PUBLIC IMPROVEMENT REQUEST FOR PROPOSAL

RFP# 25-39

High-Level Trunkline Capacity Improvements Project

City of Ann Arbor
Public Services / Engineering

Due Date: October 30, 2025 by 11:00 a.m. (local time)

Issued By:

City of Ann Arbor
Procurement Unit
301 E. Huron Street
Ann Arbor, MI 48104

TABLE OF CONTENTS

BULLETIN No. 1

RFP No. 25-39

High-Level Trunkline Capacity Improvements

The information contained herein shall take precedence over the original documents and all previous addenda (if any) and is appended thereto. **This Bulletin includes a total of 1 page.**

Proposals for RFP 25-39 were opened on October 30, 2025. The proposal recommended for award, from contractor Ric-Man Construction, Inc., was based on a different microtunneling method than designed. The proposed method involves microtunneling a 60-inch concrete jacking pipe and then installing the 36-inch fiberglass-reinforced carrier pipe inside the jacking pipe and making the shaft in First and Miller the launching shaft for both sewer runs. This alternative was discussed and approved by the project engineers. The changes to the plans and specifications due to this alternative design replace the original design documents and will now be the basis for the construction contract.

I. CORRECTIONS/ADDITIONS/DELETIONS

Changes to the construction documents which are outlined below are referenced to a page or Section in which they appear conspicuously.

Section/Page(s)	Change
Technical Specification:	
31 09 13 - Geotechnical Instrumentation and Monitoring	Replace in its entirety
31 41 00 - Shaft Construction and Support	Replace in its entirety
31 73 00 - Contact Grouting	Replace in its entirety
31 73 01 - Carrier Pipe Installation and Backfill	Add attached specification
33 05 07.36 - Microtunneling	Replace in its entirety
33 05 36 - Fiberglass-Reinforced Carrier Pipe	Replace in its entirety Replaces 33 05 36 – Fiberglass-Reinforced Jacking Pipe
33 05 40 - Reinforced Concrete Jacking Pipe	Add attached specification
Plans:	
RFP 25-39 Plan Sheets 1-42	Replace in their entirety with Revision 4 – Construction Set; 12/02/2025

ADDENDUM No. 2

RFP No. 25-39

High-Level Trunkline Capacity Improvements

Due: October 30, 2025, at 11:00 AM (local time)

The information contained herein shall take precedence over the original documents and all previous addenda (if any) and is appended thereto. **This Addendum includes seventeen (17) pages.**

The Proposer is to acknowledge receipt of this Addendum No. 2, including all attachments in its Proposal by so indicating in the proposal that the addendum has been received. Proposals submitted without acknowledgement of receipt of this addendum may be considered non-conforming.

The following forms provided within the RFP Document should be included in submitted proposal:

- **Attachment B - General Declarations**
- **Attachment D - Prevailing Wage Declaration of Compliance**
- **Attachment E - Living Wage Declaration of Compliance**
- **Attachment G - Vendor Conflict of Interest Disclosure Form**
- **Attachment H - Non-Discrimination Declaration of Compliance**

Proposals that fail to provide these completed forms listed above upon proposal opening may be rejected as non-responsive and may not be considered for award.

I. CORRECTIONS/ADDITIONS/DELETIONS

Changes to the RFP documents which are outlined below are referenced to a page or Section in which they appear conspicuously. Offerors are to take note in its review of the documents and include these changes as they may affect work or details in other areas not specifically referenced here.

Section/Page(s)	Change
Schedule of Pricing/Cost Section III, Part E	Replace in its entirety.
Technical Specification, 33 05 36 Fiberglass-Reinforced Jacking Pipe	Replace in its entirety. Removed requirements for Centrifugally Cast Fiberglass Pipe.
Detailed Specification, Project Schedule and Payment	Replace in its entirety.

Detailed Specification, Project Coordination	Replace in its entirety.
Detailed Specification, Bollard	Add attached specification.
RFP 25-39 Plans, Sheets 17, 18 and 21	Replace in their entirety.

II. QUESTIONS AND ANSWERS

The following Questions have been received by the City. Responses are being provided in accordance with the terms of the RFP. Respondents are directed to take note in its review of the documents of the following questions and City responses as they affect work or details in other areas not specifically referenced here.

Question 1: Is temporary removal or relocation of the underground fiber optic and electrical lines east of manhole S-2 feasible for shaft construction and utility work?

Answer 1: No, the proposed shaft location has been shown based on the location of these utilities. The electrical line is a substation feed which is unable to be relocated by DTE.

Question 2: Specification Section 33 05 07.36, Paragraph 1.04.F and 1.08.H state that dewatering is not allowed for the trenchless drive or shaft excavation where microtunneling is required, except when soldier pile and lagging shaft construction is used. Where are soldier pile shafts allowed?

Answer 2: Soldier pile shafts are only permitted where existing active utility penetrations prevent the installation of a watertight shaft.

Question 3: When and at what locations dewatering is allowed?

Answer 3: Dewatering is permitted for local sewer connections and when soldier pile and lagging shaft construction is utilized to accommodate existing utility penetrations into the shaft. Where soldier pile shafts are used at locations with utility penetrations, the contractor must make all efforts to minimize dewatering by using ground improvement techniques at the penetrations to prevent groundwater inflow.

Question 4: With regards to the shaft construction, is it the intent of the Engineer/Owner that all shafts be constructed watertight?

Answer 4: Yes, unless existing utility penetrations prevent watertight construction.

Question 5: Refer to Sheet 22 of 42. The Washington Diversion Structure Bypass states to bypass from MH 71-70522 to MH 71-50554. There is no MH 71-50554, is this meant to be MH 71-70554 or another manhole?

Answer 5: Yes, this is a typo and should refer to MH 71-70554 and not MH 71-50554.

Question 6: What is the pipe material for the existing 30-inch sanitary sewer on First Street?

Answer 6: The existing 30-inch sanitary sewer along First Street is concrete pipe installed in approximately 1926 via tunnel construction method. It was lined with a structural cured-in-place pipe liner in 2024.

Question 7: Reference Sheet 19. When can the 21-inch Sanitary heading to the west from MH 71-70467 be abandoned?

Answer 7: The section of 21-inch sanitary sewer can be abandoned following the installation of the proposed 36-inch sewer along Washington Street. At the Contractor's discretion, the 21-inch sewer in this section can be abandoned earlier for the construction of the shaft at Sta 150+70, but the bypass pump discharge that is routed into the 21-inch sewer must be redirected to either MH 71-70467, or MH S-2 if the proposed First Street sewer is able to accept flow.

Question 8: When can the sanitary sewer between 71-70466 and 71-70473 be abandoned?

Answer 8: The 10-inch sanitary sewer between 71-70473 and 71-70466 can be abandoned as soon as the proposed 10-inch sanitary sewer from S-10 to 71-70466 is placed into service. This proposed 10-inch sanitary sewer can be placed into service immediately after air testing and video inspection, however a mandrel test must still be completed after 30 days have passed from installation.

Question 9: Is the Owner providing and paying for all backfill, concrete subbase and other testing (other than those specifically required of the Contractor) required in the specs?

Answer 9: Yes, all material testing not required by the specifications will be provided by the Owner.

Question 10: What surveying will be provided by the Owner?

Answer 10: All construction surveying shall be performed by the Contractor.

Question 11: The tunnel project crosses below an elevated railroad on West Washington Street. The contract requires a railroad protective insurance policy. Is there a railroad agreement associated with this project, and if so can it be made available to bidders?

Answer 11: The Owner is in the process of obtaining the final railroad agreement from Watco. A railroad protective insurance policy will be required in accordance with the contract and the contractor will be expected to execute

Question 12: The contract requires surface monitoring points be installed on the RR bridge. Is there an entry agreement with the RR or any special requirements for the Contractor to follow when entering RR property to install, monitor and remove these points?

Answer 12: The Owner is in the process of obtaining the final railroad agreement from Watco. All costs associated with entering the railroad right-of-way not otherwise identified in the Contract, such as flagging, shall be covered by the Owner.

Question 13: Dewatering requirements for this project will likely exceed 70 gpm, triggering the EGLE requirements outlined in Technical specification 31 23 19 – 5, Dewatering, Section 3.03 Permitting, items A-D. The specifications allow discharge to the Ann Arbor storm sewer system provided the water is treated and meets the EGLE discharge requirements. The Contractor is directed to the EGLE website to register and then input dewatering assumptions to assist is dewatering system adequacy. Would this dewatering information be required to be submitted with the bid or just included in the dewatering plan submittal after award?

Answer 13: This information shall be included in the dewatering plan submittal after aware. The Owner has preemptively registered for dewatering under EGLE Part 327 and will update that registration as necessary based on the Contractor's dewatering plan submittal.

Question 14: The specifications call for nominal 36" FRP. FRP Jack Pipe is 34.3" ID, is this acceptable?

Answer 14: Yes.

Question 15: Plan Sheets 10 and 17 have a total of 1,489 square yards of HMA removal areas, but the bid form item 02021.00, entitled “HMA Surface, Rem”, and only has a quantity of 257 SY. Please clarify.

Answer 15: The surface callouts for Washington Street (Plan Sheet 10) are based on an HMA surface, but the boring information indicates that these sections will likely all be composite pavement and subsequently paid for as Item 02025.00 “Concrete Pavt, Any Thickness, Rem”, which is reflected in the bid form quantities.

Question 16: Plan Sheet 19 of 42 has a note located in the upper left portion of the page that states “SHAFT SIZE SHOWN IS INDICATIVE, CONTRACTOR MAY TUNNEL UNDERNEATH MANHOLE 71-70527 OR RECEIVE AND RELAUNCH MTBM AT THEIR OPTION.” The same note appears on sheet 20 of 42 and 21 of 42. We are unable to locate Manhole 71-70527. Please provide the location of this manhole?

Answer 16: Existing manhole 71-70527 is located at Station 103+80 along Washington Street, at the same location as proposed manhole S-7.

Question 17: Can you please clarify which permits are required for the project, who is responsible for applying for each, and which party (City or Contractor) will be responsible for payment?

Answer 17: The project permit list is as follows:

Permit	**Responsible for Application**	**Responsible for Payment**
EGLE Part 41 Permit	City of Ann Arbor	City of Ann Arbor
MDOT ROW Permit	City of Ann Arbor	City of Ann Arbor
WCWRC Drain Use Permit	City of Ann Arbor	City of Ann Arbor
EGLE Part 327 Water Withdrawal Permit	City of Ann Arbor	City of Ann Arbor
City of Ann Arbor Dewatering Permit	City of Ann Arbor	City of Ann Arbor
Ann Arbor (Watco) Railroad Permit to Enter (*Contractor to provide RPL Insurance)	City of Ann Arbor	City of Ann Arbor
City of Ann Arbor Lane Closure Permit	Contractor	City of Ann Arbor
City of Ann Arbor “No Parking” Signs Permit	Contractor	City of Ann Arbor
City of Ann Arbor Grading / Soil Erosion & Sedimentation Control Permit	Contractor	City of Ann Arbor
City of Ann Arbor Right-Of-Way Permit	Contractor	City of Ann Arbor

Question 18: Please clarify the stationing on Washinton Street in relation to Manhole S-2. The stationing does not align with the tunnel runs?

Answer 18: The structure stationing for S-2 is shown based on the project stationing for First Street. The associated stationing of S-2 along Washington Street is 105+65.

Offerors are responsible for any conclusions that they may draw from the information contained in the Addendum.

ADDENDUM No. 1

RFP No. 25-39

High-Level Trunkline Capacity Improvements

Due: October 30, 2025, at 11:00 AM (local time)

The information contained herein shall take precedence over the original documents and all previous addenda (if any) and is appended thereto. **This Addendum includes eleven (11) pages.**

The Proposer is to acknowledge receipt of this Addendum No. 1, including all attachments in its Proposal by so indicating in the proposal that the addendum has been received. Proposals submitted without acknowledgement of receipt of this addendum may be considered non-conforming.

The following forms provided within the RFP Document should be included in submitted proposal:

- **Attachment B – General Declarations**
- **Attachment D - Prevailing Wage Declaration of Compliance**
- **Attachment E - Living Wage Declaration of Compliance**
- **Attachment G - Vendor Conflict of Interest Disclosure Form**
- **Attachment H - Non-Discrimination Declaration of Compliance**

Proposals that fail to provide these completed forms listed above upon proposal opening may be rejected as non-responsive and may not be considered for award.

I. QUESTIONS AND ANSWERS

The following Questions have been received by the City. Responses are being provided in accordance with the terms of the RFP. Respondents are directed to take note in its review of the documents of the following questions and City responses as they affect work or details in other areas not specifically referenced here.

Question 1: Can the sign-in sheet from the pre-proposal meeting be provided?
Answer 1: Yes, the minutes and sign-in sheet from September 29, 2025, pre-proposal meeting are attached.

Offerors are responsible for any conclusions that they may draw from the information contained in the Addendum.

Pre-Proposal Meeting Notes

High-Level Trunkline Capacity Improvements Project
RFP No. 25-39

Monday, September 29, 2025
Ann Arbor City Hall, Basement Conference Room

1. Introductions / Sign-In Sheet

2. Purpose of Meeting

3. Administrative Procedures

A. Respondents are required to attend Pre-Proposal Meeting in order to submit a proposal. Failure to attend the meeting and sign the RFP sign-in sheet or be confirmed in attendance on the virtual meeting will automatically disqualify a bidder from submitting a valid proposal. See attached sign in sheet for in person and online attendance.

B. Oral statements made at this meeting or any time during the bidding process may not be relied upon or binding. All questions about the meaning or the intent of the Bidding Documents are to be submitted in writing to the Engineers below. Interpretations or clarifications considered necessary by the Engineer in response to questions will be issued by Addenda delivered to all parties recorded as having received Bidding Documents.

1) Final Day for Contractor's Written Questions is Thursday, October 16, 2025 at 5:00 pm.
2) Questions to be sent via email as indicated in the RFP.
3) Responses to Contractor's Written Questions will be addressed in an addendum during the week of October 20, 2025.

C. RFP Documents are available at no charge on MITN or the City of Ann Arbor Purchasing Website.

D. Proposals are due and must be delivered to City Hall on or before October 30, 2025, by 11:00 a.m. (local time).

E. The following documents must be included with the Proposals:

1) One (1) original proposal
2) two (2) additional proposal copies
3) one (1) digital copy of the proposal preferably on a USB/flash drive as one file in PDF format

F. A proposal may be disqualified if the following required forms are not included with the proposal:

1) Attachment B – General Declarations
2) Attachment D - Prevailing Wage Declaration of Compliance
3) Attachment E - Living Wage Declaration of Compliance
4) Attachment G - Vendor Conflict of Interest Disclosure Form

5) Attachment H - Non-Discrimination Declaration of Compliance

G. Proposals that fail to provide these forms listed above upon proposal opening may be deemed non-responsive and may not be considered for award.

H. Bid must be accompanied by bid security made payable to Owner in an amount of 5% of Bidder's maximum bid price (determined by adding the base bid and all alternates) in the form of a certified check, or a Bid Bond.

I. Davis Bacon Wage Rates will apply in accordance with City Requirements. The wage determination current on the date 10 days before proposals are due shall apply. See Section 4 – Wage Requirements in the General Conditions section of the Proposal. For this RFP the Construction Type of Heavy and Highway will apply.

J. Liquidated Damages. Assessed at $2,000.00 per day.

K. Proposal Format: Closely review RFP requirements for elements that should be included in the proposal. Organize Proposals into the following Sections:

1) Qualifications, Experience and Accountability
2) Workplace Safety
3) Workforce Development
4) Social Equity and Sustainability
5) Schedule of Pricing/Cost
6) Authorized Negotiator
7) Attachments

L. Schedule:

Activity	Date
Pre-Proposal Meeting	Monday, September 29, 2025 @ 10:00 a.m.
Final day for Contractor written questions	Thursday, October 16, 2025 @ 5:00 p.m.
Addendum Posted	Week of October 20, 2025
Proposals due	Thursday, October 30, 2025 @ 11:00 a.m.
Selection/Negotiations	November 2025
Expected City Council Authorizations	December 15, 2025
Contract Execution	January 2026
Anticipated Notice to Proceed Issued	January 12, 2026
Substantial Completion	October 8, 2026

4. Summary of Project

A. Construction of approximately 1,600 LF of FRP sanitary sewer (30" & 36") installed by microtunneling, and 200 LF of SDR 26 PVC sanitary sewer (8", 10", 18", & 24") including associated structures, leads and abandonment/removal of existing sanitary sewers.

Construction of approximately 40 LF of CL IV RCP storm sewer (24") including associated structures, storm sewer taps and abandonment/removal of existing storm sewers. This is relocation work to accommodate the required shafts.

Construction of approximately 200 LF of PC 350 DIP water main (12”) including associated fittings, structures, and removal of existing water mains. This is relocation work to accommodate the required shafts.

Approximately 1,600 SY of pavement removal and HMA paving, including associated curb & gutter removal and replacement, sidewalk and sidewalk ramp removal and replacement, machine grading, 21AA aggregate base placement, grading and compaction and pavement markings.

B. Schedule and Phasing:
   1) Note **Project Schedule and Payment** Detailed Specification for schedule and phasing information for basis of proposal.
   2) Contractor may submit an alternative schedule for Owner review that adheres to the general scheduling requirements listed.
   3) Work north of Huron Street must be completed by June 20, 2026 due to project on Ann Street.
   4) Sewer connections on Washington Street must be complete with flow shift by August 22, 2026. This corresponds with the planned University of Michigan dorm opening.
   5) Project completion by October 8, 2026 based on a Notice to Proceed date of January 12, 2026.

C. Staging and Access:
   1) The Contractor shall coordinate to utilize the existing City owned parcel located adjacent to the project site at 415 W Washington Street. The existing City owned parcel is located adjacent to the project site on Washington Street. The existing chimney on this site must be protected as a roosting spot for chimney swifts, and temporary barriers should be installed around the chimney to protect it from damage.
   2) Contractor shall review and walkthrough the proposed shaft location with the City and Engineer to determine final tree and streetlight removal requirements. If required, Contractor shall trim or remove trees and coordinate with the City to remove the streetlighting. Temporary lights shall be installed to light the sidewalk area if the streetlighting is removed.

D. Project Coordination:
   1) The Contractor shall be aware that other projects may be constructed within the City by other agencies or contractors that may affect work under this contract. The City of Ann Arbor anticipates a water main and road reconstruction project on Ann St between 1st St and 5th Ave during the 2026 construction season. Detour routes will overlap, and coordination may be required between the two projects.
   2) Hotel site at Huron & First (current empty lot), unclear when construction is planned to begin.
   3) The Contractor shall coordinate with the YMCA located at 400 W Washington Street to ensure access through the 415 W Washington site from Liberty Street for vendor deliveries, solid waste collection and bus transportation. The parking lot beneath the YMCA will be closed to normal traffic, and the parking area at 415 W Washington will be utilized by YMCA patrons. An accessible pedestrian route from this parking lot must be provided to the YMCA.

4) 220 N. Miller Parking Lot – coordinating with them for a temporary driveway off Miller to be cut in.
5) Sewer lining on the north part of First Street for existing 40” x 48” elliptical sewer that crosses over the proposed tunnel. Scheduled for CIPP lining in late Fall 2025 in advance of project construction.

E. Instrumentation and Monitoring
1) Refer to Specifications and Drawings for the instrumentation and monitoring requirements.
2) All monitoring points are within the City right-of-way.

F. Geotechnical Baseline Report
1) Refer to Geotechnical Baseline Report for existing ground conditions and contamination information.
2) Aim to limit dewatering as much as possible with construction methods due to potential treatment and disposal requirements. All dewatering locations must be directed to frac tanks for sampling prior to continuous discharge.

G. Removal and Disposal of Contaminated Material
1) The project includes a $150,000 laboratory testing allowance, $400,000 contaminated groundwater disposal allowance and an item for contaminated soil disposal in the bid proposal. Note REMOVAL AND DISPOSAL OF CONTAMINATED MATERIAL Detailed Specification for requirements on sampling and disposing of contaminated materials.
2) See the Due Care Compliance Plan that is incorporated into the contract documents.

H. Permits

1) EGLE Part 41 Permit (Sanitary Sewer Construction) – Permit was submitted to EGLE and receipt is anticipated prior to the start of construction. City will be obtaining prior to start of construction.
2) Washtenaw County Water Resources Commission (WCWRC) Drain Permit – Permit has been issued. Inspection of Allen Creek drain at crossing will be performed prior to construction. For Allen Creek Drain on Washington St.
3) MDOT Right-of-Way Permit – For Huron Street Crossing, Receipt is anticipated prior to the start of construction.
4) Ann Arbor Railroad Permit – Receipt is anticipated prior to the start of construction. Contractor shall provide RPL insurance policy.
    i. City has applied for it, but anything that might be needed from the contractor (i.e. contractor form etc.), it will be important to respond timely.
5) Grading/Soil Erosion & Sedimentation Control Permit – City of Ann Arbor
6) Lane Closure Permit – Applied for by Contractor. No fee to obtain permit.
7) No Parking Signs Permit – Applied for by Contractor. No fee to obtain permit.
8) Right-Of-Way Permit – Applied for by Contractor. No fee to obtain permit.
9) Dewatering Permit – Permit to be submitted by City prior to construction. Fees associated with discharge of dewatering water to be paid by the City. Strong preference to discharge to the county storm drain, rather than the City’s storm sewer.
10) EGLE Part 327 Groundwater Use – Registration request submitted by City of Ann Arbor. Update as necessary during construction.

5. Questions and Answers

- Where in City Hall should the proposal be dropped off?
    - See the instructions within the RFP document. The proposal can be delivered to the Customer Service Desk on the First Floor at City Hall. If being delivered after hours, there is a drop box in the northern alcove.

- Will bids be read aloud at the Bid Opening?
    - The final price of each bid is read aloud at the bid opening and the City ensures that all bonds and necessary documents are included.

- When and where will the bid opening happen?
    - The bid opening will happen on October 30, 2025, at 11:00 a.m. in the first floor conference room south at City Hall – 301 E. Huron Street, Ann Arbor, MI.

- What is the amount of calendar days to project completion?
    - 269 calendar days is identified as the completion time in the detailed specifications.

- Will the west side of the 415 W. Washington site be available for staging?
    - Yes, the west side of the 415 W. Washington site will be available for staging. That area shall be fenced off as detailed in the Contract Drawings. The east half of the site will remain available for YMCA parking.

- Will the City handle the removal of light poles and tree trimming if needed?
    - Yes, the City will handle the removal of light poles and tree trimming if needed. If the light poles need to be removed, the contractor is responsible for temporary lighting. If full tree removal is required, it will be performed by the contractor under the contract. A walkthrough shall be performed prior to the start of construction to coordinate this work.

- Is the material contaminated hazardous or contaminated non-hazardous?
    - Based on groundwater and soil sampling, there is no human exposure risk. Samples showed no exceedances of direct contact, particulate inhalation, soil volatilization or volatilization of indoor air Part 201 criteria. Concentrations do not exceed RCRA hazardous concentrations and material is non-hazardous to a landfill.

- The allowances don’t have a unit specified, should the unit be listed as one dollar?
    - The unit in the bid form is "Dollar" (or Dlr), which is used for pay items that have a monetary value rather than a physical quantity. The unit price for these items is one dollar.

- Is it possible to move shaft locations if necessary? Ie. Manhole on First Street just north of Huron.
    - Bids shall be based on proposed manhole/shaft locations identified on the drawings. If the bidder wishes to quote alternate locations for consideration by the City, follow the requirements detailed in Section III.F.

- For the railroad permit that requires the flagger request, is the cost of the flagger at the owner's expense or the contractor's expense?
    - City Expense

- What is the engineer's estimate?
    - The engineer's estimate is $13.96 million.

- Are there MBE or WBE requirements?
    - No, there are no MBE or WBE requirements.

- Who is the owner of the railroad?
    - Ann Arbor Railroad, which is owned by Wacto.

- Can a subcontractor be used for instrumentation monitoring?
    - Yes, a subcontractor can be used for instrumentation monitoring, requirements are noted in the contract documents.

ATTENDEES: See sign in sheets.

Project Title:	High-Level Trunkline Capacity Improvements	Project Number:	RFP# 25-39
Meeting Date and Time:	Monday, September 29, 2025 at 10:00 am	Meeting Location:	Ann Arbor City Hall, Basement Conf. Room, 301 E. Huron St. Ann Arbor, MI 48104

PRE-PROPOSAL MEETING SIGN IN SHEET

Name	Contractor/Representing	Email	Phone
Tony Miller	Contract Dewatering Services	tony@contract-dewatering.com	616-902-1447
Casey Wilson	SAM (Surveying and Mapping)	casey.wilson@SAM.BIZ	734-465-6611
Tracy Anderson	A2	TAnderson@a2gov.org	734-794-6410 ex 43639
TJ Lentner	OHM	tjlentner@ohm-advisors.com	734 368 7276
Chris Elenbaas	OHM	CHRIS.ELENBAAS@OHM-ADVISORS.com	734-466-4405
Brian Carrick	RIC-MAN Construction Inc.	bcarrickCRIC-MAN.com	810-459-0525
Spencer Cain	Stantec	spencer.cain@stantec.com	734.546.6694
Madison Merzlyakov	OHM	madison.merzlyakov@ohm-advisors.com	734-743-2359

Project Title:	High-Level Trunkline Capacity Improvements		Project Number: RFP# 25-39
Meeting Date and Time:	Monday, September 29, 2025 at 10:00 am	Meeting Location:	Ann Arbor City Hall, Basement Conf. Room, 301 E. Huron St. Ann Arbor, MI 48104

PRE-PROPOSAL MEETING SIGN IN SHEET

Name	Contractor/Representing	Email	Phone
Curtis Rozelle	Jay Dee Contractors, Inc.	crozelle@jaydee.us	734-591-3400
Rod Shoulders	JAY DEE CONTR.	rshoulders@jaydee.us	734-591-3400
Gino DiAgostini	Ric-Man Const Inc.	gdiagostini@ric-man.com	810-459-0505
Brendan Fons	Fonson Company, Inc.	bfons@fonsoninc.com	810-397-3065
Albert Ruiz	Stantec	albert.ruiz@stantec.com	602-245-6067

Project Title:	**High-Level Trunkline Capacity Improvements**	**Project Number:**	**RFP# 25-39**
Meeting Date and Time:	**Monday, September 29, 2025 at 10:00 am**	**Meeting Location:**	**Ann Arbor City Hall, Basement Conf. Room, 301 E. Huron St. Ann Arbor, MI 48104**

PRE-PROPOSAL MEETING ONLINE SIGN IN SHEET

Name	Contractor/Representing	Email	Phone
Phillip J. Backers	Jay Dee Contractors, Inc.	pbackers@jaydee.us	734-793-8905
Alfred Domingo	Huxted Trenchless	adomingo@huxtedtrenchless.com	941-722-6613
Eric Arquette	SAM	eric.arquette@sam.biz	


Miller Ave
N First St
W Ann St
Alley
Alley
Chapin St
W Huron St
Third St
S First St
W Washington St
Alley
Krause St
W Liberty St

E. Schedule of Pricing/Cost – 20 Points

Company:

Project: High-Level Trunkline Capacity Improvements

File #: 2024-001 **RFP #: 25-39**

ITEM NUMBER	LEGEND	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
	General				
01000.00	General Conditions, Max. $1,400,000	LSUM	1	$ 1,100,000.00	$ 1,100,000.00
01001.00	Project Supervision, Max. $700,000	LSUM	1	$ 635,000.00	$ 635,000.00
01002.00	Project Clean-Up and Restoration	LSUM	1	$ 8,000.00	$ 8,000.00
01003.00	Digital Audio Visual Coverage	LSUM	1	$ 1,900.00	$ 1,900.00
01010.00	DS_Laboratory Testing Allowance	Dlr	150,000	$ 1.00	$ 150,000.00
01011.00	DS_Contaminated Groundwater Disposal Allowance	Dlr	400,000	$ 1.00	$ 400,000.00
01012.00	DS_Contaminated Soil Disposal	Cyd	5,700	$ 41.00	$ 233,700.00
01021.00	Erosion Control, Inlet Protection, Fabric Drop	Ea	16	$ 700.00	$ 11,200.00
01040.00	Minor Traffic Control, Max. $80,000	LSUM	1	$ 10,000.00	$ 10,000.00
01050.00	Sign, Type B, Temp, Prismatic, Furn & Oper	Sft	1,272	$ 8.00	$ 10,176.00
01051.00	Sign, Type B, Temp, Prismatic, Special, Furn & Oper	Sft	419	$ 15.00	$ 6,285.00
01052.00	Temporary "No Parking" Sign	Ea	20	$ 20.00	$ 400.00
01070.00	Sign, Portable, Changeable Message, Furn & Oper	Ea	2	$ 2,000.00	$ 4,000.00
01080.00	Plastic Drum, High Intensity, Lighted, Furn & Oper	Ea	8	$ 40.00	$ 320.00
01081.00	Channelizer Cone, High Intensity, 42 In., Furn & Oper	Ea	100	$ 25.00	$ 2,500.00
01091.00	Barricade, Type III, High Intensity, Lighted, Furn & Oper	Ea	10	$ 45.00	$ 450.00
01100.00	Pedestrian Type II Barricade, Temp, Furn & Oper	Ea	4	$ 20.00	$ 80.00
01101.00	Pedestrian Channelizer Device, Furn & Oper	Ea	4	$ 20.00	$ 80.00
01102.00	Temporary Pedestrian Ramp, Furn & Oper	Ea	2	$ 50.00	$ 100.00
01103.00	Temporary Pedestrian Mat, Furn & Oper	Ft	21	$ 10.00	$ 210.00
01131.00	Pavt Mrkg, Wet Reflective, Type R, Tape, 12 In., White, Temp	Ft	60	$ 25.00	$ 1,500.00
	Removals				
02000.02	Tree, Rem, 13 In. - 19 In.	Ea	4	$ 1,200.00	$ 4,800.00
02021.00	HMA Surface, Rem	Syd	257	$ 14.00	$ 3,598.00
02025.00	Concrete Pavt, Any Thickness, Rem	Syd	1,249	$ 9.00	$ 11,241.00
02030.00	Curb, Gutter, and Curb and Gutter, Any Type, Rem	Ft	333	$ 12.00	$ 3,996.00
02040.00	Sidewalk, Sidewalk Ramp, and Driveway Approach, Any Thickness, Rem	Sft	729	$ 9.00	$ 6,561.00
	Earthwork				
03030.01	Exploratory Excavation, SD-TD-1, (0-10' Deep)	Ea	10	$ 800.00	$ 8,000.00
03030.02	Exploratory Excavation, SD-TD-1, Additional Depth	Ft	60	$ 52.00	$ 3,120.00
03001.00	Machine Grading	Syd	1,439	$ 12.00	$ 17,268.00
03070.00	Dewatering	LSUM	1	$ 150,000.00	$ 150,000.00
	Sanitary Sewer				
04000.01	8 In., SDR 26 PVC Sanitary Sewer, SD-TD-2	Ft	84	$ 213.00	$ 17,892.00
04000.02	10 In., SDR 26 PVC Sanitary Sewer, SD-TD-2	Ft	53	$ 418.00	$ 22,154.00
04000.05	18 In., SDR 26 PVC Sanitary Sewer, SD-TD-2	Ft	77	$ 331.00	$ 25,487.00
04000.07	24 In., SDR 26 PVC Sanitary Sewer, SD-TD-2	Ft	23	$ 1,220.00	$ 28,060.00
	TOTAL THIS PAGE (BF-1)				$ **2,878,078.00**

