESCRIPTION

A. Under these Items, the Contractor shall construct air release manholes in locations and of the type shown and scheduled on the Drawings and in accordance with the Contract Documents.

B. Work beyond the specified pay limits for the pipe trench, but necessary for the placement of the manholes, shall be included under this Item. Such Work shall include excavation of any material encountered, special backfill material, and pavement replacement.

C. The temporary support of utilities as required to complete the Work shall be included under these Items.

D. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas beyond the scope of other items, shall be included under these Items.

34.02 WORK NOT INCLUDED

A. Replacement of existing manholes or catch basins removed or damaged for Contractor convenience of construction and which were not planned to be removed, shall be done at the Contractor's expense.

34.03 DEFINITION OF ITEMS

A. Item 34 - Includes Air Release Manhole.

34.04 MEASURMENT

A. The quantities to be paid under Item 34 shall be for each air release manhole furnished and installed in accordance with the Specifications and Drawings.

34.05 PAYMENT

A. The unit price stated in the Bid for Item 34 shall be full compensation for each air release manhole, so measured, as specified and required.

ITEMS 35 - 55
DUCTILE IRON WATER MAIN

35.01 DECRIPTION

A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of the water mains as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

B. These Items shall include all Work to install the water mains, including but not limited to the following: excavation, backfill, compaction, bedding, pipe materials, fittings, maintenance of trenches, temporary pavement, connections to existing water mains, and related Work and materials such as blow offs to perform disinfection, flushing, performing pressure and bacteriological tests as shown on the Drawings and specified in conformance with relevant Sections of the Specifications.

C. These Items also shall include all Work under the Contract unless specifically included for payment under other Items.

D. Connections of new water lines to new and existing water lines shall be included under these Items, unless specifically included under other items. Temporary supporting of existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during construction, is included under these Items.

E. The removal or abandonment of existing water mains, including existing fittings, valves, backfill, bedding, structures and other associated appurtenances, shall be included under these items.

F. These Items shall include all water main fittings, accessories and appurtenances not included in other pay items. Fittings, including those not shown on the plans required to avoid existing utilities, shall be included under these Items.

G. All repairs of existing utilities damaged, as a result of construction, are included under these Items.

H. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under these Items, unless specifically included under other items.

35.02 WORK NOT INCLUDED

A. Pavement replacement within the Contract limits is included under other Items.

B. Hydrant assemblies including associated 6-inch water main piping and gate valve are included under other items.

C. Any Work specifically included under other Bid Items.

35.03 DEFINITION OF ITEMS

A. Item 35 - Includes 24” 22.5° Bend.

B. Item 36 - Includes 24” 90° Bend.

C. Item 37 - Includes 12” Butterfly Valve.

D. Item 38 - Includes 16” Butterfly Valve.

E. Item 39 - Includes 24” Butterfly Valve.

F. Item 40 - Includes 12” Connection.

G. Item 41 - Includes 16” Connection.

H. Item 42 - Includes 8” Gate Valve.

I. Item 43 - Includes 8” Plug.

J. Item 44 - Includes 12” Plug.

K. Item 45 - Includes 16” Plug.

L. Item 46 - Includes 24” x 12” Reducer.

M. Item 47 - Includes 24” x 16” Reducer.

N. Item 48 - Includes 24” x 8” Tee.

O. Item 49 - Includes 24” x 12” Tee.

P. Item 50 - Includes 24” x 16” Tee.

Q. Item 51 - Includes 24” Tee.

R. Item 52 - Includes 8” Watermain.

S. Item 53 - Includes 12” Watemain.

T. Item 54 - Includes 16” Watermain.

U. Item 55 - Includes 24” Watermain.

35.04 MEASUREMENT

A. The quantity to be paid under Item 35 shall be the measured quantity of each 24-inch 22.5° bend installed as specified, shown on the drawings, and so measured.

B. The quantity to be paid under Item 36 shall be the measured quantity of each 24-inch 90° bend installed as specified, shown on the drawings, and so measured.

C. The quantity to be paid under Item 37 shall be the measured quantity of each 12-inch butterfly valve and box installed as specified, shown on the drawings, and so measured.

D. The quantity to be paid under Item 38 shall be the measured quantity of each 16-inch butterfly valve and box installed as specified, shown on the drawings, and so measured.

E. The quantity to be paid under Item 39 shall be the measured quantity of each 24-inch butterfly valve and box installed as specified, shown on the drawings, and so measured.

F. The quantity to be paid under Item 40 shall be the measured quantity of each 12-inch connection to the existing water main completed as specified, shown on the drawings, and so measured.

G. The quantity to be paid under Item 41 shall be the measured quantity of each 16-inch connection to the existing water main completed as specified, shown on the drawings, and so measured.

H. The quantity to be paid under Item 42 shall be the measured quantity of each 8-inch gate valve and box installed as specified, shown on the drawings, and so measured.

I. The quantity to be paid under Item 43 shall be the measured quantity of each 8-inch plug installed as specified, shown on the drawings, and so measured.

J. The quantity to be paid under Item 44 shall be the measured quantity of each 12-inch plug installed as specified, shown on the drawings, and so measured.

K. The quantity to be paid under Item 45 shall be the measured quantity of each 16-inch plug installed as specified, shown on the drawings, and so measured.

L. The quantity to be paid under Item 46 shall be the measured quantity of each 24-inch x 12-inch reducer installed as specified, shown on the drawings, and so measured.

M. The quantity to be paid under Item 47 shall be the measured quantity of each 24-inch x 16-inch reducer installed as specified, shown on the drawings, and so measured.

N. The quantity to be paid under Item 48 shall be the measured quantity of each 24-inch x 8-inch tee installed as specified, shown on the drawings, and so measured.

O. The quantity to be paid under Item 49 shall be the measured quantity of each 24-inch x 12-inch tee installed as specified, shown on the drawings, and so measured.

P. The quantity to be paid under Item 50 shall be the measured quantity of each 24-inch x 16-inch tee installed as specified, shown on the drawings, and so measured.

Q. The quantity to be paid under Item 51 shall be the measured quantity of each 24-inch tee installed as specified, shown on the drawings, and so measured.

R. The quantities to be paid for under Item 52 shall be the horizontal length of 8-inch D.I.P. watermain measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings and valves. Vertical portions of the water main shall not be measured for payment.

S. The quantities to be paid for under Item 53 shall be the horizontal length of 12-inch D.I.P. watermain measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings and valves. Vertical portions of the water main shall not be measured for payment.

T. The quantities to be paid for under Item 54 shall be the horizontal length of 16-inch D.I.P. watermain measured parallel to the axis of the line along the surface of the

ground, with no deduction for laying length of fittings and valves. Vertical portions of the water main shall not be measured for payment.

U. The quantities to be paid for under Item 55 shall be the horizontal length of 24-inch D.I.P. watermain measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings and valves. Vertical portions of the water main shall not be measured for payment.

35.05 PAYMENT

A. The unit prices stated in the Bid for Items 35 through 51 shall be full compensation for each item, furnished and installed as specified and required.

B. The unit price stated in the Bid for Items 52 through 55 shall be full compensation for each linear foot, furnished and installed as specified, and so measured.

1. Four dollars per linear foot will be withheld from the unit price of Items 52 through 55 as stated in the Bid, for acceptance testing, in accordance with the Contract Documents. This amount shall not be considered part of retainage and shall not be released until testing has been satisfactorily completed.

ITEM 56
FIRE HYDRANT ASSEMBLIES

56.01 DESCRIPTION

A. Under this Item, the Contractor shall furnish and perform all Work necessary for the installation of the fire hydrant assemblies shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

B. This Item shall include all Work to install the fire hydrant assemblies, including but not limited to the following: excavation, pavement removal, saw-cutting, concrete drive, curb and walk removal, hauling excess spoil material from Site, backfill, compaction, bedding, pipe materials, fittings, connections to water lines, construction maintenance and removal of temporary access to the Work area, and related Work such as performing material testing, unless included under other items.

C. If a new hydrant is not replacing an existing hydrant, a new sign will be furnished and installed according to the Drawings.

D. If a fire hydrant sign is damaged, stolen, lost, or otherwise rendered unusable, the Contractor will be responsible to furnish and install a replacement sign.

E. Tee fittings at main line shall be incidental to this Item.

56.02 WORK NOT INCLUDED

A. Pavement replacement within Contract limits is included for payment under other items.

56.03 DEFINITION OF ITEMS

A. Item 56 - Includes Fire Hydrant Assembly

56.04 MEASUREMENT

A. The quantity to be paid under Item 56 shall be the measured quantity of each fire hydrant assembly completed as specified, shown on the drawings, and so measured.

56.05 PAYMENT

A. The unit price stated in the Bid for Item 56 shall be full compensation for each hydrant assembly so measured, as specified and required.

ITEMS 57 - 65
STATION 39

57.01 DESCRIPTION

A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of a valve vault near the City of Kalamazoo's Booster Station 39 as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

B. These Items shall include all Work to install the valve vault, including but not limited to the following: excavation; hauling excess spoil material from Site; backfill; compaction; bedding; pipe materials; fittings; valves; connections to existing water main; installation of flow meter; electrical conduit; telemetry programming; construction maintenance and removal of temporary access to the Work area; and related Work such as performing material testing; pressure testing and disinfection; unless included under other items.

C. Temporary supporting existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during vault construction is included under these Items.

D. No addition compensation shall be considered for water main or structures installed within 2 feet of the elevation shown on the Drawings.

57.02 WORK NOT INCLUDED

A. Damage to existing utilities shall be the responsibility of the Contractor.

B. Any Work specifically included under other Bid Items.

57.03 DEFINITION OF ITEMS

A. Item 57 - Includes Station 39 Valve Vault

B. Item 58 - Includes Station 39 16" Water Main

C. Item 59 - Includes Station 39 16" x 16" Tee

D. Item 60 - Includes Station 39 16" 90° Bend

E. Item 61 - Includes Station 39 16" Butterfly Valve

F. Item 62 - Includes Station 39 16" Check Valve

G. Item 63 - Includes Station 39 Flow Meter

H. Item 64 - Includes Station 39 1" Schedule 80 PVC Conduit

I. Item 65 - Includes Station 39 Flowmeter SCADA Telemetry Programming

57.04 MEASURMENT

A. The quantity to be paid under Item 57 shall be the measured quantity of each precast concrete valve vault installed as specified, shown on the drawings, and so measured.

B. The quantities to be paid for under Item 58 shall be the horizontal length of 16" D.I.P. watermain measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings and valves. Vertical portions of the water main shall not be measured for payment.

C. The quantity to be paid under Item 59 shall be the measured quantity for each 16-inch x 16-inch tee installed as specified, shown on the drawings, and so measured.

D. The quantity to be paid under Item 60 shall be the measured quantity for each 16-inch 90° bend installed as specified, shown on the drawings, and so measured.

E. The quantity to be paid under Item 61 shall be the measured quantity for each 16-inch butterfly valve installed as specified, shown on the drawings, and so measured.

F. The quantity to be paid under Item 62 shall be the measured quantity for each 16-inch check valve installed as specified, shown on the drawings, and so measured.

G. The quantity to be paid under Item 63 shall be the measured quantity for each flow meter installed as specified, shown on the drawings, and so measured.

H. The quantity to be paid under Item 64 shall be the measured quantity for each linear foot of 1-inch schedule 80 PVC conduit installed as specified, shown on the drawings, and so measured.

I. The lump sum stated in the Bid shall be full compensation for all Work required under Item 65.

57.05 PAYMENT

A. The unit price stated in the Bid for Item 57 shall be full compensation for each precast concrete valve vault installed as specified and so measured.

B. The unit price stated in the Bid for Item 58 shall be full compensation for each linear foot, furnished and installed as specified, and so measured.

1. Four dollars per linear foot will be withheld from the unit price of Item 58 as stated in the Bid, for acceptance testing, in accordance with the Contract Documents. This amount shall not be considered part of retainage and shall not be released until testing has been satisfactorily completed.

C. The unit price stated in the Bid for Item 59 shall be full compensation for each 16" x 16" tee installed as specified and so measured.

D. The unit price stated in the Bid for Item 60 shall be full compensation for each 16" 90° bend installed as specified and so measured.

E. The unit price stated in the Bid for Item 61 shall be full compensation for each 16" butterfly valve installed as specified and so measured.

F. The unit price stated in the Bid for Item 62 shall be full compensation for each 16" check valve installed as specified and so measured.

G. The unit price stated in the Bid for Item 63 shall be full compensation for each flow meter installed as specified and so measured.

H. The unit price stated in the Bid for Item 64 shall be full compensation for each linear foot of 1" schedule 80 pvc conduit installed as specified and so measured.

I. The unit price stated in the Bid for Item 65 shall be full compensation for flowmeter SCADA telemetry programming as specified and required.

ITEM 66
RESTORATION

66.01 DESCRIPTION

A. Under this Item, the Contractor shall restore landscape surface improvements including topsoil, seeding, mulching, and fertilizing all disturbed lawn areas within the defined construction limits as shown on the Drawings and specified.

66.02 WORK NOT INCLUDED

A. All other landscape surface improvements disturbed or damaged by the Contractor without prior approval from the Engineer shall be repaired or replaced at the Contractor's expense.

B. Wetland restoration is included under other Bid Items.

66.03 DEFINITION OF ITEMS

A. Item 66 - Includes Restoration.

66.04 MEASUREMENT

A. The lump sum price stated in the Bid for Item 66 shall be full compensation for all Work required under Item 66 - Restoration.

66.05 PAYMENT

A. The lump sum unit price stated in the Bid for Item 66 shall be full compensation for restoration as specified and required.

ITEM 67
WETLAND RESTORATION

67.01 DESCRIPTION

A. Under this Item, the Contractor shall restore landscape surface improvements in wetland areas including topsoil, seeding, mulching, and fertilizing all disturbed wetland areas within the defined construction limits as shown on the Drawings and specified.

67.02 WORK NOT INCLUDED

A. All other wetland areas disturbed or damaged by the Contractor without prior approval from the Engineer shall be repaired or replaced at the Contractor's expense.

67.03 DEFINITION OF ITEMS

A. Item 67 - Includes Wetland Restoration.

67.04 MEASUREMENT

A. The lump sum price stated in the Bid for Item 67 shall be full compensation for all Work required under Item 67 - Wetland Restoration.

67.05 PAYMENT

A. The lump sum unit price stated in the Bid for Item 67 shall be full compensation for wetland restoration as specified and required.

ITEM 68
TREES

68.01 DESCRIPTION

A. Under this Item the Contractor shall provide an allowance for the planting of new trees. The Contractor shall coordinate with the Engineer and property owners to select

locations and species. Trees shall be planted by an approved nursery under the supervision of a certified arborist.

68.02 WORK NOT INCLUDED

A. All other trees disturbed or damaged by the Contractor without prior approval from the Engineer shall be repaired or replaced at the Contractor's expense.

68.03 DEFINITION OF ITEMS

A. Item 68 - Includes Trees.

68.04 MEASUREMENT

A. The allowance price stated in the Bid for Item 68 shall be the not-to-exceed cost for all Work required under Item 68 - Trees.

68.05 PAYMENT

A. The allowance price stated in the Bid for Item 68 shall be the not-to-exceed cost for trees as specified and required.

ITEM 69
MATERIALS TESTING

69.01 DESCRIPTION

A. Under this Item, the Contractor shall coordinate with an independent laboratory to provide materials testing as specified and required.

69.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

69.03 DEFINITION OF ITEMS

A. Item 69 - Includes Materials Testing.

69.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 69.

69.05 PAYMENT

A. The unit price stated in the Bid for Item 69 shall be full compensation for materials testing as specified and required.

ITEM 70
CONSTRUCTION STAKING

70.01 DESCRIPTION

A. Under this Item, the Contractor shall coordinate with a licensed Surveyor to provide construction staking as specified. The Surveyor shall coordinate the layout and staking for the project with the Engineer.

70.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

70.03 DEFINITION OF ITEMS

A. Item 70 - Includes Construction Staking.

70.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 70.

70.05 PAYMENT

A. The lump sum unit price stated in the Bid for Item 70 shall be full compensation for construction staking as specified and required.

ITEM 71
TAPPING SADDLE

71.01 DESCRIPTION

A. Under this Item, the Contractor shall provide all Work necessary for the installation of 12-inch x 6-inch tapping saddle required for the hydrant assembly located on E. Michigan Avenue. The Contractor shall perform the live tap with a representative of the Owner present.

71.02 WORK NOT INCLUDED

A. The hydrant assembly shall be included under other Bid Items.

B. Any Work specifically included under other Bid Items.

71.03 DEFINITION OF ITEMS

A. Item 71 - Includes Tapping Saddle.

71.04 MEASUREMENT

A. The quantity to be paid under Item 71 shall be the measured quantity of each tapping saddle installed as specified, shown on the drawings, and so measured.

71.05 PAYMENT

A. The unit price stated in the Bid for Item 71 shall be full compensation for each tapping saddle installed as specified and so measured.

END OF SECTION

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SECTION 01021
ALLOWANCES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the allowances which are to be furnished by the Contractor.

B. The Contractor shall include in the Contract Price all allowances stated in the Contract Documents. These allowances shall cover the net cost of the materials and equipment delivered and unloaded at the Site, and all applicable taxes.

C. The Contractor's handling costs on the Site, labor installation costs, overhead, profit and other expenses contemplated for the original allowance shall be included in the Contract Price and not in the allowance.

D. The Contractor shall cause the Work covered by these allowances to be performed for such amounts and by such persons as the Engineer may direct, but he will not be required to employ persons against whom he makes a reasonable objection.

E. If the cost, when determined, is more than or less than the allowance, the Contract Price shall be adjusted accordingly by Change Order.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

    a. Contractor shall prepare and submit proposals for the Owner to select the items included in allowance.

2. Information for the Record:

    a. Invoices and delivery slips for items provided under the allowance shall be submitted to the resident project representative or Engineer.

1.03 PRODUCT HANDLING

A. The Contractor shall provide all labor, material and equipment to insure the safe delivery, handling and storage of goods until acceptance by Owner and Engineer.

1.04 GUARANTEE

A. Contractor shall provide manufacturer's warranties to the Owner for all goods provided.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 COORDINATION

A. Contractor shall advise Owner and Engineer of, and include in the schedule, the timing of the selection, Shop Drawing review and procurement of the goods or services required in the allowance.

B. Contractor shall be responsible for the coordination of all allowance item(s) provided with the remainder of the contract work.

3.02 ERECTION, INSTALLATION AND APPLICATION

A. Contractor shall assemble, install or apply all goods as may be required to complete the requirements of the allowance.

3.03 PROTECTION

A. Contractor shall examine all goods on delivery. All damaged or defective goods shall be returned to the manufacturer for replacement.

PART 4 SPECIAL PROVISIONS

4.01 LIST OF ALLOWANCES

		Allowance
A.	Trees	$20,000.00

4.02 DEFINITION OF ALLOWANCE

A. The Contractor shall provide to the property owner a list of available tree species from a local nursery along with cost information. The property owner shall select the tree species from the available list for installation by the nursery in accordance with the Specifications. The Engineer/Owner shall determine the property owners scheduled to receive trees and the amount of allowance allocated to each respective property owner.

END OF SECTION

SECTION 01043
COORDINATION AND CONTROL OF THE WORK

PART 1 GENERAL

1.01 SCOPE

A. This section includes coordination and control of the Work.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:

a. Haul routes to and from Site.

b. Plan and procedures for any utility shutdowns.

1.03 LINES AND GRADES

A. All Work under this Contract shall be built in accordance with the lines and grades shown on the Drawings or as altered or modified by authority of the Owner or Engineer.

1.04 EXISTING STRUCTURES SHOWN ON DRAWINGS

A. Where underground and surface structures are shown on the Drawings, the location, depth, and dimensions of such structures are believed to be reasonably correct but are not guaranteed.

B. Such structures are shown for the information of the Contractor, but information so given is not to be construed as a representation that such structures will in all cases be found or encountered just where shown, or that they represent all the structures which may be encountered.

1.05 COOPERATION OF CONTRACTOR

A. The Contractor shall conduct his operations so as to interfere as little as possible with those of the Owner, other contractors, utilities, or any public authority on or near the Work.

B. The Owner reserves the right to perform other Work by contract or otherwise, and to permit other public bodies, public utility companies, and others to do Work on or near the project during progress of the Work. If a conflict arises, the Owner will determine when and how the Work shall proceed.

C. Claims for delay or inconvenience due to operations of such other parties on Work specified, shown on the Drawings, as directed or which can be reasonably expected to be encountered by the nature and location of the Work, will not be considered.

D. Operations entailing the use of construction equipment and lights outside the hours of 8:00 am and 5:00 pm, or outside the hours allowed for construction by local ordinances or regulations, is prohibited unless otherwise authorized by the Owner or Engineer.

E. Closing off clear access to any public alley, street, road, avenue or boulevard without the prior consent of municipal officials and the Engineer is prohibited.

1.06 MAINTENANCE OF SANITARY SYSTEM DURING CONSTRUCTION

A. All construction which requires interruption of existing sanitary system flow shall be executed during periods designated by the Owner.

B. Bypassing of untreated sanitary wastewater to any stream or body of water is prohibited.

1.07 PERMANENT PAVEMENT AND FINAL RESTORATION

A. When pipeline construction is being done between April 15 and November 1, the final pavement restoration work shall be complete by November 1.

B. Pavement restoration shall include, but not be limited to, replacement of pavement, driveways, and sidewalks.

C. The fine grading, topsoil, and seeding operation shall be no further behind the pavement restoration than 2700 lineal feet.

D. If at any time the pavement restoration and the fine grading, topsoil, and seeding operation does not meet the above conditions, no further mainline pipe laying will be permitted until the Contractor is in compliance.

E. In order to comply with the above conditions, the Contractor shall complete the pipeline and all appurtenances including, but not limited to, testing, in order to begin final pavement restoration and the fine grading, topsoil, and seeding operation.

F. When pipeline construction is being done between November 15 and April 15, the Contractor shall install the main pipeline and all appurtenances and complete the testing. On April 15, final pavement restoration and the fine grading, topsoil, and seeding operation shall begin. Two months later on June 15, the final pavement restoration shall be no more than 1500 lineal feet behind the mainline pipe laying operation and the fine grading, topsoil, and seeding operation shall be no more than 2700 lineal feet behind the pavement restoration. Mainline pipe laying shall be stopped until these conditions have been met.

1.08 TEMPORARY PAVEMENT RESTORATION

A. The Contractor shall provide and maintain temporary pavement for all roads in which construction occurs. Temporary pavement shall be in accordance with Section 01565.

1.09 TEMPORARY PARKING FACILITIES

A. Parking spaces for the Contractor's personnel shall be provided and maintained in usable condition by the Contractor at all times. Provisions shall be made so that sediment is not tracked onto paved roadways from the vehicles operated by the Contractor's personnel. The parking areas shall consist of temporary parking areas or new permanent parking areas as shown on the Drawings. Temporary parking areas are to be located in the area designated by the Owner and Engineer. At the completion of the project, temporary parking areas shall be removed and the surface restored as specified, shown on the Drawings, as directed, or to its original condition.

B. The Contractor's personnel shall not utilize existing permanent parking areas unless specifically noted on the Drawings.

1.10 RESERVED

1.11 DISPOSAL OF DEBRIS

A. All debris resulting from construction operations, i.e., packaging, waste materials, damaged equipment, etc., shall be trucked from the Site by the Contractor and disposed of at spoil sites.

B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely removed from public or private rights-of-way.

C. All debris shall be disposed of in accordance with Federal, State, and Local laws and regulations.

1.12 CONTROL OF NOISE

A. The Contractor shall eliminate noise to as great an extent as possible at all times. Air compressors shall be equipped with silencers, and the exhaust of all gasoline motors and other power equipment shall be provided with mufflers. In the vicinity of hospitals, libraries, and schools, precautions shall be taken to avoid noise and other nuisance, and the Contractor shall require strict observances of all pertinent ordinances and regulations. Any blasting permitted in such locations shall be done with reduced charges.

1.13 SMOKE PREVENTION

A. Strict compliance with all ordinances regulating the production and emission of smoke will be required, and the Contractor shall accept full responsibility for all damage that may occur to property as a result of negligence in providing required control.

1.14 DEBRIS AND DUST CONTROL

A. Contractor shall perform debris and dust control in accordance with Section 01568.

1.15 SANITARY REGULATIONS

A. The Contractor shall provide all necessary housing accommodations for the workers for changing clothes and for protection during inclement weather. Toilet accommodations shall also be maintained for the use of the employees on the Work. The accommodations shall be in approved locations, properly screened from public observance and shall be maintained in a strictly sanitary manner. The Contractor shall obey and enforce all other sanitary regulations and orders, shall take precautions against infectious diseases and the spread of same, and shall maintain at all times satisfactory sanitary conditions around all shanties, tool and supply houses, and on all other parts of the Work.

1.16 USE OF EXPLOSIVES

A. The use of explosives is prohibited.

1.17 EMERGENCY MAINTENANCE SUPERVISOR

A. The Contractor shall submit to the Engineer the names, addresses, and telephone numbers of two employees responsible for performing emergency maintenance and repairs when the Contractor is not working. These employees shall each be designated in writing by the Contractor to act as his representative and shall have full authority to act on his behalf.

B. Contractor shall post the emergency numbers for the project at the job site in a conspicuous location.

C. Contractor shall be responsible for contacting the local fire, police, and emergency response personnel and organizations in advance of the Work. The Contractor shall be responsible for the coordination and compliance with emergency response plans, whether developed by the governing agency, laws, or the Contractor for the project.

D. At least one of the designated employees shall be available for a telephone call any time an emergency arises.

1.18 PUBLIC SERVICE STRUCTURES

A. Public service structures shall be understood to include all poles, tracks, pipes, wires, conduits, house-service connections, vaults, manholes, and other appurtenances used to supply the public with transportation, heating, electric, telephone, gas, water, sewer, or other services, whether owned or controlled by the Owner, by other public bodies, or by privately-owned corporations.

B. At least a week in advance of breaking ground, the Contractor shall notify the registered underground protection service, all public bodies, and other owners of such facilities of the proposed location of his operations, advising them that their property may be affected and that such measures as they may deem necessary, promptly should be taken to protect, adjust, remove, or build them.

C. In developed residential and commercial areas, the Contractor shall assume each building and dwelling has water and sewer services and that they shall be protected and repaired as needed as part of the pipeline installation. No additional payment will be made for Work associated with supporting or repairs of such services.

D. Three conditions which may be encountered will be dealt with as follows:

1. Structures which are adjacent to but not included within the limits of an excavation required for performance of the Work shall be protected, supported, and maintained in service by the Contractor at his expense.

2. Structures within the limits of the Work which can be satisfactorily supported and maintained in service and which do not require removal and rebuilding in the judgment of the Engineer, shall thus be supported by the Contractor at his expense, including cost of repair of damage incident to his operations.

    a. Supports for water and gas mains, sewers, conduits, and similar structures shall be constructed of timber or other acceptable materials; shall be supported from undisturbed foundations; and, shall be sufficiently substantial to ensure against settlement when pipe trenches or other excavations are backfilled. In all cases where permits or inspection fees are required by utilities in connection with changes to, or temporary support of their conduits, the Contractor shall secure such permits and pay all permit and inspection fees.

    b. The Contractor shall assume full responsibility for maintaining all public service structures in service, and shall support and protect, or remove and rebuild them at his own expense. Such services shall not be interrupted without permission of the owner of the public service structure.

3. In case relocation of pipelines or other utility structures is required because of direct interference with the installation of the Work, as determined jointly by the Owner, Engineer, and Contractor, the Contractor shall notify the owners of the utility or utility structure involved.

a. The Contractor will not be reimbursed for the cost of the relocation if the interference is shown on the Drawings, described in the Specifications, apparent on visual inspection, or specifically included in the Work to be performed by the Contractor.

b. The Contractor will not be paid for time lost because of such direct interference. Where it is the policy of any utility owner to perform such Work with his own forces, the Contractor shall cooperate to the fullest extent with such utility owner.

1.19 UNAUTHORIZED OR PROHIBITED WORK

A. Work done beyond the lines shown on the Drawings or ordered, Work done without required inspection, except as herein provided, or any extra work done without authority will be considered unauthorized and will not be paid for under the provisions of the Contract. Work considered unauthorized may be ordered removed at the Contractor's expense. Work done without lines and grades being given shall be considered unauthorized and subject to rejection.

B. Disposing of excess or unsuitable materials, including but not limited to excavated material, demolition debris, clearing and grubbing debris, in wetlands or flood plains is prohibited.

C. Locating stockpiles in environmentally sensitive areas is prohibited.

D. Pumping of sediment-laden water from trenches or excavations directly into any surface waters, stream, wetlands, or sewers is prohibited. Pumped water shall be properly filtered and desilted prior to discharge.

E. Open burning without a permit is prohibited.

F. Discharging injurious silica dust concentrations into the atmosphere within 200 feet of any residential, commercial, public or private places of human occupancy is prohibited.

1.20 RESERVED

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 SPECIAL PROVISIONS

4.01 MAINTAINING FLOW IN EXISTING SEWERS

A. Flow in existing storm, sanitary and private sewers shall be maintained at all times during construction of this project. The Contractor shall furnish and install all necessary

temporary facilities required to maintain the flow in existing sewers including bulkheads, plugs, stop planks, flumes, coffer dams, pumping equipment, valves, etc.

4.02 REQUIRED SAFETY DOCUMENTATION TO BE SUBMITTED

A. On all projects that require the Contractor's or subcontractor's personnel to occupy permitted confined spaces and/or hazardous atmospheres on the Site, the Contractor shall submit to the Owner, a written proposed safety program. The safety program shall comply with all Federal, State, and Local requirements. If the Owner has a safety plan that is more stringent than the Federal and State requirements, it will be made available to the Contractor for review. The submittal of the proposed safety program to the Owner shall be made well in advance of the start of construction at the Site. The submittal shall include a written Safety Management Plan including Confined Space Entry procedures. The Contractor shall be responsible to maintain documentation stating that anyone employed by the Contractor, subcontractors, or suppliers of any tier to the Contractor occupying such hazardous locations, has received the appropriate confined space entry training and other applicable training. The Contractor also is responsible to maintain completed confined space entry permits.

4.03 MAINTAINING CRITICAL OPERATIONS

A. The Contractor shall closely coordinate any needed equipment or roadway shutdowns with the Owner and Engineer.

4.04 SEQUENCING

A. Contractor shall begin the work with installation of the valve vault at Station 39 (see 4.04 B of this Section). Upon completion of the valve vault, the bypass shall remain open. Watermain work shall begin with the tie over of the existing 16-inch watermain on 33rd Street to the existing 16-inch watermain on K Avenue to Valve #23 on Sheet W-30. When that tie over is placed into service, the existing valve at Sta. 161+92 shall be closed. Watermain construction operations shall then move to the E. G Avenue intersection and proceed south.

1. Upon completion of each 2,000 linear feet of watermain, the contractor shall pressure test and disinfect per standards and place newly constructed watermain into service. Coordinate with the Engineer to determine actual section lengths to coincide with valve locations.

2. The Contractor shall provide a temporary auto-flusher, connected to the hydrant nearest the southern end of the completed 24-inch watermain. The auto-flusher will flush the new watermain for 15 minutes daily. Upon completion of the subsequent 2,000 feet, the Contractor shall relocate the auto-flusher as required.

B. Beginning work at Station 39 is contingent upon the City receiving their ACT 399 permit from the State of Michigan Department of Environment, Great Lakes, and Energy (EGLE).

1. If the City is unable to secure their Act 399 permit prior to mobilization, the Contractor shall begin with the Work to tie over the existing 16-inch watermain on 33rd Street to the existing 16-inch watermain on K Avenue to Valve #23 on Sheet W-30. When that tie over is placed into service, the existing valve at Sta. 161+92 shall be close. Watermain construction operations shall then move to the E. G Avenue intersection and proceed south. Once construction reaches the intersection at E. K Avenue, the Contractor shall install the 90° bend and a blind flange. The watermain shall not be tied into Butterfly Valve #23 until such time that the Work at Station 39 is permitted. Upon completion of Station 39 work, the Contractor shall return to E. K Avenue, remove the blind flange previously installed, and tie in the new watermain.

END OF SECTION

SECTION 01090
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes reference standards.

1.02 DESIGNATION OF ASSOCIATIONS, INSTITUTIONS, SOCIETIES AND STANDARDS

A. Whenever within these Specifications reference is made to Associations, Institutions, Societies, or Standards, they will be designated as follows:

AA	-	Aluminum Association
AAMA	-	Architectural Aluminum Manufacturers Association
AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
ADAAG	-	Americans with Disabilities Act Accessibility Guidelines
AFBMA	-	Anti-Friction Bearing Manufacturers Association
AFI	-	Air Filter Institute
AGA	-	American Gas Association
AGMA	-	American Gear Manufacturers Association
AIHA	-	American Industrial Hygiene Association
AISC	-	American Institute of Steel Construction
AISI	-	American Iron & Steel Institute
AITC	-	American Institute of Timber Construction
AMCA	-	Air Moving and Conditioning Association
ANSI	-	American National Standards Institute
API	-	American Petroleum Institute
ARI	-	Air Conditioning and Refrigeration Institute
ASA	-	American Standards Association
ASHRAE	-	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing Materials
AWPB	-	American Wood Preservers Bureau
AWS	-	American Welding Society
AWWA	-	American Water Works Association
BLS	-	Bureau of Labor Standards
CISPI	-	Cast Iron Soil Pipe Institute
FM	-	Factory Mutual
FS	-	Federal Specifications
IBR	-	Institute of Boiler and Radiator Manufacturers

IEEE	-	Institute of Electrical and Electronic Engineers
INETA	-	International Electrical Testing Association
ISA	-	Instrument Society of America
JIC	-	Joint Industrial Council
MDOT	-	Michigan Department of Transportation
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
NICET	-	National Institute for Certification in Engineering Technologies
NSF	-	National Sanitation Foundation
NRTL	-	Nationally Recognized Testing Laboratory
OSHA	-	Occupational Safety and Health Act
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC	-	Steel Structures Painting Council
MBC	-	Michigan Building Code
IBC	-	International Building Code
UBC	-	Uniform Building Code
UL	-	Underwriters Laboratories, Inc.
USBM	-	United States Bureau of Mines

B. Wherever specific standard numbers are indicated, i.e., ASTM C150, it shall be understood to mean the latest revision thereof.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes requirements for submittals.

B. Contractor shall adhere to the submittal schedule as submitted under the provisions of the General Conditions. Contractor shall modify the schedule as required to allow sufficient time for submittal review based on current construction schedule.

C. Owner, Contractor and Engineer shall utilize the Electronic Project Management System (EPMS) as specified in Section 01320 for the central repository of project related documents including but not limited to submittals, information for the record and Operation and maintenance manuals.

1.02 COORDINATION OF SUBMITTALS

A. The Contractor shall be responsible for the coordination of submittals and field verifications as required for the various parts of the Work.

B. All submittals to the Engineer, unless otherwise specified, shall be made only by the Contractor. Direct submittals from subcontractors or suppliers will not be accepted.

C. Each submittal shall reference the Specification item that it covers, the Contractor's name, the Contract title and location, and the date of submission. Submittal also shall indicate whether the information is for the Engineer's review and approval, for record purposes, or for the fulfillment of the operation and maintenance requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Two categories of information are normally required:

1. Shop Drawings for review.
2. Information for the Record:
    a. Operation and maintenance manuals.

2.02 SHOP DRAWINGS FOR REVIEW

A. Shop Drawings:

1. The Contractor shall submit Shop Drawings in accordance with the General Conditions, as required by individual Sections, as shown on the Drawings or as directed.

2. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with the General Conditions.

3. The Contractor shall clearly indicate quantities and the exact intended use of the equipment or material contained in the submittal.

4. All Submittals shall be tailored to the project by highlighting (in a color other than red) appropriate information and deleting or crossing out nonapplicable information. Where applicable the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual material or equipment furnished. All options furnished shall be indicated.

    a. Markups of shop drawings in the color red shall be reserved for the Engineer. Shop drawing markups and highlights from the Contractor shall be in a color other than red.

5. Color charts or samples shall be included for all submittals where a color selection by the Owner is required. Original Color Charts (not Color Copies) and samples shall be delivered to the Site, Engineer's RPR or to the Owner as required. The Engineer shall be copied on the transmittal letter for record purposes.

B. Samples shall be provided as required in the individual Sections. Samples shall be of the precise material proposed to be furnished. The number of samples and sample size shall be the industry standard unless otherwise stated in the individual Sections.

2.03 INFORMATION FOR RECORD

A. Material certificates shall be submitted for materials as indicated in the individual Sections. Each certificate shall state that the products have been sampled and tested in accordance with the proper industrial and governmental standards and meet the requirements of the Specifications. Certificates shall be signed by an authorized agent of the manufacturer.

B. Licenses and Permits - The Contractor shall submit copies of all licenses and permits required by Local, State, and Federal laws.

C. Installation and calibration certificates shall be submitted for equipment as indicated in the individual Sections. These certificates shall indicate manufacturer's satisfaction with the installation, the accuracy of calibration and alignment, and the operation of the equipment. Such certificates must be signed by an authorized agent of the manufacturer.

D. Progress Schedules shall be submitted in accordance with the General Conditions and Section 01310.

E. Schedule of Shop Drawings and Sample Submittals shall be submitted in accordance with the General Conditions.

F. Schedule of Values shall be submitted in accordance with the General Conditions.

G. Copy of programming for all PLC's and computers on the project shall be submitted.

2.04 OPERATION AND MAINTENANCE INFORMATION

A. Operation and maintenance manuals shall be submitted as information for the record.

B. Operation and maintenance manuals shall be submitted as electronic documents prior to the printing of the record copy.

1. Contractor shall provide one electronic copy of the manuals for preliminary review.

2. The final accepted manuals shall be provided as one electronic copy of the manual and one printed copy, as specified below.

C. Electronic manuals shall be in Portable Document Format (PDF) as generated by Adobe Professional Version 7.0 or newer. The PDF file shall be fully indexed using the table of contents, searchable with thumbnails generated. PDF documents shall have a bookmark created in the navigation frame for each major entry (Section, Chapter, Tab) in the table of contents. PDF images shall be at a readable resolution typically 300 dpi or higher. Optical Character Recognition (OCR) capture shall be performed on these images so text can be searched, selected and copied from the PDF file.

1. The opening view of each PDF document shall be the bookmarks to the left and cover page or table of contents.

2. The PDF file name shall include the Name of Owner, Project Title, Contract Number, and Specification Section. Commonly used abbreviations acceptable to the Owner may be used to minimize length of file name.

3. The Contractor's Name shall be the electronic "Author" of the PDF document.

D. This information will be reviewed only if properly identified with Specification Section numbers and only after revised, where necessary, to conform to the Engineer's notes on previous submittals that have been marked "Make Corrections Noted." Manuals shall be tailored to suit the specific equipment provided.

E. Submittals shall include but not be limited to the following:

1. Descriptive literature, bulletins, or other data covering equipment or system.

2. Complete list of equipment and appurtenances included with system, complete with manufacturer serial number and model number.

3. Utility requirements.

4. General arrangement drawing.

5. Sectional assembly.
6. Dimension print.
7. Materials of construction.
8. Certified performance curve.
9. Parts list with assembly drawings.
10. Recommended spare parts list with part and catalog number.
11. Lubrication recommendations and instructions.
12. Schematic wiring diagrams.
13. Schematic piping diagrams.
14. Description of associated instrumentation.
15. Drive dimensions and data.
16. Operating instructions.
17. Maintenance instructions including trouble-shooting guidelines, lubrication, and preventive maintenance instructions with task schedule.
18. Special tools and equipment required for operation and maintenance.
19. Description of equipment controls.
20. Pump seal data.
21. Assembly, installation, alignment, adjustment, and checking instructions.
22. Confirmation of all corrections noted on Shop Drawings marked “Make Corrections Noted.”
23. Manufacturer’s name, address, and telephone number along with manufacturer’s job number and Purchase Order number.
24. Manufacturer’s local sales representative, address, and telephone number.
25. All installation instructions that were provided to Contractor for use in installing equipment.

F. All manuals shall be tailored to the project by highlighting appropriate information and deleting or crossing out nonapplicable information, or the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual equipment furnished. All options furnished shall be indicated.

G. Manuals shall be printed on 8-1/2-inch by 11-inch size with standard three-hole punching. Large manuals shall be submitted in three-ring binders. Small manuals shall be submitted in folders with metal fasteners. Index tabs shall be furnished for all manuals containing data for three or more items of equipment. All manuals shall have a title label on the cover stating the specification item number and item name. A table of contents shall be included in all manuals.

H. Drawings shall be reduced to 8-1/2-inch by 11-inch or 11-inch by 17-inch. Where reduction is not possible, larger drawings shall be folded separately and placed in envelopes which are bound into the manual.

I. Equipment installations shall not be considered substantially complete until all associated operation and maintenance manual submittals are accepted by the Engineer.

J. Field modifications to equipment during installation shall be included in the manual so that the manual reflects as-built conditions. Revisions to the manual may be submitted for incorporation into the manual where appropriate; however, the Engineer reserves the right to return all six manuals for revision to reflect as-built conditions.

PART 3 EXECUTION

3.01 RESERVED

3.02 IDENTIFICATION OF SUBMITTALS

A. All submittals shall have a Submittal Identification & Approval cover sheet attached. A sample of the submittal cover sheet is attached for reference. The form will be provided by the Engineer and coordinated with the Contractor.

B. All submittals shall be given a consecutive number when they are entered into the Electronic Project Management System (EPMS), See Section 01320.

C. Resubmittals shall be entered into EPMS as resubmittals.

D. Submittals to satisfy the operation and maintenance information requirements shall be entered into the EPMS as a submittal. The description shall have the prefix “OM”.

3.03 PRINTING AND DISTRIBUTION

A. Contractor shall provide one (1) printed copy of the approved operation and maintenance manual and one (1) electronic copy on portable electronic media device to the Owner.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

Submittal Identification & Approval

Date:

Spec Section

Submittal No.

Drawing Sheet No.

Description:

Manufacturer(s)

Contractor Comments/Deviations/Measu nts

Contractor

Contractor Na

- ☐ Approved
- ☐ Forwarded
- ☐ Checked

By: _____ Date: _____

Engineer

SHOP DRAWING REVIEW
SUBJECT TO CONTRACT REQUIREMENTS

Jones & Henry Engineers, Ltd.

- ☐ Approved
- ☐ Approved—Make Corrections Noted
- ☐ Amend & Resubmit
- ☐ Rejected—See Remarks
- ☐ Distribute for Information

REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS

Approval in no way relieves the Contractor of any responsibility for capacities, performance, functions, compliance with Federal, State, and Local Codes; accuracy of dimensions and details; or continuity and completeness of the Project nor does approval constitute or imply any increase in Contract Price.

By: _____

Review Comments

SECTION 01310
CONSTRUCTION SCHEDULES AND DOCUMENTATION

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the requirements for construction schedules and construction sequences.

B. This Section includes the requirements for the tracking and documentation of the progress and activities driving the completion of the Work as specified, shown on the Drawings and as directed.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:

a. Preliminary Construction Schedule.

b. Contractor's Construction Schedule and monthly updates.

c. Road/Lane Closure Schedule

B. Contractor shall submit three copies of the 22-inch by 34-inch construction schedule, unless approved otherwise by the Engineer.

1.03 QUALITY ASSURANCE

A. Scheduling conference shall be held prior to the commencement of the construction to discuss the following, including but not limited to:

1. Construction sequencing.

2. Contractor's coordination of subcontractors.

3. Coordination with the Owner's operations.

4. Coordination with other contractors or other work.

5. Project milestones.

6. Owner's partial utilization.

PART 2 PRODUCTS

2.01 PRELIMINARY CONSTRUCTION SCHEDULE

A. Preliminary construction schedule shall be completed in accordance with the General Conditions and prior to the scheduling conference.

B. The preliminary schedule shall outline the Contractor's sequencing of tasks, activities, milestones, and all critical path items within the contract time.

2.02 CONSTRUCTION SCHEDULE

A. The Contractor's submission of the construction schedule will not change the contract completion date, whether reviewed by the Owner and Engineer or not. The Contractor shall incorporate all approved change orders that have resulted in a contract time extension.

B. The Contractor shall require all subcontractors engaged in the Work to submit to the Contractor construction schedules, as specified herein, for incorporation into the Contractor's construction schedule.

C. The construction schedule shall include but not be limited to the following dates:

1. Notice to Proceed.
2. Substantial Completion and Final Completion.
3. Commencement of on-site operations.
4. Milestones as specified, shown on the Drawings, and as directed.
5. Ordering, submittals, fabrication, delivery, startup, and training time for major equipment items.
6. Submittal schedule per the General Conditions.

D. The Contractor shall incorporate into the construction schedule all constraints and work restrictions specified or otherwise required by the Contractor's operations, including but not limited to the following:

1. Construction sequencing.
2. Contractor's coordination of subcontractors.
3. Coordination with the Owner's operations.
4. Coordination with other contractors or other work.
5. Project milestones.
6. Owner's partial utilization.

2.03 UPDATING CONSTRUCTION SCHEDULE

A. The Contractor shall keep the construction schedule current to the progress of the Work continually through closeout of the project. The construction schedule shall be submitted monthly for the Engineer's review.

2.04 WEEKLY CONSTRUCTION SCHEDULE

A. The Contractor shall submit a schedule of his work for each week. This schedule shall identify the foreman of each work crew and the location and type of work the crew will be doing each day. It shall be delivered to the Engineer's office no later than 4:00 p.m. of the next to last workday of the preceding week.

PART 3 EXECUTION

3.01 COORDINATION

A. All phases of the Work requiring interference with normal operations of the existing facilities shall be scheduled in accordance with agreements among the Contractor, the Owner, and the Engineer. The Contractor shall notify the Owner at least one week before such Work is to begin.

B. Contractor shall begin the work with installation of the valve vault at Station 39. Upon completion of the valve vault, watermain work shall begin at the E. G Avenue intersection and proceed south.

PART 4 SPECIAL PROVISIONS

4.01 SCHEDULED NON-WORK DAYS

A. The Contractor shall restrict Work to 8:00 a.m. to 5:00 p.m. Monday through Friday unless otherwise authorized by the Owner and Engineer. Contractor shall consider the following list of holidays as mandatory non-work days, all of which shall be incorporated into the construction schedule:

1. New Year's Day.
2. Martin Luther King Day.
3. Presidents' Day.
4. Good Friday.
5. Memorial Day.
6. Fourth of July.
7. Labor Day.
8. Columbus Day.
9. Veterans' Day.

10. Thanksgiving Day.
11. Day after Thanksgiving Day.
12. Christmas Eve Day.
13. Christmas Day.

END OF SECTION

SECTION 01320
ELECTRONIC PROJECT MANAGEMENT SYSTEM (EPMS)

PART 1 GENERAL

1.01 SCOPE

A. This section describes the requirements for the Electronic Project Management System (EPMS) which will be required on this project. The EPMS shall be provided through eCommunication by Eastern Engineering, 866-884-4115; www.easternengineering.com .

B. The Engineer shall be responsible for setting up and paying for the cost of the EPMS.

C. Engineer will implement an internet/web site based Electronic Project Management System (EPMS) for the administration of the Contract on this project. Owner, Contractors and Engineer shall be responsible to interface with EPMS and to collaborate via the EPMS on this project. The EPMS is intended to supplement the Contract Documents, and the provisions of the Contract Documents shall not be superseded by the EPMS.

1. The EPMS is intended to provide a mode of communication which is electronic and to reduce the reliance upon printed documents. Printed documents transmitted will not be reviewed, and electronic documents emailed outside of the EPMS will not be reviewed. The Owner, Contractor and Engineer will collaborate on unique situations or circumstances in order to preserve the project electronic records.

D. The Owner, Contractor and Engineer shall be required to provide project-related information/documents via EPMS. In general, the EPMS will receive information via uploaded documents as PDF documents, in their native format (when permitted or required), or other electronic formats designated or required for functionality. The EPMS shall be a central repository for information to all project team members. The EPMS will provide viewing, printing, up/downloading of various information/documents.

E. In general, the following is a partial list of information/documents which shall be tracked through the EPMS:

1. Drawings, Specifications, and Addenda (included revisions as necessary).
2. Insurance.
3. General Project Communication, Emails, Letters, Correspondence and Collaboration or any other document any participant wishes to make part of the project records.
4. Request for Information (RFI).
5. Submittals (Shop Drawings, Operation and maintenance manuals, color selections etc.)
6. Work Change Directives, Change Requests, and Change Orders.

7. Schedule of Values, Pay Requests and Certified Payroll Reports.
8. Reports and Photos (daily, monthly, etc.).
9. Schedules (project, weekly and monthly).
10. Meeting Agendas and Minutes.
11. Permits and Special Inspections Reports.
12. Laboratory Services (testing and reporting).
13. Closeout procedures (deficiency list, warranty, substantial completion).
14. Record Drawings.

F. In an effort to protect proprietary information and prohibit unauthorized use or modifications, levels of access security will be assigned in order to provide safe and secure access to information with respects to involvement and responsibility on the project. The Owner, Contractor and Engineer shall establish the levels of access and rights which are appropriate for this project.

G. Owner, Contractor and Engineer shall utilize the mark-up tool integral within the EPMS or have a PDF review software that includes the ability to mark up and apply electronic stamps (such as Adobe Acrobat, or Bluebeam PDF Revu).

H. A high-speed internet connection is required.

I. The EPMS will provide notifications regarding new or updated documents through an existing Email account outside of the EPMS.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 CONTRACT REQUIREMENTS

A. All provisions of the Contract Documents are in full effect and enforcement. The submittal procedures specified in the Contract Documents are applicable with the understanding that they will be electronic documents and submitted via the EPMS.

3.02 PRINTING, REPRODUCTION AND DISTRIBUTION

A. The Engineer will not be responsible for printing reproduction or preparation of any hard copy documents, or for the cost of doing so.

B. Contractor shall produce printed copies of all submittals as required in Section 01300 and in the Contract Documents.

3.03 TRAINING

A. One training session by the Engineer and Eastern Engineering, Inc. will be provided to the team members at the beginning of the EPMS implementation. Training will be coordinated with the Preconstruction meeting and held at the same location. There are many tutorials, help features and technical support options located on the Eastern Engineering website.

B. Engineer will provide project-related support as needed within their ability to provide it. Technical support will be available to all project team members from Eastern Engineering, Inc.

3.04 OPERATION

A. Contractor and all Subcontractors shall maintain a Windows-based computer system including high-speed internet access and ability to create/mark-up documents using Adobe Acrobat (PDF) and to scan documents.

B. Engineer will facilitate the implementation and overall operation of the EPMS with Eastern Engineering. Eastern Engineering will provide and maintain the EPMS server and will back up the information.

3.05 ARCHIVE PROJECT CLOSEOUT

A. All files on the EPMS website will be archived at the end of the project. These archives will be made available to the Owner, Contractors and Engineer for download over the internet, at the end of the warranty period.

3.06 ELECTRONIC SUBMITTAL FILE NAMING CONVENTION

A. The Contractor shall utilize the following file name convention for PDF files submitted through eComm:

1. Spec Section - Number of Submittal from Section - Number of Times Submitted.

   a. Example: 02552-01-03.

2. The example represents the first submittal from Specification Section 02552 and the third time this Submittal has been submitted.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

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SECTION 01350
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes general requirements for all materials, equipment and systems furnished or installed under this project.

B. Additional specific requirements included under a particular Section shall take precedence.

C. This Section includes, but is not limited to, the following procedural and administrative requirements:

1. Product Delivery Storage and Handling.
2. Warranties.
3. Quality Assurance and Control.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and related specification sections.

B. The specification sections and Drawings contain the specific submittal requirements.

1.03 QUALITY ASSURANCE

A. Where Contractor is required to provide design services or certification of the design, the specified product, equipment or system shall comply with the specified criteria.

1. Contractor shall submit a written request for clarification when specified criteria is incomplete or insufficient.

B. Manufacturer's name, make, model number and other designations provided in the contract documents are to establish the significant characteristics, including but not limited to, type, function, dimensions and physical properties, performance, and appearance for the purpose of evaluating comparable products. Contractor shall verify that product, equipment or system proposed meets or exceeds the requirements as specified or shown on the Drawings.

1.04 PROJECT HANDLING

A. Schedule delivery to minimize the time goods are kept in storage.

B. Deliver goods to Site in manufacturer's original packaging.

C. Inspect the goods to determine if there is visible damage to the packaging.

1. The packaging shall be removed in a manner that will allow resealing for storage.

2. If packaging cannot be removed and reused, the goods shall be repackaged per the manufacturer's recommendations.

D. Goods that are susceptible to damage by the environment or the project conditions, including but not limited to, switchgear, motor control centers, panelboards, instrument control panels, and fixtures shall be stored in a controlled environment per the manufacturer's recommendations. If no such area is available at the time such equipment is received, such space shall be provided by the Contractor at no expense to the Owner.

E. Where construction is in roads or streets, that portion of the right-of-way not required for public travel may be used for temporary storage purposes unless otherwise prohibited. Materials shall not be stored in areas where such storage creates a hazard. Any other additional space required for construction or storage of materials and equipment shall be obtained by the Contractor at his expense.

F. The Contractor shall confine his equipment, the storage of materials and equipment, and the operations of his workers to areas permitted by law, ordinances, permits, and the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

1.05 GUARANTEE

A. Manufacturer's warranty, extending beyond one-year after substantial completion for the specified product, equipment or system shall be provided to the Owner and endorsed by the Manufacturer.

B. Requirements for warranties extending beyond one-year after substantial completion are described in individual Sections of these specifications.

C. Manufacturer's limitations and disclaimers shall not relieve the Contractor from warranty obligations under the Contract Documents.

PART 2 PRODUCTS

2.01 SHOP PAINTING

A. Non-galvanized ferrous surface shall be painted.

B. Shop painting of ferrous surfaces shall be as follows:

1. Surfaces shall be thoroughly cleaned of dirt, grease, oil, rust, scale, or other foreign substances. All metal surfaces shall, as a minimum, be abrasive blasted in accordance with SSPC-SP6, Commercial Blast Cleaning.

2. Surfaces shall receive a shop coat of a primer compatible with the finish coating to be used by the Contractor.

2.02 GALVANIZING

A. Where galvanized metal is indicated, unless otherwise specified, galvanizing shall conform to ASTM A123 (Hot Dip Galvanized). Threaded parts and hardware shall be galvanized in conformance with ASTM A153.

2.03 REGULATORY REQUIREMENTS

A. Materials, equipment, coatings, and chemicals in contact with potable water, or water being treated for potable water use, shall comply with the applicable NSF Standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Products shall be installed in accordance with the manufacturer's instructions and the Contract Documents.

B. Required appurtenances, including but not limited to, anchors, grout, and leveling shims, shall be provided.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

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SECTION 01410
LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE

A. The Owner shall retain an independent laboratory.

1. The Owner shall perform the required testing on water mains prior to placing new mains into service.

2. The Owner has retained SME Engineering to perform required density testing, concrete testing, and asphalt testing.

B. Testing, inspection(s) and quality control are required to certify compliance with the Contract Documents.

1. The laboratory services do not relieve the Contractor from the responsibility of compliance with the Contract Documents.

2. Any test required by the Owner shall not relieve the Contractor from the responsibility of compliance with the Contract Documents.

3. Any test required by the Owner shall not relieve the Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate compliance with the Specifications.

C. Specific testing, inspection(s) and quality control requirements are specified in the individual Sections of the specifications.

D. Specific testing, inspection(s) and quality control requirements of any Federal, State or Local authorities are specified in the related sections of Work.

E. Testing of materials or equipment for compliance with various national or technical society standards and ordinarily performed by manufacturers, and shop and field tests of equipment, are not included under this Section but shall be performed by the Contractor or his supplier as specified elsewhere.

F. Contractor may conduct material or field test(s), inspection(s) and quality control as he deems necessary.

1. Should the Contractor, at any time, desire the Owner to consider the results of such testing, inspection(s), and quality control, such results shall be certified by an independent testing laboratory acceptable to the Owner. Any testing of this nature shall be conducted at the Contractor's expense.

1.02 SUBMITTALS

A. Submittals of all required field and laboratory test results shall be made by the independent laboratory as soon as they are available to the Owner and Engineer directly.

1. Statement of Compliance per 1.03

1.03 QUALITY ASSURANCE

1. The laboratory shall be a recognized and independent commercial laboratory with experience in conducting the required tests.

2. Laboratory shall certify compliance with ASTM E548, ASTM E329, and ASTM C1093 when masonry construction is part of the project scope. In lieu of ASTM certification, the laboratory may submit written documentation demonstrating experience and training relevant to the inspections to be performed. The documentation shall demonstrate experience with projects of similar complexity and quantity of inspections as the project herein.

3. Testing, inspection(s) and quality control shall be certified by a professional engineer specialized in the related field and in the state where the Site is located.

PART 2 PRODUCTS

2.01 TESTS

A. Aggregates, Bedding Material, and Special Backfill - For each type of material, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine compliance with the contract documents.

1. Retests shall be performed until the Specifications are met.

2. Retest shall be performed each time the source of material is changed.

B. Selected Backfill - At the discretion of the Engineer, but in no case more than one test for each 1,000 cubic yards or portion thereof, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine whether the material is suitable for backfilling purposes.

C. Mix Designs:

1. For each type of controlled density fill, concrete, and asphalt, the laboratory shall review, perform test(s).

2. The Engineer shall review, perform test(s) and approve any change in source of materials.

3. The asphalt design shall be made in accordance with ASTM D1559, the Marshall Method of Mix Design and as specified.

4. Approved mix designs shall include sieve analyses and suppliers' certificates for materials incorporated in the mix.

D. Compaction Tests:

1. For each type of backfill material, the laboratory shall determine the moisture-density curve according to ASTM D698.

2. Using ASTM D2922 test methods, the laboratory shall determine the density of placed backfill.

3. Retests shall be performed if the compaction requirements stated in the individual Sections are not met.

4. The Engineer may at his discretion require the sand cone (ASTM D1556) or the balloon (ASTM D2167) tests for density and compaction to verify questionable results of the ASTM D2922 tests.

E. The independent testing laboratory shall test and report the soil bearing capacity under all foundations and slabs on grade. The testing shall be conducted at regular intervals in all directions. The independent testing laboratory shall immediately notify both the Contractor and the Engineer of any such test not meeting the presumed soil bearing capacity contained in the Structural Design Data on the Drawings.

F. Asphalt and Concrete Quality Control Testing - Perform tests as indicated in Sections 02600 and 03300.

G. Miscellaneous Tests - Perform all other tests requested in the individual Sections of the Specifications.

2.02 PLANT INSPECTIONS

A. Inspect and certify asphalt as indicated in Sections 02600 and concrete plants as required by the City of Kalamazoo.

2.03 EQUIPMENT

A. Provide all necessary equipment to extract and store samples and perform the required tests.

PART 3 EXECUTION

3.01 COORDINATION

A. The Contractor shall provide the source of all materials requiring testing and shall arrange access for the independent laboratory to obtain representative samples and perform required tests at the material source. The information shall be supplied in advance to allow time for testing and reporting. Concrete information shall be supplied at least 45 days prior to the first concrete placement.

B. Contractor shall coordinate activities to accommodate the required quality assurance/control.

1. Contractor shall not compromise the requirement for quality assurance/control in order to maintain the schedule.

C. The laboratory shall conduct tests on materials and in locations as directed by the Resident Project Representative.

D. All tests shall be performed in accordance with the proper test methods mentioned above and in the individual Sections. Results shall be compared to the required values included in the individual Sections.

3.02 PREPARATION

A. Contractor shall prepare all Work to be tested in accordance with the testing procedures as directed and required by independent laboratory, regulatory agency, Owner or Owner's representative.

3.03 PROTECTION

A. Contractor shall at the completion of testing, repair damage to construction in accordance with these specifications.

B. Contractor shall be responsible for the protection, regardless of the responsibility for quality assurance/control.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 01500
MAINTAINING TRAFFIC

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing of all labor, materials, equipment and services necessary for maintaining and protecting vehicular and pedestrian traffic.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:

a. The Contractor shall submit the name, address, and telephone number of a local individual who will be responsible for maintaining traffic facilities when the Contractor is not working.

b. Traffic control or maintenance plans with governing authority(s) approval shall be submitted.

c. Detour routes with governing authority(s) approval shall be submitted.

d. Delivery and haul routes for Contractor's activities outside the zone of influence shall be submitted.

1.03 QUALITY ASSURANCE

A. The installation, maintenance, and operation of all traffic controls and traffic control devices shall conform to the requirements of the State Department of Transportation Manual of Uniform Traffic Control Devices for Streets and Highways, hereinafter called the MUTCD.

B. If, in the opinion of the authority having jurisdiction over traffic in the affected thoroughfares, proper maintenance of traffic facilities and proper provisions for traffic control are not being provided by the Contractor, they may take the necessary steps to place them in proper condition, and the cost of such services will be deducted from any money which may be due or become due the Contractor.

C. A traffic control conference, attended by Owner, Engineer, Contractor and governing authority, shall be held no later than 14 days prior to any traffic maintenance, placement of traffic control devices, lane closures, detouring of traffic or other activity that impedes the normal flow of traffic.

PART 2 PRODUCTS

2.01 TRAFFIC CONTROL DEVICES

A. Traffic control devices shall be provided with suitable supports of sufficient strength and stability.

B. Faces of orange construction signs, barricades, vertical panels and drum bands shall be suitably reflectorized with sheeting.

C. Traffic cones shall be a highly visible orange color.

D. Pavement markings for traffic maintenance shall conform to the requirements of MDOT, the local authority and the MUTCD.

2.02 TEMPORARY TRAFFIC SIGNALS

A. The Contractor shall furnish, erect, maintain, and subsequently remove signal and signal controller equipment of a proper type and capacity to provide the required operation, and shall meet the general requirements of MDOT and the MUTCD.

1. Any malfunctions or failures shall be corrected without delay. Temporary traffic signals not in use shall be covered or removed.

B. The Contractor shall be responsible for the procurement of and payment for electric power for temporary traffic signals.

PART 3 EXECUTION

3.01 COORDINATION

A. The Contractor shall provide and maintain in safe condition such temporary facilities for vehicular and pedestrian traffic as may be necessary to provide safe vehicular and pedestrian ingress and egress for all property adjacent to the improvements. Such access shall be provided at all times unless workers or machinery are in the immediate area. Access shall be provided to all properties at the end of the Work day.

B. When the street or highway under construction is being used by vehicular traffic, including periods of suspension of the Work, the Contractor shall maintain that portion of the street or highway being used to ensure that it is smooth, free from holes, ruts, ridges, bumps, and dust.

C. The Owner will enter upon that portion of a project where the Contractor is responsible for maintaining through traffic on part or the entire project, to place abrasives at its own expense, as may be considered advisable.

1. The Contractor shall be responsible for the removal of abrasives placed and for which no claim for additional compensation shall be allowed; nor shall the Contractor be relieved in any way of his obligation for maintenance of traffic.

D. The Owner will provide for the necessary maintenance of public streets or highways which are used as detour beyond the Work limits of the contract.

3.02 TRAFFIC CONTROL

A. Barricades, vertical panels, and cones shall be protected by adequate advance warning construction signs.

B. Equipment and material stored on the highway shall be marked at all times. At night, any such material or equipment stored within rights-of-way and easement(s) shall be clearly outlined with dependable lighted devices.

C. Contractor shall provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic in all areas where materials are stored.

D. Road Closed - When a highway has been permitted to be closed to traffic, the Contractor shall provide, erect, maintain, and subsequently remove approved traffic control devices, barricades, and suitable and sufficient red or yellow lights.

3.03 TRAFFIC MAINTAINED

A. Where the street or highway under construction is being used by vehicular traffic, including periods of suspension of the Work, the Contractor shall furnish and maintain pavement markings, lights, warning signs, road construction traffic maintained signs, and end construction signs, barricades, temporary guardrail, and such other traffic control devices, and flaggers as may be necessary to maintain safe traffic conditions within the Work limits.

B. Existing signs and traffic control devices within the Work limits shall remain in use during the construction period. If the Contractor needs to relocate or modify permanent signs and other traffic control devices as a consequence of his work, he shall provide suitable supports and may modify the devices with prior approval of the Engineer and with the concurrence of the maintaining agency. Routine maintenance of permanent traffic control devices will remain the responsibility of the maintaining agency.

C. The function of existing Stop or Yield signs shall be retained at all times although their position may be adjusted. Existing signs that must be relocated laterally shall be placed in accordance with the MUTCD.

D. When an existing signal operation must be interrupted for a period, the Contractor shall provide a temporary traffic control method.

E. The Contractor shall obtain the approval of the Owner and Engineer before closing a traffic lane or establishing a one-way traffic operation.

F. Flaggers:

1. Whenever one-way traffic is established, at least two flaggers shall be used and signs, cones, barricades, and other traffic control devices shall be erected by the Contractor in accordance with the MUTCD. The Contractor shall maintain

positive and quick means of communication between the flaggers at the opposite ends of the restricted area.

2. Flaggers shall be equipped according to the standards for flagging traffic contained in the MUTCD. At night, flaggers' stations shall be adequately illuminated.

3. The Contractor may, in lieu of flaggers or supplementing them, furnish, install, and operate a temporary traffic signal or signals for the purpose of regulating traffic.

3.04 SNOW AND ICE REMOVAL

A. The State and Local authority responsible for snow and ice removal will be responsible for removals during the construction provided the following:

1. The project area is open to public access.

2. In the opinion of the State and Local authority, the project area is accessible with their equipment.

3. In the opinion of the State and Local authority, the street surface will not cause damage to their equipment, nor will their equipment cause damage to the street.

B. The Contractor shall be responsible for snow and ice removal during construction when:

1. The project area is closed to public access.

2. When limited access is provided for local traffic but area is closed to through traffic.

3. The project area pavement has been removed or damaged to the extent that the State and Local authority's equipment will no longer effectively remove snow and ice or will cause damage to the project area.

PART 4 SPECIAL PROVISIONS

4.01 SPECIAL REQUIREMENTS

A. Contractor shall coordinate traffic control with the Road Commission of Kalamazoo County.

4.02 RESTORATION OF PAVEMENT SURFACES OUTSIDE THE ZONE OF INFLUENCE

A. Contractor shall restore all damaged pavement surfaces in streets used by the Contractor for moving materials and equipment to and from the construction area and streets used for bypassing or detouring traffic around the construction area.

B. Materials used in replacing damaged areas of the road shall be as specified in Section 02600 of these Specifications.

C. The pavement shall be restored with pavement of the same type and thickness as the existing pavement, in accordance with Section 02600 of these Specifications.

END OF SECTION

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SECTION 01565
TEMPORARY RESTORATION AND MAINTENANCE OF PAVEMENTS, CURBS, AND WALKWAYS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes temporary restoration and maintenance of pavements, curbs, and walkways.

B. Restoration - The Contractor shall promptly restore as herein specified all curbs, walks, driveways, and roadways affected by the Work done under this Contract as soon as any sufficient portion thereof has been completed. Such temporary restoration shall be maintained in satisfactory condition until the permanent restoration work replaces the temporary section.

C. Maintenance:

1. All temporary pavement, sidewalks, and other pavements affected by the Contractor's operations shall be maintained by the Contractor at his expense in a suitable and safe condition for traffic until permanent replacement is to be made.

2. This Section includes maintenance in or along streets in which construction is taking place, streets used for moving materials and construction equipment to and from the construction area, and streets used for bypassing or detouring traffic around the construction area.

PART 2 PRODUCTS

2.01 BASE AND SURFACE MATERIALS

A. Base and surface materials shall be in conformance with Section 02600 of these Specifications unless otherwise shown on the Drawings.

PART 3 EXECUTION

3.01 CONSTRUCTION OF TEMPORARY PAVEMENT, CURBS, AND WALKS

A. Preparation of Subbase - Before laying any pavements, sidewalks, or curbs, the trenches shall be compacted and all resulting holes and depressions shall be filled and tamped solid.

B. Curbs - All curbs required to be reset temporarily shall be placed in their original position or as directed, but the Contractor will not be required to set them in concrete.

C. Sidewalks - All sidewalks disturbed shall be temporarily restored immediately upon the placing of the backfill either by relaying the old sidewalk pavement, placing 4 inches of

aggregate base, laying a pavement of 2-inch-thick wooden planks, suitably fastened and flush with the adjacent sidewalk, or as otherwise directed. Permanent sidewalks shall be replaced as soon as possible.

D. Pavement - Temporary pavement shall consist of aggregate base course and bituminous surface treatment as specified below:

1. Subgrade - The subgrade for the temporary pavement shall be thoroughly rolled or rammed and brought to the required grade and cross section to receive the pavement. The subgrade for pavements over trench openings large enough to be compacted with a roller shall be rolled to a firm unyielding surface with an approved power roller weighing not less than 10 tons. For smaller trench openings, the subgrade shall be thoroughly rammed.

2. Aggregate Base Course - The aggregate base course shall be 8-inch-thick and shall conform with all requirements of MDOT Item 3.01 Aggregate Base (22A Series).

3. Bituminous Seal Coat - After the aggregate base course has been prepared, a bituminous seal coat consisting of a prime coat and one application each of bituminous material and coarse aggregate shall be applied. All Work and materials shall conform to MDOT Specifications for Seal Coat, Item 4.06. A prime coat of MC-30 or MC-70 shall be applied upon the base course at the rate of 0.3 to 0.5 gallon per square yard. The minimum curing period for the prime coat shall be 24 hours. After the prime coat has properly cured, a bituminous surface coat of RC-800 or RS-2a shall be applied at a rate of 0.20 to 0.45 gallon per square yard. After application of the surface coat, No. 25A aggregate shall be applied at a rate of 20 to 30 pounds per square yard and rolled.

3.02 SEASONAL LIMITATIONS FOR TEMPORARY PAVEMENT CONSTRUCTION

A. Weather limitations for placing bituminous seal coat shall conform to MDOT 4.06.10. Between paving seasons, the Contractor shall place 8 inches of aggregate base and maintain it until seal coat can be applied.

B. When time restrictions are not in effect, the Contractor shall prepare the base and immediately place temporary or permanent pavement surface.

3.03 MAINTENANCE – EXISTING AND TEMPORARY PAVEMENTS

A. All existing temporary pavement and sidewalk shall be maintained, by the Contractor at his own cost and expense, in a suitable and safe condition for traffic until permanent replacement is to be made or the Work finally accepted. Any depressions which develop shall be acceptably repaved when directed. Spots in the pavements which show signs of deficient bitumen or raveling shall be repaired by hand; and if deemed necessary, pavement shall be reconstructed in part or in whole as directed.

3.04 SEASONAL LIMITATIONS FOR MAINTENANCE OF BITUMINOUS PAVEMENTS

A. During that time of year when asphalt concrete cannot be placed in conformance with MDOT Specifications, the Contractor shall remove loose material from holes and fill depressions in the pavement with cold patch material as required to maintain the road surface in a condition acceptable to the Owner.

B. As soon as weather conditions permit, the Contractor shall remove the cold patch and place bituminous concrete in accordance with Section 02600.

3.05 PERFORMANCE

A. If, in the opinion of the Engineer, proper maintenance of traffic facilities and proper provisions for traffic control are not being provided by the Contractor, the Engineer may take the necessary steps to place them in proper condition, and the cost of such services will be deducted from any money which may be due or become due the Contractor.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

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SECTION 01568
POLLUTION CONTROL

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the requirements for pollution control.

PART 2 PRODUCTS

2.01 GENERAL

A. Dust palliatives shall conform to MDOT Item 922.08.

PART 3 EXECUTION

3.01 MICHIGAN GENERAL REQUIREMENTS

A. The Contractor is responsible to obtain and pay for NPDES Permit for storm water discharge.

B. The Contractor is responsible for following an erosion control plan in accordance with permits required under Act 451, Part 91 as amended (Soil Erosion and Sedimentation Control), Part 303 (Wetland Protection, formerly Act 203), Part 301 (Inland Lakes and Streams, formerly Act 346), Part 31 (Water Resources Protection, Floodplain Regulatory Authority, formerly Act 245 as amended by Act 167), Part 31 (Water Resources Protection), and National Pollutant Discharge Elimination System (NPDES). Secure Federal Section 404, Clean Water Act of 1972, permits, if required. Provide temporary and permanent erosion and sedimentation controls according to the permits.

C. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.

D. The Contractor shall perform Work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems, and to prevent dust attributable to his operations from entering the atmosphere.

E. Water containing suspended material from any part of the Contractor's operations shall be clarified before discharging to drains or streams.

F. No fill, topsoil, or heavy equipment shall be stored within 200-feet of a stream bank or within the drip line of a treed area.

G. Excess soil that is stockpiled shall be removed or regraded within 15 days of the completion of construction.

3.02 STREETS, SIDEWALKS AND DRIVEWAYS

A. Streets, haul roads, and detours and bypass roads shall be swept by automatic self-contained sweepers.

B. Excessive dirt on pavements shall be removed by means of hand shoveling or appropriate mechanical equipment and the area swept as directed above.

C. Sidewalks and driveways shall be cleaned by means of shovels and hand brooms or appropriate mechanical equipment.

D. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with calcium chloride dust palliative.

E. The Contractor shall comply with the above requirements on a daily basis. If the Contractor fails to perform the above Work in a satisfactory manner, all Work, except cleanup operations, shall be stopped until the Contractor has complied with the above requirements.

3.03 EROSION AND SEDIMENT CONTROL

A. The Contractor shall initiate appropriate vegetative practices within seven days on all disturbed areas to remain dormant (undisturbed) for more than 45 days.

1. Such practices may include: temporary seeding, permanent seeding, mulching, matting sod stabilization, vegetative buffer strips, phasing and protection of trees.

B. Permanent or temporary soil stabilization shall be applied to disturbed areas within seven (7) days after final grade is reached on any portion of the Site.

C. When seasonal conditions prohibit the application of temporary or permanent seeding, non-vegetative soil stabilization practices, such as mulching and matting, shall be used.

D. A stabilization construction entrance shall be provided to reduce vehicle tracking of sediment. The paved street adjacent to the Site entrance shall be swept a minimum of daily, or as needed, to remove any excess mud, dirt, or rock being tracked from the Site.

1. Dust and sediment along any street due to construction on this Site is to be swept a minimum of once at the end of the day or as necessary to prevent a build-up of dust and soil on the pavement surface.

E. Dump trucks hauling from the construction site shall be covered with a tarpaulin.

F. No more than 200 feet of trench shall be open at any given time. Trench opening, laying of pipe, and backfilling should occur so as to minimize the amount of disturbed area.

G. The Contractor shall minimize the width of his work area.

H. Existing trees, shrubs, and other ground cover vegetation shall be preserved where possible. Tree removal will be limited to that necessary for construction and will be

limited further to the permanent easement wherever possible. No tree removal will be permitted outside the temporary easement.

I. Storm water runoff and natural stream flow shall be intercepted or diverted when originating upgrade away from the construction site, to minimize the amount of flow over the construction site.

J. All dewatering flows are to be settled in siltation basins or directed through filters before discharge to stabilized sites, such as stream or storm sewers, and not onto exposed soils, stream banks, or any other sites where the flow could cause erosion.

K. When construction occurs near storm sewer inlets, erosion control measures such as inlet filters or hay bales shall be used to prevent silt from entering the storm sewers.

L. The cleanup and disposal of excess excavated material shall be done as soon as practical after laying of the pipe. However, cleanup work shall not fall behind the pipe laying more than 1000-feet. Should the Contractor not keep his cleanup within the aforementioned distance, Work shall stop until the cleanup work is accomplished.

3.04 SEDIMENT CONTROL

A. Contractor shall control erosion and trap sediment from all sites remaining disturbed for more than 14 days. Such practices shall include among others, sediment traps, sediment basins, silt fences, and storm drain inlet protection. Silt Fence Fabric shall be in accordance with MDOT Item 910.04 Silt Fence Geotextile.

B. Timing - Sediment control structures shall be functional throughout earth-disturbing activity. Sediment ponds and perimeter sediment barriers shall be implemented as the first step of grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is restabilized.

C. Settling Ponds - Concentrated storm water runoff from disturbed areas flowing at rates which exceed the design capacity of sediment barriers, shall pass through a sediment settling pond. The facility's storage capacity shall be 67 cubic yards per acre of drainage area.

D. Sediment Barriers - Sheet flow from runoff from denuded area shall be intercepted by sediment barriers. Sediment barriers, such as sediment fences or diversions directing runoff to settling facilities, shall protect adjacent properties and water resources from sediment transported by sheet flow.

E. Other erosion and sediment control practices shall prevent sediment-laden water from entering drain systems. Unless the storm drain system drains to a settling pond. These practices shall divert runoff from distributed areas and steep slopes where practicable and stabilize channels and outfalls from erosive flows.

3.05 CONSTRUCTION OF SLOPES

A. The Contractor shall comply with the following requirements when working on slopes exceeding 4:1.

1. The pipeline shall be constructed during dry weather, low flow periods as determined by the Engineer. The construction time for this Work shall be limited to the shortest time possible in order to minimize environmental impacts.

2. Construction equipment shall be limited to trenching equipment or rubber-tired backhoes in order to prevent soil erosion and maintain slope stabilization.

3. Biodegradable mesh shall be used for slope stabilization. The mesh shall cover the entire width of disturbed ground.

4. The trench shall be backfilled immediately after installation of the pipe. The disturbed areas shall be graded, seeded, and mulched within 24 hours after backfilling. The Contractor shall maintain all seeded and mulched areas in accordance with the Specifications until final acceptance of the Work.

5. The Contractor shall place straw or hay bales at the base of the slopes for sedimentation control. The bales shall be placed prior to construction of the pipeline and shall remain until final seeding has germinated and become established.

3.06 RESERVED

3.07 PROHIBITED CONSTRUCTION ACTIVITIES

A. Disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.

B. Locating stockpile storage areas in environmentally sensitive areas.

C. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the easement limits.

D. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.

E. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or man-made channels leading thereto.

F. Permanent or unspecified alteration of the flow line of any stream.

G. Damaging vegetation outside of the construction area.

H. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

I. Open burning of project debris without a permit.

J. Discharging into the atmosphere injurious silica dust concentrations resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or places of human occupation.

K. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously specified on the Drawings or not authorized by the Owner or the Engineer for such purpose.

L. Running well point or pump discharge lines through private property or public property and rights-of-way without the written permission of the property owner and the consent of the Engineer.

PART 4 SPECIAL PROVISIONS

None.

END OF SECTION

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SECTION 01800
CONSTRUCTION SURVEY WORK

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing of all labor, materials, equipment, and services necessary for the completion of Construction Survey Work in accordance with the Contract Documents.

B. This Work consists of the layout of all lines and grades shown on the Drawings or as altered or modified by the Engineer, control survey, and of miscellaneous survey work related to construction of the project.

1.02 PROTECTION

A. The Contractor shall protect and preserve the established reference points and monuments.

B. Whenever monuments are encountered in the line of Work, whether shown on the Drawings or not, the Contractor shall notify the Engineer in writing at least 24 hours in advance of moving same, and under no circumstances is such a stone or other monument to be removed or disturbed by the Contractor or by any of his men without a written order of the Engineer and only when a registered surveyor representative of the Owner is present.

1.03 REPLACEMENT OF LOST SURVEY POINTS

A. Whenever a reference point or monument is lost or destroyed or requires relocation, the Contractor shall, at his own expense, accurately relocate and replace all such points so lost, destroyed, or moved.

1.04 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:

a. Layout Sheets including, but not limited to, Benchmarks both temporary and permanent and Pipeline layout staking.

b. Field Notes and survey log.

c. Profile over Proposed Tunneled, Jacked, or Bored Pipe.

d. Certified Survey of Tunneled, Jacked, or Bored Pipe.

B. Contractor shall provide the Engineer and Resident Project Representative, no later than five working days after installation, all Logs, reports, field notes, drawings and documentation as specified, shown on the Drawings, or directed.

C. No Pipeline or related Work shall be considered for payment until all logs, reports field notes, drawings, and documentation as specified, shown on the Drawings, or directed, have been submitted to the Engineer or Engineer's Representative.

PART 2 PRODUCTS

2.01 CONSTRUCTION STAKING

A. All construction points shall be marked with a wooden hub and nail or a PK nail in concrete, asphalt pavements and walks.

B. All points located in areas of heavy underbrush, inaccessible or limited site distance shall be identified with a wood lath extending a minimum of 3 feet above the ground.

C. All points located in paved surfaces shall be clearly marked with paint. Contractor shall obtain written permission from Owner to use paint for marking.

PART 3 EXECUTION

3.01 COORDINATION

A. The Contractor shall provide field forces necessary to lay out the location, alignment, elevation, and grade of the Work shown on the Drawings and in conformance with the control points and benchmarks shown on the Drawings.

B. The Contractor shall use competent personnel and suitable equipment for the layout of the Work required. If the layout Work involves more than some simple distances and elevations from established reference points, the Contractor shall employ a Registered Surveyor to supervise the layout Work.

C. Contractor shall furnish the necessary labor to assist the Engineer in checking the installation, if required.

3.02 EXISTING CONNECTION POINTS

A. The Contractor shall verify critical elevation points of the existing utilities prior to commencing installation of Work. Critical points shall include all points where new Work connects to existing utilities and existing utilities that could conflict with the Work. All data shall be provided to the Engineer before commencing Work.

3.03 RIGHTS-OF-WAY AND EASEMENTS

A. Rights-of-way or easement(s) shall be staked at points along the boundaries so that at least two stakes can be seen distinctly from any point along the boundary line. The

staking shall not exceed 200 feet in any direction. All points of change in width or direction of the rights-of-way or easement(s) boundary line shall be staked.

B. When the Contractor performs construction and the zone of influence is within 10 feet of any right-of-way or easement(s) boundary line, they shall place stakes properly identifying points of change in width or direction of the boundary line and at points along the boundary line not to exceed 25 feet.

3.04 PAVEMENT

A. The Contractor shall establish a layout for location and grade on both sides of the road and 5 feet off the edge of the pavement or back of curb. Layout line shall consist of stakes set at station intervals necessary for the topography and environment to assure conformance to planned line and grade. Stakes shall be set at a minimum every 50 feet, at all vertical and horizontal points of curvature and points of tangent, and at all vertical high or low points.

B. Stakes for line and grade of pavement and curb shall be set at station intervals necessary for the topography and environment, not to exceed 50 feet, and at low and high points of vertical curves to assure conformance to planned line and grade.

3.05 PIPE IN OPEN CUT

A. The Contractor shall utilize a laser beam for establishing line and grade when installing pipeline in open-cut construction. In order to maintain control during pipeline installation and to obtain the required field data for the record documents, the Contractor shall establish construction and layout stakes. These stakes shall be based on the Contract Documents and the survey control data as provided by the Engineer.

B. The construction staking shall be placed along the pipeline route and at the location of new manholes, valves, deflections both vertical and horizontal and as specified, shown on the Drawings, or as directed. All construction layout stakes shall be offset at a minimum of 10 feet and at a right angle to the pipeline route. Layout shall be referenced to the downstream manhole or valve; in addition it may reference survey of baseline stationing.

C. Contractor shall provide to the Engineer, no later than five working days prior to the installation of the pipeline, all information of the completed construction layout staking. This information shall include but not be limited to stationing, elevations, control points, project coordinates, offset direction and distance for all deflections both horizontal and vertical, manholes, and all other points as specified, shown on the Drawings and directed by the Engineer.

D. The grade of pipe in open-cut, whether placed by laser beam or other approved methods, shall be checked using surveying equipment. The Contractor shall have a surveyor's level and level rod on the Site at all times when pipeline and appurtenances are being installed. The level rod shall be equipped with an attached "shoe" extension on the bottom for placing on the pipe invert. The pipe invert elevation shall be checked

at a maximum of 50-foot intervals, or more often, as directed by the Engineer. Checks will be performed by the Contractor, and results, including the layout station, shall be recorded in the Contractor's field log.

E. The Contractor shall furnish all equipment and labor and check his alignment from the offset stakes. Contractor shall record all information in the log.

F. Any inspection or checking of the Contractor's layout by the Engineer shall not relieve the Contractor of his responsibility to secure the proper dimensions, grades, and elevations of the Work.

3.06 RESERVED

3.07 RESERVED

3.08 LOCATION OF STRUCTURES AND UNDERGROUND PIPING

A. The location of new structures and underground utilities shall be based on the dimensions, coordinates, and requirements shown on the Drawings or specified.

B. If it is stated on the Drawings or specified that the location and/or elevation of the new structure or underground piping shall depend on the location of existing underground or otherwise hidden facilities, those existing underground or hidden facilities shall be located by the Contractor prior to his determination of the location and/or elevation of the new facilities. This requirement shall override any other specific location dimensions or coordinates shown on the Drawings for that structure or piping.

C. If the location or elevation determined by the Contractor, in accordance with the above requirements, appears to cause conflicts with existing structures or utilities or appears to potentially cause functional issues with either the existing or new structures or utilities, the Contractor shall notify the Engineer immediately.

D. In no case, shall coordinates or other location information be extracted or interpolated from the electronic CAD files that may be provided to the Contractor by the Owner or the Engineer without the specific approval of the Engineer.

3.09 CURB AND GUTTER ELEVATIONS

A. In locations where the existing curb and gutter shall be removed as part of the Work, the Contractor shall be responsible for reconstructing the existing curb and gutter to match existing alignment, elevations and grades. The Contractor shall be responsible for collecting existing curb and gutter elevation information prior to commencing the Work.

3.10 BENCHMARKS/VERTICAL CONTROL

A. Benchmarks have been set for survey and construction reference purposes.

B. The Contractor shall protect and transfer these benchmarks as needed to complete the Work.

3.11 HORIZONTAL CONTROL

A. The centerline stationing provided is not based upon physical control points found or established as part of the design.

B. The Contractor shall establish horizontal control as necessary.

PART 4 SPECIAL PROVISIONS

4.01 REGISTERED SURVEYOR

A. The Contractor shall employ the services of a Registered Surveyor for the initial layout and staking of the project. The Registered Surveyor shall be utilized at any time when reestablishing control points, elevations, and on any redesign or extension of the Work. All survey Work shall be as specified, shown on the Drawings, or as directed.

END OF SECTION

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SECTION 01810
AUDIO-VIDEO RECORDING

PART 1 GENERAL

1.01 SCOPE

A. Under this Section, the Contractor shall furnish all personnel, transportation, recording equipment, power, and materials to produce color audio-video records of existing topography along all pipeline routes and designated haul roads, in designated residences, and as directed.

1.02 SCHEDULE OF WORK

A. Unless otherwise directed in writing by the Engineer, video recording shall be scheduled in conformance with the following:

1. No recording shall be started on any portion of the Work until that portion of the Work is under Contract, unless otherwise directed by the Owner.

2. Recording shall not precede excavation for construction by more than three months.

3. Video recording shall be performed only when foliage is visible on trees, except as authorized by the Engineer.

4. Video recording shall not be performed when more than ten percent of the ground is covered with snow or leaves, unless authorized by the Owner.

B. Before proceeding with the Work, the audio-video recording Contractor shall consult with the Engineer concerning the following:

1. Scheduling recording to precede construction.

C. All recording shall be completed on a section of Contract before the Contractor starts excavation or places material or equipment in that section.

D. In areas where public utilities are to be relocated or replaced, a second audio-video recording shall be made after the public utility has concluded their work but before the Contractor commences operations.

E. The Owner shall obtain permission for the recording crew to enter private property not included in an easement. The Contractor shall give the Owner sufficient prior notice to obtain the permission.

1.03 DEFINITIONS

A. Audio-Video Recording - Zone of Influence - Shall include producing audio-video records as specified herein for the zone of influence. The zone of influence shall be defined as all

surface area within street rights-of-way or easements in which project is to be installed or within areas 50 feet on each side of a proposed utility centerline, whichever is greater, and additional features in contiguous areas as specified or directed.

1.04 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Provide a minimum of four copies of the video.

PART 2 PRODUCTS

2.01 AUDIO-VIDEO RECORDING

A. Displays - All video shall, by electronic means, display (visible on the playback viewer) continuously and simultaneously generated transparent digital information which shall include the date and time of recording, as well as the corresponding planned station numbers. The date information shall contain the month, day, and year. The time information shall consist of hours, minutes, and seconds, separated by punctuation marks. Below the stationing, periodic transparent alpha/numeric information shall appear. The information shall consist of the name of the project, name of area covered, direction of travel, viewing side, and any other pertinent data.

2.02 AUDIO-VIDEO OUTPUTTING

A. Audio-video recording shall be a digital file format such as MPEG, MP3, MP4, Wave or WMV or other current standard file formats as approved by the Engineer.

B. The electronic file organization shall reasonably match the project stationing with file names including the station number and street names.

C. The electronic files shall be stored on a single solid-state memory device, such as a jump/thumb drive, or external hard drive. Solid state memory devices shall have a USB for connection to a computer. The memory volume on the storage device shall be adequate to store the electronic video files in an unzipped capacity along with any associated or embedded data files.

2.03 AUXILIARY LIGHTING

A. Auxiliary lighting shall be used wherever necessary to ensure clarity of picture.

PART 3 EXECUTION

3.01 PERSONNEL

A. The Work shall be performed by competent personnel with knowledge of the procedures and methods to produce satisfactory records as specified herein.

3.02 PRODUCTION

A. Recording shall be composed in such a manner that filming shall, in general, proceed in the direction of the project stationing.

B. Recorded Contents:

1. Video recordings shall be supported by appropriate audio description simultaneous with the visual coverage.

2. All houses or buildings and other readily recognizable objects as required shall be identified visually and audibly in such a manner that they can be referenced to the stationing of the project. Objects selected shall be at intervals not exceeding 100 lineal feet and shall include all houses and buildings identified by house numbers.

3. Within the zone of influence, the recording shall include but not be limited to all sidewalks, driveways, ditches, parkways, lawns, inlets, culvert pipe ends, trees, shrubs, fences, houses, and buildings that could conceivably be affected by the Contractor's operations. The audio shall call attention to existing cracks or uneven areas in walks and driveways, damaged lawns, trees or shrubbery, broken or missing inlet castings, deteriorated fences, and, where feasible, broken or plugged culvert pipes.

4. Within street rights-of-way, the recording shall include but not be limited to all pavement, curbs and inlets, mailboxes, traffic signs, and street signs. The audio shall call attention to damaged mailboxes, signs, curbs and inlet castings. Damaged areas in pavements over proposed project or in pavements scheduled for resurfacing need not be referred to in the audio.

5. Audio-video recording for designated residences shall include documentation of surface conditions inside and outside of the building prior to starting project construction.

C. Control of Picture Quality - The camera carrier shall travel at a low speed to ensure against blur or distortion of the recorded pictures. A maximum rate of 48 feet per minute is recommended.

3.03 OWNER REVIEW

A. As the audio-video recording work progresses, the Contractor shall deliver completed sections to the Owner and the Engineer. The Owner and the Engineer will review the

recordings and determine if they are acceptable for clarity and coverage. A recording may be rejected if the picture is of poor quality (i.e., blurred, distorted, too light, too dark, improper color); if there is insufficient coverage, poor audio, or the recording does not meet specified requirements.

B. The area of rejected recording shall be rerecorded by the Contractor and reinserted in the electronic file in the proper sequence.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 02100
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes grubbing, scalping, and otherwise clearing of the construction site in accordance with the Drawings and as specified herein or ordered.

B. This Work includes the removing and disposing of all trees, stumps, vegetation, and debris as necessary to accommodate new construction or to recontour the Site, and the preservation of all vegetation and other objects designated to remain.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:

a. Spoil Site Permit - When the material and debris resulting from the clearing and grubbing operations are disposed of at locations off the project, the Contractor shall obtain and submit as specified, written permission from the owner of the property upon which the material and debris are to be placed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Paint required for cut or scarred surfaces of trees or shrubs designated to remain shall be a suitable asphaltum base paint.

PART 3 EXECUTION

3.01 COORDINATION

A. Clearing and grubbing shall be performed only after the Site has been surveyed and staked as required and in accordance with Section 01800.

3.02 PREPARATION

A. The Contractor shall protect and preserve all land survey monuments or property corners along the line of his work.

1. Where monuments, irons, or property corners are disturbed or removed due to operations under this Contract, the Contractor, at his own expense, shall employ the services of a registered land surveyor to establish, reset or replace such monuments, irons, or property corners.

B. The Contractor shall not damage or destroy trees or shrubs nor remove or cut them without authorization by the Owner. All trees and shrubs except those ordered to be removed shall be adequately protected by the Contractor. No excavated material shall be placed so as to damage such trees and shrubs.

1. Trees and shrubs damaged by the Contractor shall be replaced with new stock of similar size and age, or with other stock of size and age satisfactory to the Owner, at the proper season, and at the sole expense of the Contractor. Scarred surfaces shall be treated as indicated in Part 2.

C. When or where any direct or indirect damage is done to public or private property resulting from the Contractor's operations, such property shall be restored by the Contractor, at his expense, to a condition equal to or better than that existing before such damage was done, or the Contractor shall make good on such damage in manner acceptable to the owner of the property.

D. Prior to clearing and grubbing operations, the Owner, Contractor, and Engineer shall walk the site to designate the trees to be removed or to be protected. Trees shall be marked with paint and a universally accepted designation.

3.03 CLEARING AND GRUBBING

A. Only those trees and shrubs shall be removed that are in actual interference with excavation or grading work and such removal shall be subject to approval by the Owner. The Owner reserves the right to order additional trees or shrubs removed at no additional cost if, in his opinion, they cannot be maintained or have been damaged by the Contractor's operations.

B. All trees, stumps, vegetation, and debris within the Zone of Influence not designated to remain shall be cleared and/or grubbed.

C. In locations to be seeded, stumps, roots, and other protruding obstructions shall be removed to a minimum of 6 inches below the final ground surface.

D. At all times, the Contractor shall remain within the property lines and/or easement areas.

E. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with Section 02200.

3.04 SCALPING

A. Areas of excavation or embankment shall be scalped of brush, roots, sod, grass, crop residue, decayed vegetable matters, and other organic materials.

B. Scalping depth shall be only as required to remove the above. Scalping of topsoil is not included under this Section.

3.05 DISPOSAL OF DEBRIS

A. Debris resulting from the clearing and grubbing operations shall be disposed of at designated spoil sites in a legal manner, in full compliance with applicable Codes and Ordinances.

3.06 TREE AND VEGITATION REPAIR

A. The Contractor shall employ a Certified Arborist where necessary for the repair and protection of a tree and vegetation.

B. Contractor shall repair injuries to bark, trunks, limbs, and roots of remaining vegetation by properly dressing, cutting, pruning, bracing and painting utilizing tree surgery methods, tools, and materials recommended by the Arborist.

PART 4 SPECIAL PROVISIONS

4.01 TREE REMOVAL

A. A tree is defined as a live, dying or dead plant with a minimum diameter of 6 inches with snags at 4 feet above the ground surface and a minimum height of 12 feet above the ground surface.

END OF SECTION

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SECTION 02110
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes demolition of existing structures and removal of pavement, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record. The Contractor shall submit the following:

a. A copy of a signed permit from the owner of the property upon which the debris, removed under this Section, will be disposed as specified.

b. Dust and noise control measures.

c. Record documents, in accordance with the General Conditions, and photograph or video recording indicating the location of, but not limited to, the following existing, new, and abandoned:

1) Utilities.

2) Mechanical.

3) Electrical.

4) Structural.

5) Any embedded items.

d. Inventory and documentation list for removed and salvaged materials for the Owner.

1.03 QUALITY ASSURANCE

A. Contractor shall execute the Work in compliance with all federal, state, and local codes. Any removal or demolition shall not leave the Owner in violation of any such regulations or codes unless approved by the Owner and Engineer.

1.04 PROTECTION

A. Structures shall be removed in such a manner as not to damage any portions of the existing structure which are to remain in place.

PART 2 PRODUCTS

2.01 FILL MATERIAL

A. Fill material shall be in accordance with Section 02200.

PART 3 EXECUTION

3.01 COORDINATION

A. Demolition work extending beyond the limits as specified, shown on the Drawings, or as required, will be considered unauthorized. The Contractor, at no additional cost to the Owner, shall repair said damage to a condition equal to or better than that which existed prior to commencement of the Work.

B. Existing structures and equipment which are damaged in appearance or function by performance of demolition work shall be replaced or repaired, at the Owner's discretion and to an approved condition, by the Contractor at no increase in Contract Price.

3.02 PAVEMENTS, SIDEWALKS, CURBING AND SIMILAR STRUCTURES

A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat, and free from chipped or damaged edges.

B. For removal of non-reinforced concrete, the minimum depth of saw cut shall be 3 inches.

C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel unless specified otherwise.

D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

3.03 EXCAVATION OF RIGID PAVEMENT

A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purposes of this Contract.

B. Pavement shall be excavated to neat lines and, unless otherwise specified in Part 4 of this Section, only to widths required for trenches for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation. Concrete pavement and subbase shall be cut with a concrete saw in conformance with Subsection 3.02.

3.04 MANHOLES, CATCH BASINS, INLETS AND SIMILAR STRUCTURES

A. Existing manholes, catch basins, inlets, and similar structures designated to be removed shall be completely removed.

B. Manholes, catch basins, inlets, and similar structures designated to be abandoned shall be removed to an elevation of at least 3 feet below the finished subgrade or ground surface. The remaining void shall be filled with special backfill material compacted to 100% optimum density per ASTM D698 or controlled density fill, CDF if permitted by the Engineer. All sewer openings in manholes located on sewer lines that are not to be filled, shall be plugged with 8-inch minimum thickness masonry plug.