BF-1

Company:

Project: High-Level Trunkline Capacity Improvements

File #: 2024-001 **RFP #: 25-39**

ITEM NUMBER	LEGEND	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
	Sanitary (Continued)				
04006.01	DS_30 In., FRP Sanitary Sewer, SD-TD-2	Ft	32	$ 1,113.00	$ 35,616.00
04007.01	DS_36 In., FRP Sanitary Sewer, Microtunneling	Ft	1,595	$ 3,357.00	$ 5,354,415.00
04014.01	6 In., SDR 26 PVC Sanitary Service Lead, SD-TD-2	Ft	50	$ 306.00	$ 15,300.00
04030.01	Sanitary Manhole, 48 In. Dia. (0-8' Deep)	Ea	1	$ 17,407.00	$ 17,407.00
04030.02	Sanitary Manhole, 48 In. Dia., Additional Depth	Ft	3	$ 1.00	$ 3.00
04035.01	DS_Sanitary Manhole, Fiberglass, 72 In. Dia., Sta 100+47	Ea	1	$ 207,743.00	$ 207,743.00
04035.02	DS_Sanitary Manhole, Fiberglass, 48 In. Dia., Sta 103+82	Ea	1	$ 206,904.00	$ 206,904.00
04035.03	DS_Sanitary Manhole, Fiberglass, 72 In. Dia., Sta 150+70	Ea	1	$ 207,109.00	$ 207,109.00
04035.04	DS_Sanitary Manhole, Fiberglass, 48 In. Dia., Sta 155+45	Ea	1	$ 169,211.00	$ 169,211.00
04035.05	DS_Sanitary Manhole, Fiberglass, 72 In. Dia., Sta 161+30	Ea	1	$ 214,524.00	$ 214,524.00
04036.05	DS_Sanitary Diversion Manhole, Sta 100+17	Ea	1	$ 722,669.00	$ 722,669.00
04050.01	Sanitary Manhole Over Existing ("Doghouse"), 48 In. Dia.	Ea	2	$ 17,407.00	$ 34,814.00
04050.05	DS_Sanitary Manhole Over Existing ("Doghouse"), 96 In. Dia.	Ea	1	$ 112,528.00	$ 112,528.00
04051.04	DS_Sanitary Manhole Over Existing ("Doghouse"), Fiberglass, 84 In. Dia.	Ea	1	$ 536,602.00	$ 536,602.00
04060.00	Sanitary Structure Cover	Ea	13	$ 689.00	$ 8,957.00
04061.00	Sanitary Structure Cover, Adjust	Ea	13	$ 917.00	$ 11,921.00
04070.02	Sanitary Sewer Pipe, 10 In. Dia., Abandon	Ft	20	$ 280.00	$ 5,600.00
04070.05	Sanitary Sewer Pipe, 18 In. Dia., Abandon	Ft	114	$ 58.00	$ 6,612.00
04070.06	Sanitary Sewer Pipe, 21 In. Dia., Abandon	Ft	296	$ 52.00	$ 15,392.00
04080.02	Sanitary Sewer Pipe, 10 In. Dia., Rem	Ft	20	$ 49.00	$ 980.00
04080.05	Sanitary Sewer Pipe, 18 In. Dia., Rem	Ft	90	$ 50.00	$ 4,500.00
04090.00	Sanitary Sewer Structure, Abandon	Ea	3	$ 546.00	$ 1,638.00
04100.00	Sanitary Sewer Structure, Rem	Ea	1	$ 1,091.00	$ 1,091.00
04110.02	Sanitary Sewer Tap, 10 In. Dia.	Ea	1	$ 10,565.00	$ 10,565.00
04200.00	DS_Drilling and Geotechnical instrumentation and Monitoring	LS	1	$ 690,000.00	$ 690,000.00
04250.01	DS_Intermediate Shaft, Sta 103+82	LS	1	$ 359,633.00	$ 359,633.00
04250.02	DS_Launch Shaft, Sta 100+47	LS	1	$ 399,544.00	$ 399,544.00
04250.03	DS_Launch Shaft, Sta 161+30	LS	1	$ 347,101.00	$ 347,101.00
04250.04	DS_Launch/Reception Shaft, Sta 155+45	LS	1	$ 277,953.00	$ 277,953.00
04250.05	DS_Reception Shaft, Sta 150+70	LS	1	$ 1,790,885.00	$ 1,790,885.00
04300.00	DS_Sanitary Bypass Pumping	LS	1	$ 210,190.00	$ 210,190.00
	Stormwater				
06000.05	24 In., CL IV RCP Storm Sewer, SD-TD-1	Ft	37	$ 454.00	$ 16,789.00
06030.04	Storm Sewer Tap, 12 In. Dia.	Ea	2	$ 1,364.00	$ 2,728.00
06030.08	Storm Sewer Tap, 24 In. Dia.	Ea	1	$ 4,865.00	$ 4,865.00
06050.01	Storm Manhole, 48 In. Dia. (0-8' deep)	Ea	1	$ 3,981.00	$ 3,981.00
06050.02	Storm Manhole, 48 In. Dia. , Additional Depth	Ft	3	$ 1.00	$ 3.00
	TOTAL THIS PAGE (BF-2)				$ **12,005,782.00**

BF-2

E. Schedule of Pricing/Cost – 20 Points

Company:

Project: High-Level Trunkline Capacity Improvements

File #: 2024-001 **RFP #: 25-39**

ITEM NUMBER	LEGEND	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
	Stormwater (Continued)				
06050.03	Storm Manhole, 60 In. Dia. (0-8' deep)	Ea	1	$ 6,909.00	$ 6,909.00
06120.03	Storm Sewer Pipe, 12 In. Dia., Rem	Ft	21	$ 49.00	$ 1,029.00
06160.01	Storm Structure Cover	Ea	3	$ 425.00	$ 1,275.00
06160.02	Storm Structure Cover, Adjust	Ea	3	$ 1,160.00	$ 3,480.00
	Water Mains				
07000.05	12 In., PC 350 DIP w/polywrap, SD-TD-1	Ft	157	$ 343.00	$ 53,851.00
07013.01	12 In. 90° DIP Bend	Ea	12	$ 1,601.00	$ 19,212.00
07013.02	12 In. 45° DIP Bend	Ea	2	$ 1,405.00	$ 2,810.00
07090.00	Water Structure Cover	Ea	2	$ 637.00	$ 1,274.00
07091.00	Water Structure Cover, Adjust	Ea	2	$ 546.00	$ 1,092.00
07150.05	Water Main Pipe, 12 In. Dia., Rem	Ft	93	$ 36.00	$ 3,348.00
	Streets, Driveways, & Sidewalks				
08000.00	Subbase, CIP	Cyd	66	$ 47.00	$ 3,102.00
08010.03	Aggregate Base, 8 In., 21AA, CIP	Syd	954	$ 26.00	$ 24,804.00
08010.04	Aggregate Base, 10 In., 21AA, CIP	Syd	648	$ 27.00	$ 17,496.00
08070.14	HMA, 4EL	Ton	295	$ 150.00	$ 44,250.00
08070.18	HMA, 5EL	Ton	208	$ 150.00	$ 31,200.00
08110.00	Conc, Curb or Curb & Gutter, All Types	Ft	333	$ 55.00	$ 18,315.00
08121.01	Conc, Driveway Opening, Type L	Ft	25	$ 55.00	$ 1,375.00
08131.01	Conc, Sidewalk, Drive Approach, or Ramp, 6 In.	Sft	654	$ 15.00	$ 9,810.00
08131.02	Conc, Sidewalk, Drive Approach, or Ramp, 8 In.	Sft	129	$ 20.00	$ 2,580.00
08150.00	Detectable Warning Surface	Ft	15	$ 60.00	$ 900.00
08155.00	DS_Bollard	Ea	3	$ 2,690.00	$ 8,070.00
08190.01	Pavt Mrkg, Polymer Cement Surface, Bike, Large Sym	Ea	2	$ 350.00	$ 700.00
08190.03	Pavt Mrkg, Polymer Cement Surface, Bike Thru Arrow Sym	Ea	2	$ 295.00	$ 590.00
08190.06	Pavt Mrkg, Polymer Cement Surface, Bike Lane Green	Sft	450	$ 18.00	$ 8,100.00
08220.03	Pavt Mrkg, Thermopl, 12 In., Crosswalk	Ft	505	$ 8.00	$ 4,040.00
08220.06	Pavt Mrkg, Thermopl, 24 In., Stop Bar	Ft	42	$ 16.00	$ 672.00
08220.30	Pavt Mrkg, Thermopl, 18 In. x 18 In. Bikeway Marks	Ft	40	$ 50.00	$ 2,000.00
08240.02	Pavt Mrkg, Waterborne, 4 In., Yellow	Ft	1,214	$ 2.00	$ 2,428.00
	Landscaping				
10060.00	Turf Restoration	Syd	23	$ 373.00	$ 8,579.00

TOTAL THIS PAGE (BF-3)	$ **283,291.00**
TOTAL FROM PAGE BF-1:	$ **2,878,078.00**
TOTAL FROM PAGE BF-2:	$ **12,005,782.00**
TOTAL BASE BID:	$ **15,167,151.00**

STEVEN MANCINI

PRESIDENT

SMancini@Ric-Man.com
Cell: (810) 459-0502
Office: (586) 739-5210

41500 Mound Rd.,
Sterling Heights, MI 48314

RIC-MAN

GINO D'AGOSTINI

VICE PRESIDENT

GDAgostini@Ric-Man.com
Cell: (810) 459-0505
Office: (586) 739-5210

41500 Mound Rd.,
Sterling Heights, MI 48314

RIC-MAN

ANN ARBOR HIGH LEVEL TRUNKLINE CAPACITY IMPROVEMENTS PROJECT

Alternate Construction Items

With this narrative, Ric-Man Construction, Inc. (RCI) means to provide its alternate items for the construction of the Ann Arbor High Level Trunkline Capacity Improvements Project ("The Project").

MICRO-TUNNELING CONSTRUCTION AND SEQUENCE.

RCI proposes to use a Herrenknecht AVN-1500TB Mico-Tunnel Bore Machine (MTBM) for the installation of the trunkline sewer specified to be installed via micro-tunneling which will require the use of a larger Reinforced Concrete Jacking Pipe (RCJP) with an inside diameter of 60-inches and outside diameter of 73.5-inches. With this setup, RCI will construct the tunnel in two drives. The Washington Street Alignment from station 105+70 (Launch Shaft at Manhole S-2) to station 100+47 (Recovery Shaft at Manhole S-1) and the First Street Alignment from station 150+70 (Launch Shaft at Manhole S-2) to station 161+30 (Recovery Shaft at Manhole S-3). Once the respective tunnel construction is complete, RCI will install the 36-Inch FRP within the RCJP and grout the FRP in place. This sequence and method differ from those presented in the RFP documents as follows:

1. The RFP documents propose a single pass (direct jacking) tunnel.
2. The RFP documents anticipate the launch shafts for the tunnel construction to occur at Manhole S-3, Manhole S-9 and Manhole S-1 and the tunnel construction occur in three separate drives.

The alternate items are being proposed in order manage and mitigate risk on The Project due to 1) the geological conditions present at The Project, 2) the lengths of the drives presented in the RFP and, 3) the connections and ancillary construction associated with the trunkline sewer. This is further explained as follows:

1. Geological Conditions.
    a. The Geotechnical Baseline Report included in the RFP documents prepared by Stantec describes in several sections the presence of cobbles and the possibility of boulders along the tunnel alignment. The presence of cobbles along the tunnel alignment presents a challenge to the installation of the 36-Inch FRP pipe in a direct jacking method due to the relative size of the obstructions to the MTBM required for direct jacking. The size of the direct jack MTBM will restrict its ability to handle cobbles and the ability to access the face of the machine if necessary to deal with obstructions. The 36-Inch to 40-Inch MTBM (the size range of MTBM for direct jacking 36-inch FRP pipe) does not have an access door to the face of the machine and has smaller opening in the cutter head making it harder to ingest cobbles to the crushing cone. Because of this, there is a high risk of having to install a rescue shaft, excavated from the surface, in order to access the face of the machine to remove the obstruction. A rescue shaft would create additional impacts to The Project, increasing both the cost and time of construction and cause additional disruption to the local infrastructure and community. In order to mitigate (but not eliminate) the risk of the impacts of obstructions to the tunnel construction, RCI is proposing the use of a larger MTBM. The MTBM that RCI is proposing to use via a two-pass method has larger openings in the cutter wheel to increase the ability to ingest cobbles into the cutter head crushing cone and has an access door allowing for direct access to the face of the machine without the use of a rescue shaft. The presence of a high ground water table and running sands presents additional complications to face access through the access door, but those risks can be mitigated with the use of dewatering and ground treatment, which would be present even under the original RFP methods.
2. Tunnel Lengths.
    a. From our understanding, the RFP is proposing the tunnel be constructed in three separate drives as follows:
        i. The Washington Street Alignment – From station 100+47 to 105+70 – 523 linear feet.
        ii. The First Street Alignment – From station 161+30 to 155+45 – 585 linear feet.
        iii. The First Street Alignment – From station 155+45 to 150+70 – 475 linear feet.

The tunnel drive lengths above present a highly risky challenge for a direct jacking MTBM in the 36-Inch to 40-Inch size. Drives of these lengths are pushing past the very upper limits of the capability of an MTBM in this size range and are not recommended. This risk, coupled with the geological conditions present at the site greatly increases the possibility of a tunnel failure. By upsizing the MTBM and jack pipe as RCI is proposing, the tunnel construction can be completed in only two tunnel drives, the Washington Street Alignment of 523 liner feet and the First Street Alignment of 1060 linear feet. These distances are well within the range of the AVN 1500TB machines capabilities and RCI has constructed drives of this length and further on previous projects (please refer to our project qualification references). The machine is equipped with an automatic bentonite system which helps to ensure that proper lubrication of the tunnel is occurring, which is a very important aspect of the tunnel construction given the running sandy soils present at the site. RCI will construct a single drive shaft at the Manhole S-2 location and perform both tunnel drives from this shaft.

3. Connections and Ancillary Construction.

a. Constructing the tunnel from one single drive shaft at the Manhole S-2 location provides for additional risk mitigation to the downstream construction activities.

i. The launch shaft at the Manhole S-1 location requires the removal of several existing sewers in order to be installed. As a result, the flow from these sewers must be bypassed in order to facilitate their operation during tunneling construction. Since RCI is proposing that drive shafts are no longer needed at the Manhole S-1 and S-3 locations, the need for by-pass pumping of the existing sewers is greatly reduced, especially at the Manhole S-1 location. RCI plans to install the Washington Street Tunnel to the Manhole S-1 location, then construct a shaft to recover the MTBM and install Manhole S-2 and connect the sewers. This sequence will greatly reduce the time needed to bypass pump the existing sewers, thereby reducing the risk of issues that may arise with the pumping operation. Additionally, since RCI will not need a drive shaft at the Manhole S-9 location to facilitate the tunnel construction, the impacts to the community will be reduced since a shaft will only be constructed in order to install the manhole and not facilitate a tunneling operation. This would also be true for the S-1 and S-3 shaft locations.

COST SAVINGS

The alternate items proposed by RCI present the opportunity for certain cost savings to the Owner. RCI is offering a credit of $508,000.00 if the Owner elects to delete the 36-Inch FRP pipe and use the 60-Inch RCJP as the final sewer conduit. RCI would add a Xypex admixture to the RCJP to help with the longevity of the pipe and the Owner would also benefit from increased capacity of the system.

Anderson, Tracy

From: Gino D'Agostini <GDAgostini@ric-man.com>
Sent: Tuesday, November 11, 2025 9:16 AM
To: Anderson, Tracy
Cc: Chris Elenbaas (OHM Contact)
Subject: Ann Arbor High Level Trunkline

Tracy,

As discussed in our meeting on November 7th, 2025 for the above referenced project, Ric-Man Construction, Inc. agrees to reimburse the City of Ann Arbor for the additional engineering costs associated with the upsizing of the Microtunnel Bore Machine and the Microtunnel Jack pipe. Please provide us with any invoicing the City receives in connection with this work for our review. We look forward to working with you on this project.

Feel free to reach out if you need anything further.

Respectfully,

Gino D'Agostini
Vice President
Work Phone: (586) 739-5210
Cell Phone: (810) 459-0505
www.RIC-MAN.com
41500 Mound Road
Sterling Heights, MI 48314

CONTRACT

THIS CONTRACT is between the CITY OF ANN ARBOR, a Michigan Municipal Corporation, 301 East Huron Street, Ann Arbor, Michigan 48104 ("City") and Ric-Man Construction, Inc. ("Contractor") a Michigan corporation, 41500 Mound Road, Sterling Heights, Michigan 48314.

Based upon the mutual promises below, the Contractor and the City agree as follows:

ARTICLE I - Scope of Work

The Contractor agrees to furnish all of the materials, equipment and labor necessary; and to abide by all the duties and responsibilities applicable to it for the project titled **High-Level Trunkline Capacity Improvements Project, RFP# 25-39** in accordance with the requirements and provisions of the following documents, including all written modifications incorporated into any of the documents, all of which are incorporated as part of this Contract:

Non-discrimination and Living Wage Declaration of Compliance Forms
Vendor Conflict of Interest Form
Prevailing Wage Declaration of Compliance Form
Bid Forms
Contract and Exhibits
Bonds
General Conditions
Standard Specifications
Detailed Specifications
Appendices
RFP 25-39 Plans; File No. 2024-001
Bulletins
Addenda
Davis Bacon wage determination:
Heavy, MI20250157, July 4, 2025
Highway, MI20250001, Sept 5, 2025
Documentation of Due Care Compliance - High Level Trunkline Capacity Improvements Project; August 15, 2025
Ann Arbor High Level Trunkline Capacity Improvements Geotechnical Baseline Report; September 17, 2025; Project/File: 2075157602

ARTICLE II - Definitions

Administering Service Area/Unit means **Public Services Area/Engineering Unit**

Project means **High-Level Trunkline Capacity Improvements Project, RFP# 25-39**

Supervising Professional means the person acting under the authorization of the manager of the Administering Service Area/Unit. At the time this Contract is executed, the Supervising Professional is: **Nicholas Hutchinson, P.E.** whose job title is **City Engineer**. If there is any question concerning who the Supervising Professional is, Contractor shall confirm with the manager of the Administering Service Area/Unit.

Contractor's Representative means **Gino D'Agostini** whose job title is **Vice President.**

ARTICLE III - Time of Completion

(A) The work to be completed under this Contract shall begin immediately on the date specified in the Notice to Proceed issued by the City.

(B) The entire work for this Contract shall be completed within the dates specified in the Project Schedule and Payment Detailed Specification.

(C) Failure to complete all the work within the time specified above, including any extension granted in writing by the Supervising Professional, shall obligate the Contractor to pay the City, as liquidated damages and not as a penalty, an amount equal to $2,000.00 for each calendar day of delay in the completion of all the work. If any liquidated damages are unpaid by the Contractor, the City shall be entitled to deduct these unpaid liquidated damages from the monies due the Contractor.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

ARTICLE IV - The Contract Sum

(A) The City shall pay to the Contractor for the performance of the Contract, the unit prices as given in the Bid Form for the estimated bid total of:

Fifteen million, one hundred sixty-seven thousand, one hundred fifty-one and 00/100 Dollars ($15,167,151.00)

(B) The amount paid shall be equitably adjusted to cover changes in the work ordered by the Supervising Professional but not required by the Contract Documents. Increases or decreases shall be determined only by written agreement between the City and Contractor.

ARTICLE V - Assignment

This Contract may not be assigned or subcontracted any portion of any right or obligation under this contract without the written consent of the City. Notwithstanding any consent by the City to any assignment, Contractor shall at all times remain bound to all warranties, certifications, indemnifications, promises and performances, however described, as are required of it under this contract unless specifically released from the requirement, in writing, by the City.

ARTICLE VI - Choice of Law

This Contract shall be construed, governed, and enforced in accordance with the laws of the State of Michigan. By executing this Contract, the Contractor and the City agree to venue in a court of appropriate jurisdiction sitting within Washtenaw County for purposes of any action arising under this Contract. The parties stipulate that the venue referenced in this Contract is for convenience and waive any claim of non-convenience.

Whenever possible, each provision of the Contract will be interpreted in a manner as to be effective and valid under applicable law. The prohibition or invalidity, under applicable law, of any provision will not invalidate the remainder of the Contract.

ARTICLE VII - Relationship of the Parties

The parties of the Contract agree that it is not a Contract of employment but is a Contract to accomplish a specific result. Contractor is an independent Contractor performing services for the City. Nothing contained in this Contract shall be deemed to constitute any other relationship between the City and the Contractor.

Contractor certifies that it has no personal or financial interest in the project other than the compensation it is to receive under the Contract. Contractor certifies that it is not, and shall not become, overdue or in default to the City for any Contract, debt, or any other obligation to the City including real or personal property taxes. City shall have the right to set off any such debt against compensation awarded for services under this Contract.

The Regents of the University of Michigan is a third-party beneficiary of this Contract.

ARTICLE VIII - Notice

All notices given under this Contract shall be in writing, and shall be by personal delivery or by certified mail with return receipt requested to the parties at their respective addresses as specified in the Contract Documents or other address the Contractor may specify in writing. Notice will be deemed given on the date when one of the following first occur: (1) the date of actual receipt; or (2) three days after mailing certified U.S. mail.

ARTICLE IX - Indemnification

To the fullest extent permitted by law, Contractor shall indemnify, defend and hold the City and the Regents of the University of Michigan, and their respective officers, employees and agents harmless from all suits, claims, judgments and expenses including attorney's fees resulting or alleged to result, in whole or in part, from any act or omission, which is in any way connected or associated with this Contract, by the Contractor or anyone acting on the Contractor's behalf under this Contract. Contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence. The provisions of this Article shall survive the expiration or earlier termination of this contract for any reason.

ARTICLE X - Entire Agreement

This Contract represents the entire understanding between the City and the Contractor and it supersedes all prior representations, negotiations, agreements, or understandings whether written or oral. Neither party has relied on any prior representations in entering into this Contract. No terms or conditions of either party's invoice, purchase order or other administrative document shall modify the terms and conditions of this Contract, regardless of the other party's failure to object to such form. This Contract shall be binding on and shall inure to the benefit of the parties to this Contract and their permitted successors and permitted assigns and nothing in this Contract, express or implied, is intended to or shall confer on any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever under or by reason of this Contract. This Contract may be altered, amended or modified only by written amendment signed by the City and the Contractor.

ARTICLE XI – Electronic Transactions

The City and Contractor agree that signatures on this Contract may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this Contract. This Contract may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

[Signatures on next page]

RIC-MAN CONSTRUCTION, INC

By: _____

Name: _____

Title: _____

Date: _____

CITY OF ANN ARBOR

By: _____

Name: Milton Dohoney Jr.

Title: City Administrator

Date: _____

Approved as to substance:

By: _____

Name: Jordan Roberts

Title: Public Services Area Administrator

Date: _____

Approved as to form:

By: _____

Name: Atleen Kaur

Title: City Attorney

Date: _____

(Signatures continue on following page)

CITY OF ANN ARBOR

By: _____

Name: _____

Title: Mayor

Date: _____

By: _____

Name: _____

Title: City Clerk

Date: _____

PERFORMANCE BOND

(1) _____ of _____ (referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for _____ Dollars, $_____, the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City entitled _____ _____, for RFP No. _____ and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq.

(3) Whenever the Principal is declared by the City to be in default under the Contract, the Surety may promptly remedy the default or shall promptly:
(a) complete the Contract in accordance with its terms and conditions; or
(b) obtain a bid or bids for submission to the City for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, arrange for a Contract between such bidder and the City, and make available, as work progresses, sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which Surety may be liable hereunder, the amount set forth in paragraph 1.

(4) Surety shall have no obligation to the City if the Principal fully and promptly performs under the Contract.

(5) Surety agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder, or the specifications accompanying it shall in any way affect its obligations on this bond, and waives notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.

(6) Principal, Surety, and the City agree that signatures on this bond may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this bond. This bond may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

SIGNED AND SEALED this _____ day of _____, 202_.

_____	_____
(Name of Surety Company)	(Name of Principal)
By _____	By _____
(Signature)	(Signature)
Its _____	Its _____
(Title of Office)	(Title of Office)
Approved as to form:	Name and address of agent:
_____	_____
Atleen Kaur, City Attorney	_____
	_____

LABOR AND MATERIAL BOND

(1) _____

of _____(referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan, (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for the use and benefit of claimants as defined in Act 213 of Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq., in the amount of _____

_____Dollars, $ _____, for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City entitled _____

_____, for RFP No. _____; and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963 as amended;

(3) If the Principal fails to promptly and fully repay claimants for labor and material reasonably required under the Contract, the Surety shall pay those claimants.

(4) Surety's obligations shall not exceed the amount stated in paragraph 1, and Surety shall have no obligation if the Principal promptly and fully pays the claimants.

(5) Principal, Surety, and the City agree that signatures on this bond may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this bond. This bond may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

SIGNED AND SEALED this _____ day of _____, 202_

_____	_____
(Name of Surety Company)	(Name of Principal)
By _____	By _____
(Signature)	(Signature)
Its _____	Its _____
(Title of Office)	(Title of Office)

Approved as to form:

Atleen Kaur, City Attorney

Name and address of agent:

ATTACHMENT B
GENERAL DECLARATIONS

City of Ann Arbor
Guy C. Larcom Municipal Building
Ann Arbor, Michigan 48107

Ladies and Gentlemen:

The undersigned, as Bidder, declares that this Bid is made in good faith, without fraud or collusion with any person or persons bidding on the same Contract; that this Bidder has carefully read and examined the bid documents, including City Nondiscrimination requirements and Declaration of Compliance Form, Living Wage requirements and Declaration of Compliance Form, Prevailing Wage requirements and Declaration of Compliance Form, Vendor Conflict of Interest Form, Notice of Pre-Bid Conference, General Information, Bid, Bid Forms, Contract, Bond Forms, General Conditions, Standard Specifications, Detailed Specifications, all Addenda, and the Plans (if applicable) and understands them. The Bidder declares that it conducted a full investigation at the site and of the work proposed and is fully informed as to the nature of the work and the conditions relating to the work's performance. The Bidder also declares that it has extensive experience in successfully completing projects similar to this one.

The Bidder acknowledges that it has not received or relied upon any representations or warrants of any nature whatsoever from the City of Ann Arbor, its agents or employees, and that this Bid is based solely upon the Bidder's own independent business judgment.

The undersigned proposes to perform all work shown on the plans or described in the bid documents, including any addenda issued, and to furnish all necessary machinery, tools, apparatus, and other means of construction to do all the work, furnish all the materials, and complete the work in strict accordance with all terms of the Contract of which this Bid is one part.

In accordance with these bid documents, and Addenda numbered 1&2, the undersigned, as Bidder, proposes to perform at the sites in and/or around Ann Arbor, Michigan, all the work included herein for the amounts set forth in the Bid Forms.

The Bidder declares that it has become fully familiar with the liquidated damage clauses for completion times and for compliance with City Code Chapter 112, understands and agrees that the liquidated damages are for the non-quantifiable aspects of non-compliance and do not cover actual damages that may be shown and agrees that if awarded the Contract, all liquidated damage clauses form part of the Contract.

The Bidder declares that it has become fully familiar with the provisions of Chapter 14, Section 1:320 (Prevailing wages) and Chapter 23 (Living Wage) of the Code of the City of Ann Arbor and that it understands and agrees to comply, to the extent applicable to employees providing services to the City under this Contract, with the wage and reporting requirements stated in the City Code provisions cited. Bidder certifies that the statements contained in the City Prevailing Wage and Living Wage Declaration of Compliance Forms are true and correct. Bidder further agrees that the cited provisions of Chapter 14 and Chapter 23 form a part of this Contract.

The Bidder declares that it has become familiar with the City Conflict of Interest Disclosure Form and certifies that the statement contained therein is true and correct.

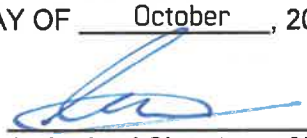
The Bidder encloses a certified check or Bid Bond in the amount of 5% of the total of the Bid Price. The Bidder agrees both to contract for the work and to furnish the necessary Bonds and insurance documentation within 10 days after being notified of the acceptance of the Bid.

If this Bid is accepted by the City and the Bidder fails to contract and furnish the required Bonds and insurance documentation within 10 days after being notified of the acceptance of this Bid, then the Bidder shall be considered to have abandoned the Contract and the certified check or Bid Bond accompanying this Bid shall become due and payable to the City.

If the Bidder enters into the Contract in accordance with this Bid, or if this Bid is rejected, then the accompanying check or Bid Bond shall be returned to the Bidder.

In submitting this Bid, it is understood that the right is reserved by the City to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

SIGNED THIS 30th DAY OF October, 2025.

Ric-Man Construction, Inc. Bidder's Name	 Authorized Signature of Bidder
41500 Mound Rd., Sterling Heights, MI 48314 Official Address	Gino D'Agostini (Print Name of Signer Above)
(586) 739-5210 Telephone Number	GDAgostini@Ric-Man.com Email Address for Award Notice

ATTACHMENT C
LEGAL STATUS OF BIDDER

(The bidder shall fill out the appropriate form and strike out the other three.)