C. Sewers designated to remain in service and connected to structures indicated to be removed or abandoned shall be rebuilt through the area with new pipe. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.

D. All castings or hydrants salvaged from abandoned or removed structures shall remain the property of the Owner, if requested by the Owner, and shall be cleaned and transported by the Contractor to a site designated by the Owner or incorporated into the Work where called for on the Drawings, scheduled, or so directed. If the Owner decides salvaged materials are not wanted, the Contractor shall dispose of them at no additional cost to the Owner.

3.05 RESERVED

3.06 GUARDRAIL AND FENCE

A. Where so required by the Drawings, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.

B. Wood posts and other materials not considered salvageable by the Owner shall be disposed of by the Contractor.

3.07 RESERVED

3.08 RESERVED

3.09 PRIVATE SIGNS

A. Private and commercial signs shall be carefully removed and relocated as directed by the Owner.

3.10 DISPOSAL OF DEBRIS

A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be trucked from the Work site by the Contractor and disposed of at spoil sites in a legal manner, in full compliance with applicable Codes and Ordinances.

B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely cleaned up.

3.11 BACKFILLING

A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Section 02200.

3.12 RESERVED

3.13 USE OF EXPLOSIVES

A. The use of explosives for the Work of removal of structures and obstructions is PROHIBITED.

3.14 PIPING REMOVAL

A. At the location where pipe removal stops, the remaining pipe end shall be capped. The cap must be pressure tight and restrained from movement due to pressures inside the pipe.

B. Piping removal includes, but is not limited to, all hangers, stands, and anchoring devices.

3.15 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 SCHEDULE OF REMOVALS

A. The following list of items once removed shall remain the property of the Owner and shall be delivered to the Owner-designated location.

1. None.

4.02 BURIED SANITARY SEWER AND WATER MAIN REMOVAL

A. As shown on the Drawings, existing water main or sanitary sewer main piping, accessories, and appurtenances shall be removed within limits shown on the Drawings or as specified.

B. The removal shall include removal and disposal of aggregate backfill, pipe bedding and control density backfill.

C. Existing pipe removed shall become the property of the Contractor and shall be properly disposed of in accordance with the requirements of this Section.

D. At locations where the pipe removal is terminated, a water-tight sewer plug shall be placed on the end of the pipe to remain.

E. Manholes shall be removed to a minimum of 6 feet.

4.03 VALVES, BOXES AND VALVE STRUCTURES ABANDONED

A. Manholes and valve box castings to be abandoned in place shall be removed to 18 inches below final grade and filled with low-strength mortar backfill in accordance with the bottom of the pavement typical section or to 12 inches below final grade in non-paved areas. The pavement section shall be removed and replaced with an additional 18 inches horizontally outside of the casting area. The void created by the removal of the casting, structure, and valve box shall be backfilled to match the surrounding pavement section or as specified for non-pavement areas.

B. Valve boxes shown on the plans may also have existing manhole castings, frames, and manhole structures around the existing valves. The abandonment of valves shall include the removal of all existing manhole castings, frames, and structure walls to the specified depths as associated with that particular valve.

C. Valve shall be abandoned in the off position when possible.

4.04 VALVES AND STRUCTURES REMOVED

A. Valves, boxes and structures to be removed shall be removed in their entirety or as approved otherwise by the Engineer.

B. All hydrant valves and boxes shall be removed as part of Hydrants Specified for Removal.

END OF SECTION

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SECTION 02200
EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SCOPE

A. This Section includes all excavations and related Work for the construction of the designated structures, pipelines, and other incidental Work.

B. Excavation includes the Work of making all necessary excavations for the construction of all Contract Work; of furnishing, placing, and the use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the Work and workers; of doing all pumping and fluming necessary to keep the excavation free from water; of providing for uninterrupted flow of existing streams, treatment plant processes, drains and sewers; of damming and cofferdamming where necessary; of supporting and protecting existing structures, pipes, conduits, sewers, culverts of all types of materials of construction; of supporting and protecting railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the Work; of removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary; of removing after completion of the Work all sheeting and shoring not necessary to support the sides of excavations; of removing and disposing of all surplus excavated material or material under structures that does not meet the soil design bearing capacities; of doing all backfilling, of compacting backfill to limits specified or ordered by the Engineer; and of restoring all property damaged as a result of the Work involved in this Contract.

C. The Work includes obtaining and transporting suitable fill material from offsite when on-site material is not available.

D. The Work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, or the disposal of all surplus material on other sites selected by the Owner.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. Sieve Analysis (ASTM C136) - One test for each material source.

   b. Submit a moisture density curve (ASTM D698) for each type of material used for backfill. Test shall be referenced to appropriate sieve analysis test. The maximum dry weight and optimum moisture content shall be indicated.

   c. Controlled Density Fill Material - Design Mix and Certified Test Results.

d. Test results for conformance with specified "Compaction Requirements":

1) Retests shall be referenced to the corresponding failing test.

e. Stripped soil and topsoil test per MDOT 816.

2. Information for the Record:

a. When excess excavated material is disposed of at locations off the Site, the Contractor shall obtain and submit written permission from the Owner of the property upon which the material is to be placed.

b. Submit details of the proposed method of installation and construction of dewatering wells.

c. Submit a schedule of the proposed sequence of dewatering well construction.

d. Submit dewatering logs.

e. Submit method for abandoning dewatering well.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Soil stripped from the Site shall consist of loose, friable, loamy topsoil without admixture of subsoil or refuse. It shall be reasonably free from peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The stockpiled soil shall be subject to the approval of the Engineer.

B. Topsoil provided shall be in accordance with MDOT 816 and be loose, friable, loamy soil without admixture of subsoil or refuse. In order for the topsoil to be considered loamy, the fraction of topsoil passing a No. 10 sieve shall contain not more than 40% clay. Topsoil shall contain not less than four percent nor more than 20% organic matter as determined by loss on ignition of oven-dried samples to constant weight at 212 degrees F.

C. Excess material shall be removed from Site, unless directed otherwise by the Owner or the Engineer.

2.02 SELECTED BACKFILL

A. Selected backfill shall be clean excavated soil. It shall be free of rock and foreign debris of any kind and shall be tested in accordance with ASTM C136 sieve screen analysis and ASTM D2487 soil classification. The material's use as selected backfill shall be approved by the Engineer.

B. Engineer may waive material testing of selected backfill. Such waiver shall apply only to the designated location and the source of the selected backfill. Such waiver shall not apply to excavated soil from locations not so designated.

2.03 SPECIAL BACKFILL MATERIAL

A. Special backfill material shall conform to MDOT 902.07 and shall meet the grading requirements of Table 902-3 Class II.

2.04 AGGREGATE BEDDING MATERIAL

A. Aggregate bedding material shall be well-graded durable crushed gravel, crushed stone, or meet the graduation requirements of MDOT Table 902-1, Class 17A. Bedding material containing a greater percentage of larger-sized aggregate shall be furnished at the direction of the Engineer.

B. Fine aggregate bedding material shall be natural sand or manufactured sand bedding material meeting the requirements of MDOT Table 902-4, 2NS.

1. Natural sand material excavated from Site may be utilized for pipe bedding provided it meets the requirements specified herein and is approved by both the Independent Laboratory and the Engineer.

2.05 CONTROLLED DENSITY FILL (CDF) MATERIAL

A. Controlled density fill material shall be a cement base fill material that can be deposited in a fluid state. It shall be composed of portland cement and approved filler material, sand and water. The mixture and shall have a compressive strength of 100 psi minimum and 500 psi maximum.

B. Filler material shall consist of mineral aggregates, slag, or fly ash. Metals, soil, or organic material will not be permitted.

2.06 SLOPE AND CHANNEL PROTECTION

A. Riprap, plain or heavy, shall be in accordance with MDOT 813.

PART 3 EXECUTION

3.01 COORDINATION

A. Construction Through Highways:

1. Permits - The Owner will obtain permits required for open cut construction through highways. Contractor shall be responsible for compliance with and furnishing any item required by permit such as Bond Security.

2. Notification - The Contractor shall give written notice to appropriate officials of the affected Department of Transportation, City, or County at least five days in advance, not including weekends and holidays, before starting construction under highways and as required under other roadways.

3. Contractor shall comply with standard permit conditions of controlling authority and special provisions noted in Part 4 of this Section.

B. Test Pits:

1. The Contractor shall perform exploratory test pits as may be necessary or ordered by the Engineer in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation. Vacuum excavation (potholing) may be used if adequate information can be obtained by such method. No additional payment shall be made for test pits.

2. Conflicts with existing utilities not located, as specified, far enough in advance of construction, shall not be considered as a basis for delay claims or additional payment.

3.02 REMOVING AND REPLACING TOPSOIL

A. Removal

1. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed: The Contractor may elect to strip soil and stockpile unless the Contract Documents direct stripping and stockpiling prior to excavation.

2. General excavation, other than trench excavation: The Contractor shall remove, and stockpile the top 12 inches of the existing soils from all areas of construction including, but not limited to, excavation and embankment areas, stockpile sites, construction yard, storage areas, etc.

B. Replacing stockpiled soil and topsoil

1. Trench excavation areas disturbed as a result of trenching operations and which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeks, tall grass, brush, sticks, litter, ground debris and wood products. The surface shall be mechanically conditioned after removal of debris. After surface is prepared, it shall be covered with topsoil or stockpiled soil material to a minimum depth of 4 inches. Topsoils and stockpiled soil material shall meet the requirements specified herein and be tested.

2. General excavation areas which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeks, tall grass, brush, sticks, litter, ground debris, wood products and construction debris including loose stone. The surface shall be mechanically conditioned after

removal of debris. After surface is prepared, it shall be covered with stockpiled soil and then have a minimum of 4 inches of topsoil placed.

C. The Work shall be in accordance with applicable portions of MDOT Sections 205.03 A.1 and 816.03 A.

3.03 GENERAL EXCAVATION

A. All necessary excavation shall be performed to accommodate the completion of all Contract Work.

B. The Drawings show the horizontal and the lower limits of structures, pipelines, sewers and other utilities. The methods and equipment used by the Contractor when approaching the bottom limits of excavation and when trimming the bottom of the excavation to a smooth surface shall be selected to prevent disturbing the soil below the bottom limits of excavation.

C. Excavation which is carried below the bottom limits shall be classified as Unauthorized Excavation, unless said excavation has been authorized by the Engineer prior to each occurrence.

D. Unauthorized excavation shall be filled with CDF material to the bottom limits. Under circumstances where structural integrity is not a factor, the Engineer may allow the filling of unauthorized excavation with pipe bedding material or special backfill material compacted to 100% density, as specified under compaction requirements.

E. Sheeting, Shoring, and Bracing:

1. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions and to protect newly built work and all existing adjacent and neighboring structures and utilities from damage by settlement.

2. Sheeting, shoring and bracing shall be arranged so as not to place a strain on portions of completed Work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built Work and to adjacent and neighboring structures and utilities.

3. Sheeting, shoring and bracing shall be removed or cut-off at the time of backfilling to avoid problems with finish grade or future excavation.

F. Construction Sheeting Left in Place:

1. The Contractor shall furnish, install, and leave in place, construction sheeting and bracing when specified or when indicated or shown on the Drawings.

2. Construction sheeting and bracing, placed by the Contractor to protect adjacent and neighboring structures and utilities, may be left in place if desired by the Contractor. All such sheeting and bracing left in place, shall be included in the cost for excavation.

3. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered, in writing by the Engineer, to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under the Contract.

G. Removal of Water:

1. The Contractor shall, at all times during construction, provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein have been completed. No water shall be allowed to rise over or come in contact with concrete or masonry until the concrete and mortar has attained a satisfactory set, except in cases where the concrete has been tremied into place with the approval of the Engineer. Water shall not be allowed to rise above the bottom of the bedding stone prior to placing pipe. In water-bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.

2. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

3.04 TRENCH EXCAVATION

A. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed shall provide adequate space for workers to place and joint the pipe properly. The trench shall be kept to a minimum width. The width of trench at the top of the pipe shall comply with the limits specified or shown on the Drawings.

B. Excavation shall be to the depth necessary for placing aggregate bedding material under the pipeline, sewer, conduits and other utilities as shown on the Drawings. If over excavation occurs, the trench bottom shall be filled to grade with compacted aggregate bedding material.

C. The amount of trench open at any one time in advance of completed Work shall be limited to the minimum necessary for conducting laying operations.

D. In general, backfilling shall begin as soon as the pipeline, sewer, conduits and other utilities are in a condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe condition.

3.05 EXCAVATION OF UNSUITABLE MATERIAL

A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as required by the Engineer. The Engineer may rely upon the Independent Laboratory retained on this Project when determining unsuitable soil conditions, removal and backfill. Such excavation shall be conducted at a time when the Engineer and Independent Laboratory are present and shall not exceed the vertical and lateral limits prescribed by both.

B. The voids left by removal of unsuitable material shall be filled with special backfill, pipe bedding material, or CDF material as listed in Part 4 or as prescribed by the Independent Laboratory and as approved and ordered by the Engineer. Special backfill or pipe bedding shall be installed as described in this Section and in general shall be compacted to 100% density as specified under compaction requirements.

3.06 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments as shown on the Drawings, shall be disposed of by the Contractor at his expense and at sites provided by him as may be required, except that the Owner reserves the right to require the Contractor to deposit such surplus at locations designated by the Owner within a five-mile radius of the Work.

B. No surplus excavated material of any class shall be deposited in any stream or watercourse or be dumped on public property without the consent of the Owner. All spoil areas shall be left smooth, level, with drainage to a water course and with proper erosion and runoff control.

3.07 BACKFILL AND COMPACTION

A. Pipe and Conduit Bedding - Unless otherwise directed, pipe, conduits and other utilities shall be installed in specified aggregate bedding material as shown on the Drawings and as specified.

B. Backfilling Under Existing Pipeline, Sewer, Conduits and Other Utilities - Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with aggregate bedding material tamped in place in 6-inch layers to the required density. The aggregate bedding shall extend outward from the spring line of the conduit a distance of 2 feet on all sides and thence downward at its natural slope.

C. Backfilling with Selected Backfill - Unless otherwise specified or directed, material excavated in connection with the Work may be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification for selected backfill. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12 inches, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry shall be

deposited closer than 24 inches from the completed outside surface of any structure or pipe.

D. Backfill Immediately - All trenches and excavations shall be backfilled immediately after completion of construction therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in unbackfilled excavation during construction or after pipe has been placed.

E. Backfilling around and over structures, pipelines, conduits and other utilities comprising the Work shall be carefully done by hand and tamped with suitable tools of approved weight when within two feet of structures, pipeline, conduit and other utilities. Selected backfill shall be used in this area unless special backfill is specified, shown on the Drawings, or required by the Engineer. The material shall be placed in uniform layers not exceeding 6 inches in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of the pipe or structure.

F. Backfilling may be done by machinery after the backfill has been placed and compacted beyond two feet horizontally of structures, pipelines, conduits and other utilities and to a minimum depth of one foot above the tops of any buried structures, pipelines, conduits, and other utilities. The backfill material shall be deposited in horizontal layers, not thicker than one foot, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfill material from a bucket be allowed to fall directly on a structure or pipe, and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

G. Backfilling Under Pavement and Walks - Where existing or new pavement, driveway, parking lot, curb and gutter, or walk is over an excavation, special backfill material shall be used to backfill the entire excavation from the bedding to the surface. The material shall be placed and compacted to the required density in accordance with one of the following methods:

1. The backfill material shall be deposited in 6-inch horizontal layers and each layer shall be thoroughly compacted to the proper density by approved compaction method before a succeeding layer is placed.

2. No method of compaction which alters the gradation of the special backfill material or prevents compaction testing by standard testing methods shall be used.

H. Backfilling with Controlled Density Fill Material (CDF) - Where called for on the Drawings, specified, or ordered, CDF material shall be used in lieu of special backfill or bedding material specified herein. Before placing CDF material, the Contractor shall take required measures to protect the Work against flotation.

I. Backfilling Under Structures - Where structural slabs, mats or footings are to be placed on a backfilled area, special backfill material shall be used unless otherwise noted on the Drawings. The backfill material shall be placed in 6-inch horizontal layers and each layer

shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. Where backfill is to be placed on undisturbed side slopes steeper than one vertical to six horizontal, steps shall be formed into the slope before each layer of the backfill is placed. These steps shall be cut vertically at no more than 2-foot intervals and shall have a horizontal dimension of not less than 3 feet.

J. Prior to backfilling under structures, the natural subgrade shall be evaluated at regular intervals in each direction by the independent testing laboratory to determine that the subgrade can obtain the design bearing capacity given by the "Structural Design Data" table on the Drawings. If the subgrade cannot obtain the design bearing capacity, then the testing laboratory shall submit a remedy to the Engineer for approval and for the Contractor to perform.

K. Clay Trench Bulkheads - Where trenches are dug through areas of lateral groundwater seepage or in areas below the groundwater table, the Contractor shall, if required by the Drawings, construct bulkheads within the trench at ordered intervals. Bulkheads shall consist of native clay soil or other fines.

3.08 COMPACTION REQUIREMENTS

A. In areas to be filled after the top 12-inches of soil has been stripped, the undisturbed subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D698 (Standard Proctor) prior to placing of fill.

B. Backfill placed under areas receiving concrete slabs, mats, footings, or within the interior of buildings shall be compacted to not less than 100% of maximum dry density per ASTM D698.

C. Backfill placed around structures where other structures, pipelines, or slabs are to be constructed shall be compacted to not less than 100% of maximum dry density per ASTM D698.

D. The material used to construct embankments and fills in locations other than under pavements, walks, structures, or slabs and around and over pipelines, shall be compacted to not less than 95% of maximum dry density per ASTM D698.

E. All other backfill, including backfill around and over pipelines, and backfill around structures not covered in Paragraphs B. and C. above, shall be compacted to not less than 95% of maximum dry density per ASTM D698.

F. The bottom of excavations upon which concrete slabs or structures are to be placed shall be compacted to obtain 100% maximum dry density per ASTM D698 in the top 12 inches.

G. All soil subgrade which will provide bearing support for pavements or curbs, shall be compacted to a width of 6 inches beyond the back of curb and to a depth of 12 inches below the bottom of excavation to a density of not less than 100% of maximum dry density per ASTM D698. All fill below the subgrade shall be compacted to not less than 98% of maximum dry density, unless specified otherwise.

H. Subgrade under the driveways and walks shall be compacted to a depth of 6 inches below the subgrade surface to density of not less than 100% of the maximum dry density determined by ASTM D698.

I. Subgrade under structures shall be compacted to a depth of 12 inches below bottom of excavation surface to a density of not less than 100% of the maximum dry density determined by ASTM D698.

3.09 COMPACTION TESTS

A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.

B. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.

C. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

3.10 RESERVED

3.11 RESERVED

3.12 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 FIELD TESTING (MINIMUM REQUIREMENTS)

A. The laboratory shall perform the following field tests:

1. Trench Backfill - One test for every 200 cubic yards of backfill material.
2. Subgrade Compaction - One test for every 300 square yards of subgrade.
3. If directed by the Engineer, additional tests shall be performed for any of the above.

4.02 WETLAND EXCAVATION

A. Removing and Replacing Wetland Topsoil

1. The Contractor shall remove and stockpile the top 8 inches to 10 inches of the existing soils in wetland areas. Wetland stockpiles shall be kept separate from other stockpiles and shall not exceed 3 feet in width and 3 feet in height. Stockpiles ideally shall not be kept during summer months. Wetland stockpiles

shall be kept cool to prevent composting and destruction of seeds and propagules. Stockpiles shall not be kept longer than 4 weeks.

a. Stockpiles kept longer than 4 weeks shall be disposed of at the Contractor's expense. Salvaged wetland soil from a suitable source may be imported as replacement soil in the event existing soils become unsuitable.

2. The Contractor shall prepare the subsoil prior to replacing wetland topsoil. The subsoil shall be ripped to a depth of 12 inches by disking, ripping, plowing, or rototilling. Ripping shall take place in two perpendicular directions.

3. Wetland topsoil shall be spread out on disturbed wetland areas immediately after subgrade preparations are complete, to a depth of 4 inches to 6 inches. Till the topsoil to a depth of 6 inches, leaving no clods greater than 3 inches in diameter. Lightly roll the topsoil surface prior to seeding. The soil shall be considered firm when a person's footprint penetrates ¼ to ½ inch deep.

END OF SECTION

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SECTION 02202
EMBANKMENT

PART 1 GENERAL

1.01 SCOPE

A. This Section includes preparation of the area upon which embankments are to be placed, construction of the embankment with excavated material and other necessary materials, the compacting of the materials, disposal of unsuitable material, and the adjustment to grade of existing castings, valve covers, monuments, etc.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:

a. Fill Material Tests.

b. Compaction Test Results.

PART 2 PRODUCTS

2.01 MATERIALS

A. Material for embankments shall consist of suitable material and shall be readily incorporated into an 8-inch layer. Muck, frozen material, roots, sod, stumps, stones, rocks or masonry, or other deleterious materials shall not be placed in embankments nor shall embankments be placed on frozen material. Borrow areas on the Site shall be as shown on plans or as directed by the Engineer.

B. For piping embankments through wetland areas, course natural crushed aggregate 1-inch to 3-inch in diameter shall be placed in 8-inch compacted layers from the in-situ suitable soils to a height 1 foot below the bottom of the pipe.

PART 3 EXECUTION

3.01 CLEARING AND CONDITIONING EMBANKMENT AREAS

A. Ground areas which will receive embankments shall be cleared, grubbed, scalped, and the topsoil shall be stripped to a depth of 6 inches and stockpiled in accordance with the Specifications.

B. Unsuitable in-situ soils shall be removed to a depth where suitable soils are encountered. Undercuts for embankments shall extend laterally on each side of the pipe alignment a minimum distance equal to the depth of the undercut (1:1 slope).

C. After stripping and prior to placing the first layer of embankment, embankment areas shall be compacted to a depth of 12 inches to the same density requirement as the material which is to be placed thereon. The Contractor may elect to remove sufficient native material, or to undercut and replace with material suitable to the Engineer, to achieve the above compaction requirements at no additional increase in contract price.

3.02 EMBANKMENT CONSTRUCTION

A. Embankments shall be constructed in 8-inch horizontal layers and each layer shall be thoroughly compacted by approved methods to the proper density before a succeeding layer is placed.

B. When embankment is to be placed on hillsides or against existing embankments, each layer of embankment shall be continuously benched. Benches shall be excavated inward a minimum of 3 feet and shall be of sufficient width to permit operations of placing and compacting equipment. The benches and material cut out of the benches shall be recompacted along with the new embankment material.

C. When delivery of material is stopped, the leveling and compaction equipment shall continue operating until all delivered material has been acceptably leveled and compacted to provide drainage.

3.03 COMPACTION REQUIREMENT

A. All embankment and backfill material shall be compacted to at least 98% of the maximum dry density as determined by ASTM D698.

B. All soil subgrade which will provide bearing support for piping embankment shall be compacted to a depth of 12 inches below the subgrade surface to a density of not less than 100% of the maximum dry density determined by ASTM D698.

C. All backfill, embankment, and subgrade material which does not contain sufficient moisture to be compacted shall be sprinkled with water by means of tank trucks equipped with sprinkling devices. The water shall be thoroughly incorporated into the material by means of discs or other approved equipment. Material containing excess moisture shall be required to dry prior to or during compaction to a moisture content of not greater than three percentage points above optimum. Material which displays pronounced elasticity or deformation under the action of construction equipment shall have its moisture content reduced to optimum. Drying of wet soil shall be expedited by plows, disk, or other approved equipment.

D. If the density of the compacted material is less than required, the Contractor shall immediately cease embankment and backfill operations until the problem has been corrected to the satisfaction of the Engineer.

3.04 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. All surplus or unsuitable excavated material not required on the project shall be disposed of as specified under Section 02200.

3.05 ADJUSTMENT TO GRADE

A. All existing castings, valve covers, inspection wells, or monuments encountered during construction shall be adjusted to the finished grade to the satisfaction of the Engineer.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

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SECTION 02552
PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing precast concrete manholes, including drops and manhole stacks of types and at locations shown on the Drawings and scheduled.

B. This Section includes removing existing structures, additional excavation to widen and deepen trenches for manhole construction, furnishing and installing concrete of classes called for, portland cement mortar, reinforcing steel, precast concrete pipe integral base sections, bottom riser sections, transition sections, and riser sections, eccentric cones, flat slab tops and grade rings, flexible manhole connections, pipe for drop connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, joint wrap installing, forming channels through manhole bottoms, making watertight connections to new and existing sewers, and other work incidental to manhole construction and testing.

C. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. Manufacturer's Shop Drawings indicating physical dimensions, pipe openings, precast section arrangement, adjusting rings, castings, and joint details for each size and type of manhole component furnished for the project. Shop Drawing shall incorporate the planned elevations and details.

   b. Manufacturer's Certification indicating that the manhole components and joints meet specifications for each production run for each size and type furnished.

2. Information for the Record:

   a. The Engineer may request test results to verify Certification. Certification documents shall be according to the Source Quality Control of this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Type of Manhole Sections:

1. Type I Manholes - Type I manholes shall mean 4-feet diameter manholes with precast integral base sections for sanitary sewers and either precast integral base sections or precast bottoms for storm sewers. Pipe connections to manholes shall be made with flexible water tight joints. Type I manholes are intended for installation of pipes 18-inch diameter and smaller unless noted otherwise.

2. Type II Manholes - Type II manholes shall mean manholes with 5-feet diameter precast integral base sections. Pipe connections to manholes shall be made with flexible water tight joints. Type II manholes are intended for installation of 21-inch through 30-inch diameter pipes unless noted otherwise.

3. Type S Manholes - S following manhole type shall mean the designated type manhole constructed with a precast flat slab top in lieu of a precast cone.

B. Precast concrete pipe manhole sections, integral base sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM C 478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.

C. Joints shall be tongue and groove type with a gasketed seal type conforming to ASTM C443.

D. The standard length of riser sections shall be 48-inch. Lengths of 32-inch or 16-inch shall be used to meet required dimensions and as specified.

E. Openings for connecting pipes in riser sections, bottom riser sections, integral base sections, and for access in flat slabs, shall be pre-formed or cored by the manufacturer. All cored openings for sewer pipe connections shall have flexible joints.

F. Precast integral base sections shall be of monolithic construction. Base flat slab floors or integral floors shall have a minimum thickness of 6-inches for risers up to and including 48-inch in diameter, and 8-inches for larger diameters. A layer of reinforcement shall be placed above the midpoint and shall have a minimum area of 0.12 square inch/linear feet in both directions.

G. Manhole sections shall be constructed with no pipe connection within 6 inches of a joint in the structure.

H. Manhole sections shall be clearly marked and identified with the manhole number, section placement order, casting date, trademark, name of the manufacturer, and location of the production plant.

2.02 ACCESSORIES

A. Manhole Steps - Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.

1. Specified manhole steps shall be factory installed to provide a continuous ladder of 16-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe has been removed from casting and carefully mortared in place with non-shrinking mortar to ensure a watertight joint. Manhole step installation shall be in compliance with OSHA regulations. If the outer surface of the pipe wall is pierced, the patch shall be completely covered with a bituminous sealer.

B. Manhole frames and covers shall be as shown on the Drawings and in conformance with requirements of Section 05540.

1. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

C. Mortar:

1. Mortar used for the structures herein specified shall conform to ASTM C270 Type S, containing no masonry cement. The mortar shall be composed of one part portland cement to two parts sand by volume.

2. Non-shrinking Mortar - Materials for non-shrinking mortar shall be Sauereisen F-100, Five-Star, or equal.

D. Cast-in-Place Concrete:

1. All cast-in-place concrete shall be according to MDOT Specification Division 7.

E. Flexible Joints - Joints for precast pipe openings shall be “A-LOK X-CEL” as manufactured by A-LOK Products, Inc., “Kor-n-seal” as manufactured by National Pollution Control Systems, Inc., or equal in accordance with ASTM C923.

F. Joint Wrap - Polyolefin backed exterior joint wrap used to cover the exterior side of joints shall be ConSeal CS212; Riser Wrap by Pipeline Seal & Insulator, Inc. or equal. Minimum width shall be 12 inches. Joint wrap shall include the use of brush or roller applied adhesive surface primer formulated for use with joint wrap. Seal shall meet the requirements of ASTM E1745, C-877, and ASTM C990.

PART 3 EXECUTION

3.01 COORDINATION

A. Location and type of manholes installed shall be as shown on the Drawings or directed.

B. Construction shall be in conformance with details shown on the Drawings and as specified.

C. Excavation for manhole construction shall be prepared as directed in applicable paragraphs of Section 02200.

3.02 INSTALLATION OF INTEGRAL BASE SECTIONS

A. The manhole base may be placed on 6 inches compacted granular bedding material.

3.03 RESERVED

3.04 RESERVED

3.05 RESERVED

3.06 INSTALLATION OF MANHOLE FRAMES

A. Manhole frames and covers shall be installed to grades shown on the Drawings or as directed.

B. Adjustment of manhole castings shall be made using specified precast grade rings and portland cement mortar joints or preferred bitumen seals.

C. Each manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.

D. The maximum depth of adjustment below any manhole casting shall be 16 inches and the minimum depth of adjustment shall be 4 inches.

E. Manhole castings located in pavement areas shall be installed with the top of the casting 1/4 inch below the finished grade of the adjacent pavement surface.

3.07 RESERVED

3.08 RESERVED

PART 4 SPECIAL PROVISIONS

None.

END OF SECTION

SECTION 02600
PAVEMENTS, CURBING AND WALKS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the construction of sidewalks, curbing pavements, and berms of various designated types as shown or scheduled on the Drawings, specified, or directed.

B. This Section includes preparation of the base and subgrade construction of walks, curbs, pavements and base courses; adjustment of manhole castings and valve boxes to conform to new pavement courses, and other work and materials incidental to the construction of pavements, curbing and walks.

C. Existing curbs and walks of stone or concrete shall be replaced using concrete.

D. This Section includes temporary pavement markings as well as restoration of permanent pavement markings as they exist at the time of bidding, unless otherwise shown on the Drawings, specified, or directed.

1.02 OWNER'S STANDARDS AND SPECIFICATIONS

A. Sidewalks, curbs, driveways, parking areas, and street pavement and berms disturbed by construction shall be restored in accordance with the Owner's present standards and specifications.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Manufacturers and suppliers shall submit material certificates.

b. A sieve analysis (ASTM C136) shall be furnished for each material source.

2. Information for the Record:

a. Delivery tickets from the asphalt and aggregate suppliers shall be given to the inspector at the unloading site. Tickets shall include (as a minimum) name of source, date, type of material, and weight.

b. Test results and certificates shall be submitted.

PART 2 PRODUCTS

2.01 AGGREGATE BASE AND SURFACE

A. The aggregate shall be crushed natural stone meeting the requirements of MDOT Table 902-1, Class 21AA or 22A.

2.02 RESERVED

2.03 ASPHALT EMULSIONS

A. The bond coat material shall be SS-1h or CSS-1h, and shall meet the requirements of MDOT Table 904-4 and 904-5.

B. The prime coat material, if required, shall be MS-Op and shall meet the requirements of MDOT Table 903-4.

2.04 BITUMINOUS AGGREGATE BASE AND ASPHALT CONCRETE

A. Bituminous Material - The asphalt cement shall be PG 58-28 performance grade (Design Temperature) and shall meet the requirements of MDOT Table 904-2.

B. Design Mix - Refer to MDOT Section 501.

1. The base course shall meet the requirements of RCKC MDOT 13A Mod.
2. The leveling course shall meet the requirements of RCKC MDOT 13A Mod.
3. The wearing course shall meet the requirements of RCKC MDOT 13A Mod.

2.05 CONCRETE (CAST-IN-PLACE)

A. All concrete used shall be grade P1 as specified in MDOT Table 601-2.

B. Reinforcing steel and dowel bars shall be as specified in MDOT Section 905 and 906.

C. Other materials required for placing concrete shall be as follows:

1. Joint Sealer:
    a. Hot Applied Sealer - MDOT Section 914.04A.
    b. Backer Rod - MDOT Section 914.04B.
2. Preformed Fiber Joint Filler - MDOT Section 914.03.
3. Curing Materials:
    a. Burlap Cloth - AASHTO M182, Class 2.
    b. Sheet Materials - ASTM C171.
    c. White Membrane Curing Compound - MDOT Section 903.06A.

d. Transparent Membrane Curing Compound - MDOT Section 903.06B.

2.06 PAVEMENT MARKING

A. Contractor shall provide temporary and permanent pavement markings equal to those markings that are removed from existing paved surfaces prior to commencement of the Work unless scheduled on the drawings, specified, or as directed.

B. Pavement markings shall be in accordance with the requirements of MDOT Item 811 and the RCKC.

C. Pavement markings shall match existing or adjoining pavement markings.

D. Pavement markings partially disturbed by construction shall be replaced entirely.

PART 3 EXECUTION

3.01 COORDINATION

A. All soil subgrade under pavements, driveways, curbs, curb and gutter, and walks shall be compacted in accordance with Section 02200.

B. All service boxes, manholes, inlets and other structures shall be adjusted or reconstructed to the required grades in both new and resurfacing pavement areas.

3.02 PAVEMENT INSTALLATION

A. All construction shall be in conformance with applicable portions of MDOT Specifications, except as otherwise specified or called for herein.

B. Unless otherwise directed by Engineer all aggregate bases which are to receive bituminous courses shall be primed as specified.

C. A tack coat at a rate as specified shall be applied to all existing pavements which are to be overlaid, and between subsequent courses when directed by the Engineer.

3.03 TRANSITION JOINTS FOR BITUMINOUS CONCRETE PAVEMENT OVERLAY

A. Types of Transition Joints:

1. Transition joints shall be either butt type or feathered type as directed by the Engineer.

2. Butt joints shall be used on State and Federal roads and main thoroughfares and feathered joints used elsewhere unless otherwise specified.

3. Butt Joints:

a. When a butt joint is called for on the Drawings or specified, the old surface shall be cut back for at least 3 feet to a depth of at least 1 inch for the full width of the joint and pavement to be installed.

b. A bituminous seal shall be placed on the finished surface at the junction of the new and old pavements.

4. Feathered Joint:

a. Feathered joints shall be constructed by manually raking the paving material to a smooth transition from the full depth material to the existing pavement surface.

b. Existing pavement surface shall be bond-coated to include the transition area.

c. Feathering shall be done by a workman skilled in the operation and shall be approved by the Resident Project Representative.

3.04 CURBING

A. Curbing shall be constructed in conformance with appliable portions of MDOT Section 802 and the MDOT Standard Construction Drawings.

B. Place 1-inch dowelled expansion joints at inlets and at spring lines of street and driveway returns. If intersecting streets and driveways are more than 300 feet apart, place expansion joints at 300-foot intervals.

C. Contraction joints shall be placed at approximately 10-foot intervals.

3.05 RESERVED

3.06 CONCRETE DRIVEWAYS

A. Concrete driveways shall be constructed in conformance with applicable portions of MDOT Section 801.

B. Dowelled contraction joints shall be placed at a maximum spacing of 20 feet. Lesser spacing shall be used on irregular areas as directed by the Engineer.

C. Expansion joint filler 1/2-inch thick shall be installed at maximum intervals of 24 feet. One-inch expansion joint filler shall be installed between the driveway and any fixed structure.

3.07 BITUMINOUS AND AGGREGATE DRIVEWAYS

A. Bituminous driveways and parking lots shall be constructed as shown on the Drawings and/or indicated in Part 4 using materials specified for asphalt concrete pavements. Placement shall be in accordance with MDOT Section 501.

B. Aggregate driveways and parking lots shall be constructed as shown on the Drawings using base aggregate meeting the requirements of MDOT Item 302.

C. Replacement of bituminous or aggregate driveways and parking lots shall conform to Section 01565 and to this Section 02600 and, in no case, shall they be inferior to that being replaced.

3.08 MILLED ASPHALT BASE

A. Where shown on the Drawings, existing asphalt concrete pavement shall be milled or pulverized, then spread, graded, and compacted as the base for a new paved roadway surface. All such Work shall be performed in accordance with MDOT Item 305-HMA Base Crushing and Shaping.

3.09 INSPECTION

A. Laboratory services will be provided by the Owner in accordance with Section 01410 and shall include:

1. A compaction test on the subgrade, aggregate base, and each layer of asphalt shall be performed for every 300 square yards of material placed.

2. Asphalt Concrete:

a. Plant Certification - The laboratory shall certify or furnish RECENT certification (within one year from January 1, 2022) that the Plant meets State requirements.

b. Plant Inspection - For the first day of production and for every day when more than 100 cubic yards of material is being delivered to the project, the laboratory shall provide a Representative at the plant who will inspect the plant, make mix design adjustments, check the temperature, and take the required samples.

c. Quality Control Testing - A sample of the mix shall be taken for each 200-cubic yard of bituminous material or fraction thereof delivered to the project. An extraction test AASHTO T164-70 and a mechanical analysis AASHTO T30-70 shall be performed on the mix samples.

d. Bituminous Material - Provide a satisfactory certificate furnished by the manufacturer stating that the materials conform to MDOT Specifications, Table 904-2, 904-3, or 904-4 as required.

e. Aggregate - A sieve analysis (ASTM C136) shall be performed on each aggregate to be used in the plant mix design.

f. Mix Designs - The supplier shall design the plant mixes in accordance with the Marshall Method of Mix Design (ASTM D1559) and shall make all mix design adjustments.

3. Cast-in-Place Concrete:

    a. Concrete shall be tested in accordance with MDOT Standard Specifications for Construction.

3.10 PROTECTION

A. No heavy construction vehicle shall operate on any pavement, curbing or walk that has been newly installed.

B. Traffic shall be prohibited on newly installed asphalt pavement until it has cooled sufficiently to avoid marking.

C. Asphalt Pavements:

1. Bituminous mixtures shall be transported and placed in accordance with MDOT Section 501.03.

D. Concrete Pavements, Curbing and Walks:

1. Concrete shall be mixed, transported, placed, and finished only within the temperature limitations specified in MDOT Sections 601.03F and 602.03T.

2. No concrete shall be mixed, transported, placed, or finished when the temperature of the base, subgrade, or air is below 40 degrees Fahrenheit or whenever, in the opinion of the Engineer, the temperature may fall below 40 degrees Fahrenheit within 24 hours after the concrete has been placed.

3. The Contractor shall take such precautions as are necessary to protect the concrete from rain.

4. The Contractor shall protect the concrete from freezing for no less than seven days or until such time that specimen beams have attained a modulus of rupture of at least 600 psi.

PART 4 SPECIAL PROVISIONS

None.

END OF SECTION

SECTION 02800
SEEDING AND MULCHING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes fine grading, placing sod, and seeding and mulching areas designated on the Drawings, specified, or ordered.

B. The Work consists of fine grading, furnishing, and placing topsoil; sod, seed, mulching material, and fertilizer; and, watering seeded or sodded areas until growth is established.

C. The Contractor shall restore all grass areas damaged by his operations.

D. Unless otherwise specified herein or directed, Work shall be in conformance with MDOT Section 816, Turf Establishment.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Manufacturer's Project Information for materials.

2. Information for the Record:

a. Submit to Resident Project Representative:

1) Invoices indicating the weight, brand, and composite analysis of fertilizer used on the project.

2) Bag tickets indicating weight and composition of all seed used on the project.

PART 2 PRODUCTS

2.01 RESERVED

2.02 SEED

A. Seed mixtures shall be in conformance with the requirements of MDOT Tables 816-1 and 917-1, Mixture TUF, unless otherwise specified in Part 4.

2.03 FERTILIZER

A. Commercial fertilizers shall be from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Michigan, Department of Agriculture. The content of nutrients shall be 12-12-12, unless otherwise approved by the Engineer.

2.04 MULCHING MATERIAL

A. Mulching material shall be straw, wood fiber or compost reasonably free of weed seed, and other foreign materials, conforming to MDOT Section 917.15A.

2.05 MATTING MATERIAL

A. Matting material shall be in conformance with the requirements of MDOT Section 917.14B, unless otherwise specified in the Special Provisions.

2.06 TOPSOIL

A. Topsoil furnished by the Contractor shall be as specified in Section 02200.

PART 3 EXECUTION

3.01 FURNISHING AND PLACING TOPSOIL

A. Areas from which the top layer of soil has been removed or disturbed shall be recovered with a minimum of 4 inches of recompacted topsoil placed in conformance with Section 02200.

3.02 PREPARATION

A. The operating of finish grading and sowing shall not be performed when the ground is frozen or muddy.

B. Areas to be Seeded:

1. Unless otherwise shown on the Drawings or specified in Part 4, all areas of disturbed soil on the Site shall be seeded.
2. The area to be seeded shall be prepared in accordance with Section 02200.
3. Fertilizer shall be applied at a rate which will provide 240 pounds per acre of chemical fertilizer nutrients in equal proportions of Nitrogen, Phosphoric Acid, and Potash. Either dry or liquid fertilizer may be used and shall be distributed in an even pattern over the specified area; then it shall be thoroughly disked, harrowed, or raked into the soil to a depth of not less than 1 inch.

3.03 INSTALLATION

A. Seeding:

1. The seed shall be mixed thoroughly and sown evenly at a rate specified by MDOT. The seed mixture may be sown dry or hydraulically unless directed otherwise in Part 4 of this Section 02800.
2. The seed mixture shall be applied when the soil is in a workable condition and shall be raked into a depth of approximately 1/4 inch.
3. Seed shall be sown only between the dates of May 1 and October 15, unless otherwise permitted by the Engineer.

B. Mulching:

1. Within 24 hours after an area has been seeded, it shall be mulched in conformance with one of the following specified methods as designated in Part 4:
2. Mulch:
   a. Mulching with hay or straw shall be in conformance with mulching requirements of MDOT Sections 816.03E, F, and G except that in front of residences the mulching material shall be kept in place by an approved non-tracking adhesive or other approved method in lieu of the specified asphalt emulsion.
   b. Matting shall be used on all slopes greater than 10:1. Matting used for mulching shall be placed in conformance with MDOT Section 816.03H.

C. Seeded and sodded areas shall be watered and maintained as specified below until they are established.

1. The seed bed shall be thoroughly watered, as soon as the seed is covered.
2. Water shall be applied by a hydro-seeder or water tank under pressure with a nozzle producing a spray that will not dislodge the mulching material.
3. Water applications shall be made at least once a week, provided significant rainfall has not occurred within the weekly period.
4. The rate of application shall be 240 gallons per 1,000 square feet
5. Mulch and matting areas shall be maintained until all Work on the Contract has been completed and accepted.
6. The seeded area shall be mowed once at an approximate height of 6 inch as directed by the Engineer to control excess growth, including weeds.
7. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. The soil in these damaged seeded areas shall be restored to the condition and grade existing prior to application of mulch or matting; and, restored areas shall be relimed, refertilized, and reseeded. Where necessary, the mulch or matting shall be completely replaced.

PART 4 SPECIAL PROVISIONS

A. Wetland Seeding

1. Wetland seed mixture shall be the Wetland Mix from Michigan Wildflower Farm or Engineer approved equal.

2. Wetland seed shall be applied by broadcasting at the seed manufacturer's recommended rate.

    a. Seeding on muddy or wet soils is acceptable in wetland areas. Seeding when standing water is present is prohibited.

3. Seed shall be lightly raked into the soil to a depth of 1/4 inch.

4. Newly seeded wetland areas shall be blanketed using biodegradable semi-permanent coir mat. Coir mat shall be Highend BioD-Mat 40 or Engineer approved equal and shall be installed per manufacturer specifications.

END OF SECTION

SECTION 02810
TREES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes protection, removal, disposal, and replacement of trees encountered in construction of the Project as specified herein and directed.

B. Trees in easements shall be included in this Section, except as otherwise stated in the Easement Agreement.

PART 2 PRODUCTS

2.01 MATERIALS

A. Trees shall be replaced at the direction of the Owner and the Engineer. Quantities, sizes, species shall be as indicated in Section 01021.

B. The Contractor may remove, preserve, and replant existing trees in lieu of installing replacement trees.

PART 3 EXECUTION

3.01 COORDINATION

A. The Engineer/Owner will designate, mark, and record the location, size, species, and variety of trees that must be protected or removed and replaced, within the Work limits.

B. The Contractor shall retain a Horticulturist to accompany the Engineer/Owner as required to identify the species and variety of trees.

C. Where authorized by the Owner, the Contractor will not be required to replace designated trees removed for construction of the Project.

D. Trees designated for removal and replacement shall be removed, preserved, and replanted or replaced by the Contractor after construction has been completed.

E. Any tree not included in the above, damaged by the Contractor's operations to the extent that it must be removed, shall be removed and replaced at the Contractor's expense.

3.02 INSTALLATION

A. Planting shall be in accordance with the applicable portions of MDOT Section 815 and performed under the supervision of a Licensed Arborist.

3.03 PROTECTION

A. The cutting of roots or branches shall be held to a minimum.

B. Cables shall not be wrapped around trees, nor shall trees be used for deadman purposes.

C. If necessary construction work will cause excessive damage to trees involved, the Contractor shall contact the Engineer before proceeding with the Work.

D. Should any of the newly planted trees die after final acceptance of the Work and during the one-year maintenance bond period, such trees shall be replaced in kind and size at the Contractor's expense.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

SECTION 05540
IRON CASTINGS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes manhole covers and frames, and other iron castings shown on Drawings.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Product literature that shall be included: General Specifications, Surface Coating, Anchor Bolts, Machine Bearing Surface.

b. Independent Shop Drawings shall be submitted for the frame and the cover.

c. A submittal of a casting schedule shall be included that clearly notates either the structure number or in what circumstances the casting is intended to be installed, i.e., roadway.

d. All dimensions for both the frame and the cover/grate shall be included.

2. Information for the Record:

a. Material certification.

b. Proof-load test data.

c. Manufacturer's installation instructions.

d. Manufacturing Capabilities and Quality Control Measures.

1.03 PRODUCT HANDLING

A. Castings shall be delivered in sufficient time to permit proper placement in pavement and slabs.

B. Castings shall be stored in such a way as to prevent warping prior to installation.

C. Additional product handling requirements are specified in Section 01350.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Castings shall be manufactured by East Jordan Iron Works, Inc., or Engineer approved equal.

2.02 MANHOLE COVER AND FRAME

A. Castings located in roadways, driveways, or other areas subject to vehicular traffic shall be suitable for heavy-duty service. Other castings shall be suitable for light-duty service.

B. Unless otherwise indicated, sewer manhole shall have a minimum access opening of 24 inches.

C. Unless otherwise indicated, heavy duty manhole cover and frame shall be East Jordan No. 1045, Product 00104510.

2.03 INLET GRATE AND FRAME

A. Castings shall be suitable for heavy duty service.

B. Unless otherwise indicated, inlet grate and frame shall be East Jordan No. 7045.

2.04 RESERVED

2.05 PERFORMANCE REQUIREMENTS

A. Castings shall be gray iron conforming to ASTM A48, Class 35.

2.06 FABRICATION

A. Castings shall be free from pouring faults, sponginess, cracks, blowholes, blisters, shrinkage strains, and other defects. Plugging of defective castings is not permitted.

B. Castings shall be true to pattern in form and dimension. Weight of castings shall not vary by more than 5% from published weight. Contractor shall submit invoices showing actual weight of casting as certified by Manufacturer.

C. Castings shall have machined bearing surfaces.

D. All castings shall be coated with a non-toxic, nonflammable, water-based, asphalt paint.

E. Lettering shall be cast on covers. Unless indicated otherwise, the Manufacturer's name shall be cast in cover.

F. Covers for water line manholes shall be solid lids and labeled "WATER".

G. Covers for sanitary sewer manholes shall be solid lids and labeled "SANITARY".

H. Covers for storm sewer manholes shall be solid lids and labeled "STORM".

I. Covers shall be furnished with bolts, locks, hinges, perforations, lifting rings, and pick holes as specified, shown on Drawings, or as directed.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor shall examine surfaces to receive castings and shall report unacceptable conditions to Engineer before proceeding with the Work.

3.02 ERECTION AND INSTALLATION

A. Castings shall be accurately set, aligned, and anchored as shown on Drawings.

B. Castings shall be installed in accordance with Manufacturer's instructions or shown on the drawings. If any discrepancies exist, then the more stringent requirements shall take precedence.

C. Stop plank grooves shall be square, set plumb, and securely anchored as shown. Grooves that are buckled, twisted, or otherwise prevent free insertion of stop plank shall be removed and replaced.

PART 4 SPECIAL PROVISIONS

None

END OF SECTION

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SECTION 15211
SMALL PIPING AND VALVES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing all pipelines and valves less than 4-inch in diameter as shown on the Drawings or as required for a complete piping system for each service or combination of services except the piping and valves included in Section 15400 and Section 15500.

B. Each piping system shall be adequate to conduct and control the flow of process water, plant water, non-potable water, instrument air, compressed air, vacuum, natural gas, sewage gas, propane, fuel oil, chemicals, sewage, sludge, sampling or other uses as specified or shown on the Drawings.

C. This Section includes, but is not limited to:

1. Securing and bearing the cost of all permits, certificates, and inspection as required by local regulations and state codes.
2. All pipe, fittings, and connections for water supply to equipment and waste to drains.
3. Valves less than 4-inch in diameter, control devices, pipe hangers, anchors, supports, and sleeves for the piping systems covered under this Section.
4. Hose bibbs, sill cocks, and hydrants.
5. Non-potable water supply, drain lines, and connections to boilers, pump priming systems, pump gland seals, valve operating cylinders, or other equipment requiring these services.
6. Compressed air piping, valves, connections to valve operators, and other equipment requiring compressed air.
7. Compressed air, non-potable water, natural gas, propane, vacuum, deionized water, and other services as required for laboratory service.

D. The Contractor shall furnish, install, and remove all temporary piping and valves that are required to maintain processes in operation during construction.

E. All wall, floor, and roof penetration and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

F. Instruments which are to be located in pipelines to be furnished under Division 16 shall be installed under this Section.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Drawings shall include plan dimensions to and elevations of sleeves, inserts, and anchors, the size and location of each run of pipe, and the location of valves and unions.

b. Manufacturer's literature, catalog data, specifications, and illustrations shall be bound in a brochure which includes a complete bill of materials.

2. Information for the Record:

a. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 RESERVED

2.02 VALVES

A. Ball Valves through 2-inch shall be screwed end bronze, two-piece, 125 psi, Teflon seats, bronze trim, and blowout-proof stem, Nibco No. T-580-BR-Y-20, or equal.

2.03 RESERVED

2.04 RESERVED

2.05 RESERVED

2.06 RESERVED

2.07 RESERVED

2.08 RESERVED

2.09 RESERVED

2.10 RESERVED

2.11 RESERVED

2.12 RESERVED

2.13 RESERVED

2.14 RESERVED

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves shall be installed with their stems horizontal or above. As far as possible, all valves of the same type shall be of the same manufacturer.

3.02 RESERVED

3.03 INSTRUMENTATION CONNECTIONS

A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.

B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.

C. Instrumentation and Controls are furnished and specified under Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

3.04 RESERVED

3.05 RESERVED

3.06 RESERVED

3.07 RESERVED

PART 4 SPECIAL PROVISIONS

None

END OF SECTION

SECTION 16902
METERING AND CONTROL EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. Work under this Section includes furnishing and installing all metering equipment which is part of the SCADA System.

B. All Work performed shall comply and be in accordance with all approved trade practices and Manufacturer's recommendations.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Manufacturer's literature including model number, type, size, materials, quantity, connections, equipment number, mounting hardware, and installation information.

2. Information for the Record:

a. Equipment Suppliers report that equipment is properly installed and satisfactory operation is obtained.

b. Software, cables, etc. for configuration, programming or operation of meters or equipment.

c. Operation and maintenance manuals.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. All metering equipment shall be as indicated on the Drawings and as specified and shall include, but not be limited to, those devices hereinafter defined. Should additional devices be required, but not specifically indicated elsewhere, in order to affect the intent of the Contract Documents, such devices shall be furnished.

B. All metering equipment used for similar applications shall be the product of a single manufacturer.

C. All features and requirements listed in the individual instrument specifications are required.

D. All field instrument enclosures shall be NEMA 4X construction.

E. All faces of panel mounted instruments shall be NEMA 4X construction.

F. Whenever an "or equal" equipment item is proposed in lieu of that specified it WILL NOT BE CONSIDERED EQUAL if it is of non-potted construction and the specified item is potted construction.

G. Metering equipment in contact with water shall be NSF-61 certified.

2.02 PERFORMANCE REQUIREMENTS

A. Intrinsically safe equipment shall be Factory Mutual approved for Class I, Division 1, Group D service.

B. Analog signals for input to a programmable controller system shall be isolated 4-20 mA DC and where required, current to current transducers or other device shall be furnished to produce an isolated signal to the programmable controller analog input modules.

C. Digital input signal sources shall provide an isolated contact rated at 5-amp minimum, 115 VAC, to the programmable controller system.

D. Power supplies shall be furnished for two-wire transmitters and other devices requiring DC power. No more than four loops shall be powered from one power supply. Separate power supplies shall be provided for duplicate instruments to ensure that failure of one power supply will not inhibit operation of secondary equipment.

E. The Site is in an area subject to radio frequency activity. Any equipment sensitive to radio frequency interference (RFI) shall be provided with the proper RFI filters, be properly shielded and grounded, or otherwise protected to allow proper operation of the equipment.

2.03 RESERVED

2.04 RESERVED

2.05 RESERVED

2.06 RESERVED

2.07 RESERVED

2.08 FLOW

A. Flow Meter ((FE)/(FIT))

Function:	Measure flow in water main and transmit signal proportional to flow
Type:	Insertion Type, Vortex shedding
Input Signal:	Analog Process Flow
Range:	0.15 through 20 ft/sec bi-directional
Temperature:	-15 to 175 degrees F
Process Wetted Parts	Vortex Sensor (Plastic), Measurement Cylinder and Bluff Body (Teflon® Coated Stainless Steel), Stem (Stainless Steel), O-Rings (BUNA N), and Compression Fitting (304 Stainless Steel)
Output Signal:	4-20 mA; Digital Pulse or Transistor (NPN) Pulse
Display Option	LCD display alternately shows one lines of seven-digit data; i.e. flow rate and totalizer
Accuracy:	+/- 2% of full scale
Power Requirements:	120 Volt
Classification:	IP68 Submersible
Manufacturer:	McCrometer
Model:	FPI Mag 394S016SR025A6N

2.09 RESERVED

2.10 RESERVED

2.11 RESERVED

2.12 RESERVED

2.13 ACCESSORIES

A. All piping and tubing for connections to instruments shall be stainless steel. Threaded pipe shall be ASTM A312, Grade TP304, Schedule 40S, and fittings shall be AISI Type 304. Tubing shall be ASTM Grade TP304, 0.028-inch minimum wall thickness for flareless "bite" type with threaded nut and ferrule fittings.

B. All mechanical fasteners such as bolts, nuts, screws, cinch anchors, clamps, etc., shall be stainless steel.

C. All special mounting brackets shall be stainless steel, galvanized, or nonferrous non-corrosive metal.

D. All equipment mounted outdoors that includes any type of visual indicator, LCD, etc., shall be furnished with a sun visor.

E. All equipment located outdoors shall include a thermostatically controlled space heater.

F. All field instruments and devices shall be equipped with a 1-inch x 3-inch stainless steel identification tag firmly affixed to the instrument or device with stainless steel fasteners. Each tag shall show the Manufacturer's name, serial number, part number,

tag number (to be approved by the Engineer), calibrated ranges, or calibration constants.

G. For each type of device installed, the Contractor shall supply two complete sets of software, hardware, calibration devices, and cabling that all can be used to configure, calibrate, or make adjustments.

PART 3 EXECUTION

3.01 GENERAL

A. The features and installation of the instrumentation shall be coordinated for optimal performance with the characteristics of the process material to be metered.

B. Care must be exercised to identify locations that meet the requirements of the Manufacturer including upstream and downstream distances, pressures, temperatures, and accessibility for maintenance.

C. Verify equipment requirements and dimensions with provisions specified under this Section 16902. Check actual field conditions, report necessary changes, and submit equipment reflecting changes.

D. Coordinate Work with other trades to avoid conflict and to provide correct rough-in and electrical connection requirements. Inform Contractors of other trades of the required access to and clearances around equipment to maintain serviceability and code compliance.

E. Where the installation of any device is dependent on, or affected by, Work performed under other sections of these Specifications, the Contractor shall coordinate the Work. Installation coordination includes the correct location and placement of devices, piping to the equipment, pipe taps, control power circuits, connections to the control system, etc.

F. Installation of instrumentation in an existing system being modified, replaced, or abandoned, shall be coordinated with the Owner and shall be performed to minimize operational disruptions and minimize time that equipment may be out of service.

3.02 INSTALLATION

A. Installation shall include the provision of materials and the coordination of all details necessary to properly install the instruments: location, arrangement in piping, power source, signal wiring and conduit, special brackets, and all mounting hardware.

B. All instrumentation devices shall be installed in accordance with the Manufacturer's installation requirements.

C. Wiring practices for intrinsically safe systems shall be in accordance with ISA RP12.06.01.

D. Instruments shall be installed so that the various components are accessible for maintenance. Care shall be taken in the installation to ensure sufficient space is provided between instruments and other equipment, including piping, for ease of removal and servicing.

3.03 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 GENERAL

A. Schedules included herein are intended to supplement the Drawings and are not guaranteed to be complete. All instrumentation devices shown in the Contract Documents or otherwise required to complete the Work shall be furnished and installed.

4.02 FLOW METER

A. The flow meter shall be McCrometer FPI Mag insertion type.

4.03 FLOW INSTRUMENT SCHEDULE

A. Flow device is lettered on the Drawings and scheduled as follows:

Item Designation	Function	Pipe Size (inch)	Range (fps)	Max Operating Pressure (psi)	Power Supply	IP & NEMA Rating	Dwg No.	Spec No.
F	Flow Metering	16	0.15 through 20 ft/sec	400	24 VDC Loop (Acopian 24J75 or equal)	IP68 NEMA 6P	C-1 (53 of 53)	16902

END OF SECTION

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CITY OF KALAMAZOO
DEPARTMENT OF
PUBLIC SERVICES

WATER RESOURCES DIVISION

PUBLIC SERVICES DEPARTMENT
WATER RESOURCES DIVISION
415 STOCKBRIDGE AVE.
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Standard Specifications for
Water Main and Service Installation
2021

STATE OF MICHIGAN
STEPHEN ANTHONY SKALSKI
ENGINEER
No. 52023
REGISTERED PROFESSIONAL ENGINEER

WATER MAIN AND WATER SERVICES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing water main systems.

B. Reconnection of proposed water main and/or water service connections to existing water main and/or water service constructions shall be in conformance with requirements of this Section.

C. This Section shall include furnishing, excavating, installing, testing, disinfecting, and backfilling all required water main pipe, water service pipes, water main appurtenances, water service, and other work incidental to the water main and/or water service installation unless specifically included under other Items.

D. This work shall also consist of providing as-constructed plans of the completed work.

1.02 SUBMITTALS

A. Submittals shall be the responsibility of the Contractor:

1. Shop Drawings for Review:

a. Manufacturer's Shop Drawings indicating physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project.

2. Information for the Record:

a. Manufacturer's certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

b. Manufacturer's installation instructions.

c. The laboratory shall submit test certifications of pipe ordered tested under "Field Quality Control," of this Section.

3. Engineer may request additional Shop Drawings or Information for the Record as required.

4. Requests for approved equals must be submitted to the Engineer for review a minimum of two (2) weeks prior to bid.

1.03 AS CONSTRUCTED RECORD

A. During construction the contractor shall be required to keep current a set of "as constructed" drawings. Before final payment shall be made, the contractor shall submit for approval to the City of Kalamazoo the complete set of as constructed drawings. Each set of "as constructed" drawings shall be labeled "As Constructed", dated, and contain at a minimum the following information (additional information may be required by the City of Kalamazoo):

1. Note distance between all fittings (Center to Center of Fittings).
2. Note Hydrant to valve, valve to main distances (Center to Center of Fittings).
3. Note the type of bend used, (# of degrees), and the Direction of Bend: (Up or down), (N-S-E-W).

4. Note lengths and locations of restrained joints.
5. Details and profiles of special field situations that relate to the water distribution system shall be included.
6. Dimensional information locating each water distribution system component to real world features, such as property lines, right-of-way lines, and centerlines of roads.
7. On all cul-de-sacs with no center island, measure bends and hydrants to center of cul-de-sac. On all cul-de-sacs with a center island, measure bends and hydrants to center of the roadway.
8. When fittings/hydrants are installed as proposed, please circle the proposed listing.
9. All hydrants shall be noted as to whether or not drip valve plugs were installed.
10. When installing 12 inch or larger valves, (Butterfly Valves), indicate which side of the main the operating nut was placed, as well as gear box style with number of turns to close.
11. The contractor shall complete the service card information including a sketch of the water service installation with dimensions and location of the curb box.
12. Contractor shall GPS all valves, hydrants, fittings, as well a minimum every 3 lengths of pipe for straight runs. DWG files shall be provided to the Engineer upon completion of the project. GPS accuracy shall be subfoot.
13. **All as-built record drawings shall be completed and turned in to the Engineer within 2 weeks from completion of the installation.**

1.04 CONTRACT WORK

A. Prior to the start of construction, the City of Kalamazoo shall be given the opportunity to provide construction services for any and all portions of the water main construction. The City of Kalamazoo shall submit an estimated cost to perform the work or will issue a bill based on time and material costs. A separate contract with the City of Kalamazoo will be needed for work to be performed by the City of Kalamazoo.

1. City of Kalamazoo shall perform all water main taps in the water system, unless otherwise directed by the Engineer.

B. The City of Kalamazoo Department of Public Services must approve the Contractor who will perform water main installation. A reference list of at least five (5) Type 1 supply water main projects completed by the Contractor shall be submitted in support of the Contractor's qualifications. The Department of Public Services maintains a list of Contractors approved for water main installation and can be contacted to receive a current copy of that list.

C. The Contractor (when hired by the City) or Developer (when the Contractor is hired to perform work by the Developer), shall provide a written statement of warranty (Warranty Bond) for a period of 2 years from the date of **final acceptance** for water main work or **after meter is installed** for water service work**.** Warranty work shall cover any necessary cost to repair water main or appurtenance leaks and water main or appurtenance leak damage at no cost to the City of Kalamazoo. Final acceptance on all water main and appurtenance work shall not occur until all items have been inspected by the Engineer, passed all required testing, as well as receipt and approval of all as built documents. Additionally, final acceptance on a water service will only be given **once the water meter is installed.**

1. Water service or water main warranty work shall be completed either a prequalified contractor under the inspection of the City of Kalamazoo, or by City of Kalamazoo field service crews. All warranty work shall be paid for by the Developer or the Contractor.

D. The Contractor is responsible for field locating all work which has not yet received final acceptance by the City of Kalamazoo. All damage to work that has not received final acceptance is the responsibility of the Contractor.

PART 2 PRODUCTS

All Products shall be supplied new from the manufacturer and certified new from the supplier. No second hand or salvaged material shall be allowed. All products shall be "**Buy American**" unless otherwise specified in this section.

2.01 DUCTILE IRON

A. Ductile Iron (DI) Pipe Specifications:

1. Ductile Iron Pipe shall be manufactured in accordance with American National Standards Institute (ANSI) and American Water Works Association (AWWA) ANSI/AWWA C150/A21.50 and C151/A21.51. Pipe shall be minimum thickness Class 52 pipe. Flanged pipe shall be manufactured in accordance with ANSI/AWWA C 115/A21.15. Pipe through concrete floors or foundations shall be minimum thickness Class 53 pipe.

a. Water pipe must be lined with a standard thickness cement mortar lining sealed with a bituminous seal coat in accordance with ANSI/AWWA C104/A21.4, unless otherwise required. The outside of the pipe must be coated with the standard bituminous seal and each length of pipe must be marked with the following information

1) Metal thickness class.

2) Net weight of the pipe without lining.

3) The nominal size.

4) The manufacturer's identifying symbol.

b. Underground pipe shall be push on or mechanical joints and above ground pipe shall be flanged joints with gaskets meeting the requirements of ANSI/AWWA C111/A21.11. Nitrile or fluoroelastomer gaskets shall must be used as indicated on the plans and in locations of known or suspected soil or groundwater contamination as necessary. Gaskets provided will be specified based on the type of contamination that is encountered. Each joint shall contain serrated silicon bronze electrical continuity wedges as directed by the Engineer or authorized representative. 4 to 6 inch pipe shall use 2 wedges, 8 to 12 inch pipe shall use 3 wedges, and 16 inch and above shall use 4 wedges.

c. Pipe used in conjunction with Horizontal Directional Drilling operations shall be Flex-Ring or TR FLEX joints.

B. Restrained Joints

1. Restrained joints shall meet the requirements of ANSI/AWWA C111/A21.11, and AWWA/ANSI C110/A21.10 or ANSI/AWWA C153/A21.53.

2. Mechanical restrained joints shall be EBAA Iron Megalug series 1100, Romac Romagrip, Ford Series 1400, or approved equal.

a. Restraint devices for nominal pipe sizes 4 inch through 54 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.

b. The devices shall have a working pressure rating of 350 psi for 4 to 16 inch, 250 psi for 18 to 48 inch and 200 psi for the 54 inch size. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.

c. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.

d. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.

e. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.

f. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.

g. All components shall be manufacture and assembled in the United States.

h. Coating for restraint devices shall consist of the following:

1) All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.

2) All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

3) The coating system shall be MEGA-BOND by EBAA Iron, Inc. or approved equal.

3. Push on restrained joint shall be field locking gasket or Flex Ring style as manufactured by US Pipe, McWane, American USA, or approved equal. Field locking or Flex Ring gasket shall match appropriately to the manufacturer of the pipe used.

4. Use of threaded rods or thrust blocks as a restrained joint shall not be permitted, unless approved by the Engineer.

5. Restrained flange adapters shall be EBAA Iron Megaflange series 2100 or approved equal.

a. Restrained flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10 (125#/Class 150 Bolt Pattern).

b. Restraint for flange adapter shall consist of plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.

c. The flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum of 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

d. All internal surfaces of the gasket ring (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. The coating shall meet ANSI/NSF-61. Exterior surfaces of the gasket ring shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

e. Restraint Ring coated with MEGA-Bond Restraint Coating System.

C. Ductile Iron Pipe Fittings

1. Fittings, plugs, and gaskets must meet the requirements of ANSI/AWWA C111/A21.11, and AWWA/ANSI C110/A21.10 or ANSI/AWWA C153/A21.53. Cement mortar linings for fittings must meet the requirements of ANSI/AWWA C104/A21.4.

2. Mechanical joints shall be EBAA Iron Megalug series 1100, Romac Romagrip, or approved equal.

3. Restrained flange adapters shall be EBAA Iron Megaflange series 2100 or approved equal.

2.02 Ductile Iron Valves

A. All underground valves in sizes from 4 inches to 10 inches shall be reduced wall, resilient-seated gate vales for water supply service meeting the requirements of AWWA C 515. Valves shall be American Flow Control Series 2500, Clow model 2638, or EJ Flowmaster Series resilient seated gate valve, Mechanical joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, stainless steel stem, mechanical joint restraint, and ¾ inch tee head bolts. Valves shall open right (clockwise) and be equipped with standard AWWA operating nut. Nut shall be color coded red. Valves shall have a working pressure rating of 250 psi or greater.

1. In lieu of a mechanical joint restraint, American Flow Control Series 2500 valves may be equipped with ALPHA joints.

B. All underground valves 12 inches and larger shall be rubber-seated butterfly valves meeting the requirements of AWWA C 504. Valves shall be Pratt Groundhog Butterfly Valves, by Henry Pratt Company, Clow, M&H, or Kennedy model 4500, mechanical joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, mechanical joint restraint, and ¾ inch tee head bolts. Valves shall open right (clockwise) and be equipped with standard AWWA operating nut. Nut shall be color coded red. Valves shall have a working pressure rating of 250 psi or greater.

C. All above ground or in pits/vaults valves between 3 inches and 10 inches shall be rubber seated gate valves meeting the requirements of AWWA C515. Valves shall be American Flow Control Series 2500 Resilient Wedge Gate Valve, Clow model 2638, EJ Flowmaster Series, or approved equal with flanged joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, stainless steel bolts, nuts and washers, stainless steel stem, and be equipped with a hand wheel to operate. Valves shall have a working pressure rating of 150 psi or greater.

D. All above ground or in pits/vaults valves 12 inches and larger shall be rubber seated butterfly valves meeting the requirements of AWWA C504. Valves shall be by Henry Pratt Company, Clow, M&H, or Kennedy, flanged joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, and ¾ inch stainless steel bolts, washers and nuts. Valves shall open right (clockwise) and be equipped with standard wheel to operate. Valves shall have a working pressure rating of 150 psi or greater.

E. All underground valves in sizes from 4 inches to 16 inches used in combination with a tapping saddle shall be reduced wall, resilient-seated gate valves for water supply service meeting the requirements of AWWA C 515. Valves shall be American Flow Control Series 2500, Clow model 2638, EJ Flowmaster Series with one flanged and one mechanical joint ends with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, stainless steel stem, mechanical joint restraint, and ¾ inch tee head bolts or approved equal. Valves shall open right (clockwise) and be equipped with standard AWWA operating nut. Nut shall be color coded red. Valves shall have a working pressure rating of 250 psi or greater.

F. All valves used in conjunction with a fire service line shall be Mueller R-2361-6 Outside Screw and Yoke (O.S.&Y.) with sample tap or approved equal. The stem shall be type 304 stainless steel. Sample tap shall have a 4 ½ inch brass nipple, brass ball valve, and brass plug meeting NSF/ANSI Standard 61 requirements. Sample tap shall be ½ inch for 4 inch and smaller valves and ¾ inch for valves larger than 4 inch.

G. All valves installed using the insertion style method shall be an all stainless steel body Resilient Wedge Gate Valve designed for permanent use in potable water systems. The design will allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service without system shutdown. No restraining devices, restraining fasteners, or transition gaskets shall be required for the installation or operation of the valve. Valves in sizes 4 inches to 12 inches shall be Hydra-Stop Insta-Valve 250 or approved equal. 16 inch valves shall be Hydra-stop Insta-Valve Plus 250 or approved equal.

2.03 HYDRANTS

A. All fire hydrants shall be American Flow Control or EJ and shall meet the requirements of AWWA C502. Hydrants shall be provided as complete units including hydrant, hydrant marker, pipe, pipe fittings and valve meeting section 2.01, 2.03 and 2.04 requirements. Hydrants shall be supplied for a bury depth of 5.5 feet. The hydrant barrel shall be painted safety yellow by the manufacturer. Hydrant caps and operating nut shall be painted John Deere green by the manufacturer.

1. American Flow Control hydrants shall be 5 ¼ inch Waterous Pacer Traffic Model WB67-250. Hydrants shall be supplied with a 16 inch upper standpipe length. The Hydrant will come equipped with a bronze upper valve washer. In lieu of a mechanical joint restraint, hydrants may be equipped with ALPHA joints.

2. EJ hydrants shall be WaterMaster Model 5BR250 with snow barrel.

B. Hydrants shall come equipped with a Carrol Drain. Drain piping shall be made of type 304 stainless steel. External port shall have removable cap for flushing hydrant. Carrol Drain assembly shall be constructed so that it is removable when replacement of assembly is necessary.

C. Hydrants shall have two 2 ½ inch national standard hose connections, 7.5 threads per inch, OD of threads 3 1/16 inch and one 5 inch integral “STORZ” type nozzle connection. Hose nozzle cap nut, weather shield hydrant operating nut, Storz nozzle cap nut, and Carrol Drain cap nut shall be square 15/16 inch at bottom of nut tapered to 13/16 inch at top (Waterous reference #19). The hydrant mechanism shall be on a non-rising stem opening clockwise. Chains shall not be supplied with the hydrant caps.

D. Hydrants shall be equipped drip valve, tapped for plug. The drip valve system shall be bronze. Draining system shall be positively activated by the main operating rod, meaning the drip valve will open when the hydrant is closed. Hydrant shall be provided with plug removed.

E. Hydrants shall have a 6 inch shoe with mechanical joint connections in conformance to ANSI/AWWA C115/21.11.

2.04 FIRE HYDRANT MARKER

A. The fire hydrant sign shall be installed on a galvanized 2 pound sign post.

B. The fire hydrant sign shall be aluminum 8 inch x 18 inch (MDOT type III-A) with hydrant symbol and down arrow of a reflective material.

C. Fire hydrant mounted marker whips shall be 4 feet x 3/8 inch solid pultrusion fiberglass shaft, with seven (7) 6 inch bands of E.G. reflective sheeting of alternating lime green and red color.

Marker shall have a single solid stainless steel spring with aluminum threaded insert, and use Zinc coated bolt & mounting hardware.

2.05 TAPPING SLEEVES

A. Tapping sleeves for size on size taps or 12 inch and larger sleeves:

1. Model shall be American Flow Control series 2800-C, Tyler Union, Smith-Blair series 665, Romac style SST III, Ford style FTSS, Ford MJTS, or approved equal.

2. Ductile Iron Tapping Sleeves.

a. Sleeves shall be of construction meeting ASTM A536. Side flange seals shall be O-ring type of round cross-sectional shape.

b. All sleeves to include the end joint accessories and split glands necessary to assemble sleeve to pipe.

c. Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.

3. Stainless Steel Tapping Sleeves.

a. Sleeves shall be 18-8 type 304 Stainless Steel in accordance with AWWA C223.

b. Bolts, nuts, and washers shall be 18-8 Type 304 Stainless Steel. Nuts shall be heavy hex, and coated to prevent galling.

B. Tapping sleeves smaller than 12 inch which are not size on size:

1. Model shall be Smith-Blair series 665, Romac style SST III, Ford style FTSS, or approved equal.

2. Sleeves shall be 18-8 type 304 Stainless Steel in accordance with AWWA C223.

3. Bolts, nuts, and washers shall be 18-8 Type 304 Stainless Steel. Nuts shall be heavy hex, and coated to prevent galling.

C. Line Stop Tapping Sleeves and appurtenances:

1. Model shall be Hydra-Stop HSF 250 Patriot or approved equal

2. Body shall be type 304 Stainless Steel in accordance with AWWA C223.

3. Blind Flange shall be Epoxy Coated Carbon Steel or type 304 Stainless Steel.

4. Bolts, Nuts and Washers shall be type 304 Stainless Steel.

5. Completion Plug shall be HSF 250 Push and Pin Style, made of reinforced composite polymer.

6. Completion Plug O-ring shall be BUNA-N Rubber

7. Completion Plug Pins shall be SAE Grade 8, Zinc coated to prevent corrosion

8. Completion Pin Plug shall be type 304 Stainless Steel, coated to prevent galling.

9. Flange O-Ring shall be BUNA-N Rubber.

D. All gaskets shall be Nitrile in compliance with NSF-61.

E. No special tools shall be required other than standard socket wrench.

F. Flange end pilot dimensions to be in compliance with MSS-Sp-60.

2.06 AIR RELEASE VALVES

A. Air Release Valves – All air release valves shall be manufactured per ANSI/AWWA C512-04. Cla-Val Series 36 Combination Air Valves, or approved equal. The valves shall be of the size listed in the plans.

1. The combination air valve shall combine the operating features of both an air and vacuum valve and an air release valve in one housing. The air and vacuum valve portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allow air to reenter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, or other emergency. The air release valve portion shall automatically release small amounts of air from the pipeline while it is under pressure.

2. The inlet and outlet of the valve shall have the same cross section area. The float shall be guided by a stainless steel guide shaft and seat drip tight against a synthetic rubber seal. 4 inch and larger valves shall have dual guided shafts of hexagonal cross section and a protective discharge hood.

3. The float shall be of all stainless steel construction and capable of withstanding maximum system surge pressure without failure. The body and cover shall be concentrically located and of ductile iron and the valve internal parts shall be stainless steel or Buna-N rubber.

4. All 1 inch and 2 inch valves shall be NPT. All valves 4 inch and larger shall be flanged.

B. Vent piping shall be 2 inch diameter, with copper piping below grade and galvanized piping above grade.

C. Air vent screens shall be black PVC, with NPT threaded to match the size of the connection pipe. Screen shall be one-piece 304 Stainless, mesh size 100. Silver reflective tape shall be placed on the vent pipe.

D. An air release valve sign shall be installed on a galvanized 2 pound sign post.

E. The valve sign shall be aluminum 8 inch x 18 inch (MDOT type III-A) with valve symbol and down arrow of a reflective material.

2.07 REPAIR SLEEVES

A. All repair sleeves shall be certified NSF/ANSI 61-G and 372, and be in accordance with AWWA C230. Sleeves without service tap shall be Smith – Blair model 226, PowerSeal model 3121, or approved equal. Sleeves with service tap shall be Smith – Blair model 238, PowerSeal model 3131, or approved equal.

B. Sleeves shall use Type 304 Stainless Steel hardware in accordance with ASTM A193/A194. Sleeves shall have conductivity feature.

C. The repair sleeves shall be of the full circle type designed to repair a fully broken (completely separated) pipe and shall be rated for a working pressure of not less than 150 psi. Repair sleeves 12 inches or under in size will have a single joint.

D. The length of the sleeves shall not be less than 7 ½ inches. Sleeves shall have no less than three (3) guide bolts of the minimum specified length. Sleeves of longer length shall have an additional guide bolt for every two (2) inches of additional band length.

E. Each sleeve shall consist of a sealing gasket, a non-magnetic stainless steel band with contact buttons protruding through specially prepared gaskets, clamp lugs, bolts and nuts.

F. No welding will be permitted in the manufacture of stainless steel repair sleeves except for the addition of the tap to repair sleeve.

G. The lugs shall not be deformed in the process of attachments to the band during assembly or during removal in the field.

H. The gasket shall be natural rubber, nitrile or approved equal and shall be of the tapered overlap design to give a pressure tight fit on the pipe surface to form a leak tight, permanent seal when the repair sleeve is installed. The gasket shall have a grid pattern to conform pipe surface irregularities.

I. The gasket shall have a stainless steel bridge plate flush mounted and securely bonded into the gasket during the molding of the gasket.

2.08 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement must be manufactured using 8 mil thick virgin polyethylene in accordance with ANSI/AWWA C105/A21.10. Provide the tube size recommended by the manufacturer to protect the pipe and fitting sizes. Provide adhesive tape for the polyethylene tube as recommended by the manufacturer. Tape for repairing damage to the polyethylene must have a life expectancy equal to or greater than the life expectancy of the polyethylene.

2.09 STEEL BLOW-OFF PIPE

A. Steel pipe shall be hot dipped galvanized meeting the requirements of ASTM A53.

2.10 WATER SERVICES AND APPURTENANCES

A. Copper Service Lines

1. Copper pipe shall be used for service lines which are ¾ inch, 1 ¼ inch and 2-inch. All copper services shall conform to AWWA C800. Water service pipe shall be copper meeting the requirements of ASTM B88, type K.

2. All appurtenances on copper service lines shall be flare copper connections. Other connections may be used in lieu of flare copper connections if approved by the Engineer prior to installation.

B. All water service appurtenances shall meet the requirements of AWWA C800 and be from The Ford Meter Box Company, Inc., A.Y. McDonald Mfg. Co., or as approved by the Engineer. All water service appurtenances for 2 inch and smaller are as follows:

1. ¾ inch services:

a. Corporation Stop ¾ inch – FB600-3-NL or AY McDonald 74701B NL (3/4 inch)

b. Service Saddle – Smith-Blair 311(4 to 12 inch water main), Smith-Blair 313 (16 to 24 inch water main), Romac 101U(4 to 12 inch water main), Romac 202SSU (16 to 24 inch water main), Ford F101(4 to 12 inch water main), or Ford F202(16 to 24 inch water main).

c. Curb Stop (for use when reducing a 1 ¼ inch street service to ¾ inch yard service) – Ford B21-555-NL, C18-35-NL, and C28-33-NL

d. Curb Stop (when using ¾ inch street service) – Ford B22-333-NL or AY McDonald 76100 NL (¾ inch)

e. Brass Fittings – All brass fittings such as tees, elbows, caps, nipples and similar items shall be manufactured in the U.S.A.

f. Couplings – Ford C22-33-NL or AY McDonald 74758 NL (¾ inch)

2. 1 ¼ inch services:

a. Corporation Stop – Ford FB600-45-NL or AY McDonald 74701B NL (1 x 1 ¼ inch)

b. Service Saddle – Smith-Blair 311(4 to 12 inch water main), Smith-Blair 313 (16 to 24 inch water main), Romac 101U(4 to 12 inch water main), Romac 202SSU (16 to 24 inch water main), Ford F101(4 to 12 inch water main), or Ford F202(16 to 24 inch water main).

c. Curb Stop – Ford B22-555-NL or AY McDonald 76100 NL (1 ¼ inch)

d. Brass Fittings – All brass fittings such as tees, elbows, caps, nipples and similar items shall be manufactured in the U.S.A.

e. Couplings – Ford C22-55-NL or AY McDonald 74758 NL (1 ¼ inch)

3. 2 inch services:

a. Tapping Valve – Ford B11-777-NL

b. Service Saddle – Smith-Blair 313, Romac 202S, or Ford F202

c. Brass Fittings – All brass fittings such as tees, elbows, caps, nipples and similar items shall be manufactured in the U.S.A.

d. Couplings – Ford C44-77-NL

4. Water meters – All water meters shall be Neptune Water Meters. They shall be supplied and installed by the City of Kalamazoo.

C. All water service appurtenances larger than 2 inch shall be in accordance with section 2.01.

D. All multiple meter settings with more than two meters excluding the fire meter shall use a fabricated meter manifold. Fabricated manifold shall be manufactured as follows:

1. Water manifold shall be made using 304 Schedule 40 Stainless Steel pipe.

2. Inlet and outlets shall be threaded or welded flange. End cap shall be welded flange with a blind flange for future additions.

E. Conduit used as sleeves shall be schedule 40 PVC or approved by Engineer.

2.11 METER SETTINGS

A. Interior meter settings shall use components from the following manufactures.

1. 1 inch meter – Ford KV23-454W-NL Angle Valve, Ford C38-44-2-625-NL, Brass Nipple, Apollo 94ALF-105-01A Ball Valve or approved equal

2. 1½ inch and 2 inch meter – Ford FV13-777W-NL Angle Valve, Ford CF35-66NL (1 ½ inch), Ford CF 35-77-NL (2 inch), Brass Nipple, Watts LFFBV-3C Ball valve or approved equal.

3. 3 inch and larger- rubber seated gate valves meeting the requirements of AWWA C515. Valves shall be American Series 2500 Resilient Wedge Gate Valve with hand wheel by American or equal flanged joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), and be equipped with a hand wheel to operate, Hymax 874-56-03008812 (3 inch), 874-56-04010812 (4 inch), 874-56-06016312 (6 inch), or 874-56-08021712 (8 inch) Flange Adaptor, and flange to plain end ductile or type 304 stainless steel spool piece.

B. Exterior meter settings shall use components from the following manufactures.

1. 5/8 inch meter – Ford V81-22-33-NL

2. ¾ inch meter – Ford V83-22-33-NL

3. 1 inch meter – Ford V84-22-55-NL Copper setter

4. 1 ½ inch and 2 inch meter – Watts LFFBV-3C Ball Valve or approved equal. Ford CF-77-1-937-NL Meter Flange, Ford C28-77-NL Coupler, and Brass Nipple.

5. 3 inch and larger – All above ground or in pits/vaults valves 3 inches and larger shall be rubber seated gate valves meeting the requirements of AWWA C515. Valves shall be American Series 2500 Resilient Wedge Gate Valve with hand wheel by American or equal flanged joint with rubber gaskets (per AWWA/ANSI C111/A21.11), and be equipped with a hand wheel to operate, Hymax 874-56-03008812 (3 inch), 874-56-04010812 (4 inch), 874-56-06016312 (6 inch), or 874-56-08021712 (8 inch) Flange Adaptor, and flange to plain end ductile or type 304 stainless steel spool piece.

2.12 FIRE SERVICE APPURTENANCES

A. All fire service appurtenances shall meet the requirements of AWWA/ANSI C110/A21.10, AWWA C115, and be from the following manufacturers.

1. Double Check Valve Detector Assembly – Zurn Wilkins Model 350DA or 350ADA with meter setting, AMES Colt LFC300 with meter setting, or approved equal. The City of Kalamazoo will supply the 5/8 inch water meter.

2. Reduced Pressure Zone Assembly – When using a RPZ in lieu of double check valve for a backflow device, a Zurn Wilkins Model 375DA or 375ADA with meter setting, AMES Colt LFC500 with meter setting, or approved equal shall be required. The City of Kalamazoo will supply the 5/8 inch water meter.

2.13 METER BOXES AND VAULTS

A. All Meter Boxes, Meter Vaults and components shall be from the following manufactures.

1. Box – Hancor MP NL1 24 0008 - 24 inch x 48 inch or ADS24X48MP 24 inchx48 inch white corrugated meter pit or Engineer approved equal.

2. Vault – Precast concrete meter vault shall have a 3 inch minimum wall thickness and size shall be depended on number of meters and meter size. The wall shall have steps that are equally spaced 12 inches apart. Meter vault shop drawings shall be submitted to the Engineer and approved for each installation.

3. Meter Pit Cover – Vestal 32-497, 32-055, 32-104, and 32-046 or approved equal.

4. Meter Vault Cover – Ford MC-24HH-MB-T

2.14 VALVE BOXES AND VAULTS

A. Curb Stop Boxes for 1 ¼ inch Service – Bingham & Taylor Fig. No. 4901-B, 94-F with 2 ½" New Style Flush Fit Cover or approved equal. Cover shall be inscribed with the word "water".

1. Curb Stop Box extensions shall be cast iron and manufactured by Bingham & Taylor, capable of being mounted directly to the curb stop box.

B. Gate Valve Box or 2 inch Service Box – the valve box shall be of adjustable length screw type. The valve box shall be a malleable iron casting conforming to subsection 908.03 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction*. This valve box shall either be a two or three piece screw type and the cover shall be inscribed with the word "water." Valve box 8550 Series (two piece) or 8560 Series (three piece) manufactured by EJ, 4905 size no. 22 manufactured by Bingham & Taylor, or approved equal.

1. Gate Valve Box extensions shall be cast iron and manufactured by EJ or Bingham & Taylor, capable of being mounted directly to the gate valve box.

C. Valve Vaults for Insta-Valves – Valve vaults used in conjunction with Insta-Valves shall be constructed with materials as detailed in WA-8-A of the City of Kalamazoo Standard Plans.

They shall be of the diameter specified and in accordance with subsection 823.02 of the Michigan Department of Transportation *Standard Specifications for Construction* for Gate Wells.

D. Valve Vaults for Air Release Valves – Valve vaults used in conjunction with Air Release Valves shall be constructed with materials as detailed in the latest WA-4-Series or WA-5-Series of the City of Kalamazoo Standard Plans. They shall be of the diameter specified and in accordance with subsection 823.02 of the Michigan Department of Transportation *Standard Specifications for Construction* for Gate Wells.

2.15 BACKFILL MATERIALS

A. Use materials meeting the requirements of section 902 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction.*

2.16 BELL JOINT LEAK CLAMP

A. Bell Joint Leak Clamps shall be Smith-Blair Model 274, Ford Meter Box FBC or MJSC style, or approved equal.

1. The bell spigot ring, section connector, and range spacer shall be ductile iron 80-55-06 in accordance with ASTM 536. Fusion bonded epoxy finish shall meet application methods per AWWA C213. Spigot ring design shall be interlocking to allow ease of installation without interrupting the flow of the pipe. The bolt head pocket shall be integral for one wrench installation.

2. Gasket shall be Nitrile Buna-N per ASTM D2000, and certified to NSF/ANSI 61-G & 372.

3. Restraint Rods and Nuts shall be Type 304 Stainless Steel. Restraint Rod shall have rolled threads, and Nut shall be fluoropolymer coated to prevent galling.

B. Bell encapsulating couplings shall be Ford Meter Box MJBE style.

1. The coupling shall be designed to fully encapsulate the pipe bell. The coupling shall be of split mechanical joint design with independent end seal and side seal gaskets.

2. All welded components shall be constructed with ASTM A 36 carbon steel.

3. The end seal and side seal gaskets shall be virgin NBR formulated for water service. The gaskets shall not require field trimming, cutting or modification.

4. The end seal compression ring shall be manufactured with ductile iron per ASTM A 526 Grade 65-45-12 or ASTM A 36 carbon steel.

5. The coupling shall be coated to an average of 12 mills thickness with a fusion-bonded epoxy that is NSF 61 listed and meeting application methods of AWWA C213.

2.17 COUPLINGS

A. Wide range couplings shall be Romac Alpha or approved equal.

1. All cast components shall be ductile iron, meeting or exceeding ASTM A 536, grade 65-45-12

2. Grippers shall be ductile iron, meeting or exceeding ASTM A 536, grade 65-45-12.

3. Gaskets shall be SBR compounded for water service per ASTM D2000 and meet NSF61 classification.

4. Bolts and nuts shall be 304 stainless steel.

5. Body shall be epoxy coated, and NSF61 Certified.

2.18 STRUCTURE CASTINGS

A. All 24 inch structure covers shall be a malleable iron casting conforming to subsection 908.03 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction.* The structure cover shall be series 1040 manufactured by EJ, inscribed with the word "Water".

2.19 STEEL CASING PIPE AND APPURTENANCES

A. Steel casing pipe shall meet the requirements in accordance with subsection 909.05.D of the 2012 Michigan Department of Transportation *Standard Specifications for Construction* with the exceptions listed below:

1. For steel casing pipe jacked under a railroad, replace in its entirety the entry for 30 inch nominal size listed in Table 909-18 with the following:

Nominal OD and Wall Thickness in Inches Jacked in Place Steel Pipe

Nominal Size	Nominal Outside Diameter	Wall Thickness
30	30.000	0.406(a)
a. Coated or cathodically protected (0.469 inch minimum if uncoated and unprotected)		

2. Steel casing must have a minimum yield strength of 35,000 pounds per square inch (psi) and be in accordance with ASTM A53, Type E or S, Grade A or B and be designed for Cooper E80 loading requirements. In all cases, the allowable jacking strength capacity of the casing pipe shall be capable of withstanding the maximum jacking forces imposed by the operation.

B. Stainless steel band spacer shall be Advance Products & Systems model SSIM or approved equal. The bands shall be constructed of circular stainless steel bands, which bolt together forming a shell around the carrier pipe. The spacers shall be designed with runners to support the carrier within the casing and maintain a minimum clearance of 1.00 inches between the casing inside diameter (ID) and the spacer outside diameter (OD). The spacers shall contain four modular runners – two on each half. Stainless steel bolts, nuts and washers shall be supplied with the casing spacers.

The band shall be manufacture of 8 inch wide 14-guage T-304 stainless steel. Abrasion resistant runners, having a minimum length of 7 inches and a minimum width of 1 inch, shall be attached to each band to minimize friction between the casing pipe and the carrier pipe as it is installed. Runner material shall be of glass filled polymer with compression strength of 33,000 psi, flexural strength of 40,000 psi, and tensile strength of 27,000 psi. The ends of thall runners shall be beveled to facilitate installation over rough weld beads or the welded ends of misaligned or deformed casing pipe.

Interior surfaces of the circular stainless steel band shall be lined with PVC, or EPDM alternate, having a minimum thickness of .090 inches with a harness of Durometer "A" 85-90.

Recommended position of the spacers is one placed not more than one foot from each end of the casing and pipe joint. Subsequent spacers shall be placed every 6-8 feet apart thereafter.

C. Casing end seal shall be Advance Products & Systems model AC or approved equal. Pull-on casing end seals shall be manufactured of 1/8 inch thick neoprene rubber assuring excellent chemical resistance and resiliency. End seals must be effectively used in the temperature range of -20 degrees to 190 degrees Fahrenheit. End seals shall include ½ inch wide T304 stainless steel bandings with 100% nonmagnetic worm gear mechanism. End seals shall be seamless, have vulcanized edges, and can be pulled on at the time of construction.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. The plans show the locations of existing utilities in accordance with available data. If the work requires precise information on the location of existing utilities, the Contractor will expose utilities shown on the plans to determine the actual locations.

Do not disturb or cut into existing in-service water mains. If the operation of valves in existing water mains is required, notify the City of Kalamazoo a minimum of 3 working days in advance. Coordinate scheduling of water main connections with the City of Kalamazoo. Secure the Engineer's or authorized representative's approval of the schedule before beginning the work.

The City of Kalamazoo will open or close in service valves and provide on-site inspections for all water main and water service installations. The City of Kalamazoo will perform this work for an estimated time and material charge. The cost of opening and closing valves and on-site inspection will need a separate contract with the City of Kalamazoo prior to start of work. This does not apply to work being contracted by the City of Kalamazoo.

Minimize the out of service time for existing water mains. Make connections at night, on Sundays, or on holidays, as conditions require or as approved by the City of Kalamazoo. Minimize interference with the water supply if abandoning existing water mains and incorporating new water mains into the water system**.**

No trees or permanent structures shall be placed within 10 feet of the centerline of the water main or service line.

3.02 TRENCH EXCAVATION

A. Excavate water main trenches to the lines and grades shown on the plans in accordance with modifications approved by the Engineer, or authorized representative, or to meet or bypass existing utility structures. Excavate trenches to the depths shown on the plans to provide 5 feet of cover from top of water main to the final grade. Excavate trenches to the widths shown on Michigan Department of Transportation Standard Plan R-83 Series.

B. Excavate the bottom of the trench to the required grade to allow 6 inches of bedding for the pipe. Do not block under the pipe.

C. Maintain trenches for water mains free of ground or surface water by pumping or as otherwise approved by the Engineer or authorized representative

D. Install, and later remove, temporary timber bracing, as required to prevent movement or damage to new or existing water mains or adjacent utilities.

E. During backfilling, carefully remove supports for sheeted and braced excavations to prevent earth banks or adjacent streets from collapsing.

F. The Contractor may leave sheeting and bracing in place during backfilling and remove after completing backfilling operations. The Contractor may leave sheeting and bracing in place, if approved by the Engineer and the Contractor cuts it off 5 feet below the ground surface.

3.03 DISPOSAL

A. Dispose of waste material as specified in section 205 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction.*

3.04 LAYING OF THE PIPE

A. Install the pipe joint restraint system in accordance with the manufacturer's recommendations, or as directed by the Engineer. Assemble the pipe in the trench. If deflections at joints are required by changes in grade, alignment, or to plumb valve stems, ensure deflections of bell and spigot joints and mechanical fitting joints do not exceed three-quarters of the maximum deflection recommended by the joint manufacturer or that allowed by AWWA C600, whichever is less. Do not store or leave tools or other objects in the pipe.

B. Provide restrained joints as indicated on the plans. No tie rods or thrust blocks shall be allowed unless approved by the Engineer or authorized representative.

C. Proper actuation of the gripping wedges of the mechanical joint restraint shall be ensured with torque limiting twist off nuts.

D. The Contractor shall provide a written statement of warranty (Warranty Bond) for a period of 2 years from the date of **final acceptance (after meter is installed).** Warranty work shall cover any necessary cost to repair water main or appurtenance leaks and water main or appurtenance leak damage at no cost to the City of Kalamazoo. Final acceptance will only be given **once the water service meter is installed.**

E. Pipe shall be laid with bell ends facing the direction of laying, unless otherwise directed by the Engineer or authorized representative. When pipe is laid on a grade of 10 percent or greater, the laying shall start at the bottom and proceed upward with the bell ends of the pipe upgrade.

F. Install silicon bronze wedges between all push-on joint pipes to allow for underground location and thawing of pipeline. 4 to 6 inch pipe shall use 2 wedges, 8 to 12 inch pipe shall use 3 wedges, and 16 inch and above shall use 4 wedges at each pipe joint.

G. Pipe shall be restrained in accordance with Table 3.1.

Table 3.1 Pipe Thrust Restraint Table								
NON-POLYWRAPPED PIPE								
Pipe Size (Inches)	**90° Bend**	**45° Bend**	**22.5° Bend**	**11.25° Bend**	**Tee***	**Reducer (One Size)**	**Reducer (Two Sizes)**	**Dead End**
4	44	18	9	5	42	-	-	42
6	62	26	13	7	59	31	-	59
8	82	34	17	9	78	33	56	78
10	100	42	20	10	94	32	58	94
12	119	50	24	12	110	33	59	110
16	157	65	32	16	143	61	85	143
20	195	81	39	20	173	61	109	173
24	233	97	47	23	204	61	111	204
30	288	120	58	29	246	86	134	246
POLYWRAPPED PIPE								
Pipe Size (Inches)	**90° Bend**	**45° Bend**	**22.5° Bend**	**11.25° Bend**	**Tee***	**Reducer (One Size)**	**Reducer (Two Sizes)**	**Dead End**
4	62	26	13	7	60	-	-	60
6	88	37	18	9	84	44	-	84
8	117	49	24	12	111	47	80	111
10	142	59	29	14	133	45	82	133
12	170	71	34	17	158	47	84	158
16	224	93	45	23	203	87	121	203
20	278	116	56	28	247	87	155	247
24	332	138	66	33	291	87	159	291
30	411	171	82	41	351	123	191	351
* Length of restraint for branch; use the size of the branch Consult Engineer for scenarios not included in table.								