Bidder declares that it is:

* A corporation organized and doing business under the laws of the State of Michigan, for whom Gino D'Agostini, bearing the office title of Vice President, whose signature is affixed to this Bid, is authorized to execute contracts.

NOTE: If not incorporated in Michigan, please attach the corporation's Certificate of Authority

~~* A limited liability company doing business under the laws of the State of _____, whom _____ bearing the title of _____ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.~~

~~* A partnership, organized under the laws of the state of _____ and filed in the county of _____, whose members are (list all members and the street and mailing address of each) (attach separate sheet if necessary):~~

_____

_____

_____

_____

_____

~~* An individual, whose signature with address, is affixed to this Bid:~~ __ _____
(initial here)

Authorized Official

_____ **Date** 10.30, 2025

(Print) Name Gino D'Agostini **Title** Vice President

Company: Ric-Man Construction, Inc.

Address: 41500 Mound Rd., Sterling Heights, MI 48314

Contact Phone (586) 739-5210 Fax (586) 739-8290

Email GDAgostini@Ric-Man.com

ATTACHMENT D
PREVAILING WAGE DECLARATION OF COMPLIANCE

The "wage and employment requirements" of Section 1:320 of Chapter 14 of Title I of the Ann Arbor City Code mandates that the city not enter any contract, understanding or other arrangement for a public improvement for or on behalf of the city unless the contract provides that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. Where the contract and the Ann Arbor City Code are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used. Further, to the extent that any employees of the contractor providing services under this contract are not part of the class of craftsmen, mechanics and laborers who receive a prevailing wage in conformance with section 1:320 of Chapter 14 of Title I of the Code of the City of Ann Arbor, employees shall be paid a prescribed minimum level of compensation (i.e. Living Wage) for the time those employees perform work on the contract in conformance with section 1:815 of Chapter 23 of Title I of the Code of the City of Ann Arbor.

At the request of the city, any contractor or subcontractor shall provide satisfactory proof of compliance with this provision.

The Contractor agrees:

(a) To pay each of its employees whose wage level is required to comply with federal, state or local prevailing wage law, for work covered or funded by this contract with the City,

(b) To require each subcontractor performing work covered or funded by this contract with the City to pay each of its employees the applicable prescribed wage level under the conditions stated in subsection (a) or (b) above.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the wage and employment provisions of the Chapter 14 of the Ann Arbor City Code. The undersigned certifies that he/she has read and is familiar with the terms of Section 1:320 of Chapter 14 of the Ann Arbor City Code and by executing this Declaration of Compliance obligates his/her employer and any subcontractor employed by it to perform work on the contract to the wage and employment requirements stated herein. The undersigned further acknowledges and agrees that if it is found to be in violation of the wage and employment requirements of Section 1:320 of the Chapter 14 of the Ann Arbor City Code it shall has be deemed a material breach of the terms of the contract and grounds for termination of same by the City.

Ric-Man Construction, Inc.
Company Name

Signature of Authorized Representative — Date: 10.30.25

Gino D'Agostini — Vice President
Print Name and Title

41500 Mound Rd., Sterling Heights, MI 48314
Address, City, State, Zip

(586) 739-5210 GDAgostini@Ric-Man.com
Phone/Email address

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500

9/25/15 Rev 0

PW

ATTACHMENT E
LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than $10,000 for any twelve-month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than $10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than $10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here [___] No. of employees___

The Contractor or Grantee agrees:

(a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as $17.08/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than $19.04/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

Check the applicable box below which applies to your workforce

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits

[X] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

(b) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

(e) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

Ric-Man Construction, Inc.
Company Name

41500 Mound Road
Street Address

Signature of Authorized Representative — 10.30.25 Date

Sterling Heights, MI 48314
City, State, Zip

Gino D'Agostini Vice President
Print Name and Title

(586) 739-5210 GDAgostini@Ric-Man.com
Phone/Email address

City of Ann Arbor Procurement Office, 734/794-6500, procurement@a2gov.org 25-26

Attachment F

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE

RATE EFFECTIVE APRIL 30, 2025 - ENDING APRIL 29, 2026

$17.08 per hour
If the employer provides health care benefits*

$19.04 per hour
If the employer does **NOT** provide health care benefits*

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than $10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

ENFORCEMENT

The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than $500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

* Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed $.50 an hour for an average work week; and the employer cost or contribution must equal no less than $1/hr for the average work week.

The Law Requires Employers to Display This Poster Where Employees Can Readily See It.

For Additional Information or to File a Complaint contact
Colin Spencer at 734/794-6500 or cspencer@a2gov.org

ATTACHEMENT G

Vendor Conflict of Interest Disclosure Form

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

Conflict of Interest Disclosure*	
Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest.	( ) Relationship to employee ( ) Interest in vendor's company ( ) Other (please describe in box below)
NONE	

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below:		
Ric-Man Construction, Inc.		(586) 739-5210
Vendor Name		**Vendor Phone Number**
	10/30/2025	Gino D'Agostini
Signature of Vendor Authorized Representative	**Date**	**Printed Name of Vendor Authorized Representative**

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500, procurement@a2gov.org

COI – Ver. 1 – 6/9/16

ATTACHMENT H

DECLARATION OF COMPLIANCE

Non-Discrimination Ordinance

The "non discrimination by city contractors" provision of the City of Ann Arbor Non-Discrimination Ordinance (Ann Arbor City Code Chapter 112, Section 9:158) requires all contractors proposing to do business with the City to treat employees in a manner which provides equal employment opportunity and does not discriminate against any of their employees, any City employee working with them, or any applicant for employment on the basis of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight. It also requires that the contractors include a similar provision in all subcontracts that they execute for City work or programs.

In addition the City Non-Discrimination Ordinance requires that all contractors proposing to do business with the City of Ann Arbor must satisfy the contract compliance administrative policy adopted by the City Administrator. A copy of that policy may be obtained from the Purchasing Manager

The Contractor agrees:

(a) To comply with the terms of the City of Ann Arbor's Non-Discrimination Ordinance and contract compliance administrative policy, including but not limited to an acceptable affirmative action program if applicable.

(b) To post the City of Ann Arbor's Non-Discrimination Ordinance Notice in every work place or other location in which employees or other persons are contracted to provide services under a contract with the City.

(c) To provide documentation within the specified time frame in connection with any workforce verification, compliance review or complaint investigation.

(d) To permit access to employees and work sites to City representatives for the purposes of monitoring compliance, or investigating complaints of non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the Ann Arbor Non-Discrimination Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Non-Discrimination Ordinance, obligates the Contractor to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract.

Ric-Man Construction, Inc.
Company Name

Signature of Authorized Representative — Date: 10.30.25

Gino D'Agostini — Vice President
Print Name and Title

41500 Mound Rd., Sterling Heights, MI 48314
Address, City, State, Zip

(586) 739-5210 GDAgostini@Ric-Man.com
Phone/Email Address

Questions about the Notice or the City Administrative Policy, Please contact:
Procurement Office of the City of Ann Arbor
(734) 794-6500

2016 Rev 0

NDO-2

ATTACHMENT I

CITY OF ANN ARBOR NON-DISCRIMINATION ORDINANCE

Relevant provisions of Chapter 112, Nondiscrimination, of the Ann Arbor City Code are included below. You can review the entire ordinance at www.a2gov.org/humanrights.

Intent: It is the intent of the city that no individual be denied equal protection of the laws; nor shall any individual be denied the enjoyment of his or her civil or political rights or be discriminated against because of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight.

Discriminatory Employment Practices: No person shall discriminate in the hire, employment, compensation, work classifications, conditions or terms, promotion or demotion, or termination of employment of any individual. No person shall discriminate in limiting membership, conditions of membership or termination of membership in any labor union or apprenticeship program.

Discriminatory Effects: No person shall adopt, enforce or employ any policy or requirement which has the effect of creating unequal opportunities according to actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight for an individual to obtain housing, employment or public accommodation, except for a bona fide business necessity. Such a necessity does not arise due to a mere inconvenience or because of suspected objection to such a person by neighbors, customers or other persons.

Nondiscrimination by City Contractors: All contractors proposing to do business with the City of Ann Arbor shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the guidelines of this section. All city contractors shall ensure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon any classification protected by this chapter. All contractors shall agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of any applicable protected classification. All contractors shall be required to post a copy of Ann Arbor's Non-Discrimination Ordinance at all work locations where its employees provide services under a contract with the city.

Complaint Procedure: If any individual believes there has been a violation of this chapter, he/she may file a complaint with the City's Human Rights Commission. The complaint must be filed within 180 calendar days from the date of the individual's knowledge of the allegedly discriminatory action or 180 calendar days from the date when the individual should have known of the allegedly discriminatory action. A complaint that is not filed within this timeframe cannot be considered by the Human Rights Commission. To file a complaint, first complete the complaint form, which is available at www.a2gov.org/humanrights. Then submit it to the Human Rights Commission by e-mail (hrc@a2gov.org), by mail (Ann Arbor Human Rights Commission, PO Box 8647, Ann Arbor, MI 48107), or in person (City Clerk's Office). For further information, please call the commission at 734-794-6141 or e-mail the commission at hrc@a2gov.org.

Private Actions For Damages or Injunctive Relief: To the extent allowed by law, an individual who is the victim of discriminatory action in violation of this chapter may bring a civil action for appropriate injunctive relief or damages or both against the person(s) who acted in violation of this chapter.

THIS IS AN OFFICIAL GOVERNMENT NOTICE AND
MUST BE DISPLAYED WHERE EMPLOYEES CAN READILY SEE IT.

Michigan Department
Of Transportation
CP-347 (04/10)

MICHIGAN DEPARTMENT OF TRANSPORTATION

CERTIFIED PAYROLL

COMPLETION OF CERTIFIED PAYROLL FORM FULFILLS THE MINIMUM MDOT PREVAILING WAGE REQUIREMENTS

(1) NAME OF CONTRACTOR / SUBCONTRACTOR (CIRCLE ONE)	(2) ADDRESS		
(3) PAYROLL NO.	(4) FOR WEEK ENDING	(5) PROJECT AND LOCATION	(6) CONTRACT ID

(a) EMPLOYEE INFORMATION	(b) WORK CLASSIFICATION	(c) Hour Type	(d) DAY AND DATE HOURS WORKED ON PROJECT							(e) TOTAL HOURS ON PROJECT	(f) PROJECT RATE OF PAY	(g) PROJECT RATE OF FRINGE PAY	(h) GROSS PROJECT EARNED / GROSS WEEKLY EARNED	(i) TOTAL WEEKLY HOURS WORKED ALL JOBS	(j) DEDUCTIONS FICA	FEDERAL	STATE		OTHER	TOTAL DEDUCT	(k) TOTAL WEEKLY WAGES PAID FOR ALL JOBS
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,
all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

GENERAL CONDITIONS

Section 1 - Execution, Correlation and Intent of Documents

The contract documents shall be signed in 2 copies by the City and the Contractor.

The contract documents are complementary and what is called for by any one shall be binding. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning have the meaning of those recognized standards.

In case of a conflict among the contract documents listed below in any requirement(s), the requirement(s) of the document listed first shall prevail over any conflicting requirement(s) of a document listed later.

(1) Addenda in reverse chronological order; (2) Detailed Specifications; (3) Standard Specifications; (4) Plans; (5) General Conditions; (6) Contract; (7) Bid Forms; (8) Bond Forms; (9) Bid.

Section 2 - Order of Completion

The Contractor shall submit with each invoice, and at other times reasonably requested by the Supervising Professional, schedules showing the order in which the Contractor proposes to carry on the work. They shall include the dates at which the Contractor will start the several parts of the work, the estimated dates of completion of the several parts, and important milestones within the several parts.

Section 3 - Familiarity with Work

The Bidder or its representative shall make personal investigations of the site of the work and of existing structures and shall determine to its own satisfaction the conditions to be encountered, the nature of the ground, the difficulties involved, and all other factors affecting the work proposed under this Contract. The Bidder to whom this Contract is awarded will not be entitled to any additional compensation unless conditions are clearly different from those which could reasonably have been anticipated by a person making diligent and thorough investigation of the site.

The Bidder shall immediately notify the City upon discovery, and in every case prior to submitting its Bid, of every error or omission in the bidding documents that would be identified by a reasonably competent, diligent Bidder. In no case will a Bidder be allowed the benefit of extra compensation or time to complete the work under this Contract for extra expenses or time spent as a result of the error or omission.

Section 4 - Wage Requirements

Under this Contract, the Contractor shall conform to Chapter 14 of Title I of the Code of the City of Ann Arbor as amended; which in part states "...that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of

subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. At the request of the City, any contractor or subcontractor shall provide satisfactory proof of compliance with the contract provisions required by the Section.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. A sample Prevailing Wage Form is provided in the Appendix herein for reference as to what will be expected from contractors. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

Where the Contract and the Ann Arbor City Ordinance are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used.

If the Contractor is a “covered employer” as defined in Chapter 23 of the Ann Arbor City Code, the Contractor agrees to comply with the living wage provisions of Chapter 23 of the Ann Arbor City Code. The Contractor agrees to pay those employees providing Services to the City under this Contract a “living wage,” as defined in Section 1:815 of the Ann Arbor City Code, as adjusted in accordance with Section 1:815(3); to post a notice approved by the City of the applicability of Chapter 23 in every location in which regular or contract employees providing services under this Contract are working; to maintain records of compliance; if requested by the City, to provide documentation to verify compliance; to take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee or person contracted for employment in order to pay the living wage required by Section 1:815; and otherwise to comply with the requirements of Chapter 23.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision covering subcontractor’s employees who perform work on this contract.

Section 5 - Non-Discrimination

The Contractor agrees to comply, and to require its subcontractor(s) to comply, with the nondiscrimination provisions of MCL 37.2209. The Contractor further agrees to comply with the provisions of Section 9:158 of Chapter 112 of Title IX of the Ann Arbor City Code, and to assure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity.

Section 6 - Materials, Appliances, Employees

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary or used for the execution and completion of the work. Unless otherwise specified, all materials incorporated in the permanent work shall be new, and both workmanship and materials shall be of the highest quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among its employees, and shall seek to avoid employing on the work any unfit person or anyone not skilled in the work assigned.

Adequate sanitary facilities shall be provided by the Contractor.

Section 7 - Qualifications for Employment

The Contractor shall employ competent laborers and mechanics for the work under this Contract. For work performed under this Contract, employment preference shall be given to qualified local residents.

Section 8 - Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringements of any patent rights and shall hold the City harmless from loss on account of infringement except that the City shall be responsible for all infringement loss when a particular process or the product of a particular manufacturer or manufacturers is specified, unless the City has notified the Contractor prior to the signing of the Contract that the particular process or product is patented or is believed to be patented.

Section 9 - Permits and Regulations

The Contractor must secure and pay for all permits, permit or plan review fees and licenses necessary for the prosecution of the work. These include but are not limited to City building permits, right-of-way permits, lane closure permits, right-of-way occupancy permits, and the like. The City shall secure and pay for easements shown on the plans unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the contract documents are at variance with those requirements, it shall promptly notify the Supervising Professional in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work.

Section 10 - Protection of the Public and of Work and Property

The Contractor is responsible for the means, methods, sequences, techniques and procedures of construction and safety programs associated with the work contemplated by this contract. The Contractor, its agents or sub-contractors, shall comply with the "General Rules and Regulations for the Construction Industry" as published by the Construction Safety Commission of the State of Michigan and to all other local, State and National laws, ordinances, rules and regulations pertaining to safety of persons and property.

The Contractor shall take all necessary and reasonable precautions to protect the safety of the public. It shall continuously maintain adequate protection of all work from damage, and shall take all necessary and reasonable precautions to adequately protect all public and private property from injury or loss arising in connection with this Contract. It shall make good any damage, injury or loss to its work and to public and private property resulting from lack of reasonable protective precautions, except as may be due to errors in the contract documents, or caused by agents or

employees of the City. The Contractor shall obtain and maintain sufficient insurance to cover damage to any City property at the site by any cause.

In an emergency affecting the safety of life, or the work, or of adjoining property, the Contractor is, without special instructions or authorization from the Supervising Professional, permitted to act at its discretion to prevent the threatened loss or injury. It shall also so act, without appeal, if authorized or instructed by the Supervising Professional.

Any compensation claimed by the Contractor for emergency work shall be determined by agreement or in accordance with the terms of Claims for Extra Cost - Section 15.

Section 11 - Inspection of Work

The City shall provide sufficient competent personnel for the inspection of the work.

The Supervising Professional shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection.

If the specifications, the Supervising Professional's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Supervising Professional timely notice of its readiness for inspection, and if the inspection is by an authority other than the Supervising Professional, of the date fixed for the inspection. Inspections by the Supervising Professional shall be made promptly, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Supervising Professional, it must, if required by the Supervising Professional, be uncovered for examination and properly restored at the Contractor's expense.

Re-examination of any work may be ordered by the Supervising Professional, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to be in accordance with the contract documents, the City shall pay the cost of re-examination and replacement. If the work is not in accordance with the contract documents, the Contractor shall pay the cost.

Section 12 - Superintendence

The Contractor shall keep on the work site, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Supervising Professional. The superintendent will be responsible to perform all on-site project management for the Contractor. The superintendent shall be experienced in the work required for this Contract. The superintendent shall represent the Contractor and all direction given to the superintendent shall be binding as if given to the Contractor. Important directions shall immediately be confirmed in writing to the Contractor. Other directions will be confirmed on written request. The Contractor shall give efficient superintendence to the work, using its best skill and attention.

Section 13 - Changes in the Work

The City may make changes to the quantities of work within the general scope of the Contract at any time by a written order and without notice to the sureties. If the changes add to or deduct from the extent of the work, the Contract Sum shall be adjusted accordingly. All the changes shall be

executed under the conditions of the original Contract except that any claim for extension of time caused by the change shall be adjusted at the time of ordering the change.

In giving instructions, the Supervising Professional shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Supervising Professional, and no claim for an addition to the Contract Sum shall be valid unless the additional work was ordered in writing.

The Contractor shall proceed with the work as changed and the value of the work shall be determined as provided in Claims for Extra Cost - Section 15.

Section 14 - Extension of Time

Extension of time stipulated in the Contract for completion of the work will be made if and as the Supervising Professional may deem proper under any of the following circumstances:

(1) When work under an extra work order is added to the work under this Contract;

(2) When the work is suspended as provided in Section 20;

(3) When the work of the Contractor is delayed on account of conditions which could not have been foreseen, or which were beyond the control of the Contractor, and which were not the result of its fault or negligence;

(4) Delays in the progress of the work caused by any act or neglect of the City or of its employees or by other Contractors employed by the City;

(5) Delay due to an act of Government;

(6) Delay by the Supervising Professional in the furnishing of plans and necessary information;

(7) Other cause which in the opinion of the Supervising Professional entitles the Contractor to an extension of time.

The Contractor shall notify the Supervising Professional within 7 days of an occurrence or conditions which, in the Contractor's opinion, entitle it to an extension of time. The notice shall be in writing and submitted in ample time to permit full investigation and evaluation of the Contractor's claim. The Supervising Professional shall acknowledge receipt of the Contractor's notice within 7 days of its receipt. Failure to timely provide the written notice shall constitute a waiver by the Contractor of any claim.

In situations where an extension of time in contract completion is appropriate under this or any other section of the contract, the Contractor understands and agrees that the only available adjustment for events that cause any delays in contract completion shall be extension of the required time for contract completion and that there shall be no adjustments in the money due the Contractor on account of the delay.

Section 15 - Claims for Extra Cost

If the Contractor claims that any instructions by drawings or other media issued after the date of the Contract involved extra cost under this Contract, it shall give the Supervising Professional written notice within 7 days after the receipt of the instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property. The procedure shall then be as provided for Changes in the Work-Section l3. No claim shall be valid unless so made.

If the Supervising Professional orders, in writing, the performance of any work not covered by the contract documents, and for which no item of work is provided in the Contract, and for which no unit price or lump sum basis can be agreed upon, then the extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

(1) The Contractor shall be reimbursed for all reasonable costs incurred in doing the work, and shall receive an additional payment of 15% of all the reasonable costs to cover both its indirect overhead costs and profit;

(2) The term "Cost" shall cover all payroll charges for employees and supervision required under the specific order, together with all worker's compensation, Social Security, pension and retirement allowances and social insurance, or other regular payroll charges on same; the cost of all material and supplies required of either temporary or permanent character; rental of all power-driven equipment at agreed upon rates, together with cost of fuel and supply charges for the equipment; and any costs incurred by the Contractor as a direct result of executing the order, if approved by the Supervising Professional;

(3) If the extra is performed under subcontract, the subcontractor shall be allowed to compute its charges as described above. The Contractor shall be permitted to add an additional charge of 5% percent to that of the subcontractor for the Contractor's supervision and contractual responsibility;

(4) The quantities and items of work done each day shall be submitted to the Supervising Professional in a satisfactory form on the succeeding day, and shall be approved by the Supervising Professional and the Contractor or adjusted at once;

(5) Payments of all charges for work under this Section in any one month shall be made along with normal progress payments. Retainage shall be in accordance with Progress Payments-Section 16.

No additional compensation will be provided for additional equipment, materials, personnel, overtime or special charges required to perform the work within the time requirements of the Contract.

When extra work is required and no suitable price for machinery and equipment can be determined in accordance with this Section, the hourly rate paid shall be 1/40 of the basic weekly rate listed in the Rental Rate Blue Book published by Dataquest Incorporated and applicable to the time period the equipment was first used for the extra work. The hourly rate will be deemed to include all costs of operation such as bucket or blade, fuel, maintenance, "regional factors", insurance, taxes, and the like, but not the costs of the operator.

Section 16 - Progress Payments

The Contractor shall submit each month, or at longer intervals, if it so desires, an invoice covering work performed for which it believes payment, under the Contract terms, is due. The submission shall be to the City's Finance Department - Accounting Division. The Supervising Professional will, within 10 days following submission of the invoice, prepare a certificate for payment for the work in an amount to be determined by the Supervising Professional as fairly representing the acceptable work performed during the period covered by the Contractor's invoice. To insure the proper performance of this Contract, the City will retain a percentage of the estimate in accordance with Act 524, Public Acts of 1980. The City will then, following the receipt of the Supervising Professional's Certificate, make payment to the Contractor as soon as feasible, which is anticipated will be within 15 days.

An allowance may be made in progress payments if substantial quantities of permanent material have been delivered to the site but not incorporated in the completed work if the Contractor, in the opinion of the Supervising Professional, is diligently pursuing the work under this Contract. Such materials shall be properly stored and adequately protected. Allowance in the estimate shall be at the invoice price value of the items. Notwithstanding any payment of any allowance, all risk of loss due to vandalism or any damages to the stored materials remains with the Contractor.

In the case of Contracts which include only the Furnishing and Delivering of Equipment, the payments shall be; 60% of the Contract Sum upon the delivery of all equipment to be furnished, or in the case of delivery of a usable portion of the equipment in advance of the total equipment delivery, 60% of the estimated value of the portion of the equipment may be paid upon its delivery in advance of the time of the remainder of the equipment to be furnished; 30% of the Contract Sum upon completion of erection of all equipment furnished, but not later than 60 days after the date of delivery of all of the equipment to be furnished; and payment of the final 10% on final completion of erection, testing and acceptance of all the equipment to be furnished; but not later than l80 days after the date of delivery of all of the equipment to be furnished, unless testing has been completed and shows the equipment to be unacceptable.

With each invoice for periodic payment, the Contractor shall enclose a Contractor's Declaration - Section 43, and an updated project schedule per Order of Completion - Section 2.

Section 17 - Deductions for Uncorrected Work

If the Supervising Professional decides it is inexpedient to correct work that has been damaged or that was not done in accordance with the Contract, an equitable deduction from the Contract price shall be made.

Section 18 - Correction of Work Before Final Payment

The Contractor shall promptly remove from the premises all materials condemned by the Supervising Professional as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement.

If the Contractor does not remove the condemned work and materials within l0 days after written notice, the City may remove them and, if the removed material has value, may store the material

at the expense of the Contractor. If the Contractor does not pay the expense of the removal within 10 days thereafter, the City may, upon 10 days written notice, sell the removed materials at auction or private sale and shall pay to the Contractor the net proceeds, after deducting all costs and expenses that should have been borne by the Contractor. If the removed material has no value, the Contractor must pay the City the expenses for disposal within 10 days of invoice for the disposal costs.

The inspection or lack of inspection of any material or work pertaining to this Contract shall not relieve the Contractor of its obligation to fulfill this Contract and defective work shall be made good. Unsuitable materials may be rejected by the Supervising Professional notwithstanding that the work and materials have been previously overlooked by the Supervising Professional and accepted or estimated for payment or paid for. If the work or any part shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good the defect in a manner satisfactory to the Supervising Professional. The judgment and the decision of the Supervising Professional as to whether the materials supplied and the work done under this Contract comply with the requirements of the Contract shall be conclusive and final.

Section 19 - Acceptance and Final Payment

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Supervising Professional will promptly make the inspection. When the Supervising Professional finds the work acceptable under the Contract and the Contract fully performed, the Supervising Professional will promptly sign and issue a final certificate stating that the work required by this Contract has been completed and is accepted by the City under the terms and conditions of the Contract. The entire balance found to be due the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of the final certificate.

Before issuance of final certificates, the Contractor shall file with the City:

(1) The consent of the surety to payment of the final estimate;
(2) The Contractor's Affidavit in the form required by Section 44.

In case the Affidavit or consent is not furnished, the City may retain out of any amount due the Contractor, sums sufficient to cover all lienable claims.

The making and acceptance of the final payment shall constitute a waiver of all claims by the City except those arising from:

(1) unsettled liens;
(2) faulty work appearing within 12 months after final payment;
(3) hidden defects in meeting the requirements of the plans and specifications;
(4) manufacturer's guarantees.

It shall also constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

Section 20 - Suspension of Work

The City may at any time suspend the work, or any part by giving 5 days notice to the Contractor in writing. The work shall be resumed by the Contractor within 10 days after the date fixed in the

written notice from the City to the Contractor to do so. The City shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this Contract as a result of the suspension.

If the work, or any part, shall be stopped by the notice in writing, and if the City does not give notice in writing to the Contractor to resume work at a date within 90 days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work suspended and will be entitled to the estimates and payments for all work done on the portions abandoned, if any, plus 10% of the value of the work abandoned, to compensate for loss of overhead, plant expense, and anticipated profit.

Section 21 - Delays and the City's Right to Terminate Contract

If the Contractor refuses or fails to prosecute the work, or any separate part of it, with the diligence required to insure completion, ready for operation, within the allowable number of consecutive calendar days specified plus extensions, or fails to complete the work within the required time, the City may, by written notice to the Contractor, terminate its right to proceed with the work or any part of the work as to which there has been delay. After providing the notice the City may take over the work and prosecute it to completion, by contract or otherwise, and the Contractor and its sureties shall be liable to the City for any excess cost to the City. If the Contractor's right to proceed is terminated, the City may take possession of and utilize in completing the work, any materials, appliances and plant as may be on the site of the work and useful for completing the work. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages where an extension of time is granted under Extension of Time - Section 14.

If the Contractor is adjudged a bankrupt, or if it makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or if it fails to make prompt payments to subcontractors or for material or labor, or persistently disregards laws, ordinances or the instructions of the Supervising Professional, or otherwise is guilty of a substantial violation of any provision of the Contract, then the City, upon the certificate of the Supervising Professional that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor 3 days written notice, terminate this Contract. The City may then take possession of the premises and of all materials, tools and appliances thereon and without prejudice to any other remedy it may have, make good the deficiencies or finish the work by whatever method it may deem expedient, and deduct the cost from the payment due the Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of finishing the work, including compensation for additional managerial and administrative services exceeds the unpaid balance of the Contract Sum, the Contractor and its surety are liable to the City for any excess cost incurred. The expense incurred by the City, and the damage incurred through the Contractor's default, shall be certified by the Supervising Professional.

Section 22 - Contractor's Right to Terminate Contract

If the work should be stopped under an order of any court, or other public authority, for a period of 3 months, through no act or fault of the Contractor or of anyone employed by it, then the Contractor may, upon 7 days written notice to the City, terminate this Contract and recover from the City payment for all acceptable work executed plus reasonable profit.

Section 23 - City's Right To Do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, 3 days after giving written notice to the Contractor and its surety may, without prejudice to any other remedy the City may have, make good the deficiencies and may deduct the cost from the payment due to the Contractor.

Section 24 - Removal of Equipment and Supplies

In case of termination of this Contract before completion, from any or no cause, the Contractor, if notified to do so by the City, shall promptly remove any part or all of its equipment and supplies from the property of the City, failing which the City shall have the right to remove the equipment and supplies at the expense of the Contractor.

The removed equipment and supplies may be stored by the City and, if all costs of removal and storage are not paid by the Contractor within 10 days of invoicing, the City upon 10 days written notice may sell the equipment and supplies at auction or private sale, and shall pay the Contractor the net proceeds after deducting all costs and expenses that should have been borne by the Contractor and after deducting all amounts claimed due by any lien holder of the equipment or supplies.

Section 25 - Responsibility for Work and Warranties

The Contractor assumes full responsibility for any and all materials and equipment used in the construction of the work and may not make claims against the City for damages to materials and equipment from any cause except negligence or willful act of the City. Until its final acceptance, the Contractor shall be responsible for damage to or destruction of the project (except for any part covered by Partial Completion and Acceptance - Section 26). The Contractor shall make good all work damaged or destroyed before acceptance. All risk of loss remains with the Contractor until final acceptance of the work (Section 19) or partial acceptance (Section 26). The Contractor is advised to investigate obtaining its own builders risk insurance.

The Contractor shall guarantee the quality of the work for a period of one year. The Contractor shall also unconditionally guarantee the quality of all equipment and materials that are furnished and installed under the contract for a period of one year. At the end of one year after the Contractor's receipt of final payment, the complete work, including equipment and materials furnished and installed under the contract, shall be inspected by the Contractor and the Supervising Professional. Any defects shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. Any defects that are identified prior to the end of one year shall also be inspected by the Contractor and the Supervising Professional and shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. The Contractor shall assign all manufacturer or material supplier warranties to the City prior to final payment. The assignment shall not relieve the Contractor of its obligations under this paragraph to correct defects.

Section 26 - Partial Completion and Acceptance

If at any time prior to the issuance of the final certificate referred to in Acceptance and Final Payment - Section 19, any portion of the permanent construction has been satisfactorily completed, and if the Supervising Professional determines that portion of the permanent construction is not required for the operations of the Contractor but is needed by the City, the Supervising Professional shall issue to the Contractor a certificate of partial completion, and immediately the City may take over and use the portion of the permanent construction described in the certificate, and exclude the Contractor from that portion.