3.05 INSTALLATION OF PIPE INVOLVING HORIZONTAL DIRECTIONAL DRILLING

A. Horizontal direction drilling (HDD) is a method of trenchless construction using a surface launched steerable drill tool controlled from a mobile drilling frame, and includes a field power unit, drilling fluid mixing system, and mobile spoils extraction system. The work generally consists of three phases:

1. Drilling a pilot hole from the surface or pit at a staring point to an exit pit at the surface beyond the obstacle or area that is to be avoided.

2. Reaming the pilot hole to make it large enough for the pipeline to be installed.

3. Pipeline is pulled into place. During the pipe pulling operation, drilling fluid (a bentonite, water, and polymer solution) is injected to stabilize the hole, remove cuttings, and lubricate the pipe.

B. Coordination

1. Drilling operations shall not interfere with, interrupt or endanger surface features or surface activities.

2. When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of drilling operation are encountered, the Contractor and Engineer shall review the situation and jointly determine the feasibility of continuing drilling operations, making adjustments or switching to an alternative construction method.

3. The contractor shall familiarize themselves with the geologic characterization of the soil stratum at the proposed drilling path. The Contractor shall be responsible for informing the Engineer of any changes that are required in the directional drilling procedure due to geologic conditions.

4. Launching and recovery pits shall be as small as practical. Dewatering of pits and excavations shall be done in accordance with the City of Kalamazoo Standard Specifications. When groundwater is encountered, the Contractor shall provide a dewatering system of sufficient capacity to keep any excavation free from water until the backfill operation is in progress. Dewatering shall be performed in a manner that removal of soil particles is held to a minimum. Water from the dewatering system shall be desilted before discharge. Methods of dewatering and desilting, including all costs shall be the Contractor's responsibility and are included in the Horizontal Directional Drilling Water Main pay item.

5. Utilities shown on the plans are approximate. In areas where there is a potential conflict, the Contractor shall dig up and verify the locations and elevations of the utilities at no additional expense to the City. The Contractor shall assume full responsibility for the protection fall utilities, structures and their foundations which may be affected by the work.

6. Before beginning the drilling process, the Engineer shall stake the proposed drill path.

C. Drill Path Survey

1. The Drill path shall be walked in the presence of the Engineer and the Contractor with the guidance system that shall be used for each segment of drill path. The contractor shall locate and record any surface and subsurface magnetic variations or abnormalities and all points of interference, as well as verifying all utility locations and corresponding utility maps. Should any discrepancies arise between utility maps, field locations and guidance system findings, the Contractor shall clarify all discrepancies prior to beginning drilling operations. The drill path survey shall be performed no earlier than two days prior to commencing drilling operations. Provide the Engineer 48-hour notice of drill path survey.

D. Equipment

1. The drilling equipment shall be capable of placing the pipe within the planned line and grade without inverted slopes.

2. The drilling equipment shall be capable of pulling product pipe from either the downstream or upstream pit locations. The equipment must be adequately sized for the application.

3. The guide system shall have the capability of measuring inclination, roll and azimuth. The guidance system shall have an independent means to ensure the accuracy of the installation. The Contractor shall demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance

system shall be capable of generating a plot of borehole survey for the purpose of a record drawing. The guidance system shall meet the following specifications:

Inclination:	Accuracy	+0.05
	Range	+90
	Repeatability	+0.02
Roll:	Accuracy	+0.05
	Range	+90
Azimuth	Accuracy	+0.05
	Range	+90

4. Equipment setup requirements at the launch and recover locations shall be determined by the Contractor in accordance with the Plans and shall be submitted to the Engineer prior to commencement of drilling operations.

E. Pilot Hole Drilling

1. The entry angle of the pilot hole and the drilling process shall maintain a curvature that does not exceed the allowable bending radii of the carrier pipe per the manufacturer's recommendations.

F. The contractor shall follow the pipeline alignment as shown on the Plans, within the specification requirements. The location and depth of the drill head in relation to the profile and centerline of the alignment shall be determined at a maximum of ten-foot intervals. Acceptable tolerance shall be 0.5 feet variation from the centerline of the pipe in both vertical and horizontal directions (1-foot tolerance window).

G. In the event of difficulties at any time during drilling operation requiring the complete withdrawal from the tunnel, the Contractor shall either be allowed to withdraw and abandon the tunnel and begin a second attempt at a different location. The alternate locations shall be approved by the Engineer before the Contractor withdraws.

H. Access pits shall be at the beginning and end segments shown on the Plans. Intermittent pits shall be approved by the Engineer prior to proceeding with drilling operations. No intermittent access pits shall be allowed in Railroad Right of Ways.

I. Installing the Carrier Pipe:

1. After the pilot hole is completed, the Contractor shall install a swivel to the reamer and commence pullback operations.

2. Reaming diameter shall not exceed 1.5 times the diameter of the carrier pipe being installed.

3. The carrier pipe being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.

4. Pullback forces shall not exceed the allowable forces for the carrier pipe.

J. The Contractor shall allow sufficient lengths of carrier pipe to extend past the termination point to allow connections to adjacent pipe sections, tees, or fittings. Pulled pipe shall be allowed 24 hours of stabilization prior to making tie-ins. The length of extra carrier pipe shall be at the Contractor's discretion.

K. Field Inspection

1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replace with a sound one in a manner satisfactory to the Engineer at the Contractor's expense.

2. Defective material shall be marked with an "X" in pink paint and shall be removed from the job site.

L. Drilling Fluid Containment and Disposal Requirements

1. The contractor shall contain, handle, and dispose of drilling fluids in accordance with the following requirements:

1. All drilling fluid and fluid additives shall be disclosed, and Material Safety Data Sheets (MSDS) shall be provided to the permit agency and the Engineer upon request.

2. Excess drilling fluid shall be confined in a containment pit at the entry and exit location until recycled or removed from the site.

3. Precautions shall be taken to ensure that drilling fluid does not enter the roadways, streams, municipal storm or sanitary sewer lines, and/or any other drainage system or body of water.

4. When installing below railroads, vents shall be installed on either side of the railroad tracks to direct any excess drilling fluid to a containment area and to prevent unintended surfacing of drilling fluid within the Railroad Right of Way.

5. Unintended surfacing of drilling fluid shall be contained at the point of discharge and recycled or removed from the site.

6. Drilling fluids that are not recycled and reused shall be removed from the site and disposed at an approved disposal site.

7. Drilling fluids shall be completely removed from the construction site prior to backfilling or restoring the site.

3.06 ABANDONING WATER MAINS

A. Remove and dispose of abandoned pipe, gate boxes, or other appurtenances, as necessary for placement of a new water main at no additional cost to the City of Kalamazoo. Remove portions of gate boxes to at least 3 feet below the pavement surface under the road, and to at least 12 inches below the planned grade outside the road. If the Engineer determines abandoned mains may remain in place, cap the end of pipe with cap and megalug or as directed by the Engineer or authorized representative. If shown on the plans or directed by the Engineer or authorized representative, fill abandoned water mains with non-structural flowable fill.

3.07 VALVES

A. Prior to installation, all valves shall be fully operated open and close to verify its functionality and number of turns. Set and join valves to the water mains as required for cleaning, laying, and jointing the required type of pipe, as shown on the plans. Install valves as required by the contract, or as approved by the Engineer. Place the valve stems plumb. Install valves to not bear on the pipe. Install anchor coupling with valves installed on tees or crosses, with swivel gland located on the valve side of the anchor coupling.

B. When installing 12 inch and larger valves (Butterfly Valves), the operating nut shall be located on the side of the valve furthest from the centerline of the roadway, unless otherwise directed by the Engineer.

3.08 LIVE TAPS TO IN SERVICE WATER MAINS

A. Prior to tapping of the main contractor shall disinfect all pipe, appurtenances, tapping machine with chlorinated water.

B. Contractor shall install all necessary tapping appurtenances according to manufacturer's recommendation.

C. Contractor shall use equipment which allows the tapping machine to rinse out metal shavings and tap water main per manufacturer's recommendations. No tap 4 inches or larger shall be allowed within 4 feet from any joint, fitting, or exiting tap regardless of location of tap. 1 ¼ inch taps located within 10 feet of previous tap shall be offset 15 degrees.

D. Once tapping is complete Contractor shall disinfect all exposed water main and appurtenances with chlorinated water.

3.09 VALVE BOXES.

A. Provide valve boxes that do not transmit shock or stress to the valve. Place valve boxes plumb over the operating nut of the valve, with the box cover flush with the pavement, or as approved by the Engineer or authorized representative. Provide firm support for valve boxes.

B. Valve boxes shall be installed, centered and plumbed over the operating nut of the gate valve. The area around the valve box shall be back-filled with Granular Material Class II placed in layers not to exceed 12 inches, and thoroughly compacted to the required density. The Contractor shall take due care to prevent the box from shifting during backfilling operations. The tops of the valve boxes shall be flush with the established pavement or ground surface.

3.10 ADJUSTING OR RECONSTRUCTING WATER SHUT OFFS OR VALVE BOXES

A. Adjust and reconstruct water shutoffs or valve boxes to the final grade or as approved by the Engineer or authorized representative. Replace shutoff or gate box materials damaged during adjustment or reconstruction, as determined by the Engineer, or authorized representative, at no additional cost to the City of Kalamazoo.

3.11 WATER SERVICES

A. Water Services shall not be connected to the water main until approved by the Engineer or authorized representative.

1. The standard size for all new services shall be 1 ¼ inch. The property owner/developer may request a larger size if needed.

2. ¾ inch service materials may only be used when performing repairs or partial replacements of an existing ¾ inch service, or when replacing the yard service of a ¾ inch service. When replacing a complete street side service of a ¾ inch service, a new 1 ¼ inch tap will be completed, new 1 ¼ inch street service line installed, and reduced down at the curb shut off per section 2.10.

B. Tap water main per section 3.08.

C. When more than two meters excluding the fire meter are required to be set on a single service line, a fabricated meter manifold shall be installed.

D. Water Services 2 inch and Smaller

1. Construct services from the distribution main to the water meter. Lay services in a straight line perpendicular to the water main unless approved by the Engineer or authorized representative. Construct service with a continuous piece of copper from the corporation stop to the curb stop and curb stop to the water meter unless

approved by the Engineer or authorized representative. Services over 300 feet will require an exterior meter setting (meter pit).

2. All couplings shall be located as close to the water main as possible, but outside roadway unless approved by the Engineer.

3. The use of thread sealant shall be not be allowed on flare fittings.

4. No splices shall be allowed for 1 ¼ inch or smaller yard services 90 feet and shorter in length.

5. Tap and curb shut off locations shall be no closer than 5 feet to edge of driveways. If a service is required to be abandoned due to improper location, service shall be fully abandoned at the water main tap location and new service installed the developer's expense. Corporation stop shall be shut off, copper piping removed, and copper disc installed on the corporation stop.

6. If finish grade changes from plan grade after installation of service, curb shutoff shall be adjusted to 5 foot bury depth at the developer's expense.

7. When the street service is installed separately from the yard service a copper disk shall be installed on the yard side of the curb valve per the manufactures recommendations as approved by the Engineer or authorized representative.

E. Water Services Greater than 2 inch

1. For services entering a building with no basement, install the stand pipe flange 12 inch from the finished floor elevation and 6 to 12 inches away from any walls. Install the flange pipe so two bolt holes are parallel from each wall (two hole). For services entering a building with a basement or into a concrete vault, install the stand pipe flange 6 to 12 inches off the wall. Install the flange pipe so that two bolt holes are parallel to the floor, normal to the wall. For all services entering a building, the service line shall be located in room located on an outside wall of the building, with enough room to maintain the service.

2. Contractor shall complete installation of service prior to pressure testing and disinfection. The Contractor shall hydrostatic test the complete fire service from the nearest outside valve to first valve (OS&Y) before installing the fire check valve per section 3.22. Service shall be cleaned, flushed and tested per section 3.23. No connection shall be made to these services until after pressure test is complete and consecutive negative bacterial test results have been received in accordance with sections 3.22 and 3.23 of this specification, and the water main approved by the Engineer or authorized representative.

3. No adapter flange or grooved pipe joint shall be used on any portion of the service to be maintained by the City of Kalamazoo, with the exception of the meter side of an OS&Y fire service valve.

4. For service lines with multiple meter settings, a valve the same size as the incoming service line shall be installed prior to the tee or manifold. If one of the meter settings is for a fire service, the valve shall be an OS&Y valve in accordance with section 2.02.F.

F. Construct the service pipe with at least 5 feet of cover, unless Engineer or authorized representative requires additional depth.

G. Make all service connections, and transfers. Maintain and protect, at no additional cost, existing service connections requiring transfer, but not shown on the plans, until reconnection or disposal.

H. If relocating a portion of water service, shut down the water service by method approved by the Engineer or authorized representative.

I. Service lines entry points into the structure shall be sealed with hydraulic cement or mastic putty and oakum to prevent groundwater infiltration. For ductile iron pipe services, link seals should be used as the preferred method.

J. FIRE SERVICES

1. The Contractor shall notify the Engineer or authorized representative a minimum of 3 working days prior to flushing the fire service or testing the fire system capacity.

2. All fire services shall have an OS&Y valve meeting the requirements of 2.02.F installed. The sample tap on the OS&Y Valve shall be installed on the downstream side of the valve.

K. INTERIOR METER SETTINGS (PREFERED)

1. Interior valve and meter inlet connection shall be installed by the Contractor in accordance with the Engineer, or authorized representative's recommendations and final approval.

2. The meter setting shall be located in a heated portion of the building. The meter setting shall not be located in a crawl space, above electrical appliance, or near an electrical panel. A clear and unobstructed access to the meter of not less than 24 inches by 24 inches shall be provided.

   a. 1 ¼ meter settings must be placed in basements. Meter setting shall be placed in the front of the building facing the street or within three feet of the front on the side unless otherwise approved by the Engineer or authorized representative. Water Services shall not be placed under footings. If service enters house under the porch and the porch footing extends below water service, a 2 inch PVC sleeve will be required.

   b. A ½ inch schedule 40 PVC conduit, or larger, shall be installed from the meter setting to the remote reading point. There shall be no more than 75 feet of conduit between pull boxes. There shall be no more than four (4) 90-degree bends between pull boxes. All pull boxes must be installed no more than 96 inches above the floor. Pull boxes shall not be installed in attics or crawl spaces.

3. The City of Kalamazoo will install the meter, readout, readout wire, copper ground wire, outlet meter connection and valve.

L. EXTERIOR METER SETTINGS

1. Exterior meter settings shall be installed by the Contractor according to the Engineer's or authorized representative's recommendations, and in accordance with City of Kalamazoo Standard Plans. Meter settings will be required for services greater than 300 feet, slab on grade, crawl spaces, where minimum 5 foot bury depth cannot be maintained, and other reasons. Contractor shall verify proper meter location with the Engineer prior to construction.

2. Meter boxes or vaults shall not be installed in any street, alley, parking area, driveway, or sidewalk. Major landscaping (shrubs, boulders, etc.) and structures (retaining walls, fences, buildings, etc.) shall not be placed within seven and a half (7.5) feet or trees shall not be planted within ten (10) feet of any meter box or vault, unless otherwise directed by the Engineer.

3. The ground surrounding meter boxes, pits and vaults shall slope away from the lid at a minimum grade of 2%

4. No plumbing or electrical connections will be allowed inside the meter box or vault, unless otherwise directed by the Engineer.

5. All tees, connections, and couplings shall be a minimum of five (5) feet downstream from the meter box or vault wall on the outlet side. Tees and connections shall not be installed between the curb stop and the meter setter or copper horn.

6. Meters shall be installed by the City of Kalamazoo upon inspection and acceptance of the meter setting.

7. Meter boxes shall be used for all 1 inch exterior meter settings. The Contractor shall install meter boxes to horizontal location and to final grade as determined by grade stakes. Meter boxes shall be installed 5 feet outside the right of way in private property. All work shall be in accordance with the current WS-8 of the City of Kalamazoo Standard Plans.

8. For services 1 ¼ inch and smaller, curb shutoffs shall be located in the right of way, centered in the curb lawn area, or as directed by the Engineer.

9. The Contractor shall install meter vaults for 1 ½ inch and larger meter settings.

10. Meters shall be installed by the City of Kalamazoo upon inspection and acceptance of the meter setting.

3.12 WATER MAINS, CUT AND PLUG

A. All work related to water main, cut and plug shall be in accordance with section 3.06.A. If the plans show cutting and plugging water mains, arrange for the City of Kalamazoo to shut down the main. Remove the section of pipe and plug the water main as shown on the plans or as approved by the Engineer or authorized representative. Construct the required restraint as directed by the Engineer or authorized representative.

3.13 FIRE HYDRANTS

A. Set fire hydrants at the locations shown on the plans and in accordance with City of Kalamazoo standard plans and manufacturer's recommendations or as coordinated with the City of Kalamazoo. When installed, the hydrant shall be located on the side of the water main furthest from the centerline of the roadway, unless otherwise directed by the Engineer. Equip the hydrant with auxiliary valves, as shown on the plans. Stand hydrants plumb, with side nozzles parallel to the curb, and with the pumper nozzle normal to the curb, unless otherwise directed by the Engineer. Place the nozzles at the height specified by the City of Kalamazoo.

B. For all gate valves connected adjacent to a tee or hydrant, the anchor between the fitting or hydrant and the valve shall be a 6 inch by 13 inch swivel by solid adapter with swivel gland. The swivel gland shall be located on the hydrant side of the solid adapter.

C. Install a valve box over hydrant valve in accordance with section 3.09.

D. Hydrants shall have a protective cover placed over hydrants prior to backfilling to ensure the hydrant is not damaged. If hydrant is damaged, the contractor shall repair or replace the hydrant at no cost to the City.

E. If site conditions are such that it is not desirable for hydrant drain into the surrounding soil (i.e. when hydrant has less than 10 feet of separation from a sewer, high ground water, impervious or contaminated soils, etc.), hydrant drip valve plug(s) shall be installed by the Contractor onsite. Final determination on drip valve plug installation shall be made by the

Engineer or his representative. As constructed records shall be noted whether or not the drip valve plug was installed.

3.14 FIRE HYDRANT MARKER

A. The sign shall be located between the hydrant and curb and offset from the pumper nozzle, or as directed by the Engineer. The sign shall be placed 3 feet away from the hydrant. The sign shall be single sided or double sided as directed by the Engineer or authorized representative. The sign shall have an installed height to the bottom of the sign of 7 feet above the final grade in areas with sidewalk and 5 feet above the final grade in areas without sidewalk.

B. A fire hydrant mounted whip may be installed in addition to fire hydrant sign if approved by the Engineer. Fire hydrant whip shall be mounted to the fire hydrant opposite the pumper nozzle in accordance with the manufacturer's specifications.

3.15 FIRE HYDRANT REMOVAL

A. If the plans show removal of a fire hydrant, remove the entire hydrant assembly, including the following:

1. Auxiliary gate valve and box, unless otherwise approved by the Engineer or authorized representative.
2. Internal valve assembly;
3. Top bonnet;
4. Standpipe; and
5. Hydrant inlet body, unless otherwise approved by the Engineer.

B. If the City of Kalamazoo approves leaving the auxiliary gate valve and box in place, remove to at least 3 feet below the pavement surface under the road, or at least 12 inches below planned grade outside the road.

C. Stockpile the removed material at a location accessible to the City of Kalamazoo. The City of Kalamazoo will maintain ownership of the hydrant, and will remove the assembly from the project site

3.16 RELOCATING FIRE HYDRANTS

A. If the plans show relocating a hydrant, arrange for the City of Kalamazoo to shut down the hydrant auxiliary valve. Remove the hydrant and reinstall at the required location. Reconnect the hydrant to the water main by shutting down the main, tapping a new hydrant outlet, or using the existing outlet. Install piping as required. If the relocated hydrant does not pass testing the hydrant shall be replaced with new at no cost to the City of Kalamazoo.

3.17 MISCELLANEOUS FITTINGS

A. Install the following at the locations shown on the plans and in accordance with good construction practices and manufactures recommendations:

1. Elbows,
2. Tees,
3. Corporation stops,
4. Blow offs,
5. Pipe adapters,
6. Pipe couplings,

7. Retaining glands, and

8. Other miscellaneous fittings.

3.18 AIR RELEASE VALVES AND VAULTS

A. Construct air release valves and vaults in accordance with the current WA-4-Series and WA-5-Series of the City of Kalamazoo Standard Plans.

B. When installing the air release valves in conjunction with new water main construction, the contractor shall use ductile iron fittings.

C. When installing the air release vaults as a retrofit to existing water main, live taps may be performed as directed by the engineer.

3.19 BACKFILLING AND COMPACTING

A. Backfill and compaction shall be in accordance with Michigan Department of Transportation Standard plan for utility trenches R-83-Series.

B. Backfilling Under Existing Conduits – Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the spring line of the conduit a distance of 2-feet on either side and thence downward at its natural slope.

C. Backfilling with Excavated Material – Unless otherwise specified or directed, material excavated in connection with the work shall be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification.

D. Backfill Immediately Following Inspection – All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer or authorized representative. Under no circumstances shall water be permitted to rise in un-backfilled trenches after pipe has been placed.

E. Service leads shall not be backfilled until the pipe ends are referenced and the Engineer or authorized representative has measured the pipe for payment.

F. Backfilling around and over structures and pipes shall be carefully done by hand and tamped with suitable tools of approved weight to a point 1-foot above the top of pipe. Selected material or, where specified or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6-inch in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.

G. Backfilling by Machinery – After the backfill has been placed and compacted around the boxes and pipe to a height of 1-foot above the top. The remainder of the trench may be backfilled by machine. The backfill material shall be deposited in horizontal layers and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

3.20 COMPACTION REQUIREMENTS

A. Compact each layer to 95% (90% if outside the influence of the roadway) maximum density as tested by the Michigan Department of Transportation Density Testing and Inspection Manual.

3.21 COMPACTION TEST

A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Compaction tests shall be performed on each layer immediately after compaction.

B. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.

C. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.

3.22 HYDROSTATIC TESTING

A. Perform hydrostatic testing of water mains in accordance with AWWA C600.

B. Ensure City of Kalamazoo personnel witness pressure testing. Give the City of Kalamazoo personnel at least 1 full working day notice before testing.

C. Provide the personnel, temporary timber bracing, plugs, test pumps, temporary connections to the Municipal water system, and any other required apparatus. Provide the water for hydrostatic testing if not available from the City of Kalamazoo. Water must be pumped from a measurable source in order to determine testing allowance water.

D. Before applying test pressure, expel air from the pipe in increments of no greater than 1,000 feet. Pressure test each section of water main. If the Contractor chooses not to pressure test against an existing valve, a new valve may be installed at the expense of the Contractor.

E. Pipe shall be pumped with water to a minimum test pressure of 150 pounds per square inch (psi) at the highest point of elevation to begin test. Test shall last for at least 2 hours, with a maximum drop of pressure of 5 psi. If the pressure drop is greater than 5 psi but less than 20 psi, a testing allowance water test shall be performed. Testing allowance water, as measured by the quantity of water pumped into the pipe to attain the pressure at which the test began must not exceed the testing allowance.

F. Testing allowance water is determined using the following formula

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

Where

L= testing allowance water in gallons per hour
S= length of pipe in feet
D= actual pipe diameter in inches, and
P= 150 psi

G. If testing allowance water is above the allowable limit occurs during hydrostatic testing, remove backfill to expose pipe and repair the joints. Repeat testing after repairs are complete. If multiple leaks occur the contractor may be required to reinstall main at Contractors expense.

H. Correct visible leaks regardless of the amount of leakage. Replace faulty pipes, fittings, gate valves, or other accessories disclosed by testing. Repeat the test until the pipes, fittings, gate valves, and other accessories meet the requirements.

3.23 DISINFECTION, FLUSHING, AND BACTERIORLOGICAL TESTING

A. Disinfect the water main in accordance with AWWA C651 and applicable Michigan Department of Environment, Great Lakes, and Energy (EGLE) regulations after successful hydrostatic testing.

B. Disinfect and flush new, and portions of existing, water mains as required by the EGLE.

C. Use blow offs, fire hydrants, or other means as shown on the plans or approved by the Engineer, or authorized representative, to flush water mains in accordance with AWWA C651, with a velocity of at least 3 feet per second. Provide hoses and other equipment and arrange a means of disposing of the water without damaging the work or adjacent property.

D. Use the continuous feed method with chorine added simultaneously with the water. Add chlorine or liquid hypochlorite to meet the requirement of at least 25 milligrams per liter of chlorine. Slowly add the water to the main and allow it to stand for at least 24 hours. At the end of the 24-hour period, ensure the chlorine residual is a minimum of 10 milligrams per liter. If not met, re-chlorinate and flush the water main until a minimum 10 milligrams per liter residual remains after 24 hours.

E. After completing disinfection, initially flush the water mains with water at a velocity of at least 3 feet per second to replace the entire volume of chlorinated water in the pipeline. After initial flushing, perform final flushing until the residual chlorine content meets the standard level for the water distribution system. The City of Kalamazoo may require a waiting period after flushing and before bacteriological sampling.

F. Dispose of chlorinated water in accordance with applicable state and local requirements. If necessary, apply a reducing agent to the water to neutralize the chlorine and create a chlorine residual of no greater than 1 ppm. Dechlorination shall be in accordance with AWWA C655.

G. After flushing, perform bacteriological testing in accordance with AWWA C651 and EGLE requirements. Test chlorine residuals before taking each bacteriological sample. Ensure the chlorine residual is less than 1.5 milligrams per liter before taking a bacteriological sample. The City of Kalamazoo will collect samples from each branch of pipe in the presence of the Engineer, or authorized representative, and contractor personnel. The City of Kalamazoo will be responsible for the transportation of the samples to a State of Michigan approved lab for testing. Two consecutive bacteriologically safe tests at 24-hour intervals for each section of pipe are required. Acceptable tests are negative for bacteria and as otherwise defined by AWWA C651 and EGLE regulations.

H. If a bacteriological test fails, repeat disinfection, flushing, and testing.

I. Pressure and chlorination taps shall be removed within one business day of passing tests, so main can be activated.

3.24 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement will be required for all ductile iron installations when the soil test evaluation is greater than or equal to 10 points based as indicated in AWWA/ANSI C105/A21.5 or as directed by the Engineer. Sampling of the soils is to be completed by the developer or municipality responsible for the installation.

B. Install polyethylene encasement on water mains and fittings installed through concrete floor and foundations and as indicated on the plans in accordance with the manufacturer's installation instructions and AWWA/ANSI C105/A21.10. Appropriately sized polyethylene encasement shall be used so that there are no longitudinal spices. This may require using one or more size larger diameter encasement than the pipe installed.

C. Polyethylene encasement shall be required for all installations when groundwater is detected in the utility trench.

D. Polyethylene encasement shall be required for all directional drilling installations involving ductile iron pipe.

3.25 WATER INFRASTRUCTURE IN STEEL CASING

A. Work shall be performed in accordance with section 401 of the Michigan Department of Transportation *Standard Specifications for Construction* and as detailed herein. In all cases, the Contractor shall submit a work plan detailing the following:

1. Means and methods for bracing and shoring;
2. Methods of maintaining and adjusting line and grade;
3. Drilled/bored diameter;
4. Drill hole stabilization procedures;
5. Size and location of the auger head relative to the casing;
6. Methods of dealing with cobbles/boulders and obstructions;
7. Estimated jacking thrust required;
8. Method of monitoring casing elevation;
9. Thrust block design calculations;
10. Record keeping system to document casing advance and jacking pressures;
11. Grouting procedures;
12. Temporary dewatering measures and;
13. Mitigation procedures if sinkholes or settlement above the pipe occurs or excessive movement of the settlement monitors is observed.

B. Minimum Allowable Depths.

1. The minimum allowable depth of the Horizontal Auger Bore (HAB) installed casing pipe shall be in accordance with Table 3.2

Table 3.2 Minimum Allowable Depths Table

Location	Minimum Depth
Base of Rail	6 Feet
Existing Ground	5 Feet
Roadway	5 Feet
Ditch Flowline	5 Feet

C. Access Pits.

1. Excavate jacking and receiving pits as necessary. Provide and install all sheeting, shoring, bracing and any other earth retention measures in accordance with section 704 of the Michigan Department of Transportation *Standard Specifications for Construction.* Provide site drainage and subsurface dewatering and other items associated with the operation as necessary to facilitate the proposed work.

D. Lead Auger/Overcut Allowance.

1. A full-size auger section shall be used as the lead section of the casing. The auger shall not protrude from the leading edge of the casing. However, if soil conditions halt the movement of the casing, the auger shall be allowed to protrude not more than 1 inch in front of the casing during the boring operation. Overcut is the annular space between the excavated hole and the outside diameter of the casing pipe. The allowable overcut diameter is one inch greater than the casing pipe radius.

E. Watertight joints.

1. Watertight joints are required to ensure the integrity of the road and railroad bed. Casing pipe shall be constructed to prevent water leakage or earth infiltration and must be certified free from any breaks or leaks throughout its entire length.

F. Lubrication Fluids.

1. Lubrication fluids are specifically required for this method regardless of the soil conditions. Any deviations from the use of lubrication shall require prior approval for the Engineer. The Contractor shall install vents on either side of the casing pipe to prevent fracking during installation. These vents shall also be used as relief in case of a water main break. Lubrication fluids, consisting of a mixture of water and bentonite or bentonite/polymer, shall be used in the annular space between the casing being installed and the native soil to stabilize and lubricate the drill hole. Grease will not be allowed for use as lubrication for this purpose.

G. Pipe Locating and Tracking.

1. One of the following tracking, locating, and guidance systems shall be used:

   a. Waterline system.

   b. Mechanical control head.

   c. Electronic (inertial) control head.

   d. Walkover system.

   e. Laser guided tunnel attachment.

   f. Laser guided pilot rod.

2. The Contractor will be responsible for submitting their proposed pipe locating tracking method at the preconstruction meeting for approval.

H. Settlement/Heaving Monitoring.

1. Settlement/Heaving monitoring shall be performed in a manner that will minimize the movement of the ground in front of, above, and surrounding the horizontal auger bore operation; and will minimize subsidence of the surface above and in the vicinity of the boring. The ground shall be supported in a manner to prevent loss of ground and keep the perimeter and face of the boring stable at all times, including during shutdown periods. A survey shall be performed one day prior to initiating this operation at each required monitoring location. A similar survey shall then be performed at each location, on a daily basis, until the permitted activity has been completed. All survey readings shall be recorded to the nearest one-hundredth (0.01) of a foot. Digital photographs of the pavement and rail conditions shall also be taken prior and after the pipe installation. Specific monitoring locations and requirements may also be provided for railway crossings.

I. Ground Water Control.

1. Dewatering shall be conducted whenever there is a high ground water table level to prevent flooding and facilitate the operation. The water table elevation shall be maintained at least 1 foot below the bottom of the casing at all times. When needed, dewatering may be initiated prior to any excavation.

2. Minor water seepage or pockets of saturated soil may be effectively controlled through bailing or pumping. This control shall be accomplished without removing any adjacent soil that could weaken or undermine any access pit, its supports, or other nearby structures.

3. Larger volumes of ground water shall be controlled with one or more well points or with staged deep wells. Well points and staged deep well pumping systems shall be installed and operated without damage to property or structures, and without interference with the right of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors. Any pumping methods used for dewatering and control of ground water and seepage shall have properly designated filters to ensure that the adjacent soil is not pumped along the water. Well diameter, well spacing and the pump's pumping rate shall provide adequate draw down of the water level. Wells shall be located to intercept ground water that otherwise would enter the access pit excavation and interfere with the work. Upon removal of a well, the hole shall be filled and grouted.

4. Existing storm sewers shall only be used to discharge water from the dewatering operation in accordance with a permit obtained from the appropriate storm sewer owner. Filters or sediment control devices shall be required to ensure that the existing system is not adversely affected by construction debris or sediment.

J. Casing End Seals/Bulkheads

1. Casing ends shall be enclosed using 1/8 inch thick synthetic rubber casing ends seals in accordance with section 2.19.C of this document. Ensure end seals are water tight and attach securely to the casing pipe and the carrier pipe (water main). Ensure end seals are acceptable to the Engineer.

K. Backfill Requirements.

1. Remove the pits and backfill the excavations as necessary with material meeting the standard specifications as approved by the Engineer.

L. Railroad Specific Requirements.

1. For Steel casing pipe jacked in place under a railroad, the following will apply in accordance with the current AREMA Manual;

   a. When steel casing pipe is used, the joints must be fully closed by welding or mechanical means as approved by the Engineer.

   b. Minimum cover over the casing must be at least 6.0 feet from the bottom of the railroad tie to the top of the casing pipe at its closest point.

   c. Casing pipe must extend beyond the limits of the entire railroad right-of-way.

   d. Jacking construction requirements must be in accordance with the current AREMA Manual, Chapter 1, Part 4.

3.26 INSTALLATION OF LINE STOPS AND INSERTION VALVES

A. Line Stops and Insertion Valves shall be performed in the locations as detailed on the plans or as directed by the Engineer. Prior to installation of the line stop or insertion valve, coordinate the deactivation of the water main so that all customers have been given proper notification

of the shutdown. No work shall be performed without the Engineer or authorized representative present.

B. Excavate and expose the water main. Remove scale from the water main and make sure there are no flaws which would affect the seal with the saddle.

C. Line Stops

1. Install permanent line stop body on the pipeline and perform line stop according to manufacturer's instructions. Upon completion of the work associated with the line stop, reactivate the water main and install permanent blind flange on the line stop body. Ensure that all as built information is recorded and submitted as detailed in section 1.03.

D. Insertion Valves

1. Install Insertion Valve body on the pipeline and perform valve insertion according to manufacturer's instructions. Operate the valve to ensure that it is fully functional.

2. Construct valve vault as detailed in WA-8-A of the City of Kalamazoo Standard Plans. Ensure that all as built information is recorded and submitted as detailed in section 1.03.

3.27 FINAL RESTORATION

A. Contractor shall restore site to preconstruction condition or better, or as detailed on the plans.

B. Final grade shall be 5 feet above competed water main or water service line, unless otherwise approved by the Engineer. If final grade is changed greater than 6 inches from the approved plans, the Developer or Contractor shall raise or lower water main and water services so that they are maintained at 5 feet below final grade. All costs associated with this work shall be paid for by the Developer or Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.01 PAY ITEMS

Measurement a payment may not apply if construction is not being funded with City of Kalamazoo funds. Please review signed construction contract for actual measurement and payment specifications.

Pay Item	**Pay Unit**
Water Main, DI __ inch, Tr Det __	Foot
Water Main, DI __inch, in Casing	Foot
Water Main, DI __inch, HDD	Foot
Gate Valve and Box, __inch,	Each
Butterfly Valve and Box, __ inch	Each
Polyethylene Encasement	Foot
Water Main, __ inch, Cut and Plug	Each
Fire Hydrant	Each
Hydrant, Rem	Each
Hydrant Relocate, Case __	Each
Water Serv	Each
Water Serv, Long	Each
Water Serv, Conflict	Each
Water Serv, Yard	Each
Copper Tubing, Additional Length	Foot
Water Serv, 2 inch	Each
Water Serv, Conflict, 2 inch	Each
Copper Tubing, Additional Length, 2 inch	Foot

Steel Casing Pipe, __inch, Jacked in Place……Foot

4.02 MEASUREMENT OF PAY ITEMS

A. Payment for Water Mains shall be measured based on the sizes and trench details required, along the centerline of the pipe, with no deductions for fittings. The unit price of Water Main, DI, includes the cost of the following:

1. Excavation and backfill;
2. Dewatering operations (trench and/or pipe);
3. Provide temporary water system to maintain service during construction;
4. Hydrostatic testing;
5. Disinfecting and flushing the water main and bacteriological testing;
6. All material, labor and equipment necessary to remedy an unsatisfactory hydrostatic test, including removing and replacing any backfill;
7. Providing and installing fittings, gaskets, bracing or sheeting, blocking and miscellaneous items for installing pipe and reconnecting to the Municipal Water System;
8. Preparing and providing as-constructed plans.

D. The City of Kalamazoo may withhold payment and/or final acceptance until the City of Kalamazoo accepts the as-built plans.

E. The cost of dewatering of trenches, pipe, or both associated with alterations to the Municipal Water System, is included in the unit price for relevant items of work.

F. The cost of excavating, disposing of excess material, and providing, placing, and compacting the backfill, is included in the unit price for related items of work.

G. The cost of removing or abandoning existing water mains, gate valve boxes, and other appurtenances to provide clearance for the proposed water main or roadway, is included in the unit price for relevant items of work.

H. Payment for Gate Valves, Butterfly Valves, and Valve Boxes, shall be as follows**:**

1. The unit prices of **Gate Valve and Box** and **Butterfly Valve and Box**, of the types and sizes required, include the cost of providing and installing the valve and valve box, complete and ready for use.

I. Payment for water services 1 ¼ and smaller shall be as follows:

1. **Water Serv** refers to services between the water main and the curb shut off no greater than 33 feet long. **Water Serv, Long** refers to services between the water main and the curb shut off greater than 33 feet long and up to 66 feet in length. Water Serv, Yard refers to the services between the curb shut off and the water meter setting, up to 25 feet in length. **Copper Tubing, Additional Length** refers to the additional copper tubing and work needed when services between the curb shut off and the water meter setting are over 25 feet in length, and when the length of the service between the center of the road and the curb shut off exceeds 66 feet. **Water Serv, Conflict** refers to relocating only a portion of a water service.

J. Payment for water services 2 inches in size shall be as follows:

1. **Water Serv, 2 inch** refers to the services between the water main and the water meter setting no greater than 58 feet in length. **Water Serv Conflict, 2 inch** refers to relocating only a portion of a 2 inch water service. **Copper Tubing, Additional length, 2 inch** refers to the additional copper tubing and work needed when services exceed 58

feet in length.

K. Services with a diameter larger than 2 inches will be measured and paid for as water mains.

L. The unit prices for **Water Serv**, **Water Serv, Long**, **Water Serv, Yard**, **Copper Tubing, Additional Length**, **Water Serv Conflict**, **Water Serv, 2 inch**, **Water Serv Conflict, 2 inch**, and **Copper Tubing, Additional Length, 2 inch**, include the cost of the following, unless otherwise accounted for in other pay items:

1. Earth excavation;
2. Removing pavement;
3. Replacing pavement;
4. Jacking and boring;
5. Providing and installing type K copper tubing, service saddle, corporation stops, service stops, and service boxes;
6. Disinfecting;
7. Providing, placing, and compacting backfill;
8. Slope Restoration to equal or better conditions; and
9. Miscellaneous material, equipment, or operations.

M. Payment for additional service connections, not shown on the plans, but maintained, protected, and reconnected or disposed of by the Contractor will be paid for as **Water Serv**, or **Water Serv, Long**.

N. The pay item **Water Serv, Conflict** will apply only to portions of water services requiring relocation due to direct conflict with utilities, other items of work, or as otherwise approved by the City of Kalamazoo. Payment for all other relocations requiring replacement of corporation or service stops will be paid for as Water Serv or Water Serv, Long.

O. Payment for **Water Main, __inch, Cut and Plug** includes the cost of cutting the existing water main, providing and placing the required plug, and thrust blocks.

P. Payment for **Fire Hydrant** includes the cost of providing and installing the hydrant, hydrant valve, valve box, and all pieces between the valve and hydrant, including the coarse gravel and concrete base, fire hydrant marker at the locations shown on the plans in a ready-for-use condition unless noted otherwise.

Q. Payment for **Hydrant, Rem** includes the cost of breaking down the auxiliary gate valve, gate box, the hydrant assembly, backfilling, and plugging the opening in the existing main.

R. Payment for **Hydrant, Relocate, Case __** (of the case required), includes the cost of vertically adjusting the relocated hydrant to final grade and the following:

1. Case 1 includes the cost of removing the hydrant, extending the existing hydrant lead from the gate valve, reinstalling the hydrant in a ready-for-use condition, adjusting the existing gate box and hydrant to final grade, and providing and installing sleeves, fittings, and joint restraints.

2. Case 2 includes the cost of removing the existing hydrant, gate valve and box, and reinstalling the hydrant and gate valve in a ready-for-use condition, adjusting the existing gate box and hydrant to final grade, and providing and installing the cutting-in-sleeve, pipe coupling, tee, elbow, and joint restraints.

S. Payment for **Steel Casing Pipe, __inch, Jacked in Place** of the size required will be paid for by the length installed. The unit price for **Steel Casing Pipe, Jacked in Place** includes the cost of excavating the pits, providing and installing sheeting, bracing, and any other safety devices, providing jacking equipment: drainage and dewatering; bulkheading and sealing the casing, providing and installing vents, grouting the annular space between the casing and native soil and any other items associated with the operation.

T. Payment for **Water Main, DI, __inch, in Casing**, of the size required will be paid for by the length installed. The unit price for **Water Main, DI __inch, in Casing** shall include the cost for furnishing and installing the water main and casing spacers inside the casing.

U. Payment for **Water Main, DI, __inch, HDD,** of the size required will be paid for by the length installed. The unit price shall include the cost of all equipment and materials, excavation and backfill, dewatering operations (trench, pit or pipe), temporary water system to maintain service during construction, hydrostatic testing, disinfecting and flushing the water mains, and bacteriological testing, all materials, labor and equipment necessary to remedy and unsatisfactory hydrostatic test, including removing and replacing any backfill, providing and install all, gaskets, bracing or sheeting, blocking and miscellaneous items for installing pipe of the required size and material and reconnecting to the water system as shown on the plans.

END OF SECTION

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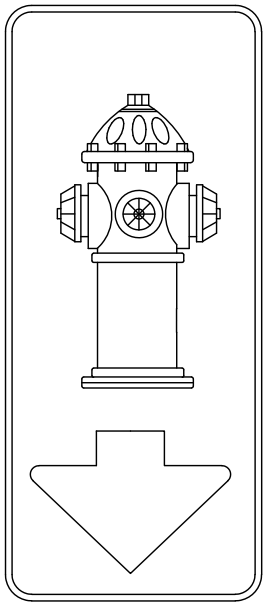
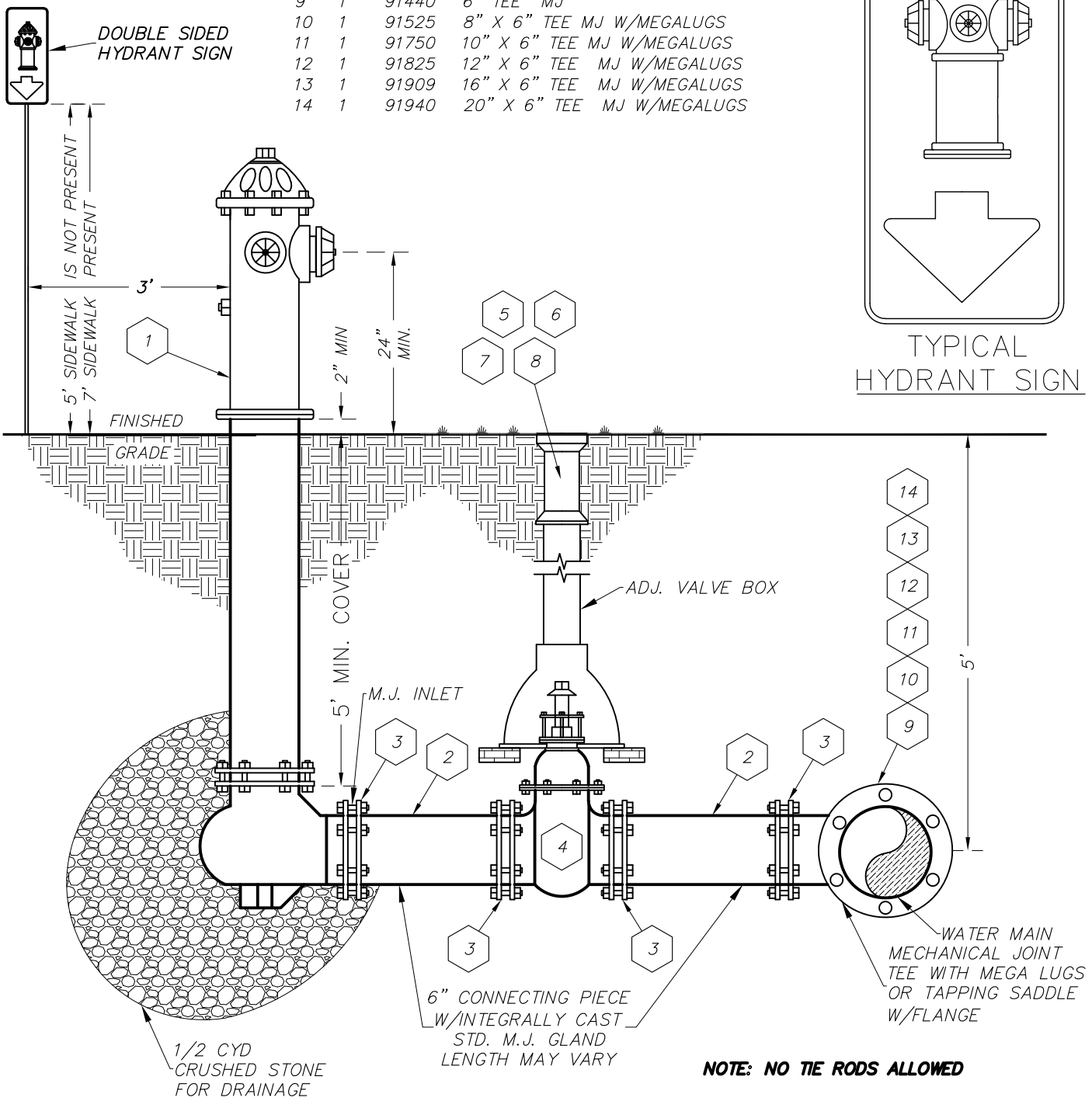
WA–1–D

ITEM	QTY.	#	DESCRIPTION
1	1	39887	6" HYDRANT W/CARROLL DRAIN
2	2	70000	CONNECTING PIECE (13")
3	4	33801	6" GASKET (MJ)
4	1	96696	6" GATE VALVE (MJ)
5	1	08550	VALVE BOX BOTTOM
6	1	08520	VALVE BOX TOP SECTION
7	1	08500	VALVE BOX RING CASTING
8	1	08490	VALVE BOX COVER
9	1	91440	6" TEE MJ
10	1	91525	8" X 6" TEE MJ W/MEGALUGS
11	1	91750	10" X 6" TEE MJ W/MEGALUGS
12	1	91825	12" X 6" TEE MJ W/MEGALUGS
13	1	91909	16" X 6" TEE MJ W/MEGALUGS
14	1	91940	20" X 6" TEE MJ W/MEGALUGS



TYPICAL HYDRANT SIGN



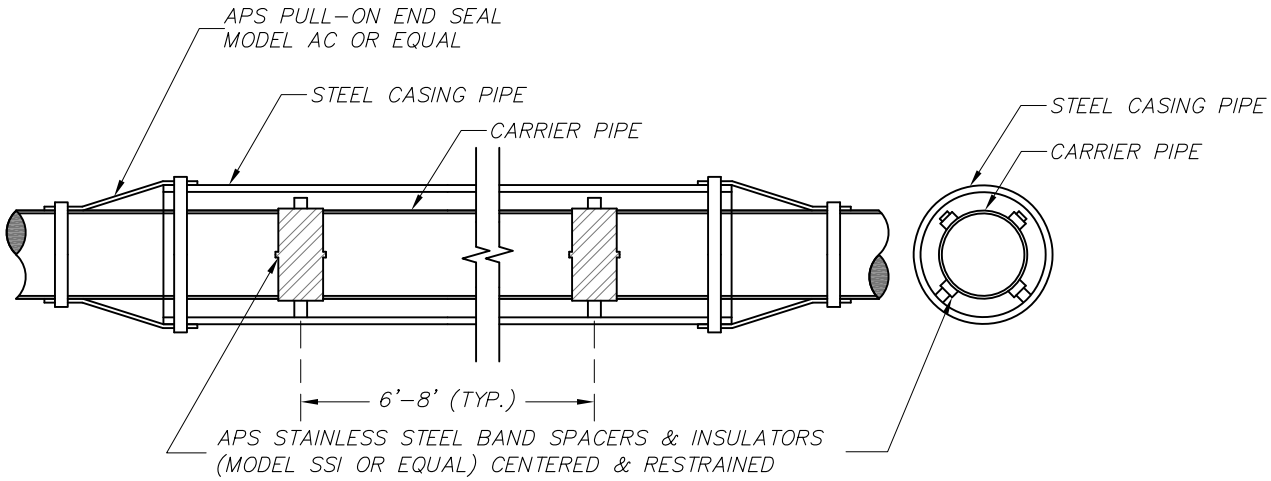
NOTE: NO TIE RODS ALLOWED

CITY OF KALAMAZOO
Department Of Public Services

TYPICAL FIRE HYDRANT & GATE VALVE DETAIL

	DATE
RECOMMENDED BY	
APPROVED BY	
APPROVED BY	
ACCEPTED BY	

WA–2–A



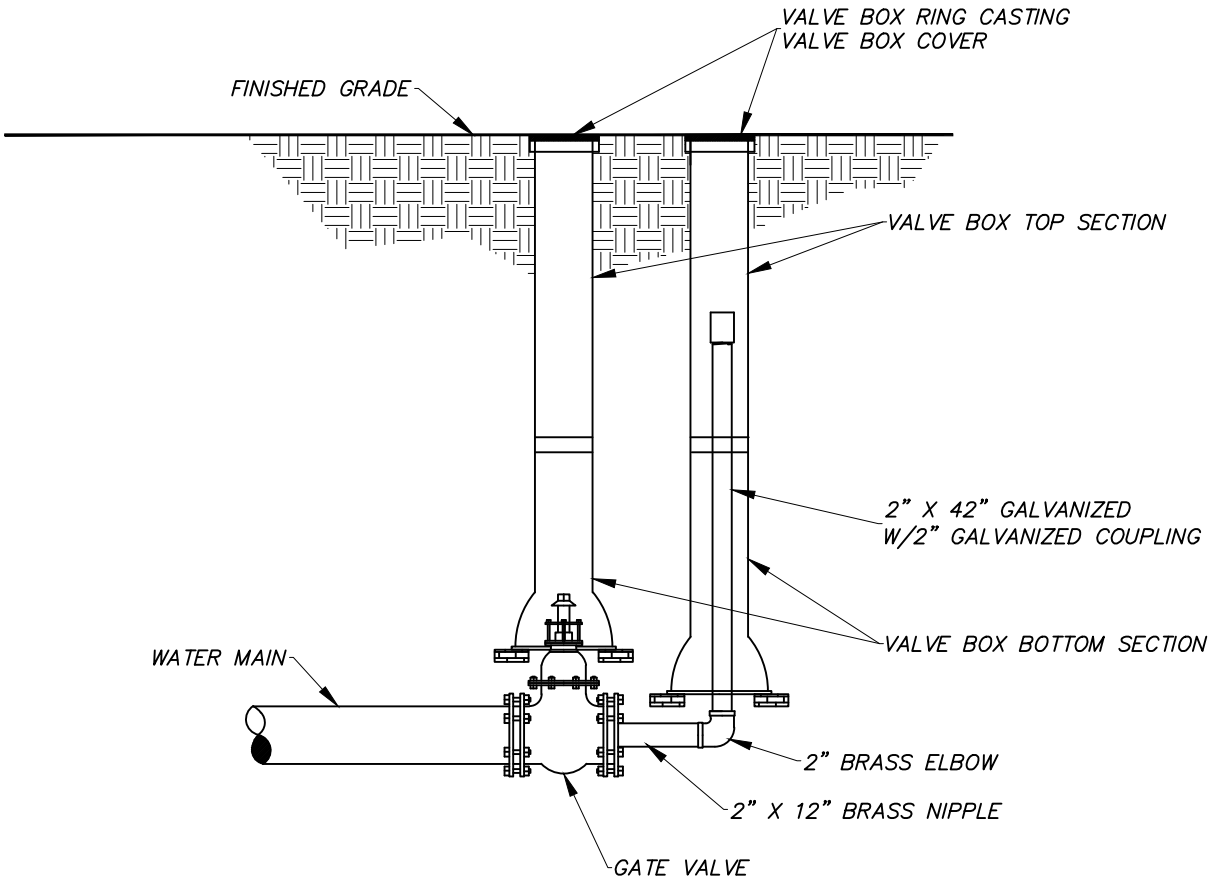
CASING CARRIER PIPE DETAIL

SIZE CASING AND CARRIER PIPES PER PLAN AND SPECIFICATIONS

TYPICAL BAND SPACER POSITIONING:
ONE PLACED NOT MORE THAN 1 FOOT FROM EACH END OF THE CASING AND
PIPE JOINTS WITH SUBSEQUENT SPACERS PLACED EVERY 6–8 FEET THEREAFTER.
FOR 18 FOOT PIPE THERE SHALL BE THREE BAND SPACERS.
FOR 20 FOOT PIPE THERE SHALL BE FOUR BAND SPACERS.

THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services		DATE
	CASING CARRIER PIPE	RECOMMENDED BY	
		APPROVED BY	
		APPROVED BY	
		ACCEPTED BY	

WA–3–C

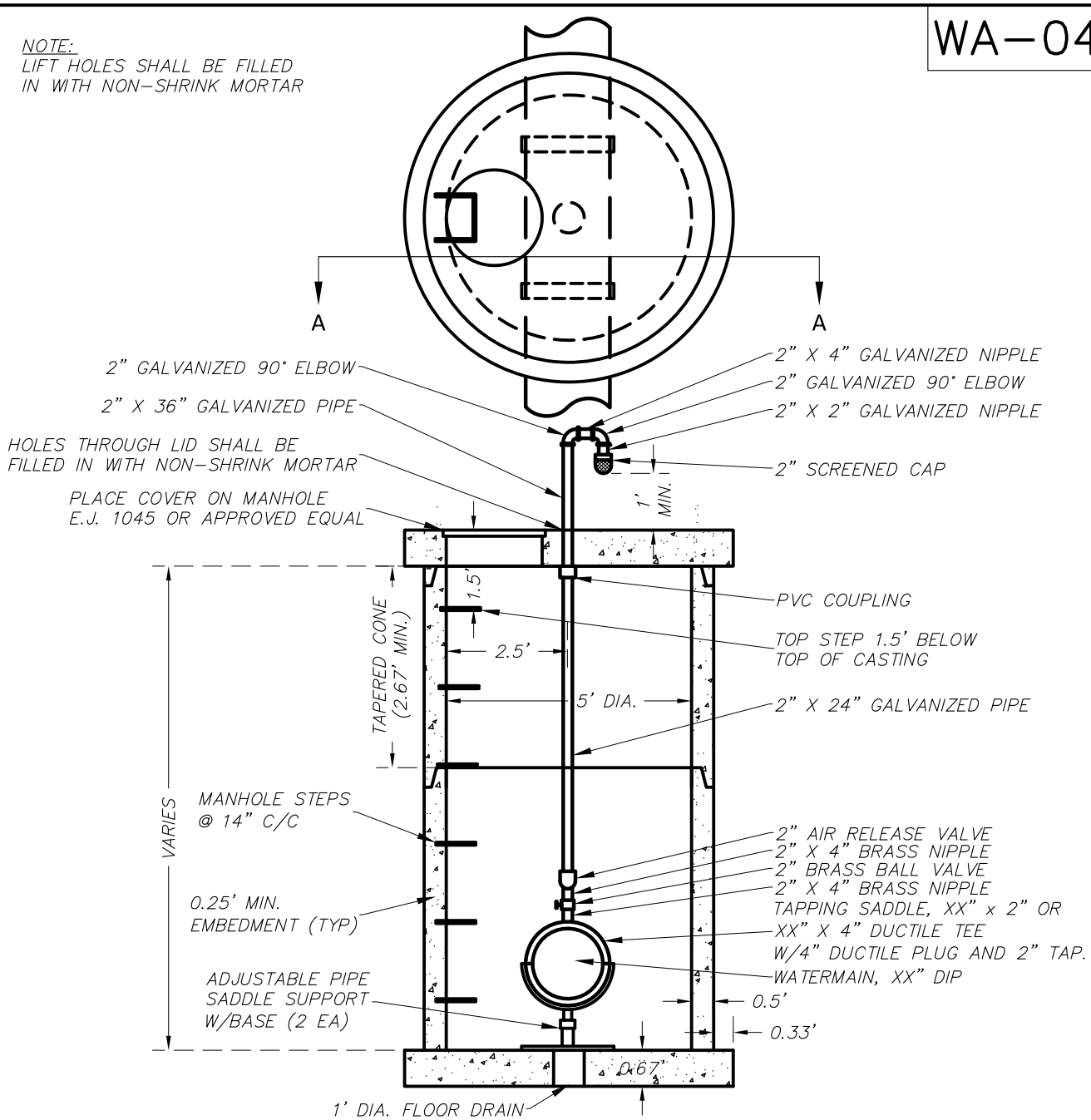


NOT TO SCALE

THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services 2" BLOW OFF CONNECTION	RECOMMENDED BY	DATE
		APPROVED BY	
		APPROVED BY	
		ACCEPTED BY	

WA–04–B

NOTE:
LIFT HOLES SHALL BE FILLED
IN WITH NON–SHRINK MORTAR



TYPICAL 2" AIR RELEASE MANHOLE

PRECAST REINFORCED CONCRETE SHOWN (OTHER OPTIONS INCLUDE
CONCRETE BLOCK, BRICK OR CAST IN PLACE WALL SECTIONS)

SCHEDULE OF FITTINGS

ITEM DESCRIPTION	QUANTITY
AIR RELEASE VALVE, 2"	1
GALVANIZED PIPE, 2" X 60"	1
GALVANIZED NIPPLE, 2" X 4"	1
GALVANIZED NIPPLE, 2" X 2"	1
GALVANIZED 90° ELBOW, 2"	2
PIPE SUPPORT BASE	2

ITEM DESCRIPTION	QUANTITY
TAPPING SADDLE, XX X 2"	1
BRASS BALL VALVE, 2"	1
BRASS NIPPLE, 2" X 4"	2

THE CITY OF Kalamazoo

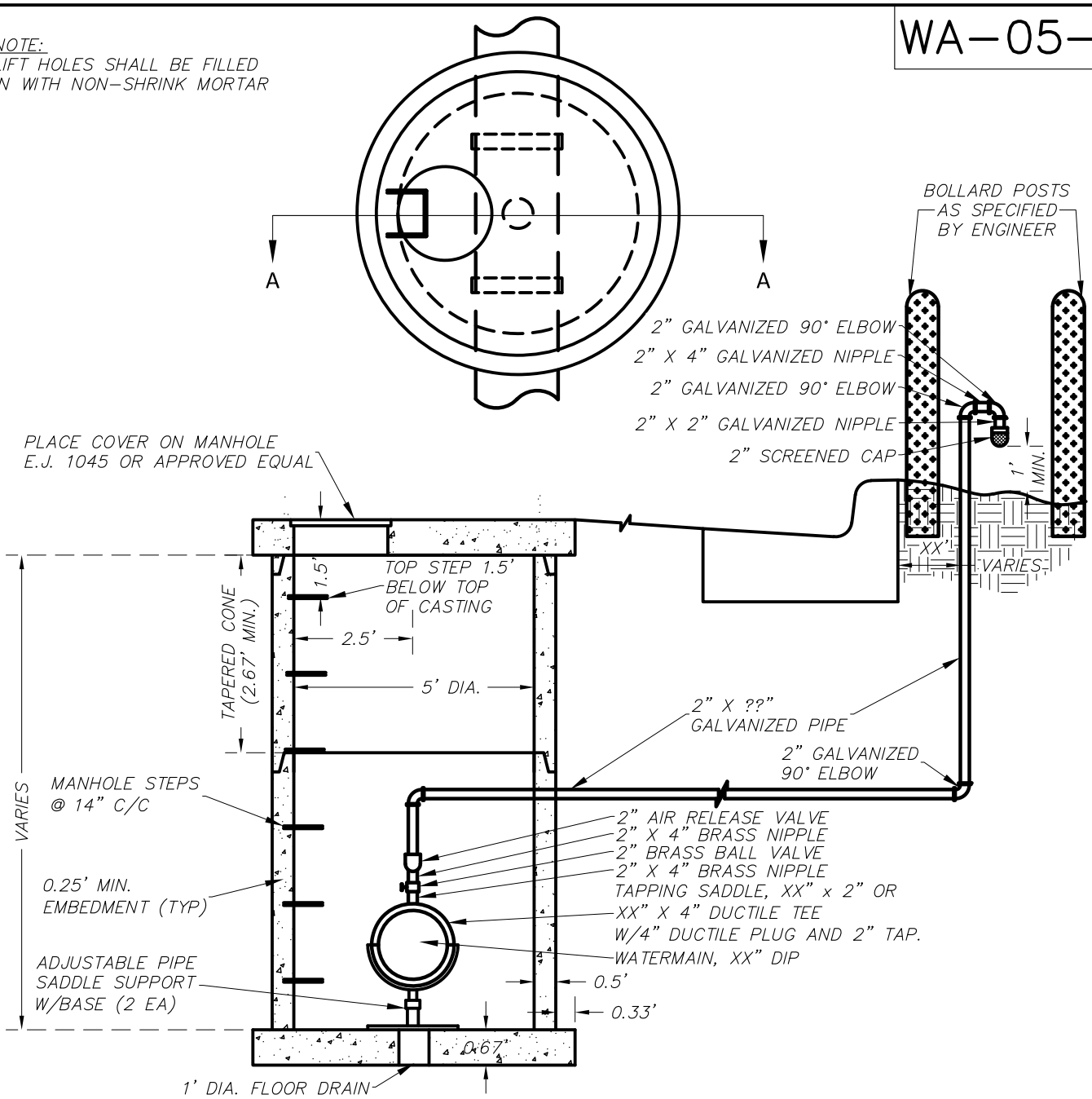
CITY OF KALAMAZOO
Department Of Public Services

AIR RELEASE MANHOLE

	DATE
RECOMMENDED BY	
APPROVED BY	
APPROVED BY	
ACCEPTED BY	

WA–05–C

NOTE:
LIFT HOLES SHALL BE FILLED
IN WITH NON–SHRINK MORTAR



TYPICAL 2" AIR RELEASE MANHOLE

PRECAST REINFORCED CONCRETE SHOWN (OTHER OPTIONS INCLUDE
CONCRETE BLOCK, BRICK OR CAST IN PLACE WALL SECTIONS)

SCHEDULE OF FITTINGS

ITEM DESCRIPTION	QUANTITY
AIR RELEASE VALVE, 2"	1
GALVANIZED PIPE, 2" X 60"	1
GALVANIZED NIPPLE, 2" X 4"	1
GALVANIZED NIPPLE, 2" X 2"	1
GALVANIZED 90° ELBOW, 2"	2
PIPE SUPPORT BASE	2

ITEM DESCRIPTION	QUANTITY
TAPPING SADDLE, XX X 2"	1
BRASS BALL VALVE, 2"	1
BRASS NIPPLE, 2" X 4"	2

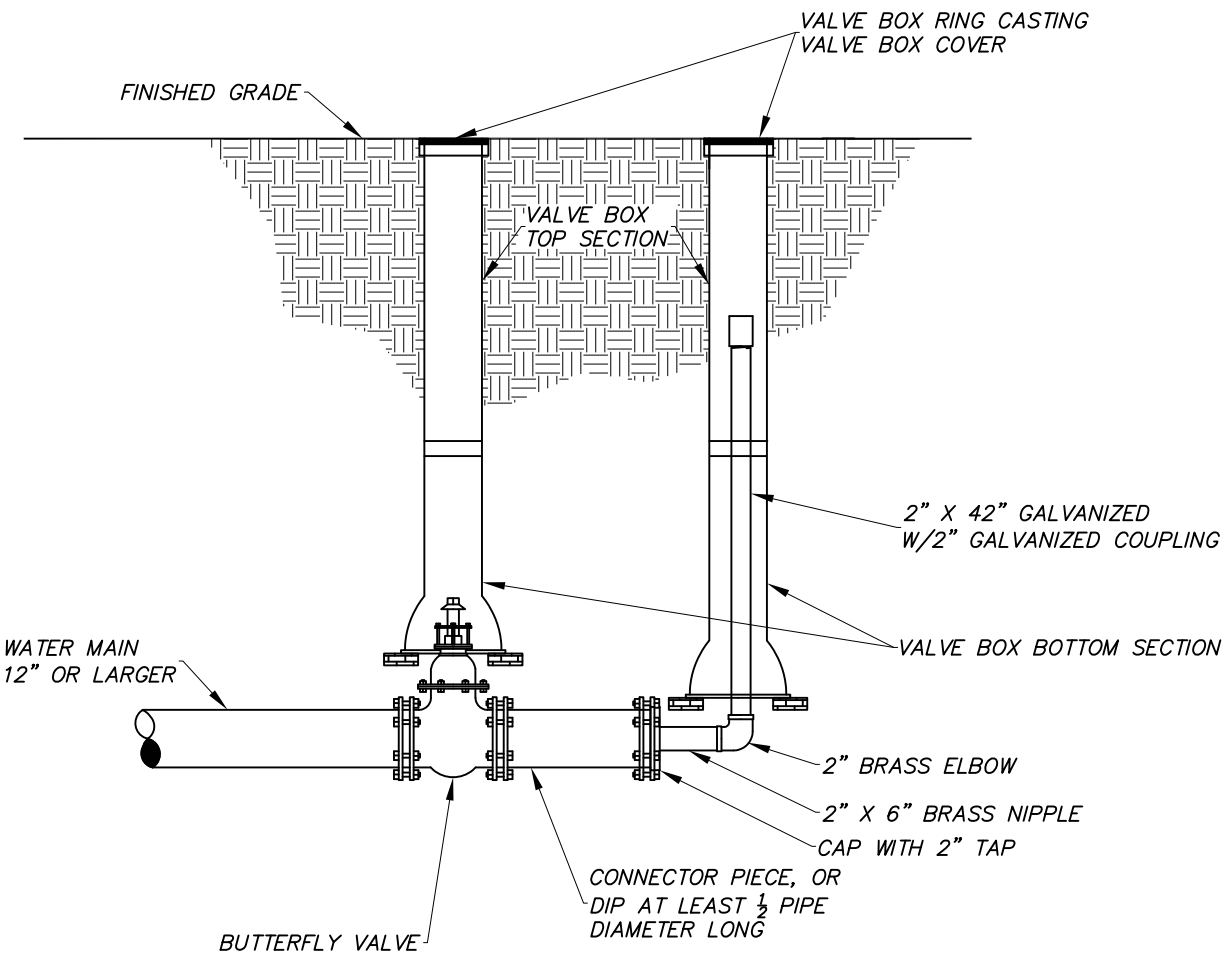
THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

AIR RELEASE MANHOLE IN ROADWAY

		DATE
RECOMMENDED BY		
APPROVED BY		
APPROVED BY		
ACCEPTED BY		

WA–6–A



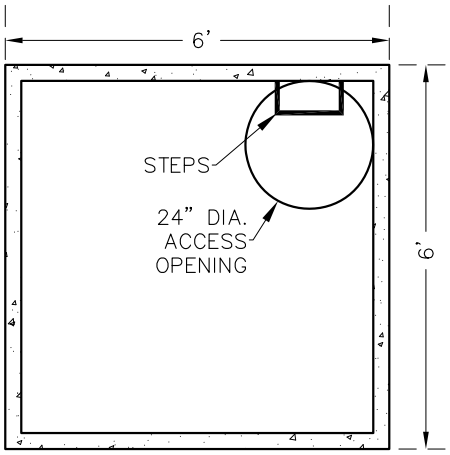
NOT TO SCALE

THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

2" BLOW OFF CONNECTION 12" OR LARGER MAIN

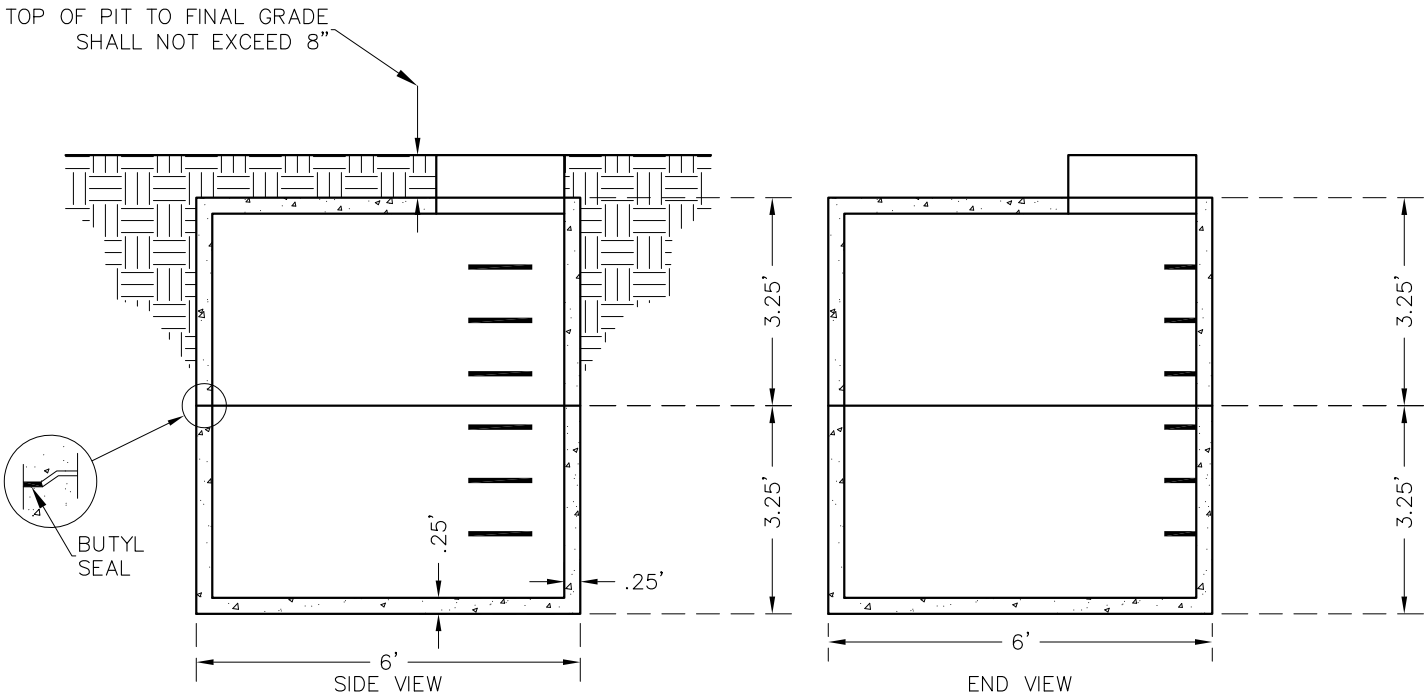
		DATE
RECOMMENDED BY		
APPROVED BY		
APPROVED BY		
ACCEPTED BY		



TOP VIEW

NOTES:

1. METER VAULT DESIGN TO BE SUBMITTED AND APPROVED FOR EACH INDIVIDUAL INSTALLATION. DESIGN SHALL CONFORM TO KALAMAZOO WATER ENGINEERING STANDARDS LATEST REVISION.
2. THE DISTANCE BETWEEN RUNGS, CLEATS AND STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
3. PLACEMENT OF CURB BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF THE CURB BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.
4. ACCESS COVER – FORD MC–24–MB–T WITH AN INNER LID, VESTAL 32–055, 32–104, AND 32–046 OR APPROVED EQUAL.

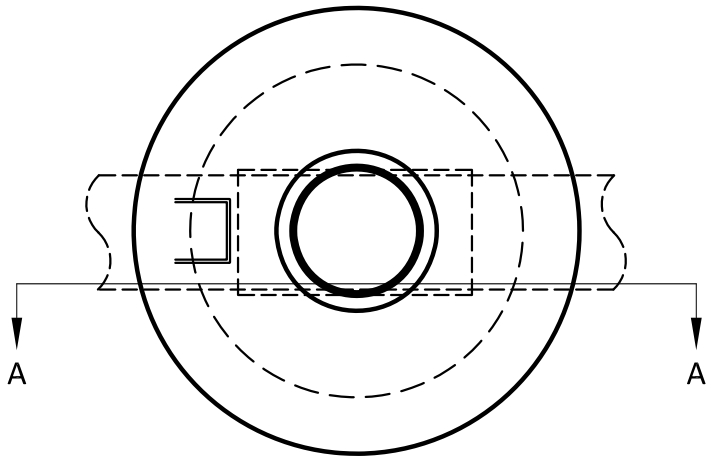


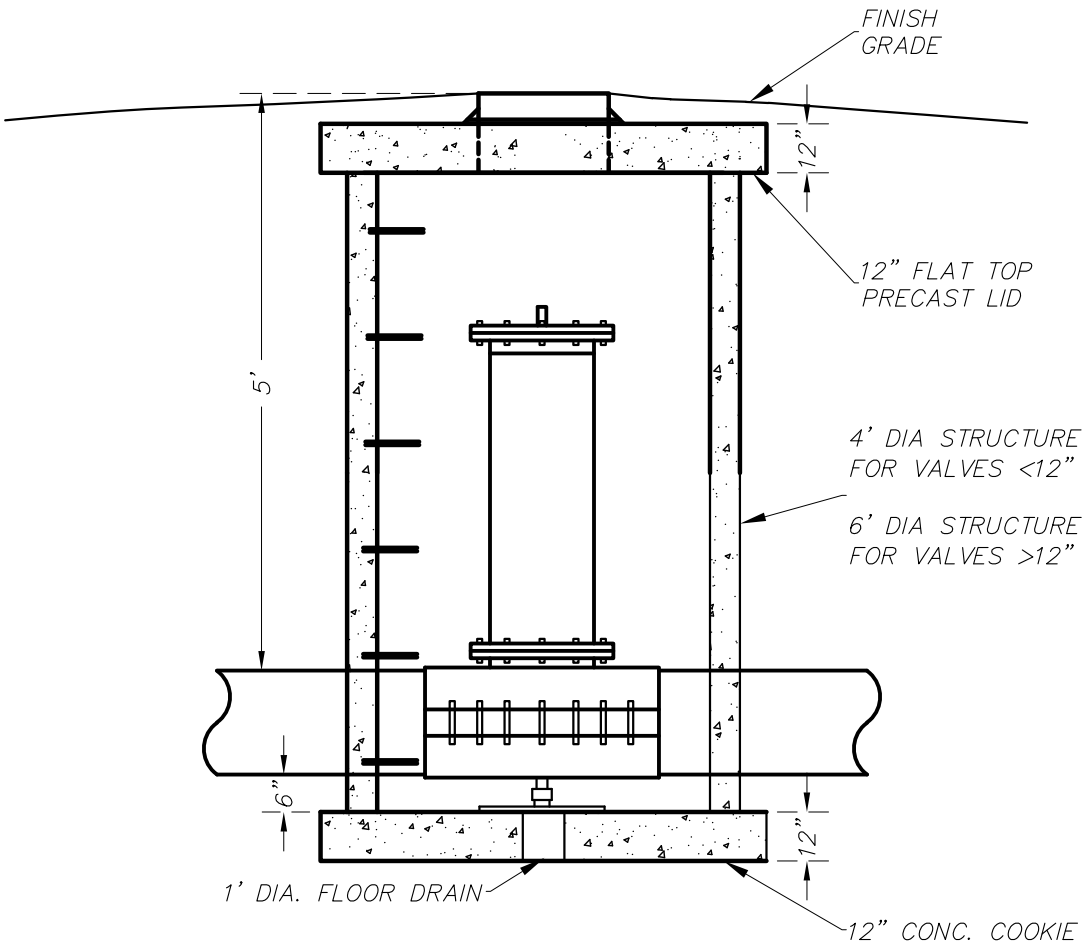
SIDE VIEW

END VIEW

CITY OF KALAMAZOO Department Of Public Services		DATE
STANDARD METER PIT	RECOMMENDED BY	
	APPROVED BY	
	APPROVED BY	
	ACCEPTED BY	

WA–08–A





TYPICAL INSERTA – VALVE

PRECAST REINFORCED CONCRETE SHOWN

THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

INSERTA–VALVE STRUCTURE

		DATE
RECOMMENDED BY		
APPROVED BY		
APPROVED BY		
ACCEPTED BY		

WS–1–A

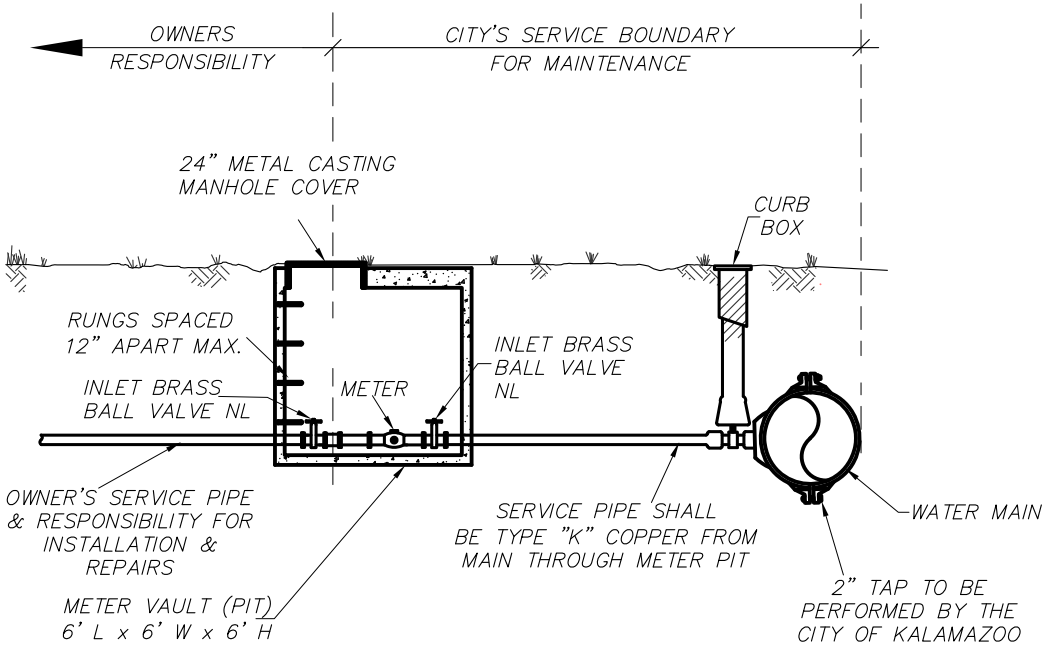
NOTES:

1. METER VAULT (PIT) DESIGN MUST BE SUBMITTED AND APPROVED FOR EACH INDIVIDUAL INSTALLATION. DESIGN SHALL CONFORM TO THE CITY OF KALAMAZOO STANDARD SPECIFICATIONS FOR WATER MAIN AND SERVICE INSTALLATION LATEST REVISION.

2. THE DISTANCE BETWEEN RUNGS, CLEATS & STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.

3. CURB BOX WILL BE INSTALLED AT THE WATER MAIN.

4. COVER FOR METER PIT & CURB BOX SHALL BE INSTALLED & MAINTAINED LEVEL WITH THE ADJACENT GROUND.



THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

2" SERVICE LINE METER VAULT

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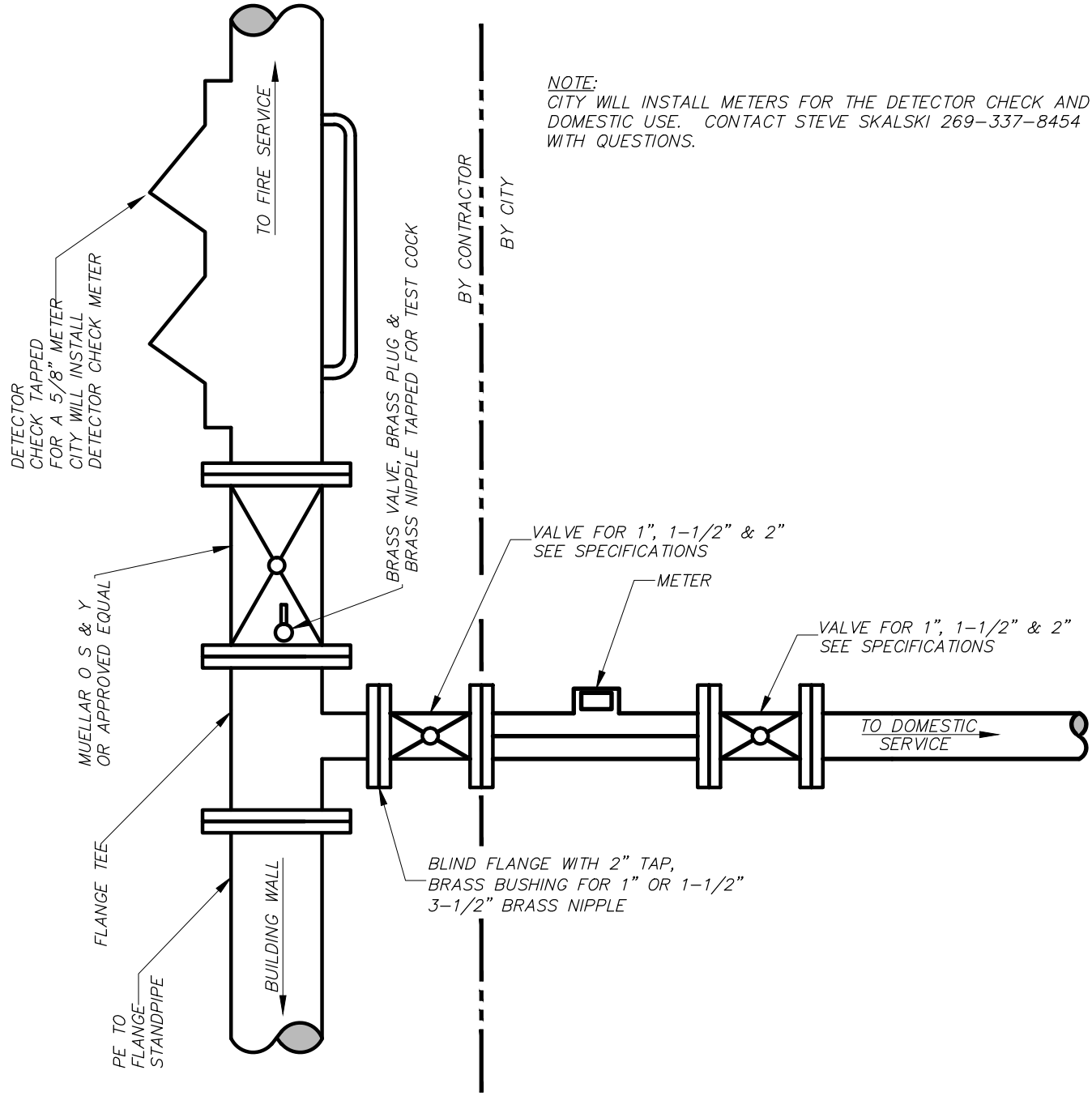
APPROVED BY		
ACCEPTED BY		

WS–3–A



NOTE:
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269–337–8454 WITH QUESTIONS.

THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

TYPICAL FIRE SERVICE DETAIL
1" 1–1/2" 2"

		DATE
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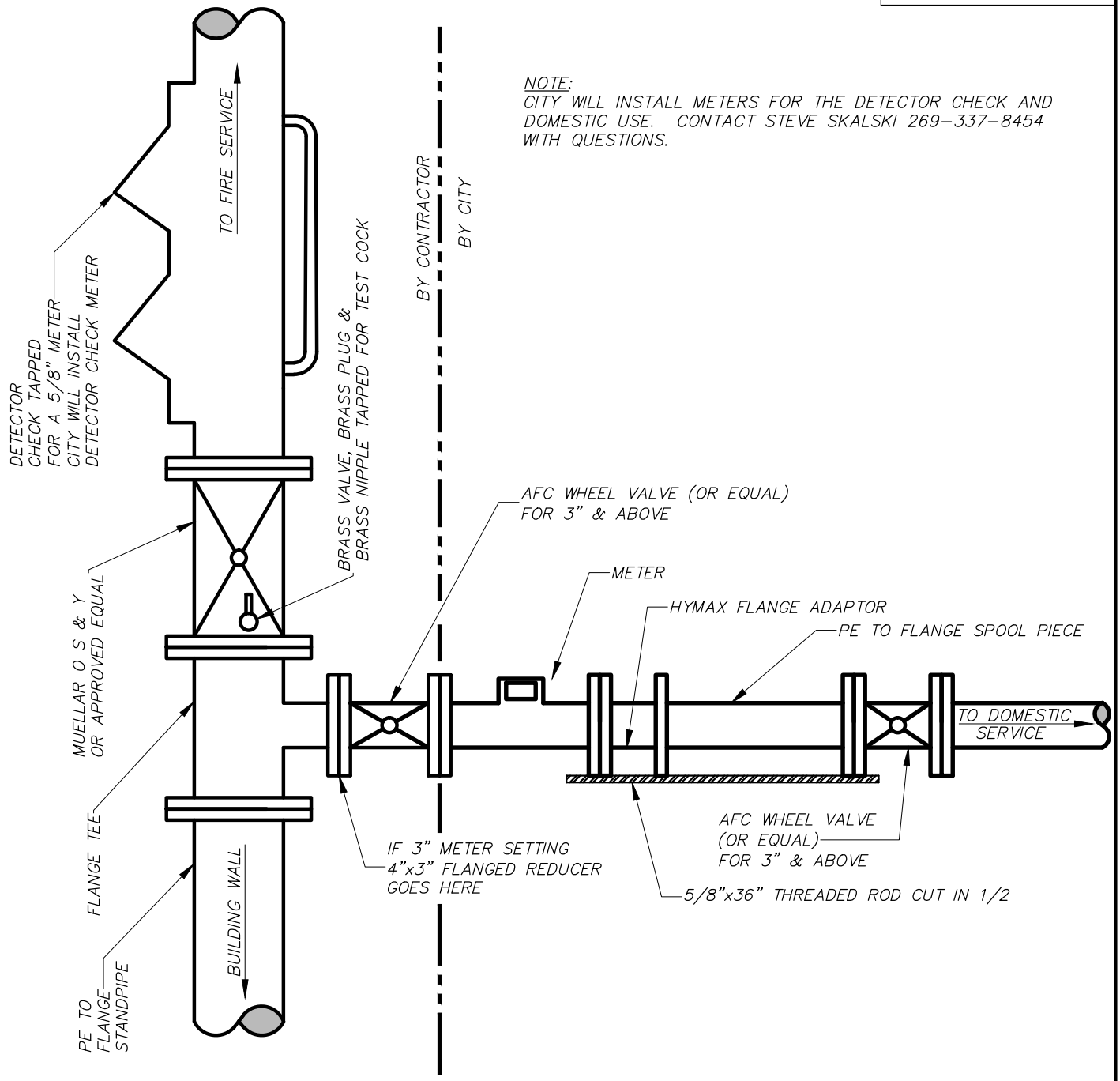
ACCEPTED BY		

WS–4–A



NOTE:
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269–337–8454 WITH QUESTIONS.

THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

TYPICAL FIRE SERVICE DETAIL
3" 4" 6"

		DATE
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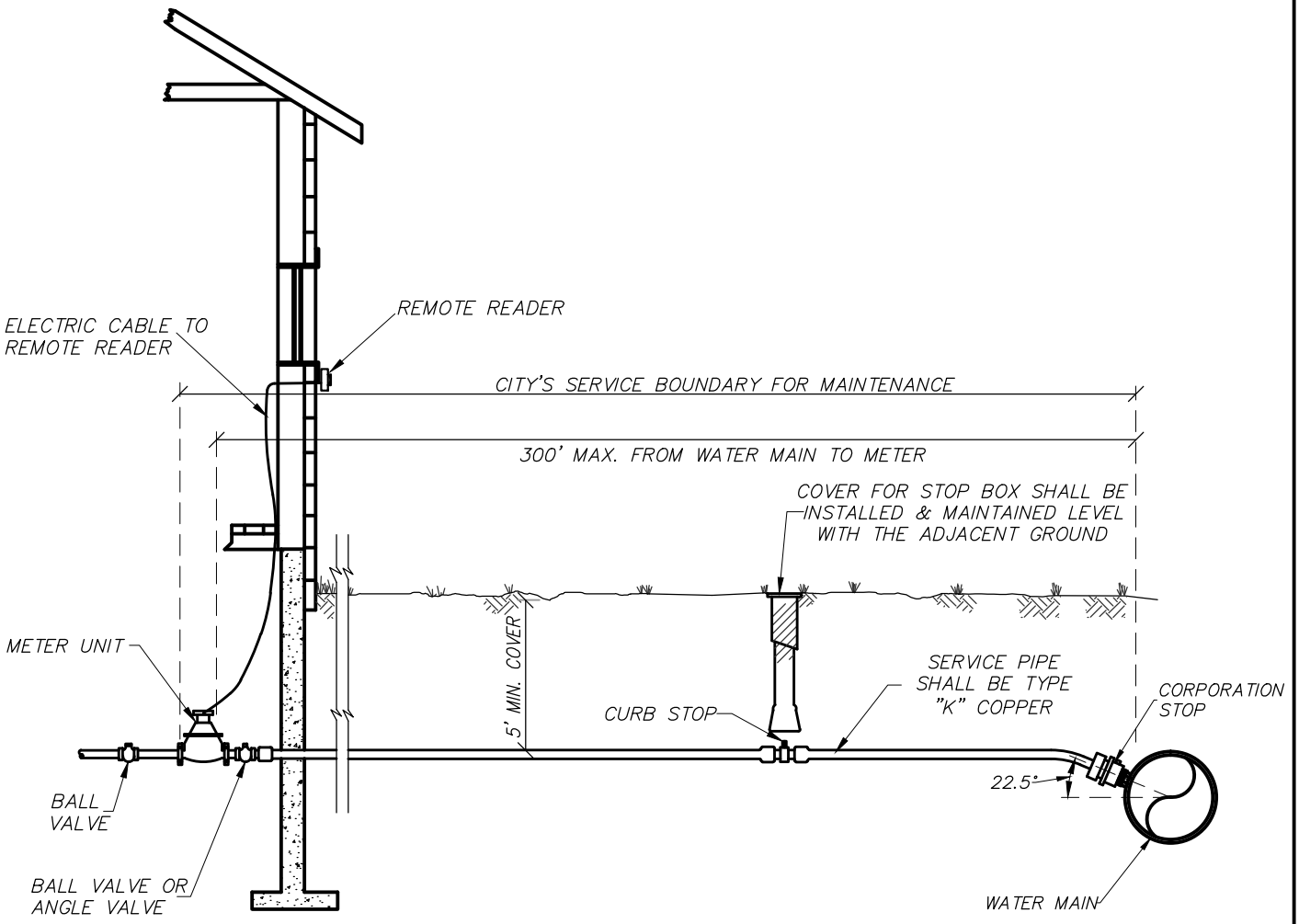
APPROVED BY		
APPROVED BY		
ACCEPTED BY		

WS–5–A

NOTES:

1. PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF THE STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.

2. CITY WATER WILL REPAIR LEAKS ON SERVICE LINES WHEN NOTIFIED, FROM THE CORPORATION STOP TO METER.



THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services SERVICE LINE, STOP BOX AND INSIDE METER INSTALLATION 1–1/4" SERVICE & 1" METER	RECOMMENDED BY	DATE
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		ACCEPTED BY	

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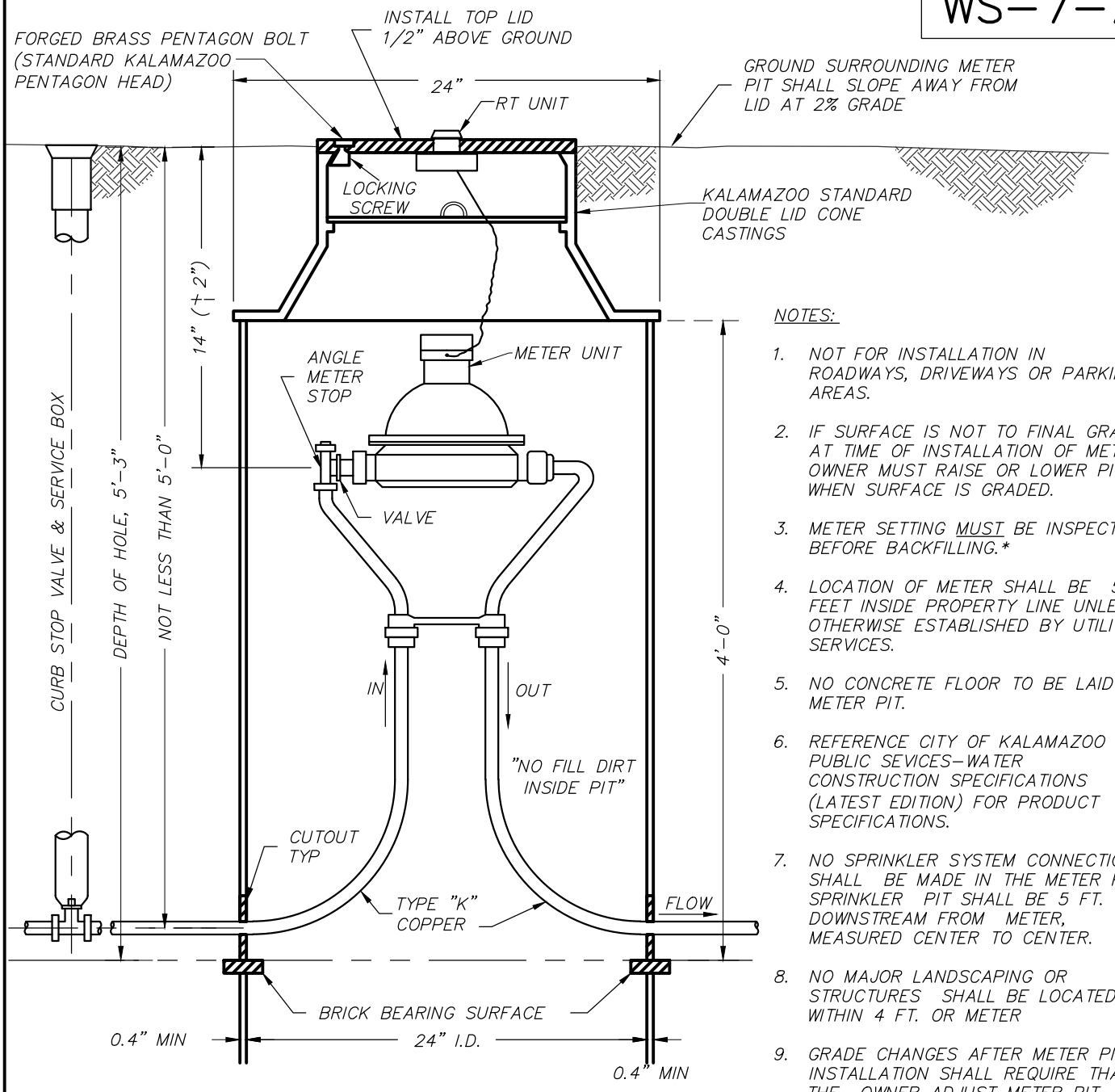
WS-7-A



NOTES:

1. NOT FOR INSTALLATION IN ROADWAYS, DRIVEWAYS OR PARKING AREAS.
2. IF SURFACE IS NOT TO FINAL GRADE AT TIME OF INSTALLATION OF METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.
3. METER SETTING MUST BE INSPECTED BEFORE BACKFILLING.*
4. LOCATION OF METER SHALL BE 5 FEET INSIDE PROPERTY LINE UNLESS OTHERWISE ESTABLISHED BY UTILITY SERVICES.
5. NO CONCRETE FLOOR TO BE LAID IN METER PIT.
6. REFERENCE CITY OF KALAMAZOO PUBLIC SEVICES–WATER CONSTRUCTION SPECIFICATIONS (LATEST EDITION) FOR PRODUCT SPECIFICATIONS.
7. NO SPRINKLER SYSTEM CONNECTIONS SHALL BE MADE IN THE METER PIT. SPRINKLER PIT SHALL BE 5 FT. DOWNSTREAM FROM METER, MEASURED CENTER TO CENTER.
8. NO MAJOR LANDSCAPING OR STRUCTURES SHALL BE LOCATED WITHIN 4 FT. OR METER
9. GRADE CHANGES AFTER METER PIT INSTALLATION SHALL REQUIRE THAT THE OWNER ADJUST METER PIT COVER TO 1/2" ABOVE FINAL GRADE.
10. IF PRESSURE REDUCING VALVE IS REQUIRED BY PLUMBING CODE, IT SHALL BE INSTALLED INSIDE THE BUILDING, IMMEDIATELY FOLLOWING THE MAIN SHUT OFF VALVE.
11. COPPER PIPE SHALL SHOW NO VISIBLE CRIMPING.

* FOR INSPECTION CALL (269) 998–6433 INSPECTOR
* FOR INSPECTION CALL (269) 337–8769 ENGINEER

CITY OF KALAMAZOO
Department Of Public Services

OUTSIDE SETTING FOR 1" METER

	DATE
RECOMMENDED BY	
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APPROVED BY	
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J:\COK CAD STANDARDS\STANDARD DETAILS\WATER\UPDATED DRAWINGS\WS-7-A OUTSIDE METER 1 INCH.dwg, 4/1/2014 8:18:07 AM

WS–8–B

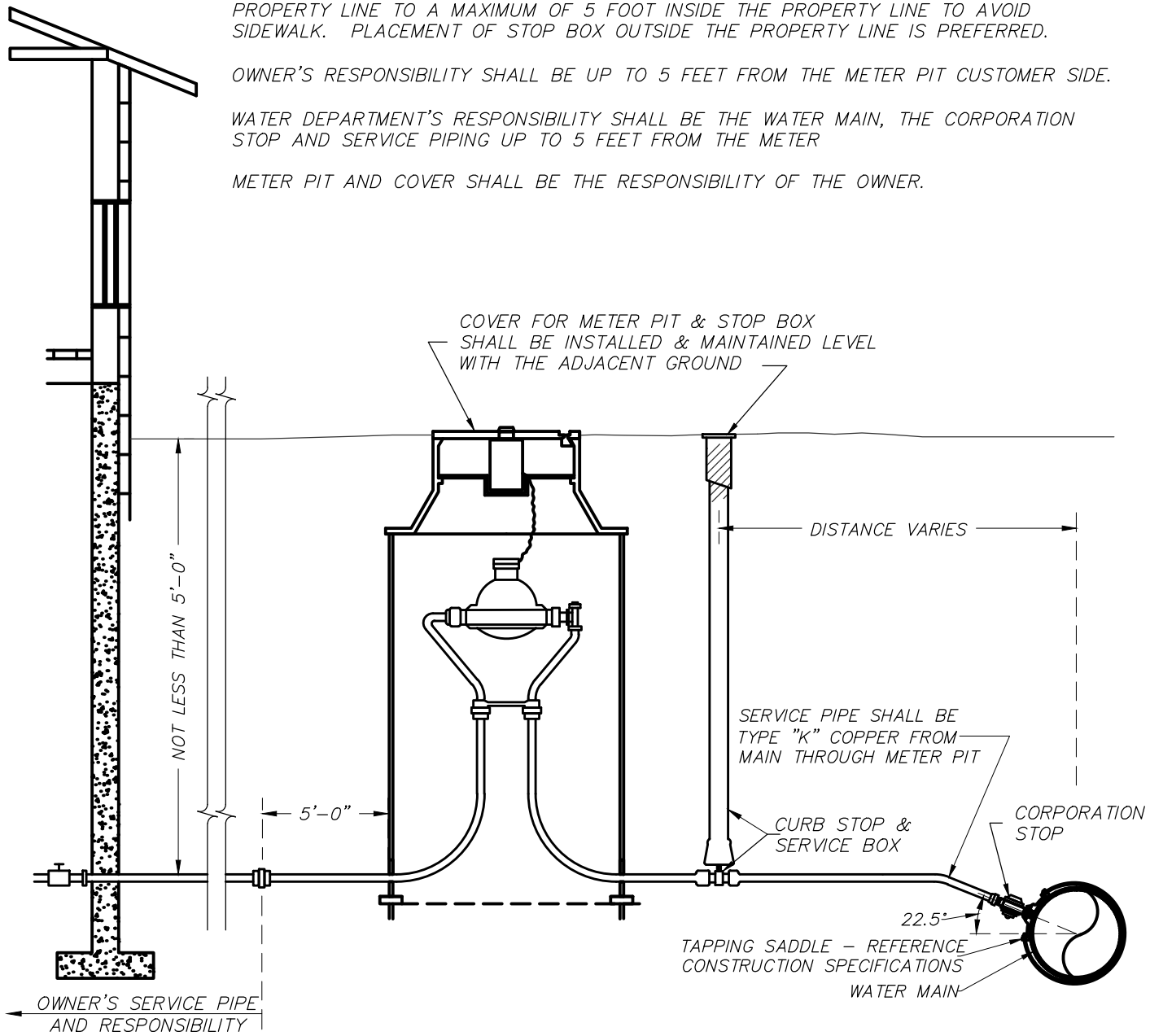
NOTES:

PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FOOT OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 5 FOOT INSIDE THE PROPERTY LINE TO AVOID SIDEWALK. PLACEMENT OF STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.

OWNER'S RESPONSIBILITY SHALL BE UP TO 5 FEET FROM THE METER PIT CUSTOMER SIDE.

WATER DEPARTMENT'S RESPONSIBILITY SHALL BE THE WATER MAIN, THE CORPORATION STOP AND SERVICE PIPING UP TO 5 FEET FROM THE METER

METER PIT AND COVER SHALL BE THE RESPONSIBILITY OF THE OWNER.



THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

1–1/4" SERVICE LINE, STOP BOX AND OUTSIDE METER INSTALLATION

		DATE
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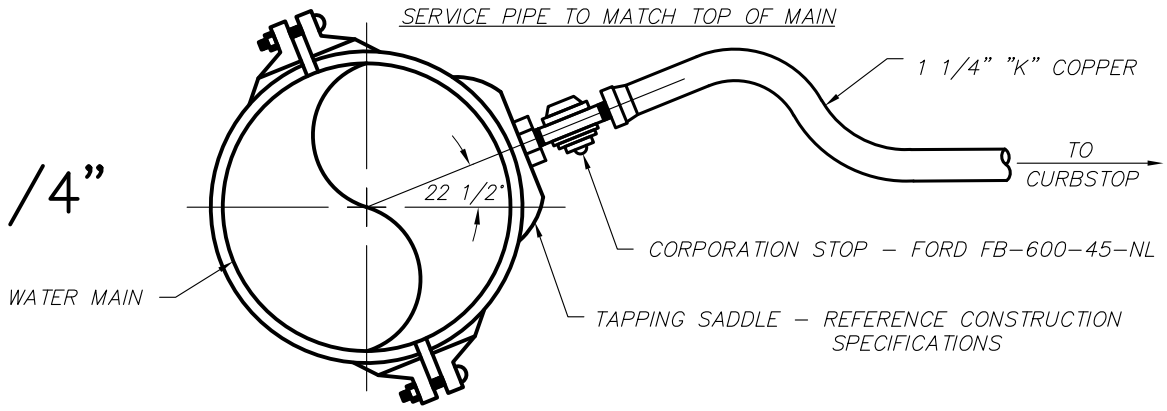
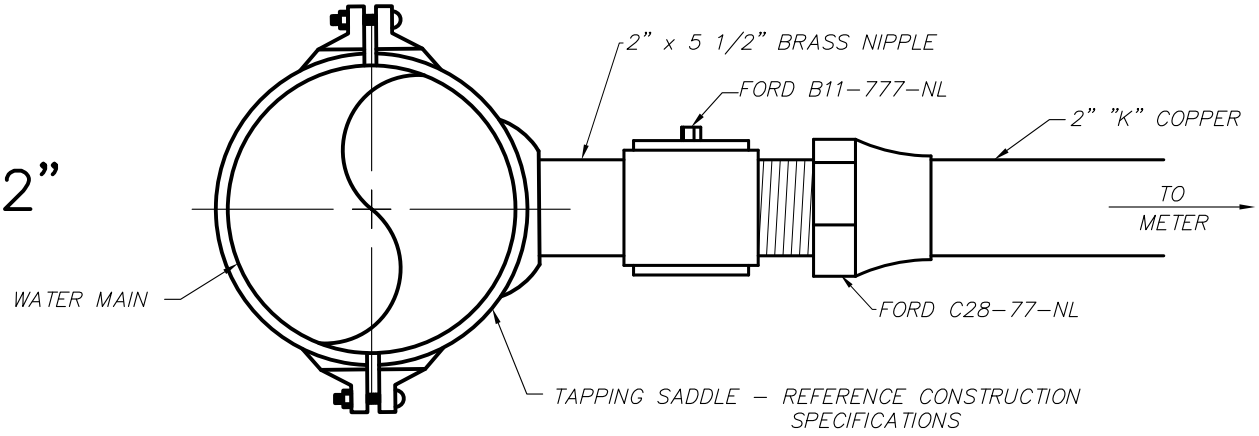
WS–9–D

1 1/4"



2"



THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

WATER SERVICE TAPPING SLEEVE

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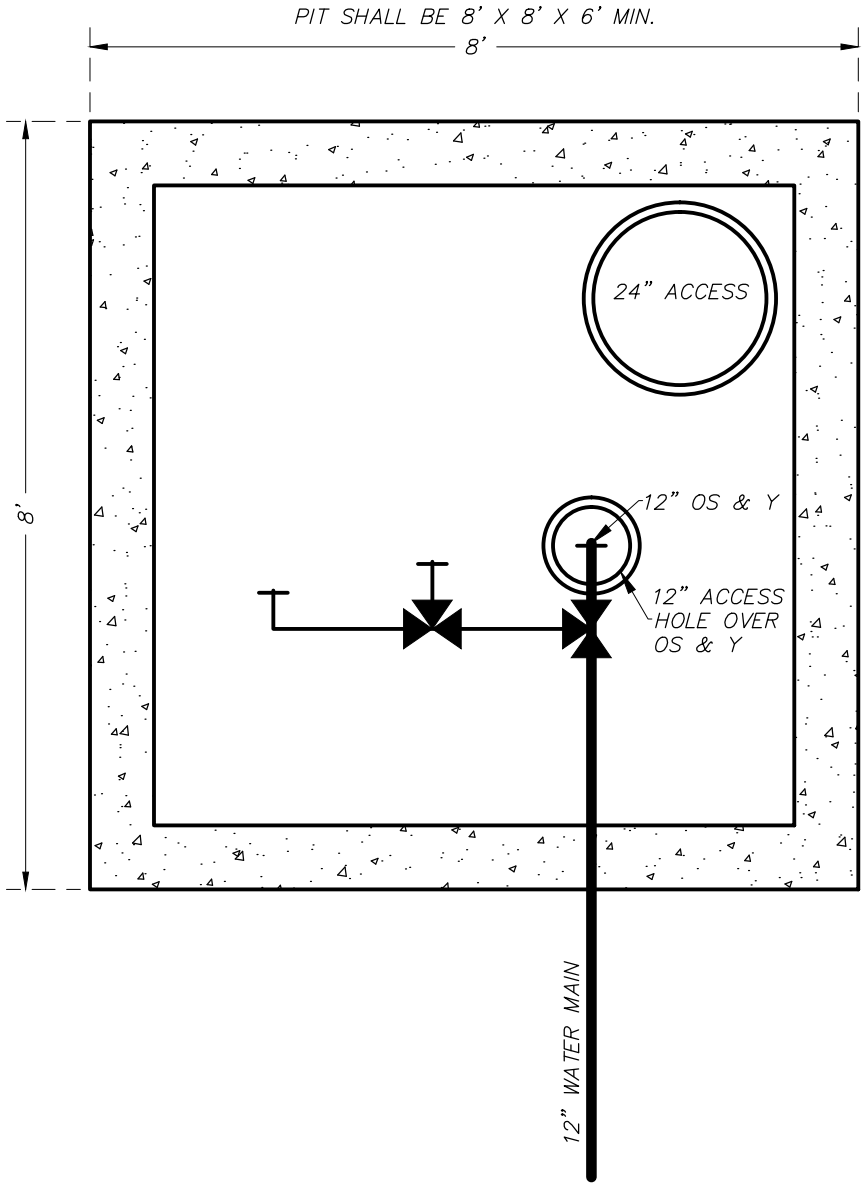
WS–10–A



THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

12 INCH METER PIT

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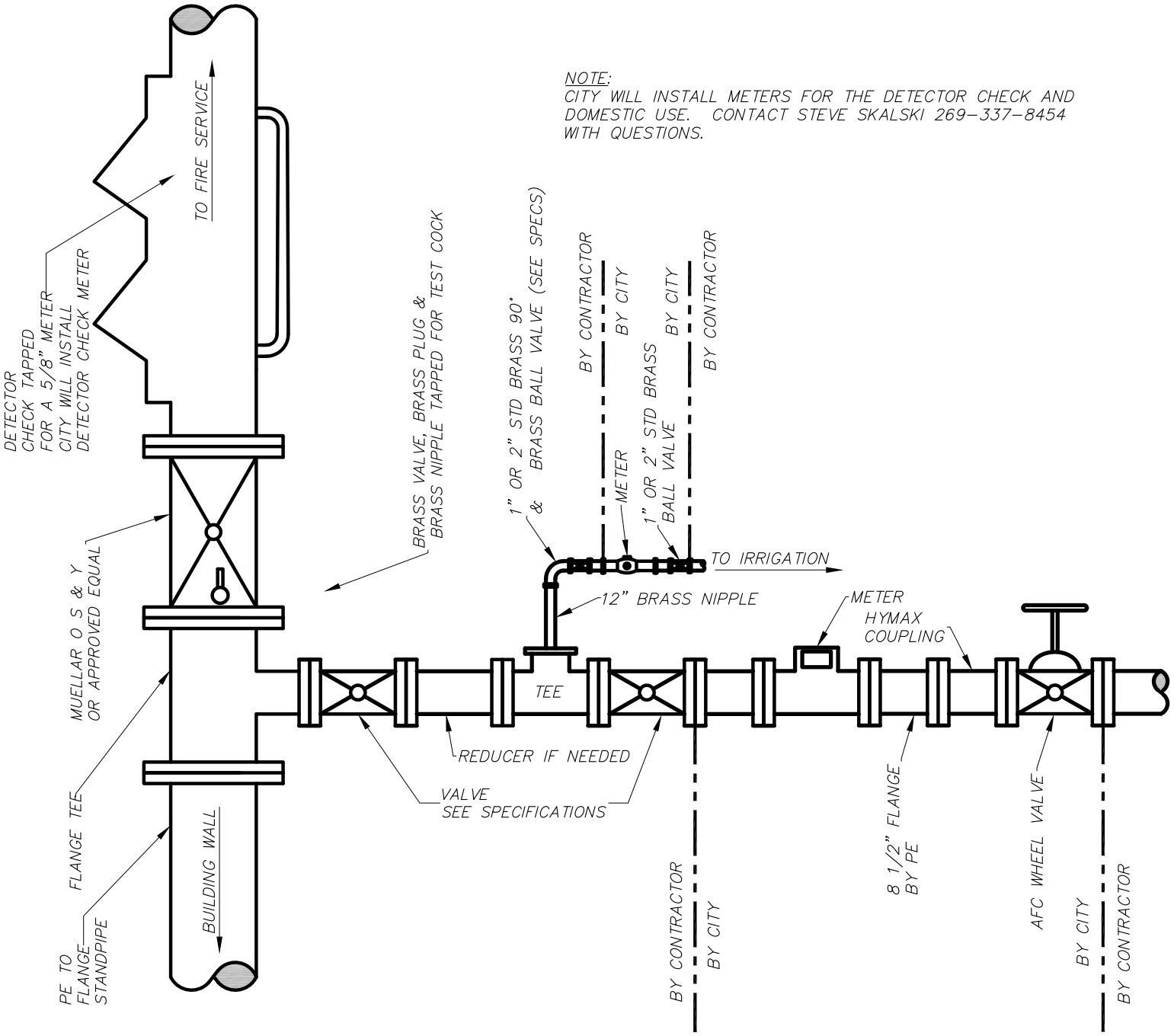
ACCEPTED BY		

WS–11–B



THE CITY OF Kalamazoo

TYPICAL FIRE SERVICE DETAIL, DOMESTIC 3", 4", & 6" & IRRIGATION 1" OR 2" VERTICAL SETTING

		DATE
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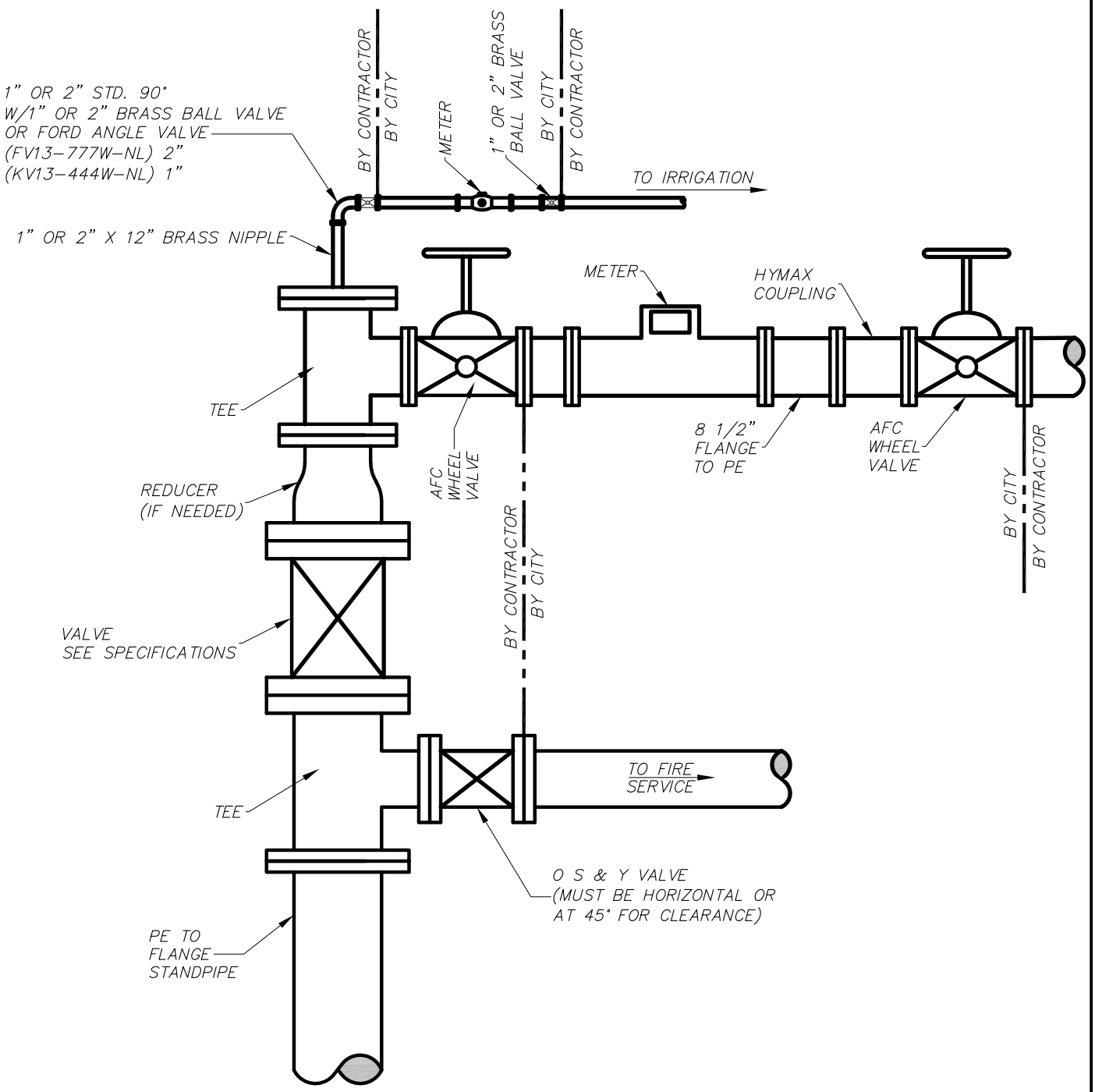
ACCEPTED BY		

WS–12–A

NOTE:
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269–337–8454 WITH QUESTIONS.



THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services TYPICAL FIRE SERVICE DETAIL HORIZONTAL SETTING W/3", 4", OR 6" DOMESTIC & 1" OR 2" IRRIGATION	RECOMMENDED BY	DATE
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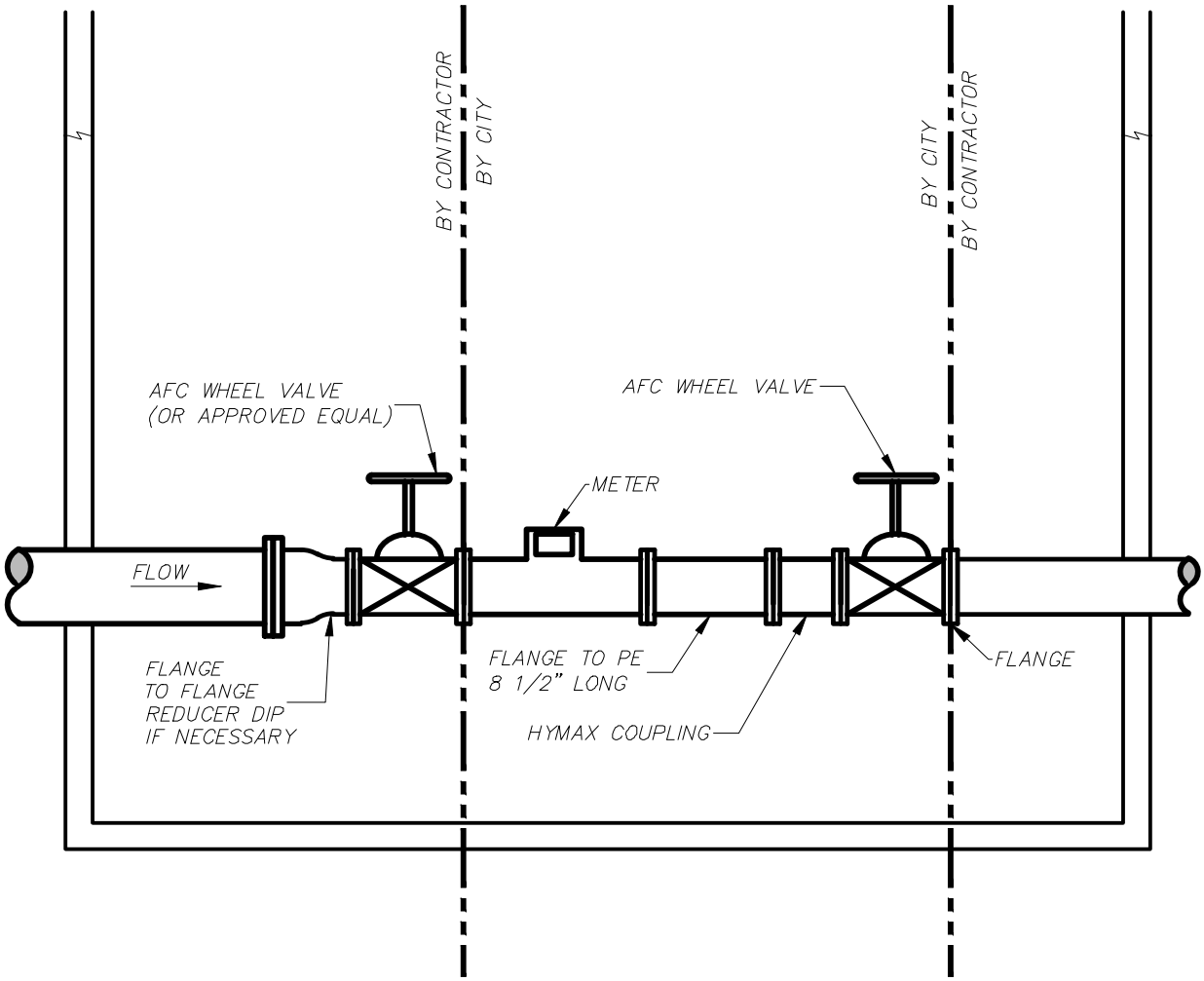
		APPROVED BY	
		ACCEPTED BY	

WS–13–B

NOTE:
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269–337–8454 WITH QUESTIONS.



THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services PIT METER SETTING DETAIL FOR 3", 4", 6" & 8"	RECOMMENDED BY	DATE
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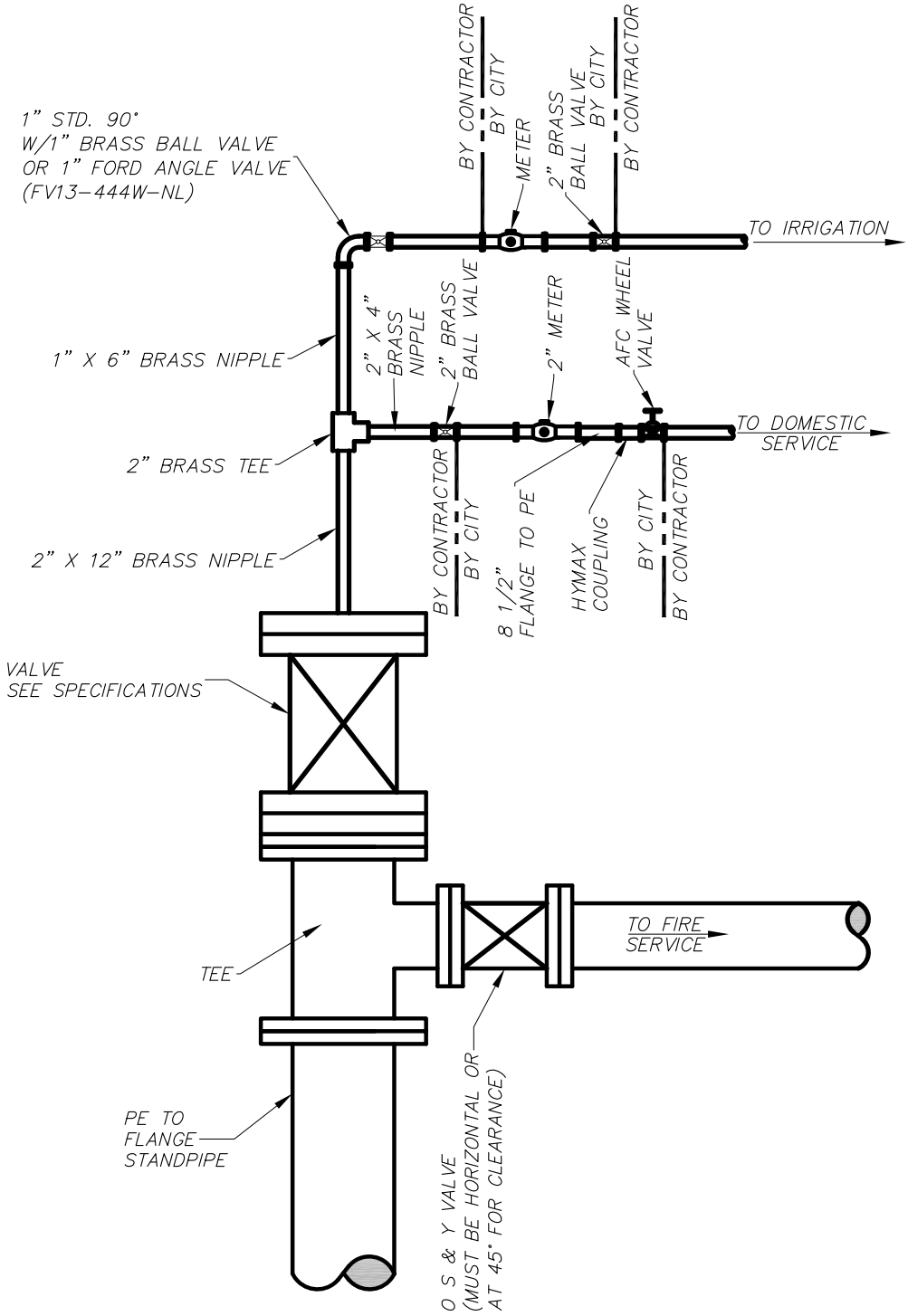
		APPROVED BY	
		ACCEPTED BY	

WS–14–A

NOTE:
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269–337–8454 WITH QUESTIONS.



THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services TYPICAL FIRE SERVICE DETAIL HORIZONTAL SETTING 2" DOMESTIC 1" IRRIGATION	RECOMMENDED BY	DATE
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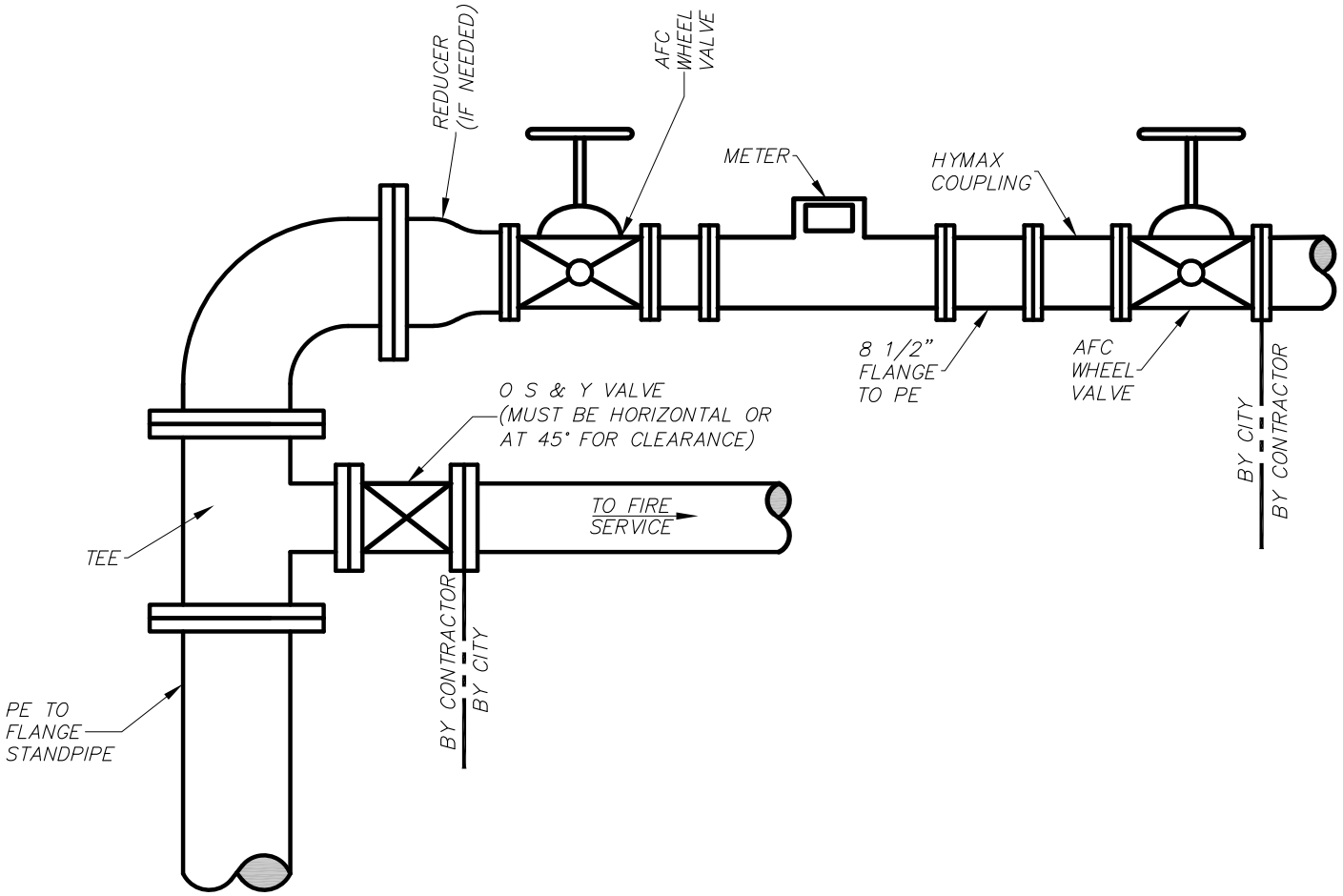
		APPROVED BY	
		ACCEPTED BY	

WS–15–A

NOTE:
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269–337–8454 WITH QUESTIONS.



THE CITY OF Kalamazoo	CITY OF KALAMAZOO Department Of Public Services TYPICAL FIRE SERVICE DETAIL HORIZONTAL SETTING W/3", 4", OR 6" DOMESTIC	RECOMMENDED BY	DATE
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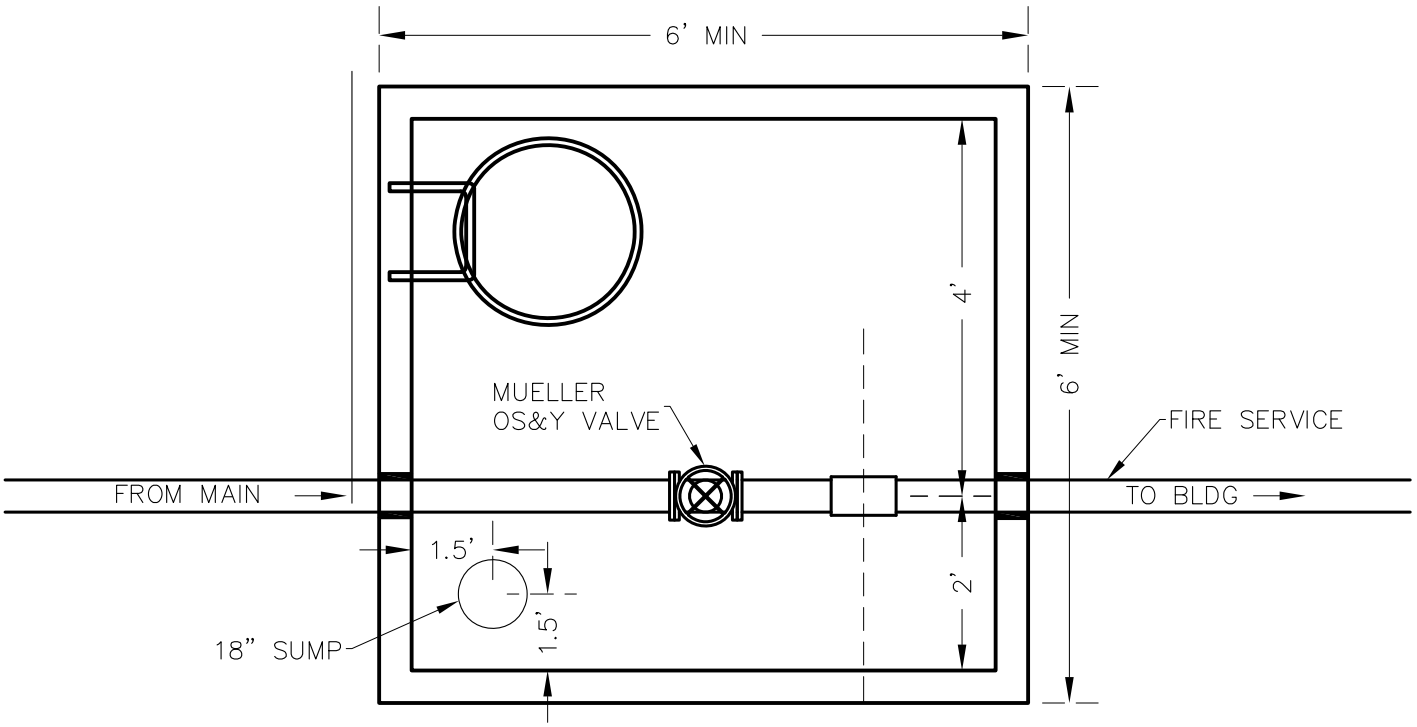
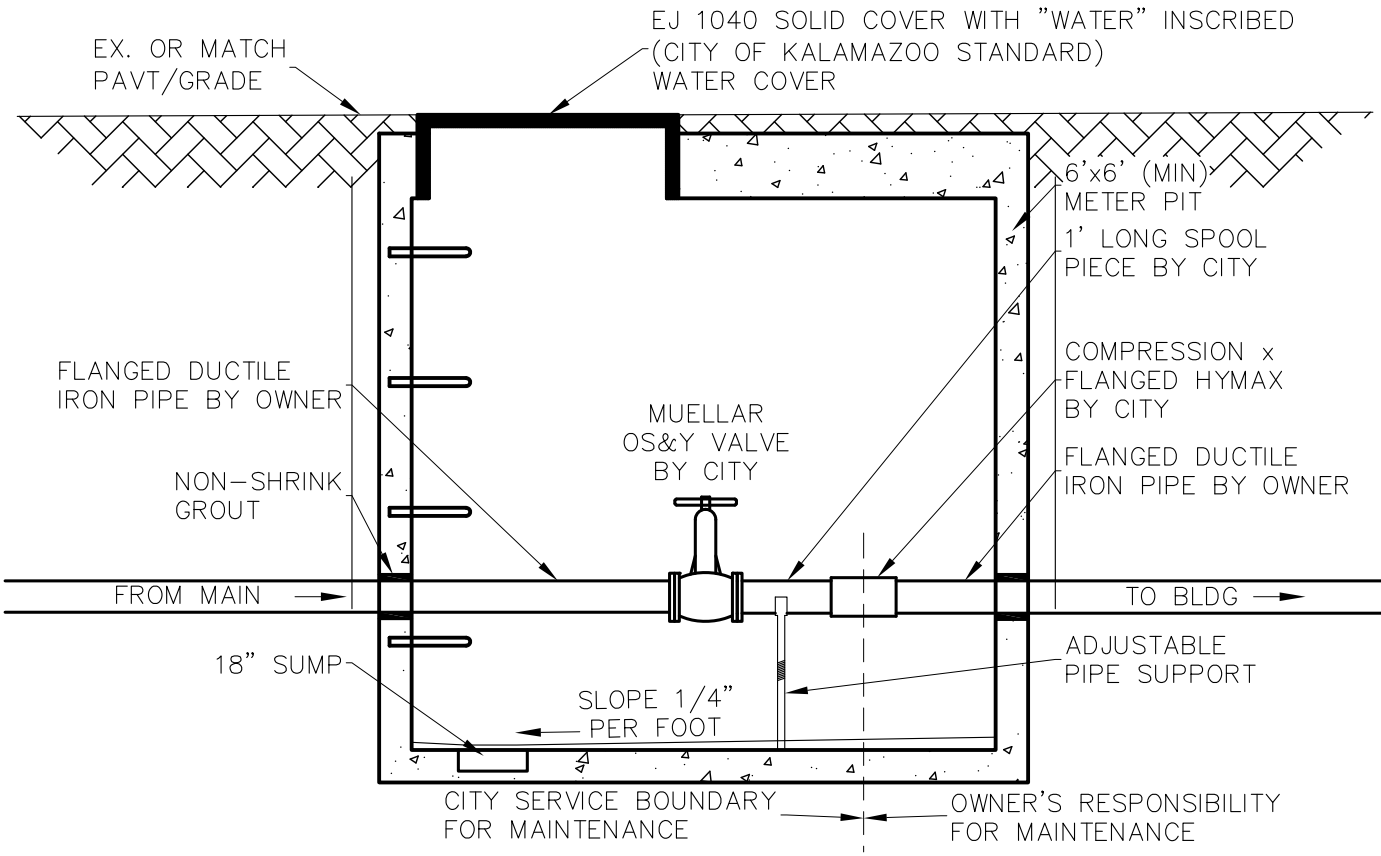
		ACCEPTED BY	

WS-16-A





THE CITY OF Kalamazoo

CITY OF KALAMAZOO
Department Of Public Services

FIRE SERVICE IN PIT DETAIL

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RECOMMENDED BY		
APPROVED BY		
APPROVED BY		
ACCEPTED BY		

GEOTECHNICAL EVALUATION REPORT

33RD STREET UTILITY IMPROVEMENTS
COMSTOCK TOWNSHIP, MICHIGAN

SME Project No. 083873.00
April 15, 2020

SME

3301 Tech Circle Drive
Kalamazoo, MI 49008-5611

T (269) 323-3555

www.sme-usa.com

April 15, 2020

Mr. Aaron Davenport, PE
Jones & Henry Engineers
4791 Campus Drive
Kalamazoo, Michigan 49008

Via E-Mail: adavenport@jheng.com (PDF file)

RE: Geotechnical Evaluation Report
33rd Street Utility Improvements
East K Avenue to East G Avenue
Comstock Township, Kalamazoo County, Michigan
SME Project No. 083873.00

Dear Mr. Davenport:

We have completed our geotechnical evaluation for the subject project. This report presents the results of our observations and analyses, our geotechnical engineering recommendations, and a general discussion on construction considerations based on the information disclosed by the borings.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact me.

Sincerely,

SME

Kevin J. Glupker, PE
Senior Consultant

Prepared by:
Zachary L. Miller, PE
Project Engineer

Reviewed by:
Kevin J. Glupker, PE
Senior Consultant

TABLE OF CONTENTS

1. INTRODUCTION

This report presents the results of the geotechnical evaluation performed by SME for the 33rd Street Utility Improvements project. This evaluation was conducted in general accordance with the scope of services outlined in SME Proposal No. P00125.20, dated January 14, 2020. Our services for this project were authorized by Jones & Henry Engineers (Jones & Henry).

To assist with our evaluation and the preparation of this report, SME was provided a PDF of a drawing prepared by Jones & Henry depicting the subject alignment of 33rd Street, as well as existing and proposed utility layouts at select intersections and areas of wetlands and waterways near the alignment (untitled drawing, provided to SME on March 13, 2020).

1.1 SITE CONDITIONS

The project site is located along North 33rd Street, between East K Avenue and East G Avenue, in Comstock Township, Michigan. The project alignment is depicted as insets (Location Maps) on the Boring Location Diagrams (Figure Nos. 1 through 3) included in Appendix A.

The project alignment is approximately 3 miles long. North 33rd Street is a two-lane asphalt surfaced roadway with aggregate shoulders. Farm fields, wooded and wetland areas, and residential houses are located along the roadway. The provided drawing depicts a large wetland area on the west side of the roadway near East G Avenue. The northernmost wetland area corresponds to an area of Houghton muck deposits indicated in USDA Web Soil Survey. The USDA Web Soil Survey maps for the project area are included in Appendix A for reference.

1.2 PROJECT DESCRIPTION

The project will include installing watermain below the northbound shoulder of 33rd Street within the project limits. We anticipate the watermain will be installed at a relatively constant depth of about 6 feet below grade along the alignment. Topographic survey and proposed utility profiles were not provided to SME at the time of this report. Based on available Google Earth™ terrain data, ground surface elevations along the roadway range from about 800 feet at the south end of the alignment, to about 900 feet near East H J Avenue, to about 850 feet at the north project extents.

SME should be allowed to review design grading plans and utility profiles, once available, so that we can review and modify the recommendations of this report, if necessary.

2. EVALUATION PROCEDURES

2.1 FIELD EXPLORATION

SME completed 32 borings (B1 through B32) along the alignment on March 23, and 24, 2020, at the approximate locations depicted on Appended Figure Nos. 1 through 3. SME and Jones & Henry jointly selected the locations for the borings based on the proposed watermain alignment, existing site features, and known wetland areas. A topographic survey of the project site was not provided to us at the time of this report and ground surface elevations were not estimated by SME at the boring locations.

SME performed standard Dynamic Cone Penetrometer (DCP) testing at select boring locations near the anticipated invert elevation of the proposed watermain. The DCP test consists of a 10-pound hammer falling 24 inches and driving a steel rod with a 1-1/8-inch-diameter conical tip into the subgrade. The number of hammer blows required to drive the cone penetrometer for each 6-inch increment are recorded and used in estimating the relative density of sandy soils. The DCP tests were incrementally advanced as the borings were advanced, as described below.

The borings were advanced using a truck-mounted hydraulic push Geoprobe® device to the termination depth of the borings. The borings were advanced to a depth of 10 feet below the surface, except at locations B21 and B27. Boring B21 was terminated at a depth of 8 feet below the surface due to sampler refusal on a possible rock. Boring B27 was extended through encountered peat and organic silt to a depth of 16 feet below the surface. The Geoprobe® recovers continuous samples of soil using acetate-lined piston samplers. The liners were sealed in the field and returned to SME's laboratory for further examination and testing. Groundwater levels in the boreholes were recorded during sampling and after completing each boring. After completion of the borings, the boreholes were backfilled with gravel fill. Therefore, long-term groundwater level information is not available from the boring locations.

More information regarding the drilling and sampling procedures is provided on the boring logs in Appendix A. Soil samples recovered from the field exploration were delivered to our laboratory for further observation and testing.

2.2 LABORATORY TESTING

The laboratory testing program consisted of performing visual soil classification on the recovered samples in general accordance with ASTM D2488. Moisture content and hand penetrometer tests were performed on portions of recovered cohesive samples. In addition, moisture content tests and/or loss-on-ignition (LOI) tests were performed on select samples were suspected of containing organics. The Laboratory Testing Procedures included in Appendix B provides general descriptions of the laboratory tests. Based on the laboratory testing, we assigned a Unified Soil Classification System (USCS) group symbol to the various soil strata encountered.

The boring logs included in Appendix A summarize our field observation and laboratory test results. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet included in Appendix A.

Soil samples retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, soil samples are normally retained in our laboratory and are then disposed of after 60 days, unless we are instructed otherwise.

3. SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

SURFICIAL MATERIALS AND FILL

The soil conditions encountered at the borings generally consisted of about 0.5 to 2.5 feet of shoulder aggregate. Surficial topsoil (about 4-inches) was encountered overlying the shoulder aggregate at boring B31. Below the surficial materials, sand and clay fill was encountered at 15 of the boring locations, extending to depths of about 2 to 4.5 feet below the existing surface. The fill at borings B29 and B31 contained topsoil seams. LOI testing performed on the fill at boring B18 indicated an organic content of 3.4 percent.

BURIED TOPSOIL AND LAYERS WITH TRACE ORGANICS

At boring B1, a buried topsoil layer was encountered below the fill at a depth of 4.5 to 5.5 feet. At borings B18, B20, B23, and B24, layers of natural silts, clays, and clayey sands with trace organics were encountered below the aggregate or fill layers. These layers varied in thickness from 1.5 to 2.5 feet, and LOI testing performed on the layers indicated organic contents of 3.2 to 3.7 percent.

ORGANIC SOIL DEPOSITS (BORING B27)

At boring B27, fibrous and amorphic peat were encountered below the fill layers, extending from 4 to 10 feet. The fibrous peat exhibited a moisture content of 345 percent, and the amorphic peat exhibited 66 percent moisture. Below the peat, soft organic silt with sand layers was encountered extending to a depth of 13.5 feet. The organic silt exhibited a 66 percent moisture content and a shear strength of 0.3 ksf.

NATURAL INORGANIC SOILS

Natural sands, clays, and silts extended below the surficial materials, fill layers, and organic soils to the explored boring depths. At the borings and elevations tested, the sands were in very loose to very dense condition. The silts were in loose to very dense condition. Clayey silts encountered at borings B18, B23, B24, and B27 exhibited a medium to stiff consistency, with moisture contents of 29 to 32 percent. Clays encountered at borings B24 and B29 exhibited a stiff consistency with moisture contents of 17 to 27 percent.

It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil, or organic layers, and when the fill appears similar in composition to the local natural soils. Therefore, the delineation of fill described above and on the appended boring logs should be considered approximate only.

The soil profile described above and included on the appended boring logs is a generalized description of the conditions encountered. The stratification depths shown on the boring logs indicate a zone of transition from one soil type to another and do not show exact depths of change from one soil type to another. Soil conditions may vary between or away from the boring locations from those conditions noted on the boring logs. Please refer to the boring logs in Appendix A for the specific soil conditions at the boring locations.

3.2 GROUNDWATER CONDITIONS

Groundwater was encountered during sampling at borings B27 and B32 at depths of 3 feet and 5 feet, respectively. After sampling was completed, groundwater was observed in eight borings (B15, B20, B26, B27, and B29 through B32) at depths ranging from 2 feet to 10 feet below grade. Groundwater was not encountered at the remaining boring locations.

Hydrostatic groundwater levels, including perched conditions, should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater information reported on the boring logs represent conditions at the time the readings were taken and may vary from the groundwater conditions encountered at the time of construction.

4. ANALYSIS AND RECOMMENDATIONS

4.1 PROPOSED WATERMAIN

4.1.1 TRENCH EXCAVATION RECOMMENDATIONS

We understand the proposed watermain alignment will be installed using open cut techniques. Open excavation with sloped sides in accordance with OSHA requirements are feasible where existing structures or utilities do not encroach upon the excavation, but could be affected near boring B27 by the presence of underlying organic soil or peat (i.e., organics) and by shallow groundwater. We anticipate

excavation to depths required to install the watermain at about 6 feet below grade will generally extend below undocumented existing fills, and layers of buried topsoil or soils with trace organics described in Section 3 (with the exception of deeper organic soils encountered at boring B27, addressed in the sections below).

Based on the groundwater observations in the borings, significant groundwater infiltration during excavation and installation of the watermain is expected near the location of boring B27. The presence of shallow groundwater and weak organic soils will contribute to poor stability of the excavation sidewalls and potential instability of the bottom of the excavation, which will not be correctable by typical methods, such as compaction-in-place. Depending on excavation depths and groundwater fluctuations at the time of construction, groundwater may also be present at or near the bottom of trench excavations near boring locations B31 and B32. We have provided dewatering considerations in Section 4.1.3 below.

Along the remaining portions of the alignment, groundwater infiltration during excavation and installation of the watermain is generally not anticipated to be a significant factor during construction above a depth of about 8 feet. However, some accumulation of water from precipitation events, surface run-off or perched groundwater sources could be encountered. We anticipate standard sump pit and pumping procedures should generally be adequate to control these accumulations, on a localized basis. A working surface of either crushed aggregate or crushed concrete may be required to protect the exposed subgrade where seepage is encountered.

The contractor must provide a safely sloped excavation or an adequately constructed and braced shoring system in accordance with federal, state, and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. For open-trench methods, it is typically difficult to maintain stable excavations through loose sandy soils. This is especially the case where excessive groundwater seepage is encountered. We recommend excavation sidewalls be adequately sloped back and/or braced to prevent sloughing and caving of sidewalls. Additionally, if material is stored or equipment is operated near an excavation, use stronger shoring to resist the extra pressure due to the superimposed loads.