The issuance of a certificate of partial completion shall not constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates if the Contractor has failed to complete it in accordance with the terms of this Contract. The issuance of the certificate shall not release the Contractor or its sureties from any obligations under this Contract including bonds.

If prior use increases the cost of, or delays the work, the Contractor shall be entitled to extra compensation, or extension of time, or both, as the Supervising Professional may determine.

Section 27 - Payments Withheld Prior to Final Acceptance of Work

The City may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to the extent reasonably appropriate to protect the City from loss on account of:

(1) Defective work not remedied;

(2) Claims filed or reasonable evidence indicating probable filing of claims by other parties against the Contractor;

(3) Failure of the Contractor to make payments properly to subcontractors or for material or labor;

(4) Damage to another Contractor.

When the above grounds are removed or the Contractor provides a Surety Bond satisfactory to the City which will protect the City in the amount withheld, payment shall be made for amounts withheld under this section.

Section 28 - Contractor's Insurance

(1) The Contractor shall procure and maintain during the life of this Contract, including the guarantee period and during any warranty work, such insurance policies, including those set forth below, as will protect itself and the City from all claims for bodily injuries, death or property damage that may arise under this Contract; whether the act(s) or omission(s) giving rise to the claim were made by the Contractor, any subcontractor, or anyone employed by them directly or indirectly. Prior to commencement of any work under this contract, Contractor shall provide to the City documentation satisfactory to the City, through City-approved means (currently myCOI), demonstrating it has obtained the required policies and endorsements. The certificates of insurance endorsements and/or copies of

policy language shall document that the Contractor satisfies the following minimum requirements. Contractor shall add registration@mycoitracking.com to its safe sender's list so that it will receive necessary communication from myCOI. When requested, Contractor shall provide the same documentation for its subcontractor(s) (if any).

Required insurance policies include:

(a) Worker's Compensation Insurance in accordance with all applicable state and federal statutes. Further, Employers Liability Coverage shall be obtained in the following minimum amounts:

Bodily Injury by Accident - $1,000,000 each accident
Bodily Injury by Disease - $1,000,000 each employee
Bodily Injury by Disease - $1,000,000 each policy limit

(b) Commercial General Liability Insurance equivalent to, as a minimum, Insurance Services Office form CG 00 01 04 13 or current equivalent. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements specifically for the following coverages: Products and Completed Operations, Explosion, Collapse and Underground coverage or Pollution. Further there shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. The following minimum limits of liability are required:

$1,000,000	Each occurrence as respect Bodily Injury Liability or Property Damage Liability, or both combined.
$2,000,000	Per Project General Aggregate
$1,000,000	Personal and Advertising Injury
$2,000,000	Products and Completed Operations Aggregate, which, notwithstanding anything to the contrary herein, shall be maintained for three years from the date the Project is completed.

(c) Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, equivalent to, as a minimum, Insurance Services Office form CA 00 01 10 13 or current equivalent. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. Further, the limits of liability shall be $1,000,000 for each occurrence as respects Bodily Injury Liability or Property Damage Liability, or both combined.

(d) Umbrella/Excess Liability Insurance shall be provided to apply excess of the Commercial General Liability, Employers Liability and the Motor Vehicle coverage enumerated above, for each occurrence and for aggregate in the amount of $10,000,000. The Umbrella/Excess Liability Insurance shall provide substantially the same coverage as the underlying Commercial General Liability Insurance, including additional insureds.

(e) Builders Risk Insurance in an amount equal to or greater than the Contract Sum. There shall be no exclusions or added endorsements limiting coverage for tunnel and subsurface construction.

(f) Professional Liability or Errors and Omissions Insurance protecting Contractor and its employees - $1,000,000.

(g) Contractor Pollution/Environmental Liability Insurance with minimum limits per occurrence and project aggregate limits of $2,000,000. The policy must provide Natural Resources Damages coverage either as part of the policy or as an endorsement.

(h) Railroad Protective Liability Insurance in the form and amount required by the applicable railroad(s).

(2) For all required insurance the City and the Regents of the University of Michigan shall be named as additional insureds without added exclusions or limiting endorsements. Insurance required under subsection (1)(b) and (1)(c) above shall be considered primary as respects any other valid or collectible insurance that the City may possess, including any self-insured retentions the City may have; and any other insurance the City does possess shall be considered excess insurance only and shall not be required to contribute with this insurance. Further, the Contractor agrees to waive any right of recovery by its insurer against the City for any insurance listed herein.

(3) Insurance companies and policy forms are subject to approval of the City Attorney, which approval shall not be unreasonably withheld. Documentation must provide and demonstrate an unconditional and un-qualified 30-day written notice of cancellation in favor of the City of Ann Arbor. Further, the documentation must explicitly state the following: (a) the policy number(s); name of insurance company(s); name and address of the agent(s) or authorized representative(s); name(s), email address(es), and address of insured; project name; policy expiration date; and specific coverage amounts; (b) any deductibles or self-insured retentions which may be approved by the City, in its sole discretion; (c) that the policy conforms to the requirements specified Contractor shall furnish the City with satisfactory certificates of insurance and endorsements prior to commencement of any work. Upon request, the Contractor shall provide within 30 days a copy of the policy(ies) and all required endorsements to the City. If any of the above coverages expire by their terms during the term of this Contract, the Contractor shall deliver proof of renewal and/or new policies and endorsements to the Administering Service Area/Unit at least ten days prior to the expiration date.

(4) Any Insurance provider of Contractor shall be authorized to do business in the State of Michigan and shall carry and maintain a minimum rating assigned by A.M. Best & Company's Key Rating Guide of "A-" Overall and a minimum Financial Size Category of "V". Insurance policies and certificates issued by non-authorized insurance companies are not acceptable unless approved in writing by the City.

(5) City reserves the right to require additional coverage and/or coverage amounts as may be included from time to time in the Detailed Specifications for the Project.

(6) The provisions of General Condition 28 shall survive the expiration or earlier termination of this contract for any reason.

Section 31 - Refusal to Obey Instructions

If the Contractor refuses to obey the instructions of the Supervising Professional, the Supervising Professional shall withdraw inspection from the work, and no payments will be made for work performed thereafter nor may work be performed thereafter until the Supervising Professional shall have again authorized the work to proceed.

Section 32 - Assignment

Neither party to the Contract shall assign the Contract without the written consent of the other. The Contractor may assign any monies due to it to a third party acceptable to the City.

Section 33 - Rights of Various Interests

Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Supervising Professional, to secure the completion of the various portions of the work in general harmony.

The Contractor is responsible to coordinate all aspects of the work, including coordination of, and with, utility companies and other contractors whose work impacts this project.

Section 34 - Subcontracts

The Contractor shall not award any work to any subcontractor without prior written approval of the City. The approval will not be given until the Contractor submits to the City a written statement concerning the proposed award to the subcontractor. The statement shall contain all information the City may require.

The Contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and all other contract documents applicable to the work of the subcontractors and to give the Contractor the same power to terminate any subcontract that the City may exercise over the Contractor under any provision of the contract documents.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the City.

Section 35 - Supervising Professional's Status

The Supervising Professional has the right to inspect any or all work. The Supervising Professional has authority to stop the work whenever stoppage may be appropriate to insure the proper execution of the Contract. The Supervising Professional has the authority to reject all work and materials which do not conform to the Contract and to decide questions which arise in the execution of the work.

The Supervising Professional shall make all measurements and determinations of quantities. Those measurements and determinations are final and conclusive between the parties.

Section 36 - Supervising Professional's Decisions

The Supervising Professional shall, within a reasonable time after their presentation to the Supervising Professional, make decisions in writing on all claims of the City or the Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

Section 37 - Storing Materials and Supplies

Materials and supplies may be stored at the site of the work at locations agreeable to the City unless specific exception is listed elsewhere in these documents. Ample way for foot traffic and drainage must be provided, and gutters must, at all times, be kept free from obstruction. Traffic on streets shall be interfered with as little as possible. The Contractor may not enter or occupy with agents, employees, tools, or material any private property without first obtaining written permission from its owner. A copy of the permission shall be furnished to the Supervising Professional.

Section 38 - Lands for Work

The Contractor shall provide, at its own expense and without liability to the City, any additional land and access that may be required for temporary construction facilities or for storage of materials.

Section 39 - Cleaning Up

The Contractor shall, as directed by the Supervising Professional, remove at its own expense from the City's property and from all public and private property all temporary structures, rubbish and waste materials resulting from its operations unless otherwise specifically approved, in writing, by the Supervising Professional.

Section 40 - Salvage

The Supervising Professional may designate for salvage any materials from existing structures or underground services. Materials so designated remain City property and shall be transported or stored at a location as the Supervising Professional may direct.

Section 41 - Night, Saturday or Sunday Work

No night or Sunday work (without prior written City approval) will be permitted except in the case of an emergency and then only to the extent absolutely necessary. The City may allow night work which, in the opinion of the Supervising Professional, can be satisfactorily performed at night. Night work is any work between 8:00 p.m. and 7:00 a.m. No Saturday work will be permitted unless the Contractor gives the Supervising Professional at least 48 hours but not more than 5 days notice of the Contractor's intention to work the upcoming Saturday.

Section 42 - Sales Taxes

Under State law the City is exempt from the assessment of State Sales Tax on its direct purchases. Contractors who acquire materials, equipment, supplies, etc. for incorporation in City projects are not likewise exempt. State Law shall prevail. The Bidder shall familiarize itself with the State Law and prepare its Bid accordingly. No extra payment will be allowed under this Contract for failure of the Contractor to make proper allowance in this bid for taxes it must pay.

Section 43

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period _____, 20___, to _____, 20 , performed any work, furnished any materials, sustained any loss, damage or delay, or otherwise done anything in addition to the regular items (or executed change orders) set forth in the Contract titled _____, for which I shall ask, demand, sue for, or claim compensation or extension of time from the City, except as I hereby make claim for additional compensation or extension of time as set forth on the attached itemized statement. I further declare that I have paid all payroll obligations related to this Contract that have become due during the above period and that all invoices related to this Contract received more than 30 days prior to this declaration have been paid in full except as listed below.

There is/is not (Contractor please circle one and strike one as appropriate) an itemized statement attached regarding a request for additional compensation or extension of time.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Past due invoices, if any, are listed below.

Section 44

CONTRACTOR'S AFFIDAVIT

The undersigned Contractor,_____, represents that on _____, 20___, it was awarded a contract by the City of Ann Arbor, Michigan to_____ under the terms and conditions of a Contract titled _____. The Contractor represents that all work has now been accomplished and the Contract is complete.

The Contractor warrants and certifies that all of its indebtedness arising by reason of the Contract has been fully paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the project, as well as all other claims arising from the performance of the Contract, have been fully paid or satisfactorily settled. The Contractor agrees that, if any claim should hereafter arise, it shall assume responsibility for it immediately upon request to do so by the City of Ann Arbor.

The Contractor, for valuable consideration received, does further waive, release and relinquish any and all claims or right of lien which the Contractor now has or may acquire upon the subject premises for labor and material used in the project owned by the City of Ann Arbor.

This affidavit is freely and voluntarily given with full knowledge of the facts.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Subscribed and sworn to before me, on this _____ day of _____, 20__
_____ , _____ County, Michigan
Notary Public
_____ County, MI
My commission expires on:

STANDARD SPECIFICATIONS

All work under this contract shall be performed in accordance with the Public Services Department Standard Specifications in effect at the date of availability of the contract documents stipulated in the Bid. All work under this Contract which is not included in these Standard Specifications, or which is performed using modifications to these Standard Specifications, shall be performed in accordance with the Detailed Specifications included in these contract documents.

Standard Specifications are available online:

http://www.a2gov.org/departments/engineering/Pages/Engineering-and-Contractor-Resources.aspx

DETAILED SPECIFICATIONS

Project Schedule and Payment

Project Coordination

Insurance Requirements

Sanitary Sewer

Removal and Disposal of Contaminated Material

Bollard

CITY OF ANN ARBOR
DETAILED SPECIFICATION
FOR
PROJECT SCHEDULE AND PAYMENT

Description

Examination of Plans, Specifications, and Work Site

Bidders shall carefully examine the Bid Form, plans, specifications, and the work site until the Bidder is satisfied as to all local conditions affecting the contract and the detailed requirements of construction. The submission of the bid shall be considered prima facie evidence that the Bidder has made such examination and is satisfied as to the conditions to be encountered in performing the work and all requirements of the Contract.

The entire work under this Contract shall be completed in accordance with, and subject to, the scheduling requirements as outlined below, and all other requirements of the Contract Documents.

1. The Contractor shall begin the work of this project on **January 12, 2026**, and only upon receipt of the fully executed Contract and Notice to Proceed. Appropriate time extensions shall be granted if the Notice to Proceed is delayed beyond this date.

2. This Contract requires microtunneled sanitary sewer, water main, stormwater improvements, road repairs and concrete repair work on Washington St between Third St and First St, and First St between Washington St to north of Miller Ave. The Contract shall be completed in phases and shall be completed within **two hundred and sixty-nine (269) consecutive calendar days**.

3. The work shall be sequenced to meet the schedule requirements identified. Contractor shall determine the exact sequence of work at the project locations and clearly note any deviations from the sequence identified below.

    a. **Relocate 10-inch sanitary sewer and other interfering utilities at First St and Washington St. (Detour Phase 1)**
    b. Install microtunneling shafts on First St, including the launch shaft at Sta. 161+30, intermediate shaft at Sta. 155+45 and reception shaft at Sta. 150+70. **(Detour Phase 2)**
    c. Install 36-inch sanitary sewer on First St starting at the Miller Ave end and constructing south. **(Detour Phase 2)**
    d. Install sewer up to low-level connection manhole at Sta. 161+46 and complete testing of sanitary sewer from Sta. 150+70 to Sta. 161+46. Place sewer in service to permit bypass pumping into the sewer. . **(Detour Phase 2)**
    e. Complete restoration of First St north of Huron St including concrete and HMA pavement by **June 20, 2026. (Detour Phase 2 ends)**
    f. **Install sanitary diversion structure at Sta. 100+17 to allow bypass pumping direct from the diversion structure. (Detour Phase 3)**
    g. Washington St microtunneling shafts can be installed once the First St microtunneling has commenced. **(Detour Phase 4)**

h. **Install 36-inch sanitary sewer on Washington St starting at the west end and constructing east.** It is anticipated that the intermediate microtunnel shaft on Washington St will be installed after completion of the Washington St microtunnel has been installed. **(Detour Phase 4)**

i. Sewer connections on Washington Street with flow through the newly installed sewer must be completed by **August 22, 2026**. **In the event that the sewer connections along Washington St are not complete by August 22, 2026, the Contractor shall be responsible to ensure that discharge of the bypass pumping from the 18-inch sanitary sewer on Washington St is directed into proposed manhole S-2 at no additional cost.**

4. The following schedule and phasing of work shall form the basis for bidding of the project. The Contractor may submit an alternative project timeline for Owner review that adheres to the general scheduling requirements previously identified.

   The entire work at these locations as required by this Contract includes, but is not limited to the following:

   - Temporary and permanent water main and valves installation, chlorinating, pressure testing and flushing.
   - Sanitary sewer structures needed for bypass pumping for microtunneling operations.
   - Storm sewer installations for installation of microtunneling shafts.
   - Pavement removal.
   - Replacement of pavement base within utility trenches.
   - Pavement base proof rolling and undercutting.
   - Replacement of storm sewer and structures.
   - Sanitary sewer installation and sanitary sewer abandonment.
   - Replacement and installation of curb and gutter, sidewalk and driveway approaches as needed.
   - Permanent placement of hot mix asphalt.
   - Restoration of all disturbed areas.
   - Removal of all traffic control devices.

5. Contractor shall sequence the sanitary sewer installation in a way that does not interrupt service of other utilities.

6. Contractor shall provide all necessary sewer flow control to maintain flow at all sewer replacement sections, sewer crossings, connections and lead transfers.

7. The following workday, hour and other work restrictions are imposed by the City of Ann Arbor.

   Contractor operations shall be limited by local municipality work time, noise and dust ordinance:

   - Monday through Friday: 7am – 8pm
   - Saturday: 7am – 8pm; Notice given to City of Ann Arbor no less than 48 hours and no more than 5 days
   - Sunday: Only with written approval from the City of Ann Arbor

   No work shall be performed during Holiday weekends as follows, unless approved by the City of Ann Arbor:

   - Memorial Day, from 3:00 p.m. Friday through 7:00 a.m. Tuesday
   - Fourth of July, from 3:00 p.m. July 2, 2026, through 7:00 a.m. July 6, 2026
   - Labor Day, from 3:00 p.m. Friday through 7:00 a.m. Tuesday
   - Thanksgiving, from 3:00 p.m. the Wednesday before Thanksgiving through 7:00 a.m. the Monday after Thanksgiving.

City Council approval is expected on or before **December 15, 2025**. The Contractor shall not begin the work without approval from the Project Engineer, and in no case before the receipt of the Notice to Proceed.

Contractor will be furnished with two (2) copies of the Contract, for his/her execution, before the aforementioned City Council meeting. The Contractor shall properly execute both copies of the Contract and return them, with the required Bonds and Insurance Certificate, to the City within ten (10) days.

Time is of the essence in the performance of the work of this contract. The Contractor is expected to mobilize sufficient personnel and equipment and work throughout all authorized hours to complete the project by the final completion date. Should the Contractor demonstrate that they must work on some Sundays in order to maintain the project schedule, they may do so between the hours of 9:00 a.m. and 5:00 p.m. with prior approval from the City. There will be no additional compensation due to the Contractor for work performed on Sundays.

Prior to the start of any construction, the Contractor shall submit a detailed schedule of work for the Engineer's review and approval. Work shall not be started until a schedule is approved in writing by the Engineer. The proposed schedule must fully comply with the scheduling requirements contained in this Detailed Specification. The Contractor shall update the approved work schedule upon request by the Engineer and present it to the Engineer within seven days of said request.

The Engineer may delay or stop the work due to threatening weather conditions. The Contractor shall not be compensated for unused materials or downtime due to rain, or the threat of rain. The Contractor is solely responsible for repairing all damages to the work and to the site, including road infrastructures, road subgrades, and any adjacent properties, which are caused as a result of working in the rain.

The Contractor shall not work in the dark except as approved by the Engineer and only when lighting for night work is provided as detailed elsewhere in this contract. The Engineer may stop the work, or may require the Contractor to defer certain work to another day, if, in the Engineer's opinion, the work cannot be completed within the remaining daylight hours, or if inadequate daylight is present to either properly perform or inspect the work. The Contractor will not be compensated for unused materials or downtime when delays or work stoppages are directed by the Engineer for darkness and/or inadequate remaining daylight reasons. The Contractor is solely responsible for repairing all damages to the work and to the site, including road infrastructures, road subgrades, and any adjacent properties, which are caused as a result of working in the dark.

Liquidated Damages

Failure to complete all work, including sub-phases, as specified herein within the times specified herein, including time extensions granted thereto as determined by the Engineer, shall entitle the City to deduct from the payments due the Contractor, **$2,000.00** in Liquidated Damages, and not as a penalty, for delays in the completion of the work for each and every calendar day beyond the times for substantial completion as required by this Detailed Specification. **These Liquidated Damages shall apply to the June 20, 2026 and August 22, 2026 intermediate project deadlines identified in this Detailed Specification, along with the substantial completion deadline.**

Substantial Completion shall include the installation of all utilities, HMA roadway pavement open to traffic including pavement markings and restoration. If restoration has not been installed, temporary erosion control measures such as staked in-place mulch blanket shall be installed. This work is included in the cost of **Turf Restoration**.

Liquidated Damages will be assessed until the required work is completed in the current construction season. If, with the Engineer’s approval, work is extended beyond seasonal limitations, the assessment of Liquidated Damages will be discontinued until the work is resumed in the following construction season.

If the construction Contract is not completed within the specified calendar day period including any extensions of time granted thereto, at the sole discretion of the City of Ann Arbor, this Contract may be terminated with no additional compensation due to the Contractor, and the Contractor may be forbidden to bid on future City of Ann Arbor projects for a period of at least three (3) years. If the Engineer elects to terminate the Contract, Contract items paid for on a Lump Sum basis shall be paid up to a maximum percentage equal to the percentage of the Contract work that has been completed.

CITY OF ANN ARBOR
DETAILED SPECIFICATION
FOR
PROJECT COORDINATION

OHM:CJE 1 of 1 10/23/25

Description

The Contractor shall be aware of other road construction work projects within the City of Ann Arbor.

The Contractor shall also be aware that other projects may be constructed within the City by other agencies or contractors that may affect work under this contract.

It is the Contractor's responsibility to coordinate efforts with other projects. It is the Contractors responsibility to investigate other projects in the area with the City and County. Additional costs incurred by the Contractor resulting from conflict with another project will not be considered for additional compensation.

The Contractor shall not receive a time extension due to reasonable work delays resulting from other projects within the area. Refer to the Proposal for information on the required completion date and associated penalties.

The City of Ann Arbor anticipates a water main and road reconstruction project on Ann St between 1st St and 5th Ave during the 2026 construction season. Detour routes may overlap and coordination maybe required between the two projects. **The City may elect to shift the detour associated with Detour Phases 2-4 to Ashley Street in place of Main Street to coordinate with adjacent projects and closures. Costs associated with moving signs for this shift will not be paid separately but included in the existing temporary sign pay items.**

The Contractor shall coordinate to utilize the existing City owned parcel located adjacent to the project site at 415 W Washington Street. The proposed staging area is identified on the contract drawings and shall be fenced off with a permanent 6' high chain link fence. The existing standing chimney on this site must be protected as a roosting spot for chimney swifts, and temporary barriers should be installed around the chimney to protect it from damage. This site includes concrete slabs and foundations from previously demolished buildings. Any surface improvements necessary to utilize the site shall be provided by the Contractor and incidental to the work.

The Contractor shall coordinate with the YMCA located at 400 W Washington Street. This includes coordinating with YMCA staff to ensure access through the 415 W Washington site from Liberty Street for vendor deliveries, solid waste collection and bus transportation. The parking lot beneath the YMCA will be closed to normal traffic, and the parking area at 415 W Washington will be utilized by YMCA patrons. An accessible pedestrian route from this parking lot must be provided to the YMCA.

All required construction staking and survey work for the project shall be performed by the Contractor in accordance with the City of Ann Arbor 2025 Public Services Standard Specifications and Section 824 of the MDOT 2020 Standard Specifications for Construction. Unless survey work is otherwise identified in other Detailed or Technical Specifications, it shall be incidental to the General Conditions pay item.

CITY OF ANN ARBOR
DETAILED SPECIFICATION
FOR
INSURANCE REQUIREMENTS

In addition to the insurance requirements noted in Section 28 of the General Conditions, the following additional insurance requirements apply:

Railroad Protective Liability Insurance naming Ann Arbor Railroad as Named Insured with limits of $5,000,000.00 per occurrence for bodily injury and property damage , with at least $10,000,000 aggregate limit per annual policy period.

The University of Michigan shall be listed as additional insured.

CITY OF ANN ARBOR
DETAILED SPECIFICATION
FOR
SANITARY SEWER

Description

This work shall consist of furnishing all labor, tools, equipment, and material to install sanitary sewer as indicated on the Plans. This work shall be performed in accordance with 2025 Public Services Standard Specifications Article 2 and Article 10, except as specified herein.

Additionally, where applicable, the work shall be performed in accordance with the following technical specifications incorporated as part of the Contract Documents:

Section 03 30 00 Cast-In-Place Concrete
Section 31 09 13 Geotechnical Instrumentation and Monitoring
Section 31 23 19 Dewatering
Section 31 41 00 Shaft Construction and Support
Section 31 73 00 Contact Grouting
Section 33 01 30 Sewer Flow Control
Section 33 05 07.36 Microtunneling
Section 33 05 36 Fiberglass-Reinforced Plastic Utility Pipe.

Materials

All precast concrete sanitary manholes and diversion structures shall contain Xypex Bio-San C500 admixture or approved equal.

Measurement and Payment

The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
DS_Sanitary Manhole, Fiberglass, ____In. Dia., Sta____	Each
DS_Sanitary Diversion Manhole, Sta ____	Each
DS_Sanitary Manhole Over Existing ("Doghouse"), ____In. Dia.	Each
DS_Sanitary Manhole Over Existing ("Doghouse"), Fiberglass, ____In. Dia	Each
DS_Geotechnical Instrumentation and Monitoring	Lump Sum
DS_ ____ Shaft, Sta ____	Each
DS_Sewer Flow Control	Lump Sum

DS_Sanitary Manhole, Fiberglass, ____In. Dia., Sta____ will be paid for at the Contract unit price for each fiberglass manhole installed. Payment includes but is not limited to furnishing the labor, equipment and materials for all necessary excavation; any needed sheeting, shoring and bracing; properly disposing off-site of all surplus or unsuitable excavated material; backfilling and compaction; frame and structure cover; and, constructing the structure complete, including pipe connections and structure cleaning, with the nominal diameter shown and up to the structure depth as detailed on the Contract Drawings.

DS_Sanitary Diversion Manhole, Sta ____ will be paid for at the Contract unit price for each precast concrete diversion structure installed as detailed on the Contract Drawings. Payment includes but is not limited to furnishing the labor, equipment and materials for all necessary excavation; any needed sheeting, shoring and bracing; properly disposing off-site of all surplus or unsuitable excavated material; backfilling and compaction; frame and structure covers; and, constructing the structure complete, including pipe connections, flow channels, stainless steel stop logs, and stainless steel orifice plate, as detailed on the Contract Drawings.

DS_Sanitary Manhole Over Existing ("Doghouse"), ____In. Dia. will be paid for at the Contract unit price for each precast concrete manhole installed as detailed on the Contract Drawings. Payment includes but is not limited to all work required to design and construct the manhole structure over and around the existing sewer pipe, including but not limited to: field investigation of existing sewer pipe, design of the manhole structure and appurtenances, submitting shop drawings to the Engineer for review and approval, fabricating and constructing the doghouse style manhole structure over and around the existing sewer pipe, constructing a concrete base for the manhole structure, furnishing and installing the manhole access riser structure with frame and cover, removal of portions of the existing sewer pipe within the new manhole structure, benching, connections into the manhole structure for sanitary outlet pipes with associated flow channels, temporary or final grade adjustments of the manhole riser structure, and all associated earthwork and backfill.

DS_Sanitary Manhole Over Existing ("Doghouse"), Fiberglass, ____In. Dia. will be paid for at the Contract unit price for each fiberglass manhole installed as detailed on the Contract Drawings. Payment includes but is not limited to all work required to design and construct the manhole structure over and around the existing sewer pipe, including but not limited to: field investigation of existing sewer pipe, design of the manhole structure and appurtenances, submitting shop drawings to the Engineer for review and approval, fabricating and constructing the doghouse style manhole structure over and around the existing sewer pipe, constructing a concrete base for the manhole structure, furnishing and installing the manhole access riser structure with frame and cover, removal of portions of the existing sewer pipe within the new manhole structure, benching, connections into the manhole structure for sanitary outlet pipes with associated flow channels, temporary or final grade adjustments of the manhole riser structure, and all associated earthwork and backfill.

DS_Geotechnical Instrumentation and Monitoring will be paid for at the Contract unit price on a lump sum basis for the scope of work as detailed in the technical specifications and on the Contract Drawings. 25% of the lump sum amount shall be paid following the initial installation and acceptance of the probes, sensors and readout devices by the Engineer. The remaining amount shall be paid based on percentage of microtunneling and shaft construction completed. The contract unit price for this item shall include all labor, supervision, tools, permits, shop drawing submittals, materials, equipment, operation, any incidental items, and all other work as noted on the Drawings and as specified herein to allow the Contractor to perform the work of furnishing, installing, monitoring, reading, recording, maintaining, protecting, and removing or abandoning geotechnical instrumentation for measuring ground movements and groundwater levels in the vicinity of trenchless installations and related work.

DS_ ____ Shaft, Sta ____ will be paid for at the Contract unit price for each access shaft constructed as detailed in the technical specifications at the locations identified in the Contract Drawings. Payment includes but is not limited to all work required to design and construct the shafts, field investigation of existing utilities, design of the shaft, submitting shop drawings to the Engineer for review and approval, installation, ground improvement, constructing a concrete working slab, and all associated earthwork and backfill.

Payment for shafts shall include 15% payment upon the delivery of materials, bracing, utility location and the mobilization of necessary installation equipment. An additional 60% payment after the installation of the shaft within project tolerances. The final 25% will be paid upon the successful removal and backfill of the temporary works. Locating existing utilities within or adjacent to the proposed shafts shall be incidental to the shaft and not paid as exploratory excavations.

DS_Sewer Flow Control will be paid for at the Contract unit price on a lump sum basis for the scope of work as detailed in the technical specifications and on the Contract Drawings. Contractor shall provide a schedule of values associated with the required sanitary bypass setups. For each setup, 50% of the lump sum shall be paid following the initial installation and acceptance of the system by the Engineer. The remaining 50% of the lump sum for each setup shall be paid upon returning the sewer back to service. The contract unit price for this item shall include all labor, supervision, tools, permits, shop drawing submittals, materials, equipment, operation, any incidental items, and all other work as noted on the Drawings and as specified herein to allow the Contractor to perform the work of diverting and bypass pumping flows.

CITY OF ANN ARBOR
DETAILED SPECIFICATION
FOR
REMOVAL AND DISPOSAL OF CONTAMINATED MATERIAL

Description

This work shall consist of furnishing all labor, tools, equipment, and material to sample, remove and properly dispose of contaminated material. This work shall be performed in accordance with 2025 Public Services Standard Specifications Article 1 and Article 10, except as specified herein.

Additionally, where applicable, the work shall be performed in accordance with the following technical specifications incorporated as part of the Contract Documents:

Section 02 61 00 Removal and Disposal of Contaminated Material
Section 31 23 19 Dewatering
Documentation of Due Care Compliance

Construction

The Contractor shall submit detailed invoices, receipts, and a summary of all costs incurred against the allowance items with each pay application. each submission must include copies of certified laboratory reports, chain of custody forms, manifests and any other documentation required by the engineer.

Measurement and Payment

The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	Pay Unit
DS_Laboratory Testing Allowance	Dollar
DS_Contaminated Groundwater Disposal Allowance	Dollar
DS_Contaminated Soil Disposal	Cubic Yard

DS_ Laboratory Testing Allowance will be paid for at the Contract unit price for dollar based on actual expenses incurred. This allowance is established to cover the costs of third-party laboratory testing, analysis, and reporting services that are directed by the Engineer and are not otherwise included in the unit prices for other pay items within the Contract. This shall include laboratory fees, sample collection and handling, courier and shipping fees, and analytical reports.

The Contractor shall submit a written request to the Engineer for authorization to perform any work to be paid from this allowance. Payment from the allowance will be made on actual costs based on invoice amounts from a third-party laboratory. The Contractor shall not add any markup or overhead to the cost of these services.

Any unused portion of the allowance upon final completion and acceptance of the work shall revert to the Owner, and no additional payment shall be made to the Contractor for this item. If the total

cost of approved laboratory services exceeds the allowance amount, the Contractor shall notify the Engineer and a Change Order will be issued to cover the additional, authorized costs.

DS_Contaminated Groundwater Disposal Allowance will be paid for at the Contract unit price for dollar based on actual expenses incurred for groundwater disposed or treated onsite due to contamination. Payment for this item shall be considered full compensation for all labor, equipment, materials, and services necessary to perform the work as specified herein, including but not limited to temporary storage in approved tanks, frac tanks, or other designated containers on-site. Installation and operation of onsite groundwater treatment systems. All on-site management of the contaminated groundwater, including routine inspections, maintenance of containment systems, and any required security measures. All costs associated with obtaining and completing any required permits for transportation and disposal, including state and local permits, and preparation of all required manifests. The mobilization of a licensed hauler and the transport of the contaminated groundwater from the project site to the approved off-site disposal facility. All fees charged by the receiving disposal facility for the treatment, disposal, or recycling of the contaminated groundwater. The provision of all required documentation, including disposal facility receipts, certified manifests, and a summary of all costs incurred.

The Contractor shall submit a written request to the Engineer for authorization to perform any work to be paid from this allowance. Payment from the allowance will be made on actual costs based on invoice amounts. The Contractor shall not add any markup or overhead to the cost of these services.

Any unused portion of the allowance upon final completion and acceptance of the work shall revert to the Owner, and no additional payment shall be made to the Contractor for this item. If the total cost of approved laboratory services exceeds the allowance amount, the Contractor shall notify the Engineer and a Change Order will be issued to cover the additional, authorized costs.

DS_Contaminated Soil Disposal will be paid for at the Contract unit price of cubic yards for disposal of contaminated soil. Payment for this item shall be considered full compensation for all labor, equipment, materials, and services necessary to perform the work as specified herein, including but not limited to the segregation of contaminated soil from clean soil within the work area as directed by the Engineer. The temporary stockpiling of contaminated soil on a designated area of the site, including the use of impermeable liners and covers to prevent runoff and exposure. All on-site management of the contaminated soil, including routine inspections, maintenance of stockpiles, and any required security measures. The mobilization of a licensed hauler and the transport of the contaminated soil from the project site to the approved off-site disposal facility. All costs associated with obtaining and completing any required permits for transportation and disposal, including state and local permits, and preparation of all required manifests. All fees charged by the receiving disposal facility for the treatment or disposal of the contaminated soil.

CITY OF ANN ARBOR
DETAILED SPECIFICATION
FOR
BOLLARD

OHM:TJL 1 of 2 10/22/2025

a. Description. This work consists of removing, fabricating, delivering and installing concrete-filled steel pipe bollards and high-density polyethylene (HDPE) bollard covers.

b. Materials.

1. Furnish steel pipe in accordance with *ASTM A53/A53M, Type E*.

2. Furnish Grade 3500 concrete in accordance with section 1004 and mortar/grout in accordance with section 1005 of the Standard Specifications for Construction.

3. Furnish yellow HDPE bollard covers.

c. Construction. Fabricate the bollard to the dimensions shown on the plans. Prior to installing grind all sharp edges to a minimum 3/32 inch radius

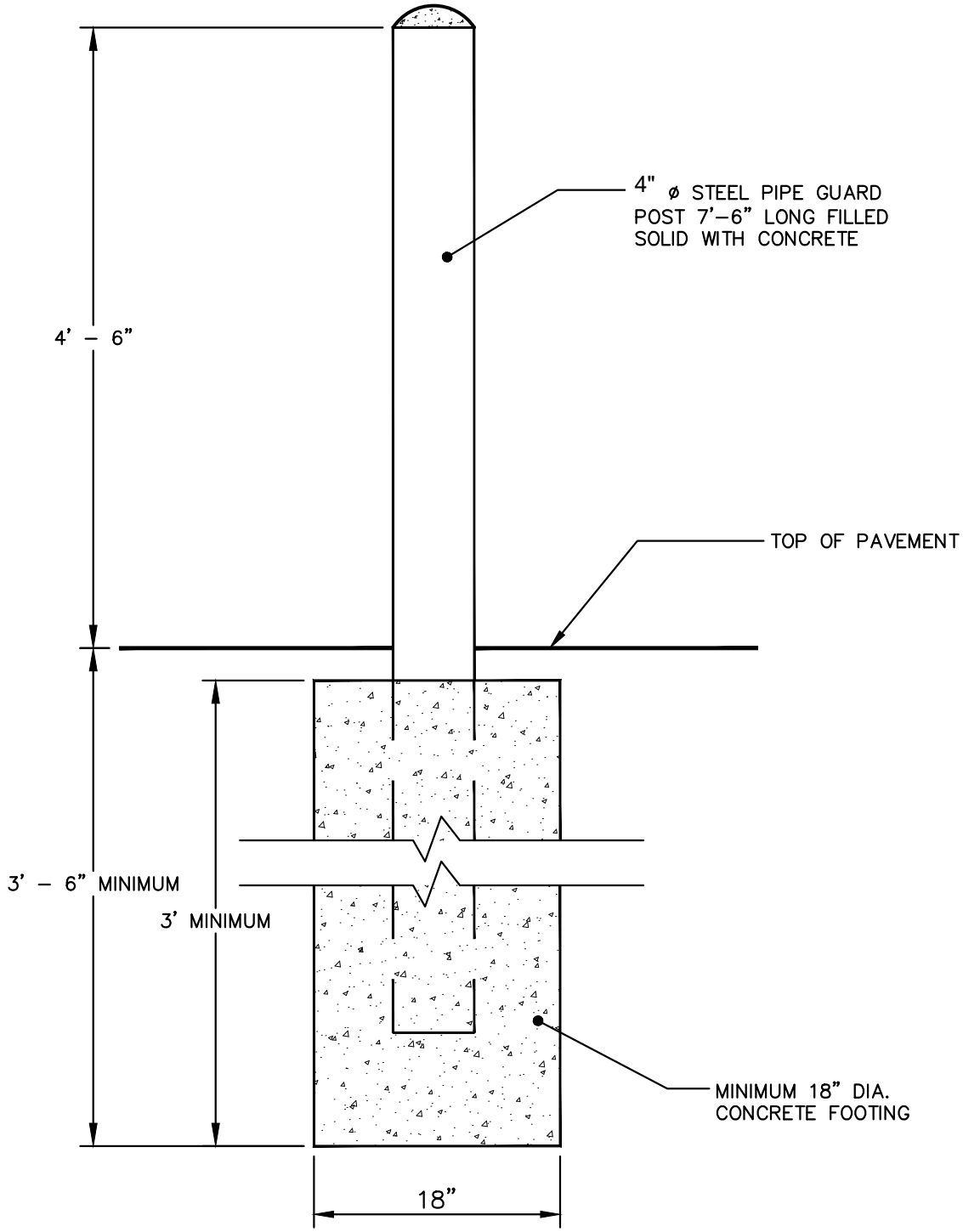
Install bollards plumb. Brace pipes to prevent displacement from center and plumb during pouring and curing of concrete. Consolidate wet concrete by rodding or vibrating. Finish concrete at top of pipe with convex (upward) dome for shedding of precipitation, while permitting bollard cover to be installed properly.

Install bollard covers according to manufacturer's specifications.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	**Pay Unit**
DS_Bollard	Each

DS_Bollard includes removing and disposing of existing bollards, fabricating, delivering, and installing the bollard and bollard cover at the location shown on the plans. The pay item **DS_Bollard** also includes the cost of placing and finishing concrete in the bollard and constructing a concrete foundation for the bollard.



CITY OF ANN ARBOR
PUBLIC SERVICES
301 EAST HURON STREET
P.O. BOX 8647
ANN ARBOR, MI 48107-8647
734-794-6410
www.a2gov.org

REV. NO.	DATE	DRAWN BY	CHECKED BY

STEEL PIPE BOLLARD

DR. ENG	CH. ENG	DRAWING NO.
SCALE N.T.S.	DATE 12/8/2023	**SD-M-3**

TECHNICAL SPECIFICATIONS

02 S61 00 - Removal and Disposal of Contaminated Material

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SECTION 02 61 00

REMOVAL AND DISPOSAL OF CONTAMINATED MATERIAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the minimum requirements for furnishing all labor, supervision, tools, equipment, materials, incidental items needed for screening, excavation, dewatering, handling, stockpiling, temporarily storing, and disposing of Hazardous or Contaminated Substances, including soils, groundwater, or debris, which are known or that may be encountered during the Work.

B. Hazardous or Contaminated Substances in soils, groundwater, and/or water are anticipated to be encountered during the Work. These conditions will require the screening, excavation, handling, stockpiling, temporary storage, profiling, transportation and off-site disposal of Hazardous or Contaminated Substances.

C. The Contractor shall take all the steps that he considers necessary to familiarize himself with the site conditions, the ground conditions, and the groundwater conditions.

D. The Contractor or his subcontractor(s) shall be currently and appropriately licensed by the State of Michigan to undertake the work covered under this Section and shall submit such information to the Engineer.

1.02 SUBMITTALS

A. Related Sections

B. Specifications, Code and Standards

1. ASTM D5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock.

2. 29 CFR 1910 Occupational Safety and Health Standards.

3. 40 CFR 262 Standards Applicable to Generators of Hazardous Waste.

4. 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

5. 40 CFR 268 Land Disposal Restrictions.

6. 40 CFR 280 Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST).

7. EGLE Part 201 Generic Cleanup Criteria and Screening levels for Nonresidential Soil, (Part 201 Criteria), dated October 12, 2023, under the Natural Resources Environmental Protection Act 1994, Public Act 451 as amended (NREPA).

8. EGLE Part 201 Generic Cleanup Criteria and Screening levels for Nonresidential and Residential groundwater, (Part 201 Criteria), dated October 12, 2023, under the Natural Resources Environmental Protection Act 1994, Public Act 451 as amended (NREPA).

C. Definitions:

1. Contaminated Substances Subject Matter Expert: Subject matter expert with knowledge of and experience in management and remedial actions for Contaminated Substances and Dangerous Waste and associated regulatory requirements.

2. Contaminated Substance Handling Plan: A work plan covering activities, excavation, staging, transport, sampling, emergency release and disposal of identified contaminated substances and dangerous waste in soil, groundwater or other environmental media.

3. Dewatering: Process of capture, extract, collect and contain groundwater encountered during construction excavation activities; dewatering water may also include trench seepage and/or infiltration which could comingle with saturated zone groundwater.

4. Hazardous and Contaminated Substances: Materials classified as Hazardous Waste, Dangerous Waste, Hazardous Building Materials, and/or Contaminated Substances.

5. Photoionization Detector (PID): A field screening device to detect contaminated materials, utilizing an ultraviolet light to detect ions from volatile organic compounds emitted from a sample.

6. Suspected Contaminated Substances – Soil, groundwater, debris or other environmental media that has not been assessed yet for verification of contamination levels and:

a. Is in contact or close proximity to known contaminated groundwater, soil or other contaminated media.

b. Has visual or olfactory evidence of contamination, or,

c. Is located in an area where hazardous or contaminated substances may be present based on-site historical information or uses.

1.03 COORDINATION

A. A preconstruction meeting with the Owner and Engineer is required before beginning any soil excavation or groundwater dewatering.

B. Schedule an on-site meeting(s) with the Owner and Engineer if suspect contaminated substances are discovered during construction.

C. Meeting(s) with the Engineer to discuss chemical analytical results prior to backfill.

D. Meeting(s) with the Owner and Engineer to review dewatering plans when contaminated substances are anticipated prior to starting dewatering.

1.04 SUBMITTALS

A. Contaminated Substance Handling Plan: 2 weeks prior to construction in areas of Hazardous or Contaminated Substances. Do not perform excavation or groundwater dewatering until the Work Plan is approved by the Engineer. The CSHP should include the following:

1. Summary of location, extent and analytical data for known and suspected Hazardous or Contaminated Substances.

2. Summary of planned construction activities in area of Hazardous or Contaminated Substances.

3. Schedule of activities.

4. Summary of plan for supplemental sampling to classify and characterize Hazardous or Contaminated Substances for disposal and/or reuse. Summary must include sampling approach and analytical methods.

5. Sampling and analysis plan(s) including identification of chemical analytical methods, chemical analytical laboratories, analyte target reporting limits, field and laboratory QC samples and frequency, sample containers and preservation methods and planned sample locations.

6. Methods and procedures of excavation and equipment to be used. Include methods to prevent the spread of Hazardous or Contaminated Substances.

7. Methods for documenting/surveying locations of samples, stockpiles and excavations.

8. Methods for field screening during excavation and dewatering in areas of Hazardous or Contaminated Substances.

9. Methods to prevent non-contaminated soil excavated from mixing with Contaminated Substances.

10. Staging and storage methods, procedures, and locations for liquid and solid Hazardous or Contaminated Substances:

11. Methods and procedures for the transportation, disposal, and off- site treatment of Hazardous or Contaminated Substances, in compliance with applicable federal, state, and local laws and regulations, including the identification of disposal and treatment facilities, and the use of certified, licensed transporters.

12. Equipment decontamination procedures to prevent cross contamination.

13. Project-wide Spill Prevention, Control, and Countermeasures Plans.

14. Methods for water management including groundwater, stormwater runoff, and surface water.

15. Procedures for documenting and reporting encounters with and/or releases of Hazardous or Contaminated Substances.

16. Analytical testing results including field screening results: within 24 hours of receipt.

17. Daily field logs during removal of Hazardous or Contaminated Substances: One week from date of activity.

18. Surveys of stockpile, sample location(s) and excavation area boundaries and elevations: 21 days from date of activity.

1.05 QUALITY ASSURANCE

A. Comply with local, state, and federal regulatory requirements and guidance documents included in this specification.

B. Qualifications:

C. Contaminated Substances Subject Matter Expert:

1. Must be a Michigan Professional Engineer, Licensed Geologist, Licensed Hydrogeologist, or demonstrate a minimum of 12 years of experience in the management of Hazardous or Contaminated Substances.

D. Site supervisor:

1. Trained and experienced in Hazardous or Contaminated Substances handling.

2. Completed OSHA training requirements for working with hazardous substances including the 8-hour supervisory course.

3. Minimum of three (3) years of experience in managing Hazardous or Contaminated Substances projects

E. Site personnel working with Hazardous or Contaminated Substances:

1. Minimum three (3) years of experience with similar work.

F. Employees entering the Exclusion Zone for Hazardous or Contaminated Substances must have HAZWOPER training and certification. For Level D and above personal protective equipment (PPE) protection:

1. Completed appropriate safety training in compliance with 29 CFR 1910.120, 29 CFR 1910.134, and WAC 296843-100.

2. Minimum of 40 hours health and safety training.

3. Minimum 24 hours of “on the job” training.

4. Eight (8) hours annual refresher training.

5. Respirator training and medical monitoring (as required for respirator use).

G. Certifications:

1. All personnel must have respirator fit test certification (qualitative/quantitative) for the respirators they intend to use.

2. Disposal sites certification for proper disposal or treatment of Hazardous or Contaminated Substances.

3. The transporter is a state-licensed transporter of Hazardous or Contaminated Substances.

H. Perform Hazardous or Contaminated Substances excavation and disposal work in compliance with applicable statutes and regulations.

I. Laboratories: Use laboratories as required by the Contract, Hazardous or Contaminated Substances Health and Safety Program.

1.06 PROJECT CONDITIONS

A. Hazardous or Contaminated Substances in soils, groundwater, and/or water are anticipated to be encountered during the Work. These conditions will require the screening, excavation, handling, stockpiling, temporary storage, profiling, transportation and off-site disposal of Hazardous or Contaminated Substances.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Obtain all required permits and notifications for removal, excavation, dewatering, storage, transportation, and disposal of Hazardous or Contaminated Substances.

B. Utilize a PID to perform screening for Hazardous or Contaminated Substance. Use a PID that is able to perform headspace analysis and is able to detect the contaminants of concern.

C. Colorimetric Field Screening Kit: A field testing kit (such as a “Hanby kit” or “RemediAid kit”) may be used in addition to the PID to screen for aromatic compounds, including BTEX, gasoline, and diesel. This screening method includes the extraction of aromatic compounds from the sample and provides a colorimetric indication of the concentration and type of contaminants present.

D. Immunoassay Test Kit: An immunoassay test kit may be used in addition to the PID/FID and OVA to screen petroleum compounds, polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs). This screening method depends on the ability of antibodies (analytes) to specifically bind to an antigen (compound); test results are measured visually or by a special instrument.

2.02 MATERIALS

A. Spill Response Materials:

1. As required and described in the Contaminated Substances Handling Plan.

2. Containers, adsorbents, shovels, and personnel protective equipment.

3. Available at all times in which Hazardous or Contaminated Substances are being handled or transported.

4. Compatible with the type of materials and contaminants being handled.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Complete site characterization, site remediation and soil management activities, including documenting site activities, removing and properly disposing of Hazardous or Contaminated Substances, and collecting soil and groundwater samples to confirm limits of Hazardous or Contaminated Substances in accordance with applicable regulations and standards of practice.

B. Contractor is responsible for obtaining all required samples.

C. Characterize Hazardous or Contaminated Substances for disposal purposes in accordance with applicable regulations and industry standards of practice. Media to be characterized may include sediment in utilities, soil, groundwater, and/or other water.

D. Anticipate a delay between the collection of confirmation samples and the completion of chemical laboratory analyses and secure and maintain excavation areas during that time. Contractor is responsible for arranging all sampling and testing, and associated delays.

E. Notify the Owner and Engineer immediately if Hazardous or Contaminated Substances are discovered, which had not been previously identified, or if other discrepancies between data provided and actual field conditions are discovered.

3.02 HAZARDOUS OR CONTAMINATED SUBTANCE REMOVAL

A. Give notification to the Engineer at least seven (7) days prior to the start of excavation or dewatering of known Hazardous or Contaminated Substances.

B. Implement environmental controls as required by the Contract prior to the start of excavation or dewatering.

C. Strip and stockpile noncontaminated soil separately from Hazardous or Contaminated Substances, for areas that are considered to be below Cleanup Levels based on field screening and chemical analytical data. The Contractor is responsible for staging and protecting this material from becoming contaminated. Dispose of such soil that becomes contaminated or characterized as Dangerous Waste as a result of work activities at the Contractor’s expense.

D. Excavate areas of contamination as required by the Work. Limit the potential for Hazardous or Contaminated Substances to be mixed with uncontaminated material during excavation. Dispose of such mixed soil that becomes contaminated and/or Dangerous Waste as a result of work activities at Contractor's own expense.

E. Maintain a log of the materials and visible indications of contamination encountered during excavation for each area of excavation. Prepare excavation logs in accordance with ASTM D5434.

F. Contain water generated during dewatering until collection and analysis of samples in accordance with applicable federal, state, and local disposal regulations until analytical results are obtained.

G. Perform field surveys immediately prior to and after excavations of Hazardous or Contaminated Substances. Develop cross-sections on 30-foot intervals and at obvious break points for excavated areas. Survey all sample locations. Perform field surveys of stockpiled soil in order to the estimate the volume of the stockpile if tonnage cannot be verified through weight tickets.

H. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests, and associated disposal notices and notifications, necessary for accomplishment of the Work:

3.03 HAZARDOUS OR CONTAMINATED SUBSTANCE STAGING

A. For known or suspected Hazardous or Contaminated Substance, place material in a staging unit immediately after excavation while awaiting test results. Use staging units that are in good condition and constructed of materials that are compatible with the material or liquid to be staged. If multiple staging units are required, clearly label each unit with an identification number and keep a written log to track the source of Hazardous or Contaminated Substance in each staging unit.

B. Isolate known and/or suspected Hazardous or Contaminated Substance from the surrounding environment.

C. Staging units may include stockpiles placed on minimum 6 mils thick plastic sheeting, water-tight barrels, water-tight portable tanks, or water-tight roll-off units lined with 6 mils thick plastic sheeting.

D. Staging units with known and suspected Hazardous or Contaminated Substances must be clearly labeled with the source, date generated, and type of material. Keep a written log to track the source of Hazardous or Contaminated Substances in each staging unit.

E. Place an impermeable cover over the units to prevent precipitation from contacting the stored material. Remove and store liquid that collects inside the units.

3.04 BACKFILL

A. Backfill excavations only after Hazardous or Contaminated Substances removal is complete.

B. All non-contaminated soil removed during the removal of Contaminated Soil must be stockpiled material, sampled and tested prior to backfill.

C. The testing for backfill must conform to the requirements of Reuse Criteria as required by the Contract and local, state and federal regulations.

D. Transmit soil chemical analytical results for material used as backfill to the Engineer prior to placement of backfill.

E. Place and compact backfill in as required by the Contract.

3.05 OFF-SITE DISPOSAL

A. Transport and dispose of excavated material with Hazardous or Contaminated Substances as required by the Contract and local, state, and federal requirements.

B. Transmit to Engineer documentation of off-site disposal facilities' acceptance criteria and associated soil sample chemical analytical data for soil to be disposed that meet acceptance criteria prior to transport of soil to facility.

C. An individual delegated with such authority must sign the waste profile as the generator. The Contractor is responsible for coordinating with the Engineer and providing sufficient chemical analytical data and information to verify waste characterization.

D. For disposal of all Dangerous Waste, with the exception of those wastes resulting from the release of Hazardous or Contaminated Substances negligently disturbed, removed, or handled by Contractor, its employees, agents, officers, or Subcontractors, or any other persons for whom the Contractor may be contractually or legally responsible, ensure that the Generator's Certification portion of the Uniform Hazardous Waste Manifest is signed only by an individual delegated with such authority.

3.06 LOGS, REPORTS AND RECORDKEEPING

A. Maintain field reports covering the implementation of all work identified in this specification.

B. Include in Daily Field Report when working in areas of Hazardous or Contaminated Substances, at a minimum, the following:

1. Date and time of day during which work was performed.

2. Weather conditions (temperature, precipitation).

3. Area (site specific) were work occurred.

4. Employees in particular area and regulators observing the work.

5. Equipment and monitoring instruments utilized in the course of the work.

6. Any substantive deviations from the specifications, plans or submittals as it relates to the daily work performed.

7. Activities completed including, but not limited to:

    a. Text and visual summary of activities including but not limited to drilling, excavation, backfill, dewatering, soil types encountered, groundwater conditions encountered, subsurface features encountered if any.

    b. Field screened sample locations and results.

    c. Map with locations, coordinates and identification of samples collected.

    d. Copies of chains of custody.

    e. Estimated quantities of soil or groundwater excavated and/or contained or disposed.

    f. Summary of disposal activities include quantity disposed and disposal locations.

    g. Mapped location and surveyed volume of stockpiles generated.

    h. Representative photographs of daily work performed.

3.07 SAMPLING, SCREENING, AND ANALYSIS

A. Sampling and Analysis:

1. The Contractor shall perform required sampling and chemical analyses relating to generation, use, release, and disposal of contaminated substances in the course of the Contractor operations.

2. The Contractor perform required characterization sampling and associated chemical analysis to determine disposal methods relating to known Contaminated Substances. Characterize and dispose of material as required in this specification.

3. The Contractor inspect the removal of existing Contaminated Substances from each area of Hazardous or Contaminated Substances. The Contractor must complete field screening during excavation. Samples must be collected in areas where contamination is likely to be present (for example same depth as known Contaminated Soil, areas where field screening indicate Contaminated Soil is present, near groundwater table etc.).

4. Have laboratory retained by the Contractor perform chemical analysis of collected samples with testing per the chemicals of concern and methods as required by the Contract.

B. Screening Procedures for Hazardous or Contaminated Substances:

1. Visually inspect all excavated soil for staining, debris, slag, or sheen. Note unusual odors to evaluate the presence of contamination. Notify Owner and Engineer

immediately if suspected Hazardous or Contaminated Substances are encountered.

2. Screen samples collected from the material excavated in the areas of suspected Hazardous or Contaminated Substance, as identified above, with a water sheen test and headspace measurements for the presence of volatile organic compounds and petroleum hydrocarbons. Screening must be conducted by collecting measurements in the vicinity of the suspect soil as excavation is completed. Conduct headspace analysis by placing suspect material into an inert sealable container, such as a glass jar or “Ziploc” bag, allowing the material to come to room temperature, and collecting measurements of the air within the container.

C. Action and Cleanup Levels.

1. Michigan Department of Environment, Great Lakes, and Energy (EGLE) Part 201 Generic Cleanup Criteria and Screening levels for Nonresidential Soil and Residential Groundwater.

2. If significant staining, sheen, odor, debris, or other evidence of Hazardous or Contaminated Substances is observed in areas where Hazardous or Contaminated Substances were not anticipated, cease all work in the area. Do not continue work in the area until potential risks are evaluated and as directed by the Owner and Engineer.

3.08 CLOSEOUT ACTIVITIES

A. Prepare and submit closeout documents related to the removal of Hazardous or Contaminated Substances. The closeout documentation must include sufficient information for the Engineer to develop the Cleanup Action Report:

B. Summary of excavation and backfill activities, sampling (if completed), and disposal.

C. Documentation prepared for regulatory agencies, including permits, notices, and closure checklists.

D. Information on who transported and accepted wastes encountered, including copies of manifests, waste profile sheets, land disposal restriction, notification and certification forms, disposal ticket and receipts, Bills of Lading, certificates of disposal, and other pertinent documentation signed by the responsible disposal facility official.

E. Surveys of sample locations, stockpiles and excavation area(s).

F. Analytical laboratory test results and chains-of-custody for samples collected.:

END OF SECTION

SECTION 31 09 13

GEOTECHNICAL INSTRUMENTATION AND MONITORING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the minimum requirements for furnishing, installing, monitoring, reading, recording, maintaining, protecting, and removing or abandoning geotechnical instrumentation for measuring ground movements and groundwater levels in the vicinity of trenchless installations and related work. The work includes, but is not limited to, installing and monitoring reflectorless monitoring points, subsurface monitoring points, and piezometers; furnishing monitoring equipment; and recording observations and measurements from the monitoring points on a periodic basis before, during, and after trenchless construction.

B. The Contractor is responsible for surveying the elevations of the monitoring points and other instrumentation locations in accordance with the requirements of this Section. Starting, or baseline, elevations or measurements shall be determined before operations begin to establish a baseline, and during and after operations to monitor any movements related to the trenchless construction. All monitoring points shall be surveyed after trenchless construction has been completed to evaluate longer-term movement or settlement, as Specified herein.

C. Minimum monitoring point location requirements are shown on the Drawings and specified herein. Additionally, the Contractor shall install other monitoring points as necessary to control operations, monitor ground conditions, and ground response to achieve specified project requirements and to prevent damage to existing structures, utilities, and facilities. The Contractor may also be required to install additional instrumentation if required to comply with permits or easements.

D. Vibration monitoring work includes, but is not limited to, furnishing and installing vibration monitoring equipment, performing vibration monitoring, and removing and abandoning equipment.

E. Contractor is responsible for procurement, installation, and monitoring of the required instrumentation.

1.02 REFERENCES

A. Related Sections

1. 31 41 00 – Shaft Construction and Support

2. 33 05 07.36 – Microtunneling

B. Specifications, Code, and Standards

1. American Railway Engineering and Maintenance-Of-Way Association (AREMA), Manual for Railway Engineering.

2. ASTM A53 – Standard Specification for Pipe. Steel, Black and Hot- Dipped Zinc-Coated (Galvanized), Welded and SeamlessASTM C778 – Standard Specification for Standard Sand.

3. ASTM D5434 – Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock.

4. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

5. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual -Manual Procedure).

1.03 DEFINITIONS

A. Geotechnical Instrumentation: General term for devices used for measuring groundwater levels, surface and subsurface movement, and movement of existing infrastructure. Includes measurement devices and appurtenant equipment, probes, sensors, cabling, readout devices, data loggers, and PC-based data management systems, as well as ancillary facilities required for their operation, such as boreholes, casings, housings, and covers.

B. Monitoring Point Array (MPA): A series of monitoring points arranged in a line perpendicular to the tunnel alignment. The array is centered over the center line of the tunnel alignment and is used to measure the settlement immediately above the tunnel and laterally away from the tunnel centerline.

C. Inclinometer (INC): Term for an instrument comprised of a specially designed probe (inclinometer probe) and a grooved casing having two sets of grooves orthogonal to each other. The casing is grouted into a borehole in proximity to a shaft or other excavation. The probe is lowered into the inclinometer casing, tracking each set of grooves to monitor horizontal ground displacements relative to fixity at the bottom of the casing that might occur during excavation of shafts or other subsurface structures.

D. Utility Monitoring Point (UMP): A system for monitoring vertical displacements of an existing utility, set on top of the existing utility.

E. Optical Survey Target (OST): Target established to monitor, by optical survey methods, the occurrence and amount of vertical and horizontal displacements.

F. Automatic Total Station (ATS): Total station that can be programmed to take readings for targets and reflectorless points without the need for manual operation.

G. Vibration Monitor (VM): A system to monitor vibrations caused by construction or blasting operations.

H. Observation Well / Piezometer: Open standpipe piezometers (piezometers or wells) consist of a slotted PVC well screen attached to a PVC riser pipe installed in a borehole with the well screen at a prescribed depth (typically the bottom of the borehole). The well screen is installed in a sand filter, the combination being referred to as the sensing

zone. The top of the sensing zone is sealed with bentonite and the annulus around the riser pipe is filled with grout.

I. Pavement Monitoring Points (PMP): A system for monitoring surface displacement induced by construction on pavement. This system shall only be used when the ATS is unavailable, in accordance with Paragraph 2.06.F.1.

J. Sleeved Settlement Monitoring Point (SSMP): A system for monitoring vertical deformation (settlement or heave) at or near the ground surface using optical survey techniques.