In areas where adequate side sloping or benching is not feasible, due to alignment constraints or proximity of existing structures, support the excavation sidewalls with internally braced sheeting or trench boxes. We recommend basing the actual type of lateral support required on the encountered soil and groundwater conditions, depth of the excavation and proximity of nearby structures, allowable movements, and including static or dynamic loads from adjacent roadways.

We recommend the design of any sheet piling retaining walls required during construction for open cut installation be provided by an experienced registered professional engineer and installed by a contractor experienced with this type of construction. Appropriate measures for providing temporary support of existing utility and pavement structures will be required where any proposed open cut portion of the alignment crosses or is in close proximity of existing utilities or structures.

4.1.2 PIPE SUPPORT

We anticipate natural sands and clays at the anticipated watermain invert depths of about 6 feet below the existing ground surface (except for those areas discussed below). We generally consider these inorganic natural soils to be suitable subgrade to support the proposed watermain. However, unsuitable soils may be encountered along portions of the alignment during installation, as discussed below.

4.1.2.1 WEAK INORGANIC SOILS

Relatively weak and high moisture clayey silts were encountered near the anticipated watermain elevation at borings B18 and B23. We recommend removing organic and unstable soils and replacing them with engineered fill to the design invert elevation. Undercut excavations to remove unsuitable soils

should be properly oversized beneath utility pipes, manholes and other structures. If wet or disturbed conditions are present, we recommend replacing these soils with a layer of crushed aggregate or crushed concrete to provide a stable working surface. The required thickness of this stabilization layer will depend on the severity of the groundwater conditions and depth of weak soils.

4.2.2.2 ORGANIC SOILS

Peat and organic silt were encountered at boring B27 and extended to a depth of 13.5 feet below existing grades. The depths and extents of the peat and organic silt deposits near boring B27 should be further delineated by reviewing site survey information and historical aerial photographs, and performing additional borings, hand-operated muck depth soundings, and/or test pits to assist with the project budget. SME can provide these services, upon request.

The risks of poor performance of utilities constructed on or above peat and organic soils include excessive total and differential movements along the pipe due to consolidation of the organics. Consolidation of these soils is inherent and will continue unless they are completely removed. The magnitude of the consolidation is directly related to the thickness of the layers, the magnitude of loads added to the soils, and the rate of biodegradation of the soils. We recommend removing the organic soils from beneath the proposed watermain. This would require undercuts extending below the anticipated invert depth of about 7.5 feet at boring B27. Deeper dewatering will be necessary to facilitate stability of the side slopes of the undercut excavations for the short amount of time they are required to remain open. The undercut excavation should extend laterally on each side of the alignment a distance at least equal to the depth of the undercut below the bottom of the invert. Therefore, for an undercut depth of 7.5 feet, the excavation should be approximately 15 feet wide. The purpose of oversizing the excavation laterally is to limit lateral squeezing of the weak peat and organic silt, which would translate into vertical movement/settlement. After the undercut is verified by SME to have exposed suitable inorganic natural soil, and to be suitably oversized laterally, the excavation should be immediately backfilled with coarse crushed aggregate that is placed in layers and tamped with the excavator bucket until it is stable. Prior to placing the pipe bedding material, the surface of the coarse aggregate should be choked with dense-graded aggregate or covered with a suitable non-woven geotextile as discussed in Section 4.2.

If total removal of the organics is not economically feasible, the amount of settlement along the watermain can be reduced, but not eliminated, in this area by excavating a partial undercut (through the peat and leaving portions of the organic silt in-place) and backfilling with a lightweight material. The partial undercut could extend as shallow as about 3 feet below the proposed pipe invert. The excavation for light-weight fill material should extend laterally for 3 feet on either side of the pipe alignment. The remainder of the trench, above the level of the pipe, can be backfilled as discussed in Section 4.2. Assuming grades are not raised, the reduction in load resulting from the lightweight backfill material should reduce settlement over the life of the utility. Contact SME for specific design recommendations if this partial undercut and light-weight fill solution is desired to be implemented.

4.1.2.3 PIPE BEDDING

Following subgrade stabilization, as required, we recommend bedding the new pipeline with an approved granular material meeting the requirements of the appropriate municipal agency. The placement and compaction of the bedding material should also conform to the requirements of the appropriate municipal agency and acceptable buried pipe design practices.

4.1.3 DEWATERING CONSIDERATIONS

Based on the depth of groundwater encountered and the anticipated watermain invert depth, dewatering will be needed to control groundwater within the trench excavations near the location of boring B27. Groundwater control is necessary to maintain stability of slopes, reduce the potential for disturbance to the subgrade, and permit construction of the watermain in dry conditions. We recommend lowering the groundwater level to a minimum of 3 feet below the anticipated excavation bottom. The specific

dewatering operations will depend on the rate and volume of groundwater flow and should be determined in the field by the dewatering contractor. Based on the granular soil conditions encountered in the borings, we anticipate relatively high capacity dewatering methods, such as the use of well-points, will likely be necessary to sufficiently dewater the excavations. If higher capacity dewatering methods are used, an evaluation of the potential effect of the anticipated groundwater drawdown on adjacent structures should be performed and the devices must be filtered to resist "sanding" or loss of fine soil from around the wells. The contractor should provide monitoring of sanding using meters made for that purpose or other techniques, such as diverting flow into a large barrel (usually a 50-gallon drum) to check for sand content. The final design of the dewatering system is typically the responsibility of the contractor and their geotechnical engineer. We would be pleased to assist you in the development of a performance-based specification for this portion of the project, if requested.

Even after dewatering, the subgrade can remain in a wet condition and sensitive to disturbances. In such cases, it may be necessary to undercut soft or disturbed subgrade to encounter suitable, undisturbed subgrade, and then backfill the undercut excavation with a layer of crushed aggregate, as discussed in Section 4.2. We recommend an SME representative be on-site during installation to identify unsuitable subgrade conditions requiring remediation, document subgrade improvement activities performed by the contractor, and verify subgrade for watermain support.

4.2 ENGINEERED FILL REQUIREMENTS

Engineered fill placed within the construction area, including utility trench backfill, should be an approved material, free of frozen soil or other deleterious materials. The proposed fill should not contain more than 4 percent organics. The fill should be spread in level layers not exceeding 9 inches in loose thickness and be compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with the Modified Proctor test. Sand fill should be compacted with appropriate vibratory compaction equipment that is capable of achieving the specified density throughout the entire lift thickness. Thinner lift thicknesses may be required to achieve suitable compaction using smaller compaction equipment.

Portions of the natural sands encountered in the borings are considered suitable for re-use as fill, provided these soils meet the requirements listed in the previous paragraph. However, soils with greater concentrations of clay or silt (e.g., soils having USCS group symbols "SC" or "SM") are moisture-sensitive, susceptible to disturbance when wet and often more difficult to compact. It may not be feasible to compact clayey or silty soils using smaller, walk-behind type compactors, as are commonly used to backfill utility trenches and foundation excavations. We do not recommend using clays or silts as structural trench backfill (e.g., soils having USCS group symbols "CL", "ML", "CL/ML" or "ML/CL").

The successful re-use of the alignment soils with greater concentrations of clay or silt for engineered fill will depend on the time of year, the care the earthwork contractor uses to slope subgrades and remove water during construction, and the time allowed in the construction schedule to moisture-condition soils, as-needed. During cold and wet periods of the year, the site sands containing greater concentrations of clay or silt may become wet and disturbed and it may not be feasible to sufficiently dry the soils so that they can be suitably compacted. The more existing soils that cannot be reused, will increase the amount of soil disposal and the amount of imported granular material (sand) needed to use as engineered fill. The potential effects of soil moisture conditions during the anticipated construction season should be considered when developing the project earthwork budget and schedule.

Coarse crushed aggregate used to backfill undercuts or to stabilize subgrades should consist of a well graded, crushed natural aggregate or crushed concrete ranging from 1 to 3 inches in size with no more than 7 percent by weight passing the No. 200 sieve. In cases where granular engineered fill will be placed over the crushed aggregate, the surface of the coarse crushed material should be choked with a layer of at least 6 inches of MDOT 21AA dense graded aggregate or covered with a suitable non-woven geotextile to prevent migration of the sand into the coarser crushed material.

4.3 CONSTRUCTION CONSIDERATIONS

The contractor must take precautions to protect adjacent existing structures during construction of the proposed improvements. Care must be exercised during the excavating and compacting operations so that excessive vibrations do not cause settlement of existing buildings, pavements, and utilities, and to avoid undermining existing foundations, pavements, or utilities when performing excavations for the proposed construction. In areas where there is not insufficient space to temporarily slope back excavations in accordance with applicable regulations, temporary earth retention systems will be required during construction. Underpinning, shoring and earth retention systems should be designed by a qualified professional engineer, and installed by a contractor experienced with construction of these systems.

Moisture conditioning, as discussed in Section 4.2, will likely not be feasible during seasonally cold and wet times of the year, resulting in a need for additional imported fill, and additional exported material, if the work is performed between the late fall and early spring seasons. Performing site work during the drier summer months should reduce the potential for subgrade disturbance and the need for improvement of the subgrade.

The contractor must provide a safely sloped excavation or an adequately constructed and braced shoring system in accordance with federal, state, and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, appropriate shoring must be used to resist the extra pressure due to the superimposed loads.

Handling, transportation, and disposal of excavated materials should be performed in accordance with applicable environmental regulations.

APPENDIX A

BORING LOCATION DIAGRAM (FIGURE NOS. 1 THROUGH 3)
BORING LOG TERMINOLOGY
BORING LOGS (B1 THROUGH B32)
USDA WEB SOIL SURVEY MAPS

SITE 1

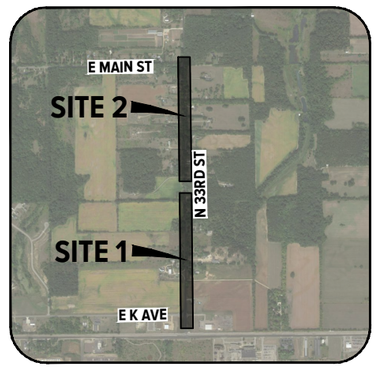
SITE 2

GRAPHIC SCALE: 1" = 200'

LEGEND

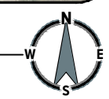
APPROXIMATE BORING LOCATION

NOTE:
BASE DRAWING INFORMATION TAKEN FROM GOOGLE EARTH PRO WITH IMAGE DATE 09/10/2017.



LOCATION MAP

NOT TO SCALE



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Project
33RD STREET UTILITY IMPROVEMENTS

Project Location
COMSTOCK TOWNSHIP, MICHIGAN

Sheet Name
BORING LOCATION DIAGRAM

No.	Revision Date

Date 04/09/2020
CADD JGR
Designer ZLM
Scale AS NOTED
Project 083873.00
Figure No. 1

PLOT DATE: Apr 10, 2020 - 7:41am - rios
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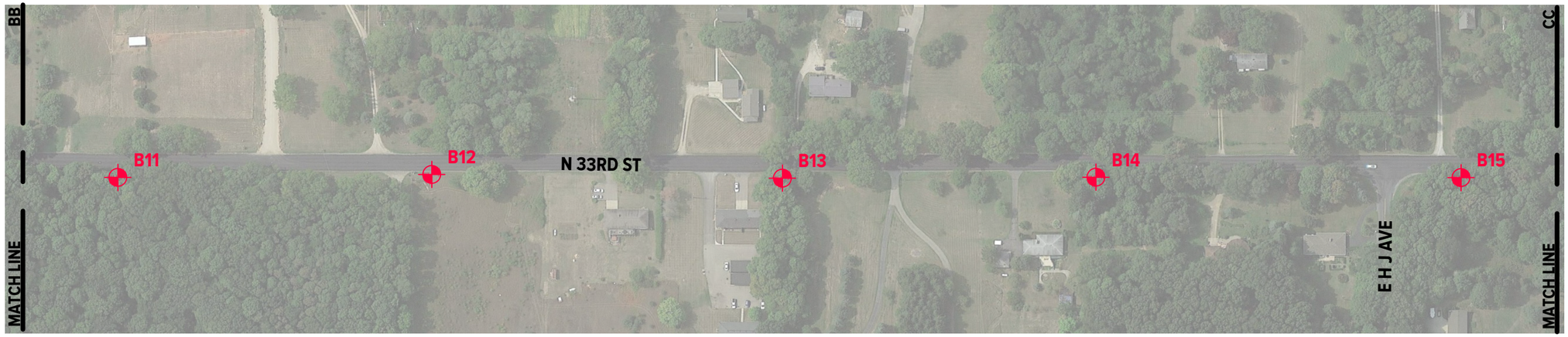
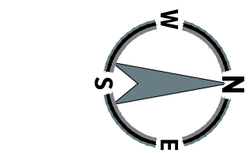


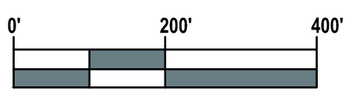
SITE 1

SITE 2

LEGEND

APPROXIMATE BORING LOCATION





GRAPHIC SCALE: 1" = 200'

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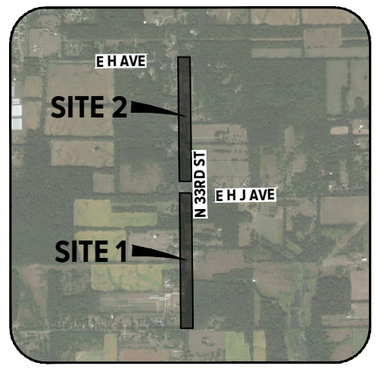

LOCATION MAP

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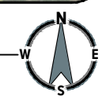

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COMSTOCK TOWNSHIP, MICHIGAN

Sheet Name
BORING LOCATION DIAGRAM

No.	Revision Date

Date 04/09/2020
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Project 083873.00
Figure No. 2

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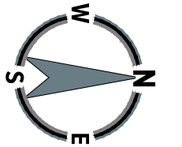
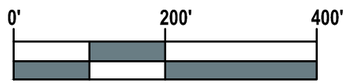
SITE 1

SITE 2





GRAPHIC SCALE: 1" = 200'

LEGEND

APPROXIMATE BORING LOCATION

NOTE:
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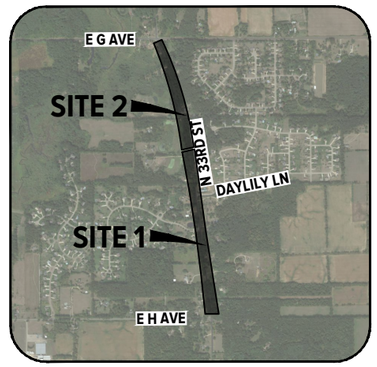
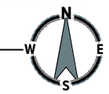


LOCATION MAP
NOT TO SCALE



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Project Location
COMSTOCK TOWNSHIP, MICHIGAN

Sheet Name
BORING LOCATION DIAGRAM

No.	Revision Date

Date: 04/09/2020
CADD: JGR
Designer: ZLM
Scale: AS NOTED
Project: 083873.00
Figure No.: 3

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BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)			
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)			
SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt, Glacial Till, Siltstone, Base, Coal, Limestone, Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

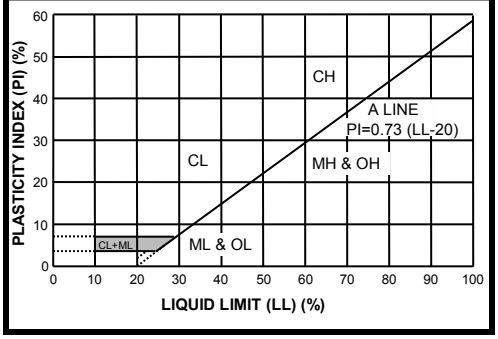
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)
- GM-GC (CLAYEY SILTY GRAVEL or CLAYEY SILTY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.0074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)
- OL/OH (ORGANIC SILT or ORGANIC CLAY)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressure Meter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N-Value (Blows per foot)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	50 to 80
Extremely Dense	Over 80

Cohesive Soils

Consistency	N-Value (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	0 - 2	0.25 or less
Soft	2 - 4	0.25 to 0.50
Medium	4 - 8	0.50 to 1.0
Stiff	8 - 15	1.0 to 2.0
Very Stiff	15 - 30	2.0 to 4.0
Hard	> 30	4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted.

BORING B 1

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel and Asphalt Pieces- Dark Brown- Moist (SM)		
1.0	FILL- Fine to Medium SAND with Silt and Gravel- Brown- Moist (SP-SM)	LS1	
2.0	FILL- Fine SAND- Brown- Moist (SP)		
3.5	FILL- Fine to Medium SILTY SAND- Brown and Dark Brown- Moist- Loose to Medium Dense (SM)	LS2	14, 11, 16
4.5	BURIED TOPSOIL- Sandy CLAYEY SILT- Occasional Wood and Roots- Dark Brown- Soft (ML/CL)		50/2"
5.5	Fine to Coarse SAND with Silt and Gravel- Brown- Moist- Medium Dense (SP-SM)		16, 13, 16, 16, 17, 17, 17
7.5	Fine to Medium SAND- Brown- Moist (SP)	LS3	18
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○ : 10 20 30 40; 50+

DRY DENSITY (pcf) -- ■ : 90 100 110 120
MOISTURE & ATTERBERG LIMITS (%) : PL MC LL; 10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF) : 1 2 3 4; 0.5

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 2

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 14 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Dark Brown- Moist (SM)	LS1	
1.0			
	Fine to Medium SILTY SAND- Frequent Clayey Sand Layers- Brown- Moist- Medium Dense to Loose (SM)	LS2	10, 21, 24, 30
5			35, 26, 26, 23
		LS3	19, 14, 11, 12
9.0			
	Fine to Medium SAND- Brown- Moist (SP)		
10.0			
10	END OF BORING AT 10.0 FEET.		
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 3

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Dark Brown- Moist (SM)	LS1	
2.0			
	Fine SAND with Silt- Brown- Moist- Loose to Medium Dense (SP-SM)	LS2	10, 8, 11, 16
5			16, 24, 29, 17
7.0			14, 23, 16, 16, 18
	Fine SAND- Brown- Moist- Medium Dense (SP)	LS3	
9.0			
	Fine to Coarse SAND- Brown- Moist (SP)		
10.0			
10	END OF BORING AT 10.0 FEET.		
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 4

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DCP (○)
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND- Dark Brown- Moist (SM)	LS1		
1.0				
	Fine to Medium SAND with Silt- Brown- Moist- Loose (SP-SM)	LS2	13 10 9 8	13 10 9 8
5			7 8 9	7 8 9
7.0		LS3	6 7 6 8 8	6 7 6 8 8
	Fine to Coarse SAND with Silt- Occasional Roots- Brown- Moist- Very Loose (SP-SM)			
10.0				
10	END OF BORING AT 10.0 FEET.			
15				

DRY DENSITY (pcf) -- ■ (90 100 110 120)
MOISTURE & ATTERBERG LIMITS (%) (PL MC LL) (10 20 30 40)
▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1 2 3 4)
REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 5

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 14 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)						
1.0	Fine SAND with Silt- Brown- Moist (SP-SM)	LS1					
2.5		LS2	10 16 20 19	10 16 20 19			
5	Fine to Medium SAND- Brown- Moist- Loose to Medium Dense (SP)		18 19 15 15	18 19 15 15			
		LS3	24 16 16 19	24 16 16 19			
10.0	END OF BORING AT 10.0 FEET.						
10							
15							

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 6

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 14 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Brown- Moist (SM)		
1.0		LS1	
	FILL- Fine to Medium SILTY SAND- Frequent Clayey Sand Seams- Brown- Moist (SM)		
4.0		LS2	
5			
	Fine SAND- Light Brown- Moist- Loose to Medium Dense (SP)	LS3	10 19 14 13 30 34
10.0			
10	END OF BORING AT 10.0 FEET.		
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 7

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ◈ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		OFFSET: 14 ft. East of Centerline STREET: 33rd Street LANE: Northbound Shoulder						
		SHOULDER AGGREGATE- Fine to Coarse SAND with Silt and Gravel- Brown- Moist (SP-SM)	LS1					
		1.5						
		Fine to Medium SAND- Brown- Moist- Loose to Very Loose (SP)	LS2					
5			LS3	11 13 7 5 4 4	11 13 7 5 4 4			
		8.5						
		Fine SAND- Light Brown- Moist (SP)						
		10.0						
10		END OF BORING AT 10.0 FEET.						
15								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 8

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Medium SILTY SAND with Gravel- Frequent Roots- Dark Brown- Moist (SM)	LS1	
1.0	Fine to Medium SILTY SAND- Brown- Moist (SM)		
4.0	Fine SAND with Silt- Brown- Moist- Medium Dense to Very Loose (SP-SM)	LS2	
5		LS3	14, 20, 13, 10, 5, 6
9.0	Fine to Medium SAND- Brown- Moist (SP)		
10.0	END OF BORING AT 10.0 FEET.		
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B 9

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Occasional Asphalt Millings- Brown- Moist (SM)	LS1	
1.0	FILL- Fine to Coarse CLAYEY SAND with Gravel- Frequent Clay Seams- Brown- Moist (SC)	LS2	
4.0	Fine to Medium SAND- Brown- Moist- Medium Dense (SP)	LS3	26 15 19 53 56 50/3"
7.0	Fine to Coarse SAND with Gravel- Brown- Moist- Medium Dense to Dense (SP)		
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B10

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Medium SILTY SAND with Gravel- Dark Brown- Moist (SM)	LS1	
1.5	FILL- Fine to Coarse CLAYEY SAND- Brown- Moist (SC)		
2.5	Fine to Medium SAND with Silt- Brown- Moist (SP-SM)	LS2	
3.5	Fine to Coarse SAND with Silt- Brown- Moist (SP-SM)		
5.5	Fine to Coarse SAND with Gravel- Brown- Moist- Medium Dense to Dense (SP)	LS3	17 29 37 35 55 62
9.0	Fine SAND- Light Brown- Moist (SP)		
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B11

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION (OFFSET: 13 ft. East of Centerline; STREET: 33rd Street; LANE: Northbound Shoulder)	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ☒ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⌖ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0		SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Occasional Roots and Asphalt Pieces- Brown- Moist (SM)	LS1					
2.0		FILL- Fine to Coarse SILTY SAND- Frequent Clay Seams- Brown- Moist (SM)						
3.0		FILL- Fine SILTY SAND- Frequent Roots and Clayey Sand Layers- Brown- Moist (SM)	LS2					
5.0		FILL- Sandy LEAN CLAY- Brown- Stiff (CL)				18	▽	
6.5		Fine to Medium SILTY SAND- Frequent Clay Seams- Brown- Moist- Medium Dense (SM)	LS3	34 33 30 28 28 30	34 33 30 28 28 30			
8.0		Fine to Medium SAND- Brown- Moist- Medium Dense (SP)						
10.0		END OF BORING AT 10.0 FEET.						
10								
15								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B12

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)	LS1	
2.0	Fine to Medium CLAYEY SAND- Dark Brown- Moist (SC)	LS2	
4.0	Fine to Medium SAND with Silt- Brown- Moist (SP-SM)		
6.0	Fine SAND with Silt- Brown- Moist- Medium Dense (SP-SM)	LS3	17 16 25 28 28 28
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B13

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 14 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Occasional Clay Seams and Roots- Brown- Moist (SM)	LS1	
2.5	Fine to Medium CLAYEY SAND- Frequent Silty Sand Layers- Brown- Moist (SC)	LS2	
5.0	Fine SAND with Silt- Brown- Moist (SP-SM)	LS3	
8.5	Fine SAND- Light Brown- Moist (SP)		
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○ (10, 20, 30, 40)

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)

MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B14

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)	LS1	
1.5	Sandy SILT- Frequent Clay Layers- Brown- Moist (ML)	LS2	
4.5	Fine SAND- Light Brown- Moist (SP)		
5			
5.5	SILT- Occasional Clay Layers- Brown- Moist- Loose to Dense (ML)	LS3	30 17 13 45 52 60
10			
10.0	END OF BORING AT 10.0 FEET.		
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B15

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SAND with Silt and Gravel- Brown- Moist (SP-SM)	LS1	
2.5	Fine SAND with Silt- Brown- Moist (SP-SM)	LS2	
5.0	SILT- Occasional Sand Seams- Brown to Gray- Moist to Wet- Medium Dense to Very Dense (ML)	LS3	21 40 66 50/2"
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

DEPTH (FT)

▼ AT END OF BORING: 9.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B16

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) (PL MC LL; 10 20 30 40)	▽ HAND PENE. ☒ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ◈ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)	LS1					
2.0							
	Fine SAND with Silt- Brown- Moist- Medium Dense (SP-SM)	LS2					
5							
		LS3	25	25			
			21	21			
			20	20			
			15	15			
			20	20			
			22	22			
8.0							
	Fine to Medium SAND- Brown- Moist (SP)						
10.0							
10	END OF BORING AT 10.0 FEET.						
15							

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B17

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)		
1.0	Fine to Medium SILTY SAND- Brown- Moist (SM)	LS1	
2.0	Fine to Medium SILTY to CLAYEY SAND- Brown- Moist (SM/SC)		
3.5		LS2	
5	Fine to Medium SAND with Silt- Frequent Clay Layers- Brown- Moist- Medium Dense to Dense (SP-SM)	LS3	16 19 22 18 16 50
10.0	END OF BORING AT 10.0 FEET.		
10			
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B18

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)		
1.0	FILL- Fine to Medium SAND with Silt- Occasional Clay Layers and Asphalt Pieces- Brown- Moist (SP-SM)	LS1	
3.0	Sandy CLAYEY SILT- Frequent Root Fibers- Trace Organics- Brown- Stiff to Medium (ML/CL)	LS2	
5.5	Fine to Coarse CLAYEY SAND with Gravel- Brown- Moist (SC)		60/3"
7.0	Fine to Medium SAND- Brown- Moist (SP)	LS3	
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40
60+

DRY DENSITY (pcf) -- ■
90 100 110 120
MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40
29
32

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4
0.5

REMARKS

Moisture content and shear strength tests performed on a clay layer. A loss-on-ignition (LOI) test performed at 2.5 feet indicates an organic content of about 3.4 percent. A loss-on-ignition (LOI) test performed at 4 feet indicates an organic content of about 3.2 percent. Blow counts were influenced by a possible rock.

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B19

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/23/20 **COMPLETED:** 3/23/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 14 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Occasional Asphalt Pieces and Roots- Brown- Moist (SM)	LS1	
2.0	FILL- Sandy LEAN CLAY- Occasional Roots- Brown- Stiff (CL)		
3.0	Fine to Coarse CLAYEY SAND- Occasional Roots- Brown- Moist (SC)	LS2	
5.0	Fine SAND- Brown- Moist- Medium Dense (SP)	LS3	28 30 31 31 25 22
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B20

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 16 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)		
1.0	Fine to Medium CLAYEY to SILTY SAND- Frequent Clay Layers and Root Fibers- Trace Organics- Brown- Moist (SC/SM)	LS1	
2.5	Fine to Medium SAND with Silt- Frequent Clayey Sand Layers- Brown- Moist (SP-SM)		
3.5	Fine to Medium SAND- Brown- Moist- Medium Dense (SP)	LS2	
5			
7.0	Fine to Coarse SAND with Silt and Gravel- Brown- Moist- Dense to Very Dense (SP-SM)	LS3	20 28 50 50/3"
9.5	Fine SILTY SAND- Brown- Moist to Wet (SM)		
10.0	END OF BORING AT 10.0 FEET.		
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⌖ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

The moisture content and shear strength tests were performed on a clay layer. A loss-on-ignition (LOI) test performed at 2 feet indicates an organic content of about 3.3 percent.

GROUNDWATER & BACKFILL INFORMATION

DEPTH (FT)

▼ **AT END OF BORING:** 10.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B21

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	REMARKS
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Brown- Moist (SM)			
1.0	Fine to Medium CLAYEY to SILTY SAND- Brown- Moist (SC/SM)	LS1		
2.5	Fine SAND with Silt- Brown- Moist (SP-SM)	LS2		
5		LS3	70/3"	Blow counts were influenced by a possible rock.
8.0	END OF BORING AT 8.0 FEET.			
10				
15				

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40
70+

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⌖ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B22

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	SYMBOLIC PROFILE	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES
0		SHOULDER AGGREGATE- Fine to Medium SILTY SAND with Gravel- Brown- Moist (SM)		
1.0		FILL- Fine to Medium SILTY SAND- Frequent Clay Seams- Brown- Moist (SM)	LS1	
4.0		Fine to Medium SAND with Silt- Brown- Moist- Very Loose (SP-SM)	LS2	
5			LS3	7 7 5 3 4 6
9.0		Fine to Medium SAND- Brown- Moist (SP)		
10.0		END OF BORING AT 10.0 FEET.		
10				
15				

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B23

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ◈ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Dark Brown- Moist (SM)	LS1					
1.5	FILL- Fine to Medium SILTY SAND- Brown- Moist (SM)						
2.5	CLAYEY SILT- Frequent Root Fibers- Trace Organics- Brown- Stiff (ML/CL)	LS2			MC = 32	▽	A loss-on-ignition (LOI) test performed at 4 feet indicates an organic content of about 3.7 percent.
5							
5.0	Fine to Medium SAND with Silt- Brown- Moist- Medium Dense (SP-SM)	LS3	16 20 21 24 28 30	○ 16 ○ 20 ○ 21 ○ 24 ○ 28 ○ 30			
9.5	Fine to Medium SAND- Brown- Moist (SP)						
10	10.0 END OF BORING AT 10.0 FEET.						
15							

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B24

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan

DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20 **BORING METHOD:** Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe **LOGGED BY:** JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%) PL MC LL	SHEAR STRENGTH (KSF) ▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU)	REMARKS
0 – 1.5	SHOULDER AGGREGATE- Fine to Coarse CLAYEY SAND with Gravel- Frequent Asphalt Pieces- Dark Brown- Moist (SC)	LS1					
1.5 – 2.5	CLAYEY SILT- Frequent Root Fibers- Trace Organics- Brown- Medium (ML/CL)	LS1			MC 29	0.6 (Torvane shear)	
2.5 – 4.0	Sandy LEAN CLAY- Brown- Stiff (CL)	LS1			MC 17	Hand pene.	
4.0 – 5.5	Fine to Medium SILTY SAND- Brown- Moist (SM)	LS2					
5.5 – 10.0	Fine to Coarse SAND- Brown- Moist- Medium Dense to Loose (SP)	LS3	21, 22, 17, 13, 13, 8	21, 22, 17, 13, 13, 8			

END OF BORING AT 10.0 FEET.

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B25

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DCP (○)
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces and Roots- Dark Brown- Moist (SM)	LS1		
1.0	FILL- Fine to Medium CLAYEY SAND- Brown- Moist (SC)	LS2		
4.5	Fine to Medium SILTY SAND- Brown- Moist- Loose to Medium Dense (SM)	LS3	15 12 9 12 15 21	15 12 9 12 15 21
8.0	Fine to Medium SAND- Brown- Moist- Medium Dense (SP)			
10.0	END OF BORING AT 10.0 FEET.			
15				

DRY DENSITY (pcf) -- ■ (90 100 110 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)
▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1 2 3 4)
REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B26

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 16 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Medium SILTY SAND with Gravel- Frequent Roots- Dark Brown- Moist (SM)		
1.0	Fine to Medium SAND- Brown- Moist (SP)	LS1	
3.0	Fine to Coarse SAND- Brown- Moist to Wet- Medium Dense to Loose- (SP)	LS2	
5		LS3	38
			36
			22
			12
			12
			19
9.0	Fine to Medium SAND- Brown- Moist to Wet (SP)		
10.0	END OF BORING AT 10.0 FEET.		
10			
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⌖ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

DEPTH (FT)

▼ **AT END OF BORING:** 8.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B27

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○	DRY DENSITY (pcf) -- ■ / MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Millings- Brown- Moist (SM)						
1.0	FILL- Fine to Medium SILTY SAND- Frequent Silty Clay Layers- Brown- Moist to Wet (SM)	LS1			29	0.3 ⊠	Moisture content and shear strength tests performed on a clay layer.
2.5	FILL- Fine to Medium SAND with Silt- Frequent Clay Layers- Gray- Wet (SP-SM)	LS2			29	0.5 ⊠	Moisture content and shear strength tests performed on a clay layer.
4.0	FIBROUS PEAT- Black (PT)				>> 345		
6.0	AMORPHIC PEAT- Frequent Sand Layers- Brown (PT)	LS3	8 11 15 17 22 23	8 11 15 17 22 23	>> 66		
10.0	Sandy ORGANIC SILT- Frequent Sand Layers- Brown- Soft (OL)	LS4			>> 67	0.2 ⊠	
13.5	CLAYEY SILT- Gray- Medium (ML/CL)	LS5				0.8 ⊠	
14.5	Fine to Coarse SAND- Gray- Wet (SP)						
16.0	END OF BORING AT 16.0 FEET.						

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	3.0
▼ AT END OF BORING:	2.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B28

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 16 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND- Occasional Roots- Dark Brown- Moist (SM)	LS1	
1.5	FILL- Fine to Medium SILTY SAND- Brown- Moist (SM)	LS2	
4.0	Fine to Medium SAND- Brown- Moist- Medium Dense (SP)	LS3	35 27 26 26 19 23
5			
10	END OF BORING AT 10.0 FEET.		
10.0			
15			

DYNAMIC CONE PENETROMETER (DCP) -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B29

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 14 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Frequent Asphalt Pieces- Brown- Moist (SM)						
1.0	FILL- Fine to Medium SAND with Silt- Brown- Moist (SP-SM)	LS1					
2.5	FILL- Fine to Medium CLAYEY SAND- Buried Topsoil Seam at 3.5 feet- Brown- Moist (SC)	LS2					
3.5	LEAN CLAY- Occasional Sand Seams- Brown- Stiff (CL)	LS3	12 12 13 24 31 22	12 12 13 24 31 22	27 26	▽ ▽	
5							
8.0	Fine to Medium SILTY SAND with Gravel- Brown- Moist- Medium Dense (SM)						
9.0	Fine to Medium SAND- Brown- Wet (SP)						
10.0	END OF BORING AT 10.0 FEET.						
10							
15							

GROUNDWATER & BACKFILL INFORMATION

DEPTH (FT)

▼ AT END OF BORING: 9.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B30

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 15 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ⊕ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	SHOULDER AGGREGATE- Fine to Medium SILTY SAND with Gravel- Brown- Moist (SM)	LS1					
0.5							
	Fine to Medium SAND with Silt- Brown- Moist- Loose to Medium Dense (SP-SM)	LS2					
5		LS3	15	15			
			20	20			
			24	24			
			20	20			
			15	15			
			13	13			
8.0							
	Fine to Medium SAND- Brown- Moist to Wet- Loose (SP)						
10	END OF BORING AT 10.0 FEET.						
10.0							
15							

GROUNDWATER & BACKFILL INFORMATION

DEPTH (FT)

▼ AT END OF BORING: 8.5

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B31

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 13 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120) / MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	HAND PENE. ▽ / TORVANE SHEAR ⊠ / UNC.COMP. ○ / VANE SHEAR (PK) ⊡ / VANE SHEAR (REM) ⤫ / TRIAXIAL (UU) ⌖ SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
0	0.3 4 inches of TOPSOIL						
	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Dark Brown- Moist (SM)						
	1.0 FILL- Fine to Medium SILTY SAND- Frequent Topsoil Seams- Brown- Moist (SM)	LS1					
	2.0	LS2					
5	Fine to Medium SAND with Silt- Occasional Silty Sand Layers- Gray- Moist to Wet- Loose to Medium Dense (SP-SM)	LS3	11 13 15 17 16 14	11 13 15 17 16 14			
10	10.0 END OF BORING AT 10.0 FEET.						
15							

GROUNDWATER & BACKFILL INFORMATION

DEPTH (FT)

▼ **AT END OF BORING:** 6.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B32

PROJECT NAME: 33rd Street Utility Improvements
PROJECT NUMBER: 083873.00
CLIENT: Jones & Henry Engineers
PROJECT LOCATION: Comstock Township, Michigan
DATE STARTED: 3/24/20 **COMPLETED:** 3/24/20
BORING METHOD: Direct Push
FIELD REPRESENTATIVE: ZAH **EQUIPMENT:** Geoprobe
LOGGED BY: JWM **CHECKED BY:** ZLM

OFFSET: 18 ft. East of Centerline
STREET: 33rd Street
LANE: Northbound Shoulder

DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO.	BLOWS PER SIX INCHES
0	SHOULDER AGGREGATE- Fine to Coarse SILTY SAND with Gravel- Brown- Moist (SM)	LS1	
1.5	FILL- Fine to Medium CLAYEY SAND- Occasional Silt and Clay Layers- Brown and Dark Brown- Moist (SC)	LS2	
4.5	Fine to Medium SAND- Gray- Moist to Wet- Loose to Medium Dense (SP)	LS3	14, 20, 21, 20, 22, 23
10.0	END OF BORING AT 10.0 FEET.		

DYNAMIC CONE PENETROMETER (DCP) -- ○ (10, 20, 30, 40)

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10, 20, 30, 40)

▽ HAND PENE.
⊠ TORVANE SHEAR
○ UNC.COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF) (1, 2, 3, 4)

REMARKS

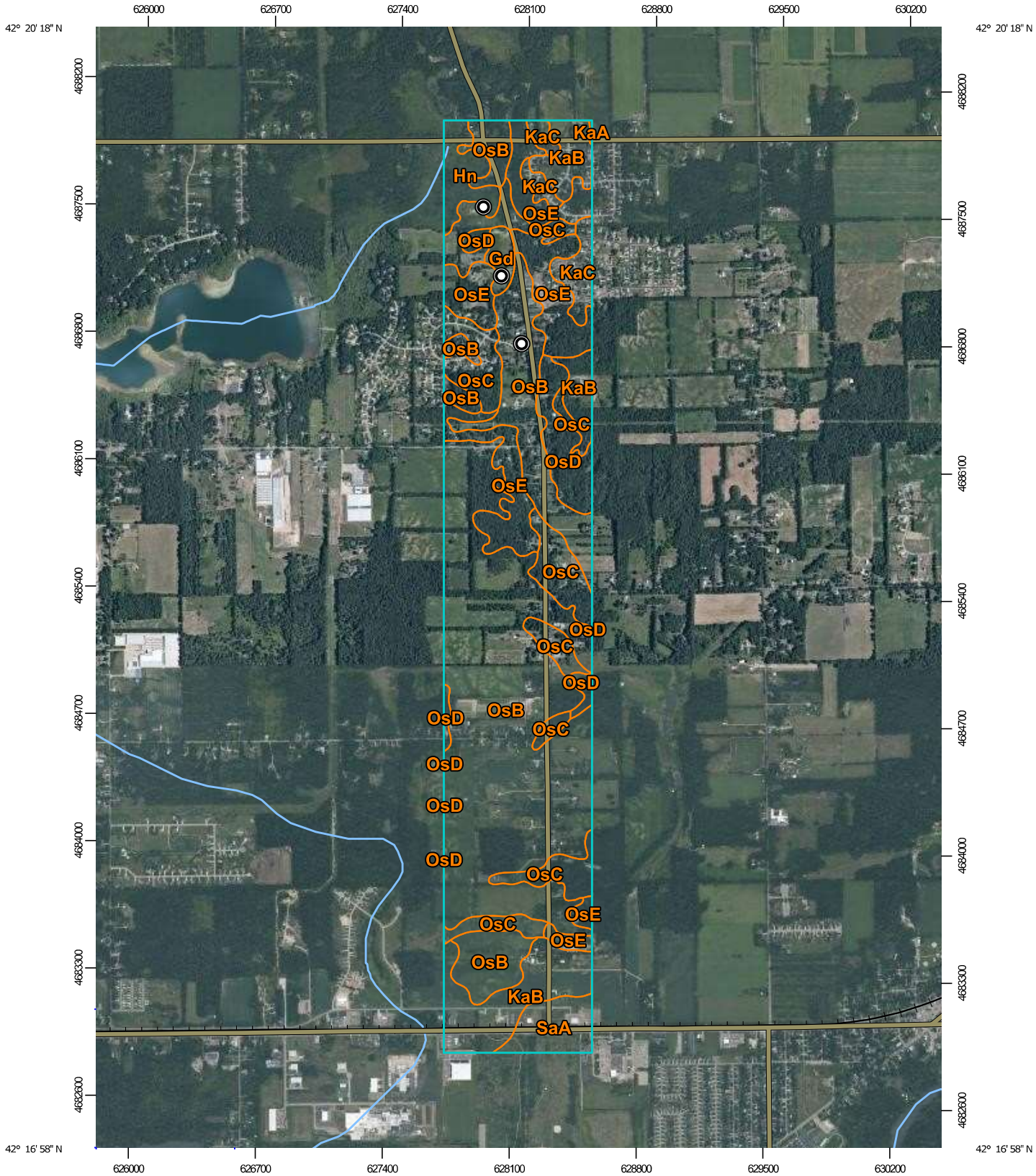
GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)
▽ DURING BORING:	5.0
▼ AT END OF BORING:	5.0

BACKFILL METHOD: Sand & Gravel

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

Soil Map—Kalamazoo County, Michigan
(33rd Street)



Map Scale: 1:30,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 400 800 1600 2400

Feet: 0 1000 2000 4000 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kalamazoo County, Michigan
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

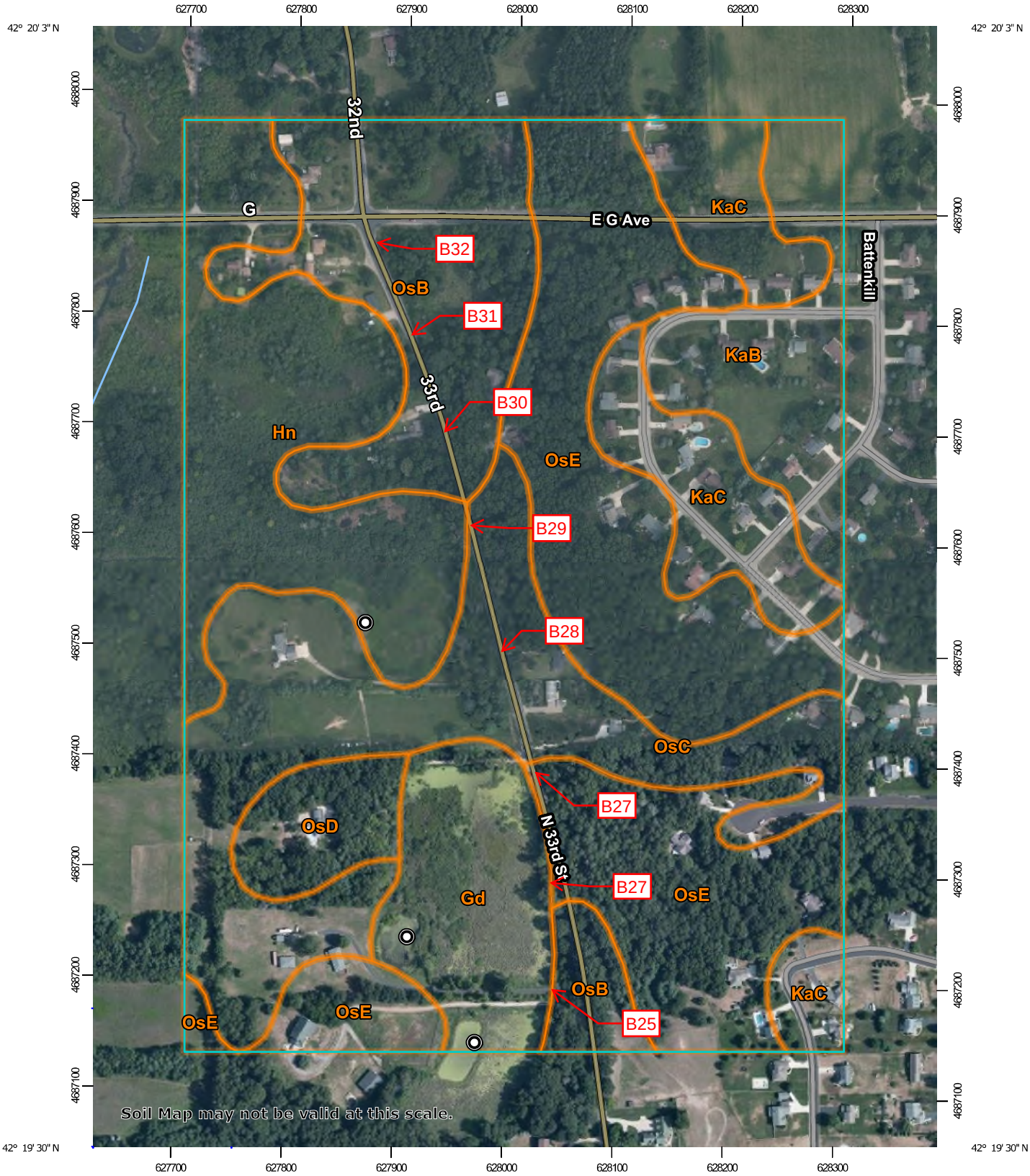
Date(s) aerial images were photographed: Jul 5, 2018—Sep 4, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Gd	Gilford sandy loam, 0 to 2 percent slopes, gravelly subsoil	10.8	1.0%
Hn	Houghton muck, 0 to 1 percent slopes	27.2	2.6%
KaA	Kalamazoo loam, 0 to 2 percent slopes	0.4	0.0%
KaB	Kalamazoo loam, 2 to 6 percent slopes	102.2	9.8%
KaC	Kalamazoo loam, 6 to 12 percent slopes	28.7	2.8%
OsB	Oshtemo sandy loam, 0 to 6 percent slopes	525.7	50.5%
OsC	Oshtemo sandy loam, 6 to 12 percent slopes	132.3	12.7%
OsD	Oshtemo sandy loam, 12 to 18 percent slopes	46.1	4.4%
OsE	Oshtemo sandy loam, 18 to 35 percent slopes	135.1	13.0%
SaA	Schoolcraft loam, 0 to 2 percent slopes	31.5	3.0%
Totals for Area of Interest		**1,040.0**	**100.0%**

Soil Map—Kalamazoo County, Michigan



Map Scale: 1:4,930 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kalamazoo County, Michigan
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 5, 2018—Sep 4, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Gd	Gilford sandy loam, 0 to 2 percent slopes, gravelly subsoil	8.8	7.1%
Hn	Houghton muck, 0 to 1 percent slopes	18.3	14.7%
KaB	Kalamazoo loam, 2 to 6 percent slopes	8.7	7.0%
KaC	Kalamazoo loam, 6 to 12 percent slopes	12.0	9.6%
OsB	Oshtemo sandy loam, 0 to 6 percent slopes	17.5	14.0%
OsC	Oshtemo sandy loam, 6 to 12 percent slopes	22.4	17.9%
OsD	Oshtemo sandy loam, 12 to 18 percent slopes	3.8	3.0%
OsE	Oshtemo sandy loam, 18 to 35 percent slopes	33.5	26.8%
Totals for Area of Interest		**124.9**	**100.0%**

APPENDIX B

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

GENERAL COMMENTS

LABORATORY TESTING PROCEDURES

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110º C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440º C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

Passionate People Building
and Revitalizing our World

SME

33rd STREET UTILITY IMPROVEMENTS – MUCK PROBE RESULTS
SME Project No. 083873.00
DATE: May 15, 2020
Performed By: JM/KG

MUCK PROBE	MUCK PROBE LOCATION		REFUSAL DEPTH BELOW GROUND SURFACE
	STATION	OFFSET EAST OF EDGE OF METAL	
MP 1	80 Feet South of Culvert	8 Feet	2 Feet
MP 2	60 Feet South of Culvert	7.5 Feet	4 Feet
MP 3	40 Feet South of Culvert	6.5 Feet	6 Feet
MP 4	20 Feet South of Culvert	8.5 Feet	8 Feet
MP 5	At Culvert	8.5 Feet	12 Feet
MP 6	20 Feet North of Culvert	8 Feet	14 Feet
MP 7	40 Feet North of Culvert	8 Feet	12 Feet
MP 8	60 Feet North of Culvert	7 Feet	8 Feet
MP 9	80 Feet North of Culvert	7.5 Feet	9 Feet
MP 10	100 Feet North of Culvert	8 Feet	7 Feet
MP 11	120 Feet North of Culvert	8 Feet	4 Feet
MP 12	140 Feet North of Culvert	8 Feet	3 Feet

NOTES:

1) Muck probes performed along east side of N. 33rd Street.
2) Muck probe stations referenced from an existing culvert located approximately 1,420 feet north of Daylily Lane.
3) Muck probe refusal depths referenced from existing ground surface elevation.
4) Ground surface at the muck probe locations ranged from about 1 to 3 feet below the adjacent pavement surface.
5) MP5 performed adjacent to existing culvert.
6) MP7 performed adjacent to Boring B27.