K. Reflectorless Point (RLP): Location established to monitor vertical displacements by automatic total station (ATS) that does not involve the installation of a reflector or target on the ground.

1.04 MONITORING CRITERIA

A. Contractor's ground control measures to minimize ground movements during shaft and trenchless construction activities as stated elsewhere in these Specifications shall be implemented to prevent ground movements from exceeding the applicable values listed in Paragraph 3.05.B. and values listed in applicable permits.

B. Tolerances:

1. General: Install geotechnical instruments within 1 foot of the theoretical location specified or indicated, except where otherwise approved by the Engineer. Avoid obstacles and utilities.

2. Survey Control: Achieve a level circuit closure with closure error no less accurate than third-order closure.

3. Survey Reference Point Readings:

a. Elevation: Within 0.05 in.

b. Position: Within 0.1 in.

1.05 QUALIFICATIONS

A. Installation and Monitoring Personnel: At least one (1) year of experience installing and reading instrumentation of the type specified. Where installation requires a drilled borehole, installation personnel shall be a geologist, geotechnical engineer, or qualified technician with at least three years of experience with geotechnical drilling and logging soil and rock samples.

B. Surveyor: Land Surveyor registered in the State of Michigan with at least three (3) years of experience in surveying of structure or surface deformations.

C. Manufacturer: The instrumentation manufacturer/supplier specializes in the fabrication and distribution of instrumentation of the type specified.

1.06 SUBMITTALS

A. General:

1. All instrumentation readings shall be reported in imperial units.

2. All submittals except for monitoring records and record drawings shall be provided a minimum of 30 days prior to the scheduled installation of any monitoring points.

3. All monitoring points to be installed or established in a timeframe allowing initial readings to be submitted in accordance with Paragraph 1.06.B.11.

B. Required Submittals:

1. Product Data: Submit manufacturers' catalog sheets, specifications, and installation, operating, and maintenance instructions for each type of data acquisition and management system, instrumentation component, and monitoring device shall be submitted at least 30 days prior to installing instruments.

2. Geotechnical Instrumentation Layout Drawings:

a. Indicate and describe instrumentation types, locations, and layouts in conjunction with a detailed plan of existing surface and subsurface utilities at a scale no less 1:40 (1-inch equals 40 feet). Include the identification number or label with elevation, station, offset, and coordinates as applicable for each instrumentation location.

b. Proposed deviations from the Geotechnical Instrumentation layouts shown on the Contract Drawings must be identified in appropriate submittals and accepted by the Engineer prior to installation at revised locations. Submit drawings with proposed locations, quantities, or types of instruments and a detailed description of the reason for the requested change.

c. Locations of all installed or established monitoring instrumentation on drawings showing monitoring locations in relation to trenchless shafts and segments. Drawings to be provided in DWG or pdf format.

3. Method Statements:

a. Method statements for installing, monitoring, maintaining, protecting, replacing damaged, and removing or abandoning instrumentation.

b. Method statements for installation shall include the equipment used for drilling and grouting, including the manufacturer and model of drilling rigs and methods to be used for advancing the borings.

c. Description of methods and materials for installing and protecting surface and subsurface monitoring points.

d. Installation and monitoring schedule.

e. Corrective measures when Threshold Value, Contractor Response Value, and Maximum Allowable Value are reached.

4. Mix Designs: Materials, admixtures, other additives, and grout mix design required for the instrumentation installation. Provide manufacturer's product descriptions for all admixtures and additives.

5. Drill Logs.

   a. Detailed boring logs including but not limited to soil and rock classification, top of rock elevations, drilling rates, recovery and RQD values, blow counts, groundwater elevation during drilling, voids, and notes describing karstic features, if encountered.

   b. Drilling activities shall be supervised, and boring logs recorded by a geologist or geotechnical engineer experienced with the specific types of earth materials to be encountered.

   c. Drafted logs shall be prepared using gINT, or similar logging software, and submitted to the Engineer.

   d. Field logs shall not be an acceptable submittal.

   e. Soils shall be classified in accordance with ASTM D2487 and D2488.

6. Preconstruction and Post-Construction Surveys of Adjacent Structures

   a. At the pre-construction conference, the Contractor shall submit plans for the preconstruction survey to the Engineer and Owner. This information should be complete and of sufficient detail to inform both the Engineer and Owner of the extent and detail to be achieved throughout the Work. During the course of the survey the Contractor shall keep the Engineer and Owner informed of the progress of the Work and shall notify them of any modifications to the initial plan.

   b. The Engineer and Owner will not be responsible for the accuracy, adequacy, and results of the pre-construction survey. Review of the Contractor's plan shall not denote an assumption of liability by either the Engineer or Owner due to the implementation of the survey or construction operations by the Contractor. The Contractor shall bear full responsibility for damages to either surveyed or un-surveyed property caused by construction operations.

7. Quality Control: Submit a quality control plan describing how the quality of materials and installation will be controlled (e.g. measurements, inspections, testing, etc.), including:

   a. Proposed methods for identifying instrumentation.

   b. Proposed format for presenting raw data readings. Include the date, time, and name of personnel taking measurements or performing monitoring.

c. Methods for assuring the quality of data readings.

d. Methods for protecting instrumentation and, if damaged, assuring their timely repair or replacement.

8. Certifications:

a. Calibration by the manufacturer for each sensor, probe, readout device, inclinometer, and data logger.

b. Provide certifications by the manufacturer for materials specified in Part 2.

9. Acceptance Criteria: Provide certification to indicate that the manufacturer's test equipment is calibrated and maintained in accordance with the manufacturer's calibration requirements, and that all calibrations have been made with equipment certified as meeting standards established for that purpose.

10. Testing: Calibrate all sensors and readout instruments at the manufacturer's facility prior to shipment and provide calibration records to the Engineer.

11. Initial Readings: Submit initial or baseline readings for all monitoring points at least seven (7) days prior to commencing trenchless shaft construction.

C. Reports and Records:

1. Within 72 hours following the installation of each monitoring point, piezometer, and inclinometer, submit:

a. Drawings showing the surveyed as-built location for each monitoring instrument relative to shaft or tunnel alignment.

b. As-installed details including identification numbers, ground elevations, location in terms of stations and offsets, and coordinates as applicable for each type of instrumentation.

c. Details of installed monitoring instruments, accessories, and protective measures including all dimensions and materials used.

d. For subsurface monitoring instrumentation, such as piezometers and inclinometers, provide the instrument tip elevation; sensing zone depths and elevations for piezometers; piezometer installation details, including sensing zone length, bentonite seal thickness and depth, backfill details, and protective good box details; and depths of inclinometer casings and groove orientations.

e. Procedures and sequence used for installation of each instrument.

2. A report including a summary of all monitoring data collected shall be submitted the day following collection of each set of monitoring data. Reporting frequency shall match the measurement frequency for instruments as specified herein.

Provide the data electronically and in hard copy in a format acceptable to the Engineer.

1.07 NOTIFICATIONS

A. Notify the Engineer as described below:

1. Seven (7) working days prior to the intended instrument installation.

2. Immediately upon discovering damaged or malfunctioning instrumentation.

3. Immediately for any reading exceeding specified levels or limits.

4. Immediately for any reading exceeding the Threshold Value Levels specified in Paragraph 3.05.B.

5. Two weeks prior to abandoning existing instrumentation previously installed for this contract.

1.08 WARRANTY

A. Equipment warranty as provided by the manufacturer.

B. Installation warranty shall be for the period of construction and post-construction instrumentation monitoring as specified herein.

PART 2 - PRODUCTS

2.01 MONITORING POINT ARRAY (MPA):

A. As shown on the Contract Drawings or as directed and accepted by the Engineer.

2.02 INCLINOMETER (INC)

A. Provide an inclinometer readout system that is capable of data storage and retrieval for immediate representation by a printer in either tabular form, graphic form, or both. The system shall allow editing, correction, and adjustment of data and shall provide error-checking routines.

B. Casing shall be an aluminum or plastic pipe with internal longitudinal grooves and with telescoping couplings, caps, and fittings. The casing shall have a minimum inside diameter of 3.3 inches.

C. Provide an inclinometer sensor with 100 feet of cable.

2.03 UTILITY MONITORING POINT (UMP)

A. As shown on the Contract Drawings and as directed or accepted by the Engineer.

2.04 OPTICAL SURVEY TARGETS (OST)

A. Surveyor's prisms or reflectors compatible with the survey equipment used and capable of providing measurements within the specified tolerances. Provide optical survey targets as shown on the Contract Drawings and specified herein.

B. If OSTs detach from mounting locations, the Contractor shall reinstall the OSTs within 24 hours or less, when such failure is observed by either the Contractor or Engineer.

2.05 SURFACE SURVEY POINTS ON RAILROAD TRACKS (OST):

A. Optical survey targets as shown on the drawings and as directed or accepted by the Engineer.

B. If OSTs on railroad tracks detach from mounting locations, the Contractor shall reinstall the OSTs within 24 hours or less, when such failure is observed by either the Contractor or Engineer.

2.06 AUTOMATIC TOTAL STATION (ATS)

A. Use Sixense Centaur automatic total station, or equivalent.

B. The Contractor shall choose suitable positions for the Automatic Total Stations to provide continuous readings of optical survey targets (OST) on railroad rails and reflectorless points (RLP) subject to the approval of the Engineer. The ATS shall be set to provide an unbroken line-of-sight to all monitoring points providing readings at all times without the need to move and re-establish either the ATS or any monitoring point. If such line-of-sight cannot be established and maintained, a second ATS shall be used.

1. The term “continuous” means that one optical survey target measurement shall be obtained at least every three hours.

C. Automatic total stations shall be robust and weather resistant and capable of operating to the specified accuracy in all weather conditions.

D. ATS shall be suitably mounted on a secure foundation or purpose-built bracket. The mounting shall be birdproof and vandal and theftproof.

E. The positions of the reference prisms are to be selected by the Contractor outside of the construction zone and zone of influence of the underground works. Where reference points are within the zone of influence, the data processing software shall recalculate the position of these points based on a survey by other ATS to allow correct calculation of the position of all total stations using those reference points. The Contractor shall propose the number and position of reference points outside the zone of influence, subject to the agreement of the Engineer.

F. During the monitoring period, one spare ATS shall be maintained for use as an emergency replacement for damaged or malfunctioning equipment. A damaged or malfunctioning ATS shall be replaced within one business day. The Contractor shall allow for replacement setups, including calibration, at no additional cost to the Owner.

1. The Contractor shall install an equivalent number of pavement monitoring points (PMP) to be monitored daily by a licensed surveyor for the duration of the delay, at no additional cost to the Owner. The PMPs shall only be used when the ATS is unavailable, due to malfunction or maintenance.

G. Results from monitoring reflectorless points by the ATS system shall be presented as a change in elevations with an overall accuracy of 0.01 foot (0.12 inch).

H. Provide the Engineer web-based access to the monitoring system, readouts, and any monitoring software required, such that the Engineer is able to view all ATS measurements at the same time as the Contractor.

2.07 VIBRATION MONITORS (VM)

A. Vibration Monitoring: Construction vibrations shall be monitored by the Contractor in terms of peak particle velocity using a seismograph with continuous recording capability. The vibration sensors shall be capable of recording three (3) orthogonal components of vibration.

2.08 OBSERVATION WELLS / PIEZOMETERS

A. Piezometers shall be installed as indicated in the Drawings.

B. Piezometers shall consist of 2-inch nominal diameter Schedule 40 PVC riser pipe with a vented cap in which an air vent hole of 0.2 inches in diameter has been drilled and a slotted Schedule 40 PVC well screen has been installed. The cap shall be easy to remove. The well screen shall conform to the requirements shown on the Drawings.

C. Filter sand shall conform to ASTM C778, Standard Specification for Standard Sand, type 20-30 sand.

D. Granular bentonite shall be Enviroplug Medium, manufactured by Wyo-Ben, Inc., Billings, Montana, or Holeplug, manufactured by Barold Division, Petroleum Services, Inc., Houston, Texas, or equivalent.

E. Water level indicator shall be an electrical indicator cable of appropriate length with graduations at 12-inch or smaller intervals. Provide two water level indicators to enable independent readings by the Contractor and the Engineer.

2.09 PAVEMENT MONITORING POINTS (PMP)

A. If used in lieu of Reflectorless Monitoring Points, or conditionally used when the ATS is unavailable, Pavement Monitoring Points in paved areas shall be hardened steel markers with an exposed convex head having a minimum diameter of 1/2 inch, a minimum length of two (2) inches, and similar to surveyor's "PK" nails.

2.010 ACCESS COVERS

A. Furnish access cover and install at the ground surface to protect installed inclinometer casings, soil deformation monitoring points, and piezometers. Use steel of sufficient

strength to withstand AASHTO (HS-20) truck loadings where traffic rated covers are required. Provide a traffic rated, minimum 8” ID, watertight access cover.

B. Grout covers in place in areas where instrumentation is subject to damage by construction operation. Install suitable barriers or guard posts as necessary to protect the monuments.

PART 3 - EXECUTION

3.01 PRECONSTRUCTION AND POST-CONSTRUCTION SURVEYS

A. Contractor shall perform a preconstruction survey of the interior and exterior of all structures, buildings, and utilities within 500 feet of each trenchless segment. The Engineer will assign a representative to participate in the survey. The Contractor shall be required to submit the results of the survey in a report. The survey shall include photographing and videotaping the exterior of each structure and building and recording (including sketches) any evidence of distress, such as cracks, distortions of the building frame, and any evidence of total and differential settlement. In the event that any cracks or other evidence of distress are observed, it may become necessary to enter the buildings (where distress is evident) to map any other evidence of distress in the building. Cracks and other evidence of existing distress shall be marked, catalogued, photographed, and crack-monitoring gauges shall be installed at the direction of the Engineer or the Engineer’s representative. The gauges can be glued to the wall spanning across the crack. The crack gauges shall allow monitoring of movement as reflected by enlargement of the cracks. For each building, a file shall be prepared that contains the photographic records, and a form report that records the preconstruction observations. This information shall be presented in a report and provided to the Owner. Where evidence of distress or damage is present, the information shall have to be disclosed to the owner of the structure. The Engineer may concurrently perform independent surveys at selected locations to verify the Contractor’s survey. The Contractor and the Engineer shall exchange results of the surveys and reconcile any differences in their findings before construction begins.

B. Periodic surveys to assess the condition of existing structures may be required. Such additional surveys may be conducted if there is evidence of damage to any of the adjacent properties or any allegations of damage by any of the property owners along the project alignment. At least one post-construction survey shall be performed at the end of all construction activities for each trenchless segment.

3.02 INSTALLATION

A. General

1. Notify the Engineer in advance of installation in accordance with Paragraph 1.07 NOTIFICATIONS. Install instrumentation in accordance with accepted submittals and other requirements of the Contract Documents.

2. Install instrumentation as shown on Drawings, as directed or accepted by the Engineer, and consistent with the Contractor’s submittals. Install in accordance with the manufacturer's printed instructions and as specified in this Section. Install within the accuracy limits specified by the manufacturer.

3. Inspect and log any drilled hole for instrument installation in accordance with ASTM D 5434. Confirm the ground conditions are compatible with the proposal installation.

4. Protection: Install protective housing with cap for piezometers, inclinometers, and sleeved settlement monitoring points. Protective housing shall be installed within a flush-mounted precast concrete box or vault if in traffic lanes or paved areas, so as not to obstruct vehicle or foot traffic, and shall be in accordance with standards and permit requirements. Install access covers as specified herein where required.

B. Monitoring Point Array (MPA)

1. Install monitoring points as close as practicable to the locations shown on the Contract Documents with the intent of locating them within 0.5 feet of the horizontal and vertical location shown on the Contract Documents or as directed by the Engineer. The Engineer may modify monitoring point locations depending on field conditions, conflicting utilities, and monitoring objectives.

C. Inclinometers

1. Inclinometers shall be provided as shown on the Contract Drawings.

2. Install inclinometer casings in accordance with the manufacturer's recommendations and the approved submittals. Grout annulus between the inclinometer casing and the drill hole in accordance with the manufacturer's recommendations. Grout installations from the bottom of the hole to the ground surface. Use a grout tube inside the casing, connected to grout port connection in bottom cap only when external tremie pipes will not be possible. Grout casing into hole immediately after installation.

3. Labeled protective covers shall be installed above each inclinometer.

D. Utility Monitoring Points (UMP)

1. Drill and probe with methods that will not damage the utility.

2. Use drill casing as necessary for hole stability and proper installation.

3. After completion of installation, the as-built location in horizontal position shall be determined to an accuracy of ± 1 ft and the elevation of the top of the riser pipe to an accuracy of ± .01 ft

E. Optical Survey Targets (OST)

1. Install one optical survey target, centrally located horizontally and vertically, on each of the shaft walls. Optical survey target locations are to be approved by the Engineer.

F. Automatic Total Station (ATS)

1. The contractor shall submit the proposed ATS installation locations for acceptance by the Engineer in accordance with Paragraph 1.06 SUBMITTALS.

G. Observation Wells / Piezometers

1. Piezometers shall be installed at the locations and depths required on the Drawings.

2. Bentonite and other types of drilling mud shall not be used when drilling boreholes for piezometer installation.

3. For any piezometer to be installed in the soil overburden, a standard split spoon sample shall be taken at the top and bottom of the piezometer sensing zone.

4. The well screen, riser pipe, filter pack, filter pack seal, and annular space seal shall be installed as shown on the Drawings. Pipe joints shall be made secure and watertight. The drill casing shall be withdrawn slowly as the backfill materials are placed, at the same rate as backfill placement, so that collapse of the borehole does not occur. Casing shall not be rotated during withdrawal.

5. Filter pack material shall be placed slowly so that bridging does not occur in the boring and to prevent the well screen and riser pipe from being lifted as the casing is withdrawn. A measuring rod, cylindrical sounding hammer or similar device shall be used to measure the height of the filter pack to ensure that the filter pack is installed over the proper depth interval. The measuring rod shall be carefully raised and lowered while the filter pack is installed, to prevent bridging and to tamp the filter pack in place.

6. After the filter pack is placed, the filter pack seal, consisting of granular bentonite, shall be placed as shown on the Drawings. Granular bentonite shall be placed slowly so that bridging does not occur in the boring and to prevent the well screen and riser pipe from being lifted as the casing is withdrawn. Depth to the top of each increment of granular bentonite shall be checked using a cylindrical sounding hammer. The granular bentonite shall not be tamped.

7. An annular space seal, consisting of Portland cement grout, shall be placed above the filter pack seal to fill the annular space between the riser pipe and borehole. The annular space seal shall be placed by tremie grouting. The grout shall be placed in such a manner as to not disturb the integrity of the filter pack and seal.

8. Each installation shall be developed a minimum of 24 hours after completion. Development shall be continued until the water becomes clear and, in the opinion of the Engineer, the material soil filter has been developed.

9. After completion of piezometer development, a post-installation acceptance test shall be performed within seven (7) calendar days after development by conducting a falling head permeability test to verify seal integrity to the satisfaction of the Engineer.

H. Seismographs

1. Two seismographs per shaft location shall be installed and in operation for each day the Contractor conducts vibration inducting operations including, but not limited to, installation of support of excavation systems, pile driving, excavation, and backfilling. The seismographs shall be installed adjacent to existing structures within 25 feet of the work. If there are no existing structures within 25 feet, the seismograph shall be installed on a firm surface 25 feet from the work zone.

2. Vibration sensors shall be firmly mounted on the surface of concrete or asphalt.

3.03 SURVEYS AND INITIAL READINGS

A. After installation, survey the location of the top of each instrument or its marker point to horizontal and vertical accuracy as stated in this Section. Submit location information to the Engineer.

B. After completion of each instrument installation, take 3 sets of verification data readings for each instrument to demonstrate the adequacy of the installation, to demonstrate the proper operation of the instrument, and to establish an initial or baseline value. Submit the initial readings to the Engineer for approval. Location survey for each monitoring point and establishment of baseline readings shall be completed at least 7 days prior to the start of shaft excavation or trenchless construction.

C. Initial readings of vibrations shall be performed by the Contractor and shall consist of at least three days of monitoring prior to the start of vibration producing construction activities. Readings shall be taken at various locations within the proposed work zones to provide information on background vibration levels.

3.04 MONITORING

A. General: The Contractor shall monitor all instruments during construction. Upon the Engineers' request, the Contractor shall provide such assistance, labor and equipment necessary for the Engineer to monitor instruments, if desired, at no additional cost to the Owner.

B. Coordinate with such instrumentation monitoring activities as follows:

1. Make probes, sensors, and readout devices available as required by the Engineer.

2. Schedule employees' and subcontractors' activities to minimize interference.

3. Remove obstructions from lines of sight when requested.

C. Temporarily cease activities that create hazards to instrument monitoring or surveying personnel.

D. Be available to discuss the interpretation of instrumentation data as used in evaluating tunneling performance and controlling settlements to prevent damage to structures, facilities, and utilities.

E. Monitoring frequency: The frequency of instrument reading shall be as follows unless otherwise indicated:

1. All monitoring instrumentation at and adjacent to shafts and along tunnel alignments shall be monitored daily during shaft and tunnel excavation for that tunnel drive, regardless of whether work progresses at the site that day. Monitoring can be reduced to twice per week after the trenchless excavation is complete.

2. Once related construction operations are complete, all monitoring devices and points shall be surveyed once at seven days, once at 14 days, and once at 30 days after completion of the trenchless excavation. In this context, “completion” means that the jacking pipe has been installed, piping in the launch and reception shafts is placed, and the shafts are fully backfilled.

3. Upon completion of construction, monitoring shall continue for any monitoring points that show movement from the prior survey until three consecutive surveys, each performed on different days, show no additional movement.

F. Additional measurements are required in the following cases:

1. Double the frequency of measurements when measurements reach Threshold Values.

2. Take additional, immediate measurements where measured values indicate excessive variability, as determined by the Engineer.

3.05 RESPONSE VALUES

A. The response values listed herein are only the maximum allowed and do not relieve the Contractor of the responsibility of controlling the work and preventing damages.

B. The Contractor shall abide by the following response values. The Contractor shall use more stringent response values as necessary to control the work and prevent damage to all facilities.

Instrument	Threshold Value	Shutdown Value
Inclinometer	0.50 inch	1.0 inch
(1) Optical Survey Target	0.50 inch	1.0 inch
Settlement Monitoring Point	0.50 inch	1.0 inch
Structural Monitoring Point on Railroad Bridge	0.1 inch	0.25 inch
Utility Monitoring Point	0.25 inch	0.50 inch
Vibrations: PPV	1.0 in/sec	1.5 in/sec

(1) Maximum allowable deflection (Shutdown Value) of shaft walls is 1 inch or designer’s recommendation, whichever is less.

When a given response value is reached, the Contractor shall respond in accordance with the following:

Threshold Value: The Contractor shall meet with the Engineer to: 1) review interpretation of the data and results, 2) review the construction means and methods, and 3) determine what changes, if any, shall be made to better control movement.

Shutdown Value: The Contractor shall stop all work immediately, if it is safe to do so, and meet with the Engineer to develop a plan of action before work can be resumed.

C. When the threshold value is reached, the frequency of readings for any affected instruments shall be double the frequency stated herein, or as otherwise directed by the Engineer. The increased frequency of readings shall be maintained until readings made during five (5) consecutive days are below the Threshold Value for the instrument(s) in question or reading values have stabilized, as determined by the Engineer.

3.06 INSTRUMENT PROTECTION, MAINTENANCE AND RESTORATION

A. Protect and maintain instruments throughout the duration of monitoring. Drain water or flush debris from under traffic covers. Keep traffic covers secured.

B. Provide substantial protective barriers such as bollards or Engineer approved equal around instruments in construction areas that are suitable for protecting instruments from damage due to construction activities.

C. Maintain instrumentation in accordance with manufacturer recommendations.

D. Repair or replace damaged or missing instrumentation in accordance with manufacturer recommendations. Repair or replace damaged or missing instrument components or the entire instrument within 24 hours or as approved by the Engineer. All repairs and replacements will occur at no additional cost to the Owner.

E. If any instruments deemed by the Engineer to be critical are damaged, the Contractor will be instructed to cease Work until the damaged instrument is replaced and readings re-established. The Contractor will not be entitled to additional time or compensation resulting from this delay or the cost of materials, labor, and equipment to install the replacement.

F. For replacement instrumentation, take initial readings and correlate with previous readings to the satisfaction of the Engineer.

3.07 REMOVAL OR ABANDONMENT

A. All instrumentation shall remain the property of the Contractor following completion of the work and shall be removed or abandoned according to this section and the Contract Documents, applicable codes, permits, and standards unless otherwise noted.

B. Removal:

3. Verify with the Engineer that instrumentation is no longer required.

4. Remove instrumentation prior to substantial completion of the work unless otherwise indicated.

5. Remove all instrumentation per the requirements and methods of the applicable regulatory agency. Backfill holes with grout mix approved by the applicable regulatory agency, or the Engineer, and restore surfaces to conditions existing before installation.

6. Fill holes drilled in masonry or concrete surfaces with cement mortar to present an appearance matching the surrounding surface.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the minimum requirements for furnishing all labor, supervision, tools, equipment, appliances, materials, incidental items, and the installation, operation, and maintenance needed to lower and control the groundwater levels and hydrostatic pressures to permit all excavation and construction specified under this contract to be performed in the dry. The control of all ice, snow and surface water shall be considered as part of the work under this Section.

B. The Contractor shall take all the steps that he considers necessary to familiarize himself with the site conditions, the ground conditions, and the groundwater conditions.

C. The Contractor or his dewatering subcontractor shall be currently and appropriately licensed by the State of Michigan to undertake the work covered under this Section and shall submit such information to the Engineer.

D. Groundwater depths in the proposed sanitary alignment area are expected to be encountered based on soil boring data. Select metals were identified in the groundwater in excess of Michigan Department of Environment, Great Lakes, and Energy (EGLE) Part 201 Generic Cleanup Criteria and Screening levels for Nonresidential Soil, (Part 201 Criteria), dated October 12, 2023, under the Natural Resources Environmental Protection Act 1994, Public Act 451 as amended (NREPA). These metals include arsenic, lead, copper, mercury, silver and zinc. The south end of First Street may also have tetrachloroethene (PCE) present. Treatment will be required prior to discharge through the City of Ann Arbor stormwater infrastructure.

E. All dewatering shall be in compliance with the Documentation of Due Care Compliance incorporated into the Contract Documents.

1.02 SUBMITTALS

A. Prior to commencement any excavation within three feet. of the prevailing groundwater levels, the Contractor shall submit a detailed plan and operation schedule for dewatering of excavations. The detailed plan shall include mitigation measures to prevent settlement of nearby structures and a contingency plan for restoring nearby structures if settlement is observed as a result of the Contractor’s dewatering operations. The Contractor may be required to demonstrate the system proposed and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times. The Contractor's dewatering plan is subject to review by the Engineer.

B. Submit dewatering plan as an informational submittal no less than 30 days before installation of dewatering systems. Review will be solely for conformance to requirements of this section with no warranty of whether reviewer believes the plan

will work. Contractor shall review available geotechnical information in development of the dewatering plan and gather any additional information necessary to inform the plan.

C. The dewatering plan shall include the following elements:.

1. Applicable permit requirements
2. Equipment proposed
3. Methods proposed
4. Standby equipment proposed
5. Capacities of pumps, motors and engines, including standby equipment
6. Power supply
7. Standby power
8. Contaminant monitoring requirements
9. Pollution control facilities
10. Proposed discharge locations
11. Operation procedures
12. Equipment removal and/or abandonment procedures.

D. For each submittal and re-submittal, the Contractor shall allow at least 14 calendar days from the date of the submittal to receive the Engineer's acceptance or request for revisions. The Engineer's comments shall be incorporated into the re-submitted plans, calculations, and descriptions. The Engineer's acceptance of the plan is required before beginning the work. Re-submittals shall be reviewed and returned to the Contractor within 14 calendar days. Required revisions will not be a basis of payment for additional compensation, extra work, or an extension of contract time. The Contractor shall include time for this entire review process in their schedule.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work. Contractor must be registered with EGLE for projects in Michigan.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic

pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.

D. Prevent surface water from entering excavations by grading, dikes, or other means acceptable to the Engineer and Authorizing Jurisdictions.

E. Accomplish dewatering without damaging existing buildings, structures, sensitive natural features (i.e. wetlands, etc) and site improvements adjacent to excavation. Method shall prevent loss, caving, loosening or softening of ground as water is removed.

F. Remove dewatering system when no longer required for construction.

2.02 DEWATERING BAGS

A. Bags shall be constructed from a robust geotextile filter fabric made for the purpose of accommodating flow from groundwater dewatering operations. They shall include integrated hose inlets.

B. Fabric shall be a heavy-duty needle punched non-woven geotextile filter fabric; fabric shall provide high permittivity pore structure that allows water to pass through while containing fine soils.

C. Bags shall be sized to accommodate the volume of water being pumped, the quantity and type of sediment, the permittivity of the bag, and the volume of materials being contained. The volume per bag is dependent on pumping rates, soil composition, and site conditions.

PART 3 - EXECUTION

3.01 DEWATERING

A. The Contractor shall provide all equipment necessary for dewatering. The Contractor shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

A. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

B. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

C. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

D. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with approved aggregate.

E. The Contractor shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation, construction, backfilling, and up to acceptance.

F. Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

G. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

H. No water shall be drained into work built or under construction without prior consent of the Engineer. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.

I. After all requirements of this Section are met; the Contractor shall remove all materials and equipment used during this operation. All holes, wells, and pits shall be filled immediately with suitable material.

3.02 PRE-INSTALLATION CONFERENCE

A. Conduct conference at project site to review methods and procedures related to dewatering including, but not limited to, the following:

1. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.

1. Geotechnical report.

2. Proposed site clearing and excavations.

3. Existing utilities and subsurface conditions.

4. Coordination for interruption, shutoff, capping, and continuation of utility services.

5. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

6. Testing and monitoring of dewatering system.

3.03 PERMITTING

A. All water removed from the excavation will be managed and discharged to the stormwater system in accordance with City of Ann Arbor Dewatering Permit requirements. Permit for discharge to the stormwater system has been submitted to the City of Ann Arbor Systems Planning Unit for review and approval.

B. The Contractor shall temporarily store water from the excavation in frac tanks staged. Water from the initial frac tank will be sampled and analyzed by a laboratory. If the water meets the requirements in the permit, the water will be discharged to an existing stormwater manhole.

C. If the water does not meet the permit requirements, the Contactor shall arrange for disposal of the water, or can utilize a portable treatment system (granular activated carbon or similar) to pre-treat the water prior to discharge.

D. Contractor shall register with Michigan EGLE for large quantity water withdrawal, should the estimated water withdrawals with a capacity of 70 gpm or more, be expected. Registration is required before the withdrawal can begin. Use the WWAT to determine requirements based on your bid assumptions: https://www.egle.state.mi.us/wwat/(S(ihruwth5tbgqfices1qqxbbl))/Default.aspx.

3.04 REGULATORY REQUIREMENTS

A. Comply with governing jurisdiction regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. In Michigan, dewatering is subject to review by EGLE. Natural Resources and Environmental Protection Act 451, 1994, Part 327, Section 32 4. 32723 identifies permit and registration requirements. There are limits on the amount of groundwater that can be withdrawn without a permit or registration.

C. Contractor is responsible to obtain a Part 327 groundwater discharge permit if necessary for construction. Contractor is responsible to comply with the Part 327 groundwater discharge permit or registration required by EGLE for this project, and the Washtenaw County Department of Health.

D. Michigan Department of Environment, Great Lakes, and Energy EGLE Part 201 Generic Cleanup Criteria and Screening levels for Nonresidential and Residential groundwater, (Part 201 Criteria), dated October 12, 2023, under NREPA. Requirements.

3.05 NOISE CONTROL

A. All noise generated by the dewatering operation shall not exceed the sound limits as required by City Code and shall follow necessary procedures as required for temporary exemptions.

B. The Contractor shall provide a secondary sound barrier for pumps and any power generating equipment.

3.06 DEWATERING BAGS

C. Bags shall be placed at locations approved by the Engineer and Owner. Bags shall not be placed on steep sloped surfaces, as the bag may roll.

D. Lay bags flat on ground. If manufacturer's recommendations allow for it, bags can be placed on trailers or dump trucks to facilitate removal.

E. To improve the performance levels of the filtration bags, placement on a permeable or porous surface (such as hay bales or aggregate) may help to facilitate a faster dewatering process. Select a media that will not damage the bag. All temporary surfaces must be removed after the completion of dewatering operations, and all areas restored to original conditions.

F. Water runoff from the bag shall be guided to the nearest watercourse without causing any soil erosion.

G. Monitor the performance to ensure that pump rates or concentration of sediment are not excessive. Replace the bag when the bag stops filtering and passing water at a normal rate.

H. Avoid multiple pipe discharges into one bag.

I. Used bags and collected contents shall be disposed of by the Contractor off- site.

3.07 GROUNDWATER CONTAMINATION

A. Where non-perched groundwater is encountered, it may contain tetrachloroethylene, arsenic, lead, copper, mercury, silver and zinc as shown in the appended geotechnical information.

B. Contractor shall include provisions to pre-treat or properly dispose of water that does not meet EGLE Part 201 Generic Cleanup Criteria and Screening levels for Nonresidential and Residential groundwater, (Part 201 Criteria), dated October 12, 2023, under NREPA. requirements.

C. Groundwater will need to be directed through an activated carbon filter before discharging. The groundwater will be sampled every four days during active continuous dewatering. Contractor is responsible for replacing filter media when needed to maintain concentrations to state-approved levels. Submit dewatering plan and coordinate with the Owner's operations.

D. Water shall be initially staged in a frac tank and sampled for the parameters listed in Part 201. Contractor will be responsible to conduct the water sampling.

E. Once approved by the City and Engineer, the water can be discharged to the storm sewer system via an approved discharge manhole. Any additional frac tanks utilized shall be sampled by the Contractor for a reduced list of parameters (in accordance with the permit), and the Contractor shall monitor the headspace in the tank(s) for lower explosive limit (LEL) to verify it is below 10%.

F. Costs for sampling, treatment and storage of groundwater shall be paid from the allowance items associated with groundwater contamination. All other costs associated with dewatering shall be paid for under the lump sum dewatering pay item.

END OF SECTION

SECTION 31 41 00

SHAFT CONSTRUCTION AND SUPPORT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall design, furnish, install, and maintain a system of temporary supports, including all bracing and associated items, to retain excavations in a safe manner, to control ground movements, and to control groundwater inflows. Upon completion of the required excavation and pipe installation, the Contractor shall remove the support system and backfill the excavations. Certain types of shoring may be cut off below grade and left in place below a specified depth. This section covers requirements for all shafts to be constructed under this Contract for trenchless construction.

B. The Contractor shall have sole responsibility for sizing the shaft excavations to accommodate shoring, bracing, and pipe installation to the specified lines, grades, and tolerances to meet the Contractor's means and methods and subject to constraints or limitations shown on the Drawings or stated in the Specifications. The shafts shall also be sized to facilitate the construction of connections, valves, vaults, manholes, and other permanent structures shown on the Drawings.

C. The work shall include site grading; temporary access road construction; fencing and signage; construction staging areas; design and construction of shaft excavations and excavation support systems; material disposal; control and disposal of infiltrating groundwater, surface water, and construction water; backfilling and abandoning shafts; and site restoration.

D. Acceptable types of shaft support include: interlocking steel sheet piles, concrete caisson, secant pile or other Contractor-proposed construction methods which meet all requirements of this Section, and are subject to the review and written approval of the Owner. Soldier piles and lagging with external dewatering, may be used in situations where penetrations into the shaft wall for existing utilities make the shoring options listed above infeasible.

1.02 REFERENCES

E. RELATED SECTIONS

1. 03 30 00 – Cast-In-Place Concrete

2. 31 09 13 – Geotechnical Instrumentation and Monitoring

3. 31 23 19 – Dewatering

4. 33 05 07.36 – Microtunneling

5. 33 05 40 – Reinforced Concrete Jacking Pipe

F. SPECIFICATIONS, CODES, AND STANDARDS

1. City of Ann Arbor – 2025 Standard Specifications for Construction

2. ANSI/AWS D1.1 – Structural Welding Code.

3. ASTM A 36 – Standard Specification for Carbon Structural Steel.

4. ASTM A 328 – Standard Specification for Steel Sheet Piling.

1.03 DEFINITIONS

1. Ground Improvement: A term referring to creation of a prism of stabilized ground just outside the shoring system using grouting methods appropriate for the ground conditions.

2. Sheetpile Shaft: A watertight excavation support system consisting of interlocking steel sheetpiles driven or vibrated into place. A concrete working slab, of sufficient thickness to resist buoyant forces on the dewatered shaft and to limit groundwater inflows to those specified herein, is then placed at the bottom of the shaft. Sheet pile shafts can be constructed to provide a watertight shoring system.

3. Soldier Pile and Lagging Shaft: A non-watertight excavation support system composed of vertical steel piles, wales, struts, and lagging. The vertical piles extend from ground surface to a sufficient depth below the final excavation depth to provide adequate resistance against earth pressures. Lagging, consisting of wooden boards or steel sheets is inserted between the flanges of the adjacent H-beams to support the excavation and prevent soil from sloughing or caving into the excavation. Wales are horizontal support beams installed and welded to the vertical soldier piles to stiffen the support system and are sized and installed at a vertical spacing to safely support external earth loads. The shaft bottom is covered with a concrete slab with one or more sumps. The support system must be coupled with external dewatering. Concrete Caisson Shaft: A watertight excavation support system composed of either precast or cast-in-place concrete rings or segments that are fitted together to form circumferential rings to support the shaft walls. The first ring is typically fitted with a metal cutting shoe to increase ground pressure and aid in sinking. Rings are constructed at the ground surface and soil excavated from within the ring, allowing the rings to sink under self-weight into the soil as excavation progresses. Alternatively, rings can be jacked into the soil if adverse conditions are encountered. A concrete working slab, of sufficient thickness to resist buoyant forces on the dewatered shaft and to limit groundwater inflows to those specified herein, is then placed at the bottom of the shaft.

4. Secant Pile Shaft: A watertight excavation method that involves blind drilling holes to below shaft invert level and then filling the holes with concrete which may be reinforced or unreinforced depending on the design. In the first phase of installation every other secant pile is installed. The spacing between these holes is set so that when the remaining holes are drilled, they will overlap with the primary holes to create a contiguous structure. A concrete working slab, of sufficient thickness to

resist buoyant forces on the dewatered shaft and to prevent groundwater inflows to those specified herein, is then placed at the bottom of the shaft.

5. Watertight: defined as a groundwater inflow rate into the excavated volume of the shaft not to exceed 10-gallons per minute at any time during the useful life of the temporary structure or until permanent shaft structure is constructed and backfilled.

6. Working Slab: A concrete slab poured at the bottom of a shaft for the purpose of providing a level working platform, bearing capacity to support the loading and operation of all trenchless equipment, and resisting uplift pressure from any groundwater that may be present.

1.04 GENERAL REQUIREMENTS

A. The design shall include all elements of the support of the shaft excavations, including maximum depths of excavation prior to installation of support, as well as the design calculations of the thrust reaction block and the capacity of the shaft wall to resist the reaction thrust if the thrust is transferred to the shaft wall.

B. Coordinate with the submittal required by Section 33 05 07.36 – Microtunneling and Section 33 05 40 – Reinforced Concrete Jacking Pipeto ensure the shoring system is designed to withstand the maximum planned jacking forces.

C. The launch shaft shall be of adequate size to meet the operational requirements of the tunneling machine, jacking frame, thrust block, and other components necessary to support the tunneling. The Contractor can select different shaft dimensions and shape from those shown on the Drawings, with the concurrence of the Engineer and subject to constraints delineated on the Drawings or elsewhere in the Specifications.

D. All excavations shall be protected in accordance with the relevant safety regulations and project requirements.

E. In no case shall the pits remain open without appropriate lights and safety barricades, fencing or guardrails. Placement of construction equipment shall not be used in lieu of fencing, barricades and/or guardrails. Pits/shafts are to be adequately plated over when not in use.

F. Portable concrete traffic barriers will be placed around the perimeter of the staging area or pits, meeting applicable safety standards providing a barrier from the surrounding roadways. Concrete traffic barriers shall be angled in the direction of the traffic flow; do not place barriers perpendicular to on-coming traffic.

G. A staircase or ladder shall be provided in accordance with the relevant safety regulations and guidelines. A minimum of two means of egress shall be provided.

1.05 QUALIFICATIONS

A. Contractor performing the work shall have successfully completed at least three (3) shafts using the proposed shaft construction methods of similar size, depth, complexity, and in similar soil conditions, within the past five (5) years.

B. Shaft construction superintendent shall have had at least five (5) years of shaft and excavation construction experience and shall have worked on at least two (2) similar projects within the past five (5) years using similar types of equipment required for this work and in similar soil and groundwater conditions.

C. The Design Engineer responsible for the design shall have a minimum of 10 years of experience in the design of similar structures for support of excavation of shafts for launching and receiving tunneling equipment as appropriate for the shaft. All designs and shop drawings shall be signed and sealed by the approved design engineer meeting these qualifications. The Design Engineer must be a Professional Engineer registered in the State of Michigan.

1.06 SUBMITTALS

A. The following pre-construction submittals shall be submitted at least 30 days prior to the start of any shaft excavation unless stated otherwise:

1. Qualifications: Written documentation summarizing the qualifications and experience of the trenchless Contractor, superintendent, and Design Engineer responsible for the shaft construction and support work. Required documentation shall be submitted no more than 30 days after the Notice to Proceed.

2. Schedule: Proposed schedules and methods of construction, equipment, facilities, method for removal of spoil from shaft excavation, and any other pertinent details.

3. For each shaft excavation, provide scaled drawings (plan and section views with dimensions and sizes) showing the proposed shaft support elements, including connection details and installation sequence in relation to the excavation; groundwater control provisions; adjacent and nearby existing structures and utilities; details of all pipe penetrations; work areas for all shaft construction operations such as sheet pile storage, drilling fluid tanks, and/or caisson form storage at each site.

4. Details of procedures for preloading bracing members.

5. Details for protecting existing utilities and structures within the zone of influence of the shafts that could be impacted by shaft construction.

6. Methods and sequencing of excavation and installation of staged excavation support, including a schedule with major milestones for shaft excavation and support such as driving of sheets, drilling secant piles, installation of reinforcement and placement of structural concrete in the caisson or secant pile, pouring of concrete working slab or plug in the base of the shaft, grouting, and dewatering of the shaft interior, etc.

7. Layout of the jacking thrust block and its reaction transfer connection details the shaft temporary support and base slab.

8. The contractor’s work plan shall identify the location, size, depth, layout, and ground support design of the launch and receiving pits as well as the spoil storage areas.

9. Methods and sequencing of launch/retrieval of the tunneling machine through the shaft wall. Describe in detail the steps that will be taken to ensure the ground is stable and groundwater is controlled prior to boring through/removal of the shaft wall. The Contractor shall submit ground improvement methods and details of construction that will be used to stabilize ground at the launch/retrieval locations to prevent the inflow of soil and groundwater into the shaft.

10. Details and drawings of the tunnel entry and exit seals that will be implemented at the launch and retrieval shafts to prevent loss of ground and groundwater inflow into the shafts.

11. Procedures for checking and maintaining plumbness of the shaft and ensuring proper elevation is reached.

12. Concrete mix information and placement procedures for the working slab, secant piles, and/or annular grout.

13. Contingency Plan for anticipated difficulties and proposed resolutions, including unfavorable performance of the selected construction method, excessive movement of shaft elements, tilting, flooding, and bottom heave.

14. Work Plan for backfilling of voids as required to minimize ground movement and protect adjacent property.

15. Describe procedures for control of groundwater inflows, method of maintaining bottom stability, and protection of subgrade.

16. Details for handrails and protective barriers, fences, and covers at each shaft location.

17. Method for establishing survey control and transferring line and grade to shaft entry and exit locations.

18. Plans and procedures for backfilling and removal of shaft wall components upon completion of all relevant work in the launch and retrieval shafts.

19. Procedures for disposal of excavated materials at an approved disposal site.

20. Calculations: Submit calculations in a neat, legible format. Assumptions used in calculations shall be clearly stated and shall be consistent with the ground conditions described in the Geotechnical Report, and conditions anticipated by the Contractor. All calculations shall be prepared by or under the direct supervision of a Professional Engineer licensed in the State of Michigan, who shall stamp and sign calculations:

    a. Calculations for the shaft support elements and all bracing, indicating it can withstand all earth and groundwater pressures, thrust forces, equipment, applicable traffic, construction loads, and other surcharge loads in accordance with the site conditions and any other requirements described in the Contract Documents.

b. Calculations for the structural design of the tremie plug and/or working slab, and uplift resistance of the shaft. Confirm that tremie plug and/or working slab weight, structural connection to shaft walls, weight of casing, determination of shaft wall embedment depth below bottom of excavation, and any frictional resistance assumed along sidewalls of the shaft are adequate to resist uplift and that assumptions are reasonable and appropriate. Confirm that an adequate factor of safety against uplift of at least 1.5 is achieved under the most extreme loading conditions.

c. Estimated ground settlement and lateral deflection of each wall face and groundwater drawdown.

d. Calculations for shaft covers outside of the roadways.

21. Steel Sheet Pile Shafts:

a. Describe the equipment and procedures to be used to construct the sheetpile shafts.

b. Describe methods for ensuring sheetpile tips reach design depth and interlocks remain engaged.

c. Describe the procedure for installing and sealing corners.

d. Describe procedure for installing tremie plug and/or working slab to the required thickness and at the correct elevation.

e. Describe method of monitoring deviation of shaft supports and proposed corrective measures to be implemented.

f. Describe procedures for providing control of groundwater inflows and soil inflows at launch/retrieval locations.

22. Secant Pile Shafts:

a. Description of construction sequence and procedures to be used to construct the drilled secant pile shafts, including excavation, installation of steel reinforcement, and placement of structural concrete. Steel reinforcement shall not be permitted within the tunnel eye. Glass reinforced plastic (GRP) reinforcement shall be used at tunnel eyes.

b. Describe procedure for installing and backfilling the shafts, including sequence of operations and grout mixture.

c. Describe procedure for installing tremie plug and/or working slab to the required thickness and at the correct elevation.

d. Describe the procedure used to tie the shaft to the temporary support system for the adjacent riser sections of pipe, if utilized.

e. Concrete mix design.

f. Describe procedures for providing control of groundwater and soil at launch/retrieval locations.

g. Describe method for monitoring deviation of secant piles and proposed corrective measures to be implemented.

23. Caisson Shafts:

a. Describe construction sequence and procedures to be used to construct the concrete caisson shafts including excavation, installation of steel reinforcement and placement of structural concrete. Steel reinforcement will not be permitted within the tunnel eye. Glass reinforced plastic (GRP) reinforcement shall be used at tunnel eyes.

b. Provide details for cutting shoe design on the leading caisson ring.

c. Describe procedure for installing and verifying elevation and thicknesses of tremie plug and working slab.

d. Describe procedures for providing control of groundwater and soil at launch/retrieval locations.

e. Concrete mix design whether using precast concrete segments or cast-in-place concrete segments.

f. Describe method of monitoring deviation of rings and proposed corrective measures to be implemented if necessary.

24. Soldier Pile and Lagging Wall Shafts with Dewatering:

a. Describe the equipment, procedures, and sequence to be used to construct the soldier pile shafts or slide rail shafts.

b. Provide details for installing piles, lagging, plates, wales, struts and braces.

c. Describe method of monitoring deviation of shaft supports and proposed corrective measures to be implemented. External dewatering plan to be in conjunction with Soldier Pile and Lagging.

B. Construction Submittals: During construction, the Contractor shall submit the following to the Engineer at the times indicated:

1. Daily progress reports: Progress reports shall have field logs recorded at intervals of five feet or less during excavation and shall be submitted to the Engineer within one working day of the shift for which the excavation occurred. As a minimum, the logs shall include:

a. The date, starting time, and finish time.

b. Equipment used and personnel on site.

c. Actual quantities and descriptions of excavated material, including soil/ rock types and presence of groundwater if encountered.

d. Any unusual conditions, breakdowns, and delays, including problems with support, bottom instability, and obstructions.

e. Detailed description of the support installed, including sizes, lengths, spacing, and elevations relative to excavation elevation.

f. Pumping rates from shafts and inflow conditions for all shafts or flooding levels for shafts excavated “in the wet.”

2. Deformation monitoring: Excavation monitoring data of horizontal and vertical deflections of shaft supports, settlement, and deformation monitoring data associated with each shaft shall be submitted in accordance with Section 03 09 13 – Geotechnical Instrumentation and Monitoring. Include records of action taken by the designer of record and the Contractor if deflections are outside the tolerances specified in the Contract Documents.

3. Results of all material and field tests shall be submitted at the end of each shift, and results of lab tests within one week of sampling.

C. Post-Construction: Within 15 days of the backfill of excavations, the Contractor shall submit a detailed as-built location plan of all remaining buried shoring members including size, location, and cutoff elevation.

1.07 DESIGN CRITERIA

A. All shaft design and related calculations shall use the highest observed groundwater level recorded as of the date the calculations are prepared or as required by the Engineer. A lower observed groundwater level may be used in calculations if that results in a more conservative load case.

B. The type and design of shaft construction methods that meet the specification requirements herein are the Contractor’s responsibility and shall be of a size large enough to facilitate all the necessary groundwater control, construction operations, pipeline equipment and operations, microtunneling, and to accommodate indicated connections to other reaches of the project. Shaft design is subject to review and approval by the Engineer. Allowable shaft construction options are as described above in Paragraph 1.01 Scope of Work.

C. In all areas, excavation support systems shall be designed by the Contractor’s Design Engineer to support earth pressure, unrelieved hydrostatic pressures, bottom heave, overall buoyancy, utility loads, equipment, applicable traffic loads, applicable rail loads, maximum safe jacking loads, and other surcharge loads in such manner as will allow safe construction and will prevent damage to adjacent structures (including existing buildings, roads, pipelines, and utilities) and injury to workers and the public.

D. Shaft excavation support systems shall be designed to be compatible with the geologic conditions described in the Geotechnical Baseline Report, including any adjacent

slope support structures. Design support systems shall use a minimum factor of safety of 2.0 for lateral loads or as determined by the Contractor's design engineer.

E. The support system shall be designed to protect adjacent utilities from damage and to limit movements to less than the allowable values for deformation and groundwater variations specified in Section 31 09 13 –Geotechnical Instrumentation and Monitoring.

F. All welding shall conform to the applicable provisions of ANSI/AWS D1.1.

G. Contractor shall perform all water control work and properly dispose of all collected water in accordance with permit requirements and other applicable Sections. The Contractor shall not discharge water into storm sewers, sanitary sewers, water bodies, or streets without obtaining and submitting copies of the required permissions and/or permits.

H. The Contractor's groundwater control methods shall provide means to prevent removal of soil/fines from the surrounding ground, or other adverse effects. In the event any damage does occur as a result of groundwater control efforts, or lack thereof, the Contractor shall be fully responsible for correction of damage.

I. All shafts shall have a concrete working slab and shall be designed to protect the excavation invert in accordance with these minimum design criteria:

    1. The finished concrete working slab shall incorporate an adequate sump system to control groundwater inflows through the bottom of the shaft and to resist uplift at the baseline groundwater level, as defined in the Geotechnical Baseline Report for each shaft location. The slab design, including its weight, structural connection to the shaft walls, and any assumed frictional resistance along the sidewalls, shall be sufficient to resist uplift with a minimum factor of safety of 1.5. Additionally, the slab must be capable of safely resisting bending moments caused by buoyant uplift forces with a minimum factor of safety of 1.5. All shafts shall also be designed to provide a minimum factor of safety of 1.5 against bottom heave

    2. Be capable of supporting such combined dead and live loads as required by the Contractor's means and methods.

J. Shaft support systems shall be constructed within 1% of vertical plumbness, i.e., within 1 foot in 100 feet.

K. The strength of the grout mixture used to fill the annulus between the sheet piles or other support and the excavation shall be selected to allow the tunneling machine to excavate or advance through the grouted annulus during both launch and retrieval.

L. Traffic plates or other approved covers used within the roadway shall be designed for AASHTO HS-20 loading and any additional construction loads required by the Contractor. Shaft covers not within the roadway shall be designed for a 100 psf minimum live load as well as any additional construction loads required by the Contractor.

M. Sheet Pile Shafts:

1. Fully interlocking steel sheetpiles shall be used to construct the sheetpile shafts.

2. Sheetpiles shall be driven or vibrated into place.

3. Install sheetpiles using pre-drilling if needed based on the expected ground conditions.

4. Constructed sheet pile walls shall be designed to accommodate the maximum planned jacking forces exerted by the thrust block to the sheet pile wall without causing excessive deflection or separation of sheet piles during loading.

N. Secant Pile Shafts:

1. Fully overlapping secant piles shall be used to construct the secant pile shafts.

2. The shaft excavations shall be safely supported at all times during and after construction using polymer or bentonite, or any other approved means necessary. The polymer or bentonite shall have adequate viscosity, gel strength, and density to safely support earth and groundwater loads at the upper limit baseline groundwater level described in the Geotechnical Report.

3. Polymer or bentonite shall be disposed of offsite by Contractor, at Contractor's expense at an approved disposal facility.

4. Constructed secant pile walls shall be designed to accommodate the maximum planned jacking forces exerted by the thrust block to the pile wall without causing excessive deflection or failure of piles during loading.

O. Caisson Shafts:

1. A cutting shoe shall be utilized on the bottom ring of the concrete caisson to aid in sinking the ring after soil excavation.

2. If precast concrete segments are to be used for ring building, rubber gaskets shall be used between each segment and between each ring to control the inflow of groundwater.

3. Install caisson to the shaft tip elevations shown on the drawings.

4. Constructed concrete caisson walls shall be designed to accommodate the maximum planned jacking forces exerted by the thrust block to the caisson wall without causing excessive deflection or failure of caisson during loading

P. Soldier Pile and Lagging Wall Shafts with Dewatering:

1. Install piles to the tip elevations shown in approved submittals.

2. Provide timber, steel, or precast concrete lagging or sheets of sufficient thickness to withstand lateral earth pressures.

3. It shall be anticipated that pre-drilling will be required to install soldier piles.

4. Dewatering must be applied in conjunction with Solider Pile and Lagging application.

1.08 QUALITY CONTROL, TESTS, AND INSPECTIONS

A. The Contractor's Design Engineer shall provide quality control, testing, and inspection of their designs in accordance with accepted submittals. The Design Engineer shall visit the site to observe the shaft construction work in progress on a weekly basis or more frequently, if required by the Engineer, and provide an assessment of their inspection of the installation.

B. The Contractor shall coordinate with the Engineer regarding additional quality assurance testing to be provided at the Owner's discretion. The Contractor shall permit free access during the construction of shoring systems for the Owner's testing staff and the Engineer. The Contractor shall allow access to the Engineer and shall furnish necessary assistance and cooperation to aid the Engineer in observations, and data and sample collection at all times at no additional cost to the Owner.

C. The Contractor shall notify the Engineer, in writing, within 24 hours when any problems are encountered with equipment or materials.

D. Construction Monitoring: Ground, utility, and structure monitoring of shaft and adjacent facilities shall be conducted in accordance with Section 31 09 13 – Geotechnical Instrumentation and Monitoring.

1.09 WARRANTY

A. The Contractor shall be solely responsible for and bear the sole burden of cost for any and all damages resulting from improper shaft support.

B. The safety of workers, the protection of adjacent structures, property and utilities, and the installation of adequate supports for all excavations shall be the sole responsibility of the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Structural Steel: ASTM A36 or better, unless approved otherwise.

B. Steel Sheet Piles: ASTM A328.

C. Concrete for cast-in-place secant piles, caissons, and working slabs shall be in accordance with the requirements for concrete as stated in Section 03 30 00 – Cast-In-Place Concrete.

D. All timber and structural steel used for the shoring systems, whether new or used, shall be sound and free from defects that may impair strength.

PART 3 -- EXECUTION

3.01 GENERAL

A. Shaft excavations and site development shall commence only after approval or acceptance of applicable submittals by the Engineer. Install excavation support systems in accordance with approved submittals.

B. Before beginning excavation, install geotechnical instrumentation as shown on the Drawings and consistent with Section 31 09 13 – Geotechnical Instrumentation and Monitoring. Adequately protect existing structures, utilities, trees, shrubs, and other existing facilities. The Contractor shall repair damage to existing facilities at no cost to the Owner.

C. Excavation shall be performed in sequence with shaft and support installation in a manner that limits settlement of surrounding ground and adjacent utilities, vaults, structures, or roads and offers no hazard to building movement or occupancy, train, truck, or automobile operations.

D. The Contractor shall notify the Engineer not less than 15 days before beginning any shaft excavation.

E. The Contractor shall conduct all excavation, shoring, shaft support, temporary facilities, materials storage, and construction traffic within construction easements established for this project. All work shall be in accordance with applicable permits.

F. Shafts not in active use for a period of 8 hours or longer shall be covered with traffic plates or other covers as approved by the Engineer. Shaft staging areas shall be completely fenced in to prevent unauthorized access at all times.

G. Any correction of shaft deviation and any construction and associated costs resulting from the relocation of appurtenances inside the shaft, including pipe connections and the launch and retrieval seals, caused by the shaft's deviation from plumb or other deficiencies in workmanship shall be accomplished at the Contractor's expense and shall not be cause for schedule extension.

H. All excavated spoils, polymers, drilling fluids, or other materials used during shaft construction shall be completely contained when stockpiled on site. Disposal of spoils shall be in accordance with approved disposal procedures at an approved disposal site.

I. Pumping from shaft sumps shall not result in boils, softening of the ground, or loss of fines. Sumps shall use suitable filters or screens so that fines are not removed from the formation.

J. The Contractor shall use ground improvement and other measures to stabilize the ground at shaft penetrations. Do not begin microtunneling until the Contractor has implemented ground improvement at all entry and exit locations for the planned tunnel drives and behind thrust blocks or elements where necessary and as directed by the Engineer to stabilize the ground.

K. Perform shaft construction activities in conformance with all federal, state, and local regulations.

3.02 SHEET PILES INSTALLATION

A. Steel sheet piling shall be used to the full depth of penetration required and to proper alignment and plumbness without damage to the sheet piling or rupture of its interlocks.

B. Sheet piles shall be driven in a plumb position, with each sheet pile interlocked with adjoining piles for its entire length to form a continuous diaphragm throughout the length of each run of the wall, bearing tightly against the original ground. Sheet piles shall be driven to the depth indicated on the approved shop drawings. Care shall be exercised in driving so that interlocking members can be extracted without damaging adjacent structures or utilities. The methods of driving, cutting, and splicing shall conform to the approved shop drawings.

C. Sheet pile corners shall be installed with interlocks properly engaged for the full depth of sheet piles. If interlocks cannot be properly engaged for full depth, corner connections shall be welded continuously to seal all cracks and avoid inflows of groundwater and soils.

D. Internal supports, including wales, struts, and corner braces, shall be installed sequentially as the shaft is excavated. At no time shall the unsupported excavation depth exceed the design spacing plus two (2) feet of horizontal support members as shown on approved submittals. All internal supports shall be installed within +/- 3 inches of design locations shown on approved submittals.

E. The sheet piles shall be flush with the ground surface where traffic plates are required. The sheet piles may extend not more than 5 feet above the ground surface where shafts are not within traffic lanes or shoulders.

F. Safety rails shall be installed in accordance with applicable safety regulations.

G. The internal bracing support system for sheet pile shafts shall include wales, struts, and/or shores where necessary.

1. Struts with intermediate bracing shall be provided to enable sheet piles to carry maximum design loads without distortion or buckling.

2. Web stiffeners, plates, or angles shall be included as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

3. All bracing support members shall be installed and maintained in tight contact with each other and with the surface being supported.

4. Bracing members shall be preloaded by jacking struts, if necessary, to control shoring movement. Bracing members shall be preloaded in accordance with methods, procedures, and sequence as described in the submittals. Excavation work shall be coordinated with the installation of bracing and preloading. Steel shims and steel wedges shall be welded or bolted in place to maintain the preloading force in the bracing after release of the jacking equipment pressure.

Support and preload shall be installed immediately after installation and prior to continuing excavation.

5. Procedures that produce uniform loading of bracing member shall be used without eccentricities or overstressing and distortion of members of the system.

3.03 SECANT PILES INSTALLATION

A. At all times during drilling, reaming, and installation of reinforcement, the drilling mud/polymer used to support the excavation shall be maintained at or above the ground surface to safely support the excavation and resist caving and sloughing. The polymer used shall have adequate viscosity, gel strength, and density to safely support earth and groundwater conditions described in the Geotechnical Baseline Report.

B. If groundwater is present in the drilled shaft holes, the hole shall be dewatered prior to placing concrete, or concrete shall be placed using tremie methods. If a temporary casing is used, care shall be taken to avoid the creation of voids in the completed shaft by withdrawing the casing during concrete placement while maintaining the concrete level above the bottom of the casing.

C. Overlap of adjacent secant pile shafts shall be sufficient to prevent soil and groundwater movement into the completed Work.

D. Care should be exercised during excavation to avoid damaging the concrete shafts.

E. Any voids in the completed shaft detected during excavation shall be immediately repaired to the satisfaction of the secant pile shaft designer before excavation progresses.

3.04 CAISSON INSTALLATION

A. To the extent possible, centralize the tunnel or pipe jack on a joint between two adjacent pre-cast units. Inlet and outlet pipes should be located as far as practically possible to minimize loss in overall integrity of the caisson structure. The construction of a suitably designed thrust wall is required.

B. Utilize metal angles or another method to assist in maintaining the verticality of the caisson.

C. Center of caisson to be installed not more than 4 inches from center location shown on the submitted drawings.

D. Excavate the pit at least 3 feet deep and 1.5 feet greater than the overall diameter of the cutting shoe.

E. A bottom/choker ring shall be designed and constructed to provide a seal diameter between the shaft and excavated ground, so that the fluid in the annulus above the ring is retained.

F. If suitable for the anticipated soil conditions, a steel cutting edge will be added beneath the choker ring to cut through the ground as well as act as a stiffener.

G. The choker concrete collar rings should be designed and constructed on the surface around the location of the shaft to act as a work platform and ground support, as well as serve as a guide for sinking subsequent caisson units.

H. As the excavation progresses, introduce bentonite slurry into the annulus between the shaft and the soil to lubricate and reduce the friction force between the caisson structure and the ground.

I. For pre-cast concrete caisson units, sealant strips shall be used at all joints.

J. The lower-most unit of the caisson shall be sunk to a depth of at least 3 feet below the invert of the tunnel.

K. The annular space shall be filled with approved grout material upon completion of the installation of the caisson.

L. The concrete base might be cast manually if conditions are dry or via a tremie tube if the shaft is flooded. If cased under flooded conditions, under no circumstances shall the shaft be pumped out until the base concrete has matured.

3.05 SOLDIER PILE AND LAGGING INSTALLATION

A. Install piles in predrilled holes, to the tip elevations shown in approved submittals. Provide casing or drilling mud, as necessary, to prevent caving of holes and loss of ground.

B. After each soldier pile has been seated plumb in the drill hole, encase it with concrete or crushed rock from the tip to the bottom level of the final excavation. Apply vibration through the pile. Concrete strength shall be in accordance with submittals, and concrete shall be placed by means of a tremie system.

C. Provide timber, steel, or precast concrete lagging or sheets that spans completely between adjacent solider piles, and of sufficient thickness to withstand lateral earth pressures.

D. Lagging shall be advanced concurrent with the excavation and at no time shall the unsupported excavation depth exceed 2 feet.

E. Install lagging with no gap between adjacent boards. As installation progresses, backfill the voids between the excavation face and the lagging with sand, pea gravel, or other self-compacting material. Pack with materials such as hay, burlap, or geotextile fabric where necessary to allow drainage of groundwater without loss of ground due to piping. Dewatering must be applied in prior to the application of Solider Pile and Lagging.

3.06 SHAFT WALL PENETRATION

A. Shaft entry and exit seals are required to be installed completely prior to initiating penetration through the shaft wall. The Contractor shall improve the ground outside the shaft seals as described above and as necessary to ensure stability during the launching or receiving of the tunneling machine. The ground shall be improved to the

extent that the ground will remain stable without soil or water inflow into the shaft while the machine is being launched or received.

B. Successful completion of shaft wall penetrations and related activities necessary to demonstrate such shall be at the Contractor's sole expense.

3.07 INSTRUMENTATION AND MONITORING

A. Conform to the requirements of Section 31 09 13 – Geotechnical Instrumentation and Monitoring. The Contractor shall make modifications to the excavation and shaft support as required based on monitoring results. Revised shop drawings and calculations shall be submitted to the Engineer. Changes to excavation sequence and support shall be implemented as necessary at no additional cost to the Owner.

3.08 SHAFT BACKFILL AND RESTORATION

A. Shafts shall be backfilled to within 6 feet of the ground surface with flowable fill.

B. Backfill shall be per City of Ann Arbor – 2025 Standard Specifications for Construction.

3.09 REMOVAL OF SUPPORT SYSTEM

C. Excavation support shall not be removed until support can be removed without damage to existing facilities, completed work, or adjacent property.

D. Temporary excavation support shall not be removed until permanent shaft structure is installed and shaft has been backfilled.

E. As a minimum, excavation support shall be removed from the existing adjacent surface grade to a depth of 5 feet. As-built drawings shall be prepared showing the location of temporary shoring and bracing that remains in place.

F. The design, planning, installation, and removal of all supports shall be accomplished in such a manner as to maintain the stability of the required excavation and prevent movement of soil that may cause damage to adjacent shoring systems, structures, and utilities, damage or delay the work, or endanger life and health.

G. Excavation support shall be removed in a manner that will maintain support as excavation is backfilled and will not leave voids in the backfill. Removal of the support system shall be performed in a manner that will not disturb the pipeline, the compacted backfill, or adjacent construction or facilities.

H. Any void left by the shoring system or voids created by the removal of the shoring system shall be filled with lean concrete or cement grout, as approved by the Engineer, to provide ground support between the backfill zone and the native ground. Implement contact grouting, if needed, in addition to void filling.

I. Sheet piling removal shall be performed in a manner that will avoid "vibro-consolidation" of sandy or granular material below the excavation that could lead to settlement of the pipeline or other works of construction.

J. The support system removed from the excavation shall remain the property of the Contractor and shall be removed from the site.

3.010 CLEANUP

A. The Contractor shall remove all construction debris, spoil, drilling fluid, oil, grease, and other materials from shafts, pipelines, and all surface work areas upon completion of construction to the satisfaction of the Engineer. Cleanup will be incidental to the construction. No separate payment shall be made for the cleanup.

END OF SECTION

SECTION 31 73 00

CONTACT GROUTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section covers the work necessary for contact grouting including furnishing, mixing and placing grout; furnishing all labor, materials, equipment and incidentals; and all other related work necessary for grouting, complete.

B. The Contractor's work under this Section shall include: all work necessary to perform grouting operations including furnishing, handling, transporting, and storing of all materials and equipment for grouting; mixing and injecting grouts; capping, patching, and plugging the finished grout holes; cleanup of work areas; and all other operations incidental to grouting.

C. Contact grouting is to fill gaps and displace lubricant outside of the jacking (casing) pipe at completion of the microtunneling drive. Contact grouting includes using grout to fill void space between the casing pipe and the ground where over excavation occurs. Contact grouting is to be performed for Washington Street, First Street, and associated shafts.

1.02 REFERENCES

A. Related Sections

1. 31 09 13 – Geotechnical Instrumentation and Monitoring

2. 31 41 00 – Shaft Construction and Support

3. 33 05 07.36 – Microtunneling

4. 33 05 40 – Reinforced Concrete Jacking Pipe

B. Specifications, Code, and Standards

1. ASTM A53 – Standard Specification for Pipe. Steel, Black and Hot- Dipped Zinc-Coated (Galvanized), Welded and Seamless.

2. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

3. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)

4. ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of concrete

5. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete

6. ASTM C172 – Standard Test Method for Sampling Freshly Mixed Concrete

7. ASTM C311 – Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.

8. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

9. ASTM C940 – Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Preplaced Aggregate Concrete in the Laboratory

10. ASTM C1090 – Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

1.03 DEFINITIONS:

A. Contact Grouting: An injection of neat cement grout into voids outside of initial support systems and final linings of shaft excavations and jacking pipe installed during microtunnel operations to achieve continuous and permanent contact between support systems or lining/casing pipe and the ground. This definition includes grouting the annular space outside the casing pipe string after microtunnel installations are complete.

B. Refusal: The point at which grouting is stopped on a grout hole. It is defined as a grout injection rate of less than one-half cubic foot of grout over a 5-minute interval, at 100 percent of the required pressure.

C. Voids: Spaces within soil that are filled with air, water, slurry, lubricant, or disturbed ground resulting in void ratios (volume of voids divided by volume of solids) greater than 2.0 in any given sample volume.

1.04 SUBMITTALS

A. Provide all submittals at least 30 days in advance of contact grouting operations, with the exception of daily reports which are to be submitted per the schedule specified below.

B. Grout Mixes:

1. The Contractor shall submit to the Engineer all proposed grout mixes for contact grouting. The submittal shall be made a minimum of 30 days prior to start of grouting operations. The Contractor shall resubmit as appropriate if the mixes are modified during the course of the work.

2. Submit mix designs for each contact grout mix proposed for use. Each mix design shall show the ingredients of the mix and shall include:

a. Type, brand, source, and amounts of cement, admixtures, and other additives.

b. Source and amount of water.

c. Provide three representative UCS test results of the same grout materials and mix proportion.

d. Combined gradation of each mix design.

e. Specific gravity of all materials in the mix.

f. Results of each Uniaxial Compressive Strength (UCS) of required tests.

3. Submit a certificate of compliance signed by the supplier identifying the type of fly ash (if used) and stating that the fly ash is in accordance with ASTM C618, MDOT Standard Specifications and these Specifications. Supporting test data shall be furnished for the proposed grout mixes. All testing and sampling procedures shall be in accordance with ASTM C311.

4. Submit material specifications and instructions for use of any proposed concrete admixtures.

C. Work Plan: The Contractor shall submit, prior to the start of any excavation, a work plan for contact grouting. The work plan for placing contact grout shall cover each type of contact grouting required and shall include:

1. Contact grouting methods, procedures and sequences for each tunnel segment as well as locations determined within the shafts that require contact grout.

2. Method of transporting grouting equipment, grout, and materials into and within the tunnel and shafts.

3. Quantitative prediction of grout volumes required at each location, with consideration of volume of annular space due to difference between the excavated diameter and outside diameter of initial support system or jacked pipe, ground loss volumes, soil stand-up time and diametrical closure.

4. Means for measuring grout takes (volume) per foot or segment of initial support system or pipe.

5. Means for measuring grout pressures and planned grout pressure limits for refusal criteria.

6. Timing of grout injection.

7. Maximum grout pressure for shaft and for tunnel, signed and sealed by the Contractor’s professional engineer licensed in the State of Michigan.

D. Grouting Equipment:

1. Submit prior to the start of grouting operations calibration records for all meters and gauges to be used in grouting operations.

2. Submit the following for the contact grouting equipment proposed:

a. Manufacturer's specifications and operation instructions for grout conveyance equipment.

b. Pump specifications.

c. Grout hose, valve and port sizes and specifications.

d. Grout pressure gauges and pressure gauge calibration data.

E. Grouting Records and Testing: All sampling shall be performed in accordance with ASTM C172. The Contractor shall submit records of grouting operations as specified hereinafter.

1. Submit prior to performing grouting of microtunnel segment:

a. Mill test reports for Portland cement.

b. Certificates of compliance for each load of Portland cement and fly ash (if used).

c. Certificates of compliance for all admixtures.

d. Proposed contact grout mix designs with mix data for all components, mix properties including admixtures, slump (per ASTM C143), wet unit weight, cured unit weight (per ASTM C138), bleed (per ASTM C940), height change per ASTM C1090, and compressive strength tests (per ASTM C39 or C109) from an AASHTO and ASTM certified testing laboratory.

2. Submit the following daily reports and records for contact grouting within a day of completion:

a. Daily logs of grouting operations at all contact grouting locations (station and position) of grout ports, including pressures, volumes, and grout mix pumped, times of injecting, locations where grout samples for test cylinders are taken, and grout slump results per ASTM C143.

b. An analysis of overcut annulus volume at the time of grouting with consideration of soil stand-up time, diametrical closure and effects of injected bentonite slurry volumes. Provide a comparison of anticipated annulus volume with grout volume placed by contact grouting for each pipe.

c. Compressive strength test reports from a certified testing laboratory in accordance with ASTM C39 or C109 test methods.

PART 2 - PRODUCTS

2.01 CONSTITUENTS OF PORTLAND CEMENT GROUT

A. Portland cement, water and flyash shall conform to the requirements of the MDOT Standard Specifications.

B. Bentonite or other clay-like materials shall not be used as an admixture.

2.02 FLUIDIFER

A. Fluidifier shall be a compound with characteristics that will hold the solid constituents of the grout in colloidal suspension, be compatible with the cement and water used in the grout mix and contain a shrinkage compensator. Fluidifier shall not contaminate the groundwater.

B. Fluidifier shall be furnished in moisture resistant paper sacks shipped in sealed containers and shall be handled and stored to avoid absorption of moisture, damage, or waste. Material which has become caked due to moisture absorption will be rejected.

2.03 CONTACT GROUT

A. Contact grout shall consist of a mixture of water and Portland cement or other suitable materials, with mineral fillers or admixtures as necessary to achieve a non-shrink (less than 0.1% height change per ASTM C1090), non-bleed (0% wick induced bleed at 3 hours per ASTM C940) flowable grout. The grout shall have a minimum 24-hour compressive strength of 100 psi (1.4 MPa) and a minimum 28-day compressive strength of 250 psi (3.5 MPa).

2.04 EQUIPMENT, CONTACT GROUTING

A. Mixers shall be colloidal type capable of providing a homogenized mix and shall be capable of an impeller speed of not less than 1500 RPM. The grout mixer shall pump the grout into a mechanically agitated holding tank. Mixer and mechanical agitator tanks shall be of sufficient capacity to ensure an uninterrupted supply of grout to the grout pump. Means of accurately measuring the separate grout ingredients at the mixer shall be provided. Means shall be provided for increasing or decreasing the water-cement ratio, as required by the ground conditions encountered.

B. Pumping equipment shall deliver grout from the holding tank to the point of injection at a steady pressure without pulsation. Grout pumps shall be capable of delivering grout to the point of injection at a pressure equal to 3 psi for every foot of overburden. Pumping equipment shall be capable of handling water-cement ratios of the Contractor’s proposed mix design.

C. Means shall be provided for accurately determining the amount of grout injected. The flowmeter shall be accurate within 10 percent at a flow rate of 2.5 gallons per minute.

D. The grout plant shall be equipped with reliable pressure gauges at point of injection and at the pump. The pressure gauges shall have a range such that the maximum pressure specified shall be approximately two thirds of the capacity of the gauge. The gauges shall be protected from grout contamination by an oil or air buffer and shall be easily cleaned in the field.

E. Flexible hose for pressure grouting shall have an inside diameter not less than 1 inch and shall be capable of withstanding the maximum water and grout pressures to be used. Grout pipes shall have an inside diameter of 1.5 inch or larger. A diaphragm valve shall be provided on each grout hose and a straightway valve at each grout pipe

to regulate flow. Packers for grouting shall be pneumatic, hydraulic, or mechanical expandable rubber packers.

F. At the point of injection or bulkhead, suitable valves and pressure gauge shall be provided so that the pressure may be monitored, and the grout flow regulated by increasing or decreasing the flow. Suitable stop valves shall be provided at the collar of the hole for use in maintaining pressure as required until the grout has set.

G. All metal pipe, standard plugs, and fittings required for grouting operations shall be minimum Schedule 40 pipe conforming to ASTM Designation A53.

PART 3 - EXECUTION

3.01 GENERAL

A. The Engineer shall be notified at least 24 hours in advance of the start of grouting operations.

B. If out of visible contact, continuous communication shall be maintained between the Contractor's personnel at the grout plant and the injection point by radio or other means acceptable to the Engineer.

C. Grout in the mixer and holding tanks shall be continuously agitated. Portland cement grout which is not injected into the hole within 2 hours after mixing shall be removed from the mixer, holding tank and supply line and shall be discarded.

D. Grout shall be maintained at temperature above 50º F until injected. The temperatures of mixing water shall range from 50º F to 100º F when added to the grout mixer. Grout materials shall be stored at temperatures above freezing. Grouted ground shall be no colder than 41º F when grout is injected.

E. Grout holes shall be protected from becoming clogged or obstructed prior to grouting by means of a cap or other suitable device on the collar of the hole. Any hole that becomes blocked or otherwise unsuitable for its intended purpose shall be cleaned out in a satisfactory manner or replaced at the expense of the Contractor.

F. All grout hole locations shall be flagged and protected. In addition, they shall be clearly labeled for easy identification and shall be clearly visible.

G. Contact grouting shall be performed in such a manner as to reduce groundwater inflow, to fill voids, to minimize ground movement into the excavation, and to provide firm and uniform contact between the support system and the ground.

H. Equipment and lines shall be kept clean by constant circulation of grout and periodic flushing with water. Leakage from connections shall not be permitted. Plugs on ends of nearby grout holes or pipes shall be removed to permit escape of air and water and the filling of spaces with grout.

I. Once started, grouting of a hole shall not be interrupted. Grouting of a hole shall not be considered complete until that hole refuses to take grout as defined under Paragraph 1.03.B. After grouting of a holding or any stage of a hole has reached

refusal, the pressure on the hole shall be maintained by means of a stopcock or other suitable device until the grout has set. The grouting of any hole shall not be considered complete until all voids have been filled to the maximum extent practicable. After the grouting of any hole is finished, the pressure shall be maintained by means of the stop valve until the grout has set to the extent that it will be retained in the hole.

J. Check operating gauges daily to determine that they are in working order. Do not grout without appropriate gauges in place and in working order.

K. Where grouting in soil, the grouting pressure at the injection point shall not exceed 1 psi per foot of depth of soil overburden, unless otherwise proposed by the Contractor, with the Engineer's concurrence. In all cases, the grouting pressures shall be limited as necessary to avoid damage to the pipeline and avoid grout release at the ground surface.

3.02 CONTACT GROUTING

A. Contact Grouting for Shaft Excavations:

1. Locate grout holes as necessary to accomplish the work and to thoroughly fill the voids outside of the initial support system. Drill grout holes for contact grouting through the initial supports and into the annular space between the initial support and surrounding ground.

2. Perform contact grouting to reduce groundwater inflow, to fill voids, to minimize ground movement into the excavation, and to provide firm and uniform contact between the support system and the ground. The Contractor's ground support design engineer shall determine a refusal criteria and the maximum grout pressure that is consistent with the design of the ground support system. The Engineer may periodically request that check holes be drilled to determine if unacceptable voids exist outside of the ground support system. Additional contact grouting shall be completed at no additional cost to the Owner where checking indicates the presence of unacceptable voids.

B. Contact Grouting of Jacking (Casing) Pipe Installed by Microtunneling:

1. For grouting of jacking pipe, commence contact grouting promptly following completion of the drive. Once started for a tunnel drive, perform continuous contact grouting until contact grouting for the entire drive has been completed. Contact grouting of jacking pipe shall be completed within three (3) days of the completion of tunneling.

2. Inject grout in continuous progression of the grout holes along the length of the tunnel.

3. Attempt to hook-up and pump grout at every port. In general, contact grouting at a port will be considered completed when refusal is met per Paragraph 1.03.B (also see Paragraph 3.01.I). After grouting is finished, the valve shall be closed until grout has set. After a valve is closed following injection, the grout header and hoses shall be moved to the next port in progression.

4. Volume of contact grout injected shall be measured, recorded, and compared with the anticipated volume per foot of pipe grouted with compensation for grout wasted in lines. Submit this data as part of the grouting record submittals.

5. At the completion of grouting, remove valves after grout has set and replace valves with screw type grout plugs.

3.03 GROUT AND DRAINAGE HOLES

A. Grout ports for contact grouting of jacking pipe shall be pre-installed pipe nipples. Holes for injecting grout through jacking pipe shall be formed by casting in the pipe. New grout holes shall not be drilled through pipe walls.

B. Grout pipes shall be fixed in the holes in the casing pipe to prevent grout return around the perimeter of the pipe. Grout pipes and fittings shall be thoroughly cleaned before connecting to each grout hole. Grout pipes shall be set so that grout can flow freely to voids behind the pipe.

C. Suitable stop valves shall be provided at the collar of the grout hole for use in maintaining pressure as required until the grout has set.

3.04 FIELD QUALITY CONTROL

A. Data or notes taken by the Engineer during periodic inspections of grouting will not relieve the Contractor's responsibility in documenting grouting operations.

B. Test three cylinders for every 250 cubic feet or fraction thereof of grout placed. Minimum cylinder diameter shall be 3 inches, conforming to ASTM C39. Tests performed on grout cubes or prisms shall not be accepted for verifying strength.

C. During grouting operations, verify:

1. Hole location, depth, and spacing satisfy criteria specified herein.

2. Ensure that grouting is performed from the bottom upwards, and continuously in all aspects.

3. Maximum recommended grout pressures are not exceeded.

4. Grout mixes satisfy the criteria specified herein.

5. Grout lines are not plugged or obstructed.

6. Grouting operations are performed in the correct sequence, specified herein.

7. Closure criteria and/or refusal criteria are satisfied prior to terminating grouting of each hole.

D. Master Gauges and Meters:

1. Perform testing of all field gauges and meters no less often than weekly using master gauges and meters.

2. Perform field tests in the presence of the Engineer.

3. Verify accuracy of master gauges and meters through the use of a test laboratory no less frequently than every two months.

3.05 RECORDS

A. The Contractor shall record the stationing and the volume of contact grout pumped and grout pressure behind the jacking (casing) pipe or shaft support lining during each day of grouting at each grout hole location. The records shall be submitted to the Engineer after each day of grouting by noon on the following day.

3.06 CLEANUP

A. The Contractor shall prevent the setting of grout which may escape upon finished pipe or structure surfaces, and shall remove such grout slurry, water and all other materials, and restore the surface to its original condition.

END OF SECTION

SECTION 31 73 01

CARRIER PIPE INSTALLATION AND BACKFILL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section presents requirements for installation of the fiberglass-reinforced Carrier pipe in the reinforced concrete casing and backfilling the annulus.

1.02 REFERENCES

A. Related Sections

1. 33 05 07.36 Microtunneling

2. 33 05 36 Fiberglass-Reinforced Carrier Pipe

3. 33 05 40 Reinforced Concrete Jacking Pipe

B. Reference Specifications, Codes, and Standards

The publications and standards listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the abbreviation only. Unless otherwise stated, the most recent version or edition of each publication or standard is implied.

1. American Society for Testing and Materials (ASTM)

a. C495 – Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.

b. C796 – Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.

c. C869 – Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

1.03 GENERAL REQUIREMENTS

A. The annulus outside Carrier Pipe shall be completely backfilled throughout the entire tunnel length.

B. Backfill shall be cellular concrete.

C. Backfilling shall be conducted in accordance with all the requirements for safety, permits and underground work presented Section 33 05 07.36 – Microtunneling.

D. The Contractor shall provide testing of materials and verification of material properties as stated in Section 33 05 40 – Reinforced Concrete Jacking Pipe and 33 05 36 – Fiberglass-Reinforced Carrier Pipe.

1.04 QUALIFICATIONS

A. The Installation Specialty Contractor or subcontractor shall meet all the following experience requirements:

1. At least five years of experience in the installation of pipe in tunnels.

2. Successfully completed at least three projects installing prefabricated pipe in tunnels. At least two of those projects shall have used similar methods in which a pipe string was pushed or pulled into a tunnel.

B. The Backfilling Specialty Contractor or subcontractor shall meet all the following experience requirements:

1. At least five years of experience in the development and use of cellular concrete for tunnels and underground excavations.

2. Successfully completed at least three similar backfill projects with cellular concrete using equipment and methods similar to this project. At least two of those projects shall have used Backfill Delivery Lines to introduce and verify backfill of cellular concrete in a tunnel.

C. The Installation Superintendent shall meet all the following experience requirements:

3. At least five years of experience in tunneling and placement of prefabricated pipes in tunnels.

4. Successfully completed at least three jobs within the last five years installing prefabricated pipe in tunnels and been in responsible charge of at least one of those projects. At least two of those projects shall have used similar methods in which a pipe string was pushed or pulled into a tunnel.

5. The Installation Expert shall be thoroughly knowledgeable about the transportation, placement, securement of prefabricated pipe in tunnels, and shall be knowledgeable about cellular concrete and backfilling.

D. The Backfilling Superintendent shall meet all the following experience requirements:

1. The Backfill Expert shall be thoroughly knowledgeable about the properties, behavior, and placement methods of cellular concrete, including in underground applications.

2. At least five years of experience in tunneling and backfilling with cellular concrete for tunnels and underground excavations.

3. Successfully completed at least three similar projects within the last five years and been in responsible charge of at least one of those projects. At least two of those

jobs shall have used Backfill Delivery Lines to introduce and verify backfill of cellular concrete in a tunnel.

4. The Backfill Expert shall be approved by the manufacturer and supplier of foaming agent to use the foaming agent with the methods and equipment proposed.

1.05 SUBMITTALS

A. Pre-Construction Submittals

1. Written documentation summarizing the qualifications and experience of the Contractor's Installation and Backfilling specialty contractor or subcontractor, including details of the projects listed in fulfillment of the required experience.

2. Detailed Pipe Installation and Backfill Work Plan describing the methods, equipment, and materials of the work. The submittal shall include the following as a minimum:

d. Descriptions and shop drawings describing and illustrating methods and equipment proposed for installation of the Carrier Pipe in the tunnel. The submittal shall address as a minimum pipe transportation, assembly of the Carrier Pipe with the Pipe Supports, pipe section joining, and jacking.

e. Descriptions, shop drawings, and calculations for securing the pipe during Annulus Backfilling. Calculations shall be submitted which evaluate: the buoyant force(s) generated during backfilling of each stage; the loads on the Pipe Supports; stresses on the Carrier Pipes; bending stresses on the Carrier Pipe between the Pipe Supports, and the maximum allowable backfill injection pressure. The calculations shall be prepared, stamped, and sealed by a Professional Engineer registered in the State of Michigan with experience in comparable tunneling and pipeline work.

f. Provide method and equipment for measuring the jacking or pullback force on the pipe during the pullback operation for real-time measurements and recording of the maximum stress imposed on the pipe during installation.

g. Certification from the pipe supplier that proposed securing details to prevent flotation, and backfilling procedures are in accordance with their recommendations and will not damage pipe.

h. Design and details of the Pipe Supports including manufacturer and model number, if applicable.

i. Backfill mix including; 1) proportions of constituent materials, 2) wet properties of density and viscosity, 3) properties of the cured Backfill including density and strength.

j. Description of equipment and methods proposed to mix cellular concrete, including mixing equipment, quantity controls and instrumentation. Description of trial batches, trial batch testing and proof of acceptable delivery and placement of cellular concrete in the tunnel.

k. Arrangement of the Backfill injection points and Backfill Delivery Lines in the tunnel including the length, position, and termination point of Lines.

l. Sequence and pressure(s) for Backfilling including stages and observations of verification of Backfill position such as with backflow and sensing through the Backfill Delivery Lines, and verification that the Backfill is complete.

m. Injection methods for the Backfill including pumping equipment, hoses, boosters, pumping distances, flow rates, and pressures. Include methods and description of instrumentation to monitor and control placement of the Backfill, and procedures to be used to verify Backfill volumes.

B. Construction Submittals

1. Pipe Installation and Backfill Schedule. Submit a schedule of pipe installation and backfill activities at least three weeks before beginning the work and update weekly. Notify the Engineer at least one working day in advance of schedule changes.

2. Written Installation and Backfill Logs. The Written Daily Logs shall have as a minimum the information specified below in this Section. Logs shall be submitted at the end of each shift.

3. Results of all material tests specified herein. Test results shall be submitted within one week after completion of each test.

4. Written Daily Logs. The Written Daily Logs shall have as a minimum the information specified below in this Section.

5. Results of all material tests specified herein including field tests and laboratory tests. Test results shall be submitted within one week after completion of each test.

6. Survey results of the Carrier Pipe prior to installation of the Casing Pipe.

C. Post-Construction Submittals

1. Summary sheet of the quantity of backfill placed each shift, the total backfill placed, and the theoretical volume of the annulus.

PART 2 - EQUIPMENT AND PRODUCTS

2.01 MATERIALS

A. Annulus Backfill

2. Annulus Backfill shall be cellular concrete.

3. Cellular concrete shall be composed of cement, water and foam. No aggregate or fillers are allowed. Additives may be used only with review and approval of the Engineer.

4. The foaming agent for cellular concrete shall be in accordance with ASTM C 869 and shall be tested in accordance with ASTM C 796.

5. Cellular concrete shall have a minimum wet density of 40 pcf.

6. Cellular concrete shall have a minimum 7-day compressive strength of 50 psi, a minimum 28-day compressive strength of 150 psi, and shall be tested in accordance with ASTM C 495.

2.02 PRODUCTS

A. Backfill Delivery Lines: Small diameter sacrificial pipes used to introduce backfill into the tunnel and to monitor the progress of the backfill operation. The Contractor shall determine the size and material for the Backfill Delivery Lines. The Backfill Delivery Lines shall not soften, deform, or melt with the temperatures experienced in the backfill operation.

B. Carrier Pipe Support (Casing Spacers)

1. Casing Spacers shall be constructed of circular stainless-steel bands, which bolt together forming a shell around the carrier pipe. The spacers shall be designed with risers and runners to support the carrier pipe within the casing and maintain a clearance of no greater than 1.00” between the casing ID and the spacer OD. See casing spacer drawing for details. The design shall maintain pipeline integrity in the event the pipeline floats during installation of backfill grouting.

2. The band shall be manufactured of 12” wide 14-gauge T-304 stainless steel. The risers shall be constructed of 10-gauge T-304 stainless steel having a minimum length of 10” and a height to be determined based on the annular space between the carrier OD and the casing ID. The number of runners and risers is to be determined by the manufacturer’s recommendation.

3. Abrasion resistant runners, having a minimum length of 10” and a minimum width of 2”, shall be attached to each band and/or riser to minimize friction between the casing pipe and the carrier pipe as it is installed. Runner material shall be a polymer with a minimum compressive strength of 33,000 psi, flexural strength of 40,000 psi and tensile strength of 27,000 psi. The ends of all runners shall be beveled to facilitate installation over rough weld beads or welded ends of misaligned or deformed casing pipe.

4. Interior surfaces of the circular stainless-steel band shall be lined with PVC, having a minimum thickness of .090” with a hardness of Durometer “A” 85.

5. Position spacers 1 to 2 feet on either side of the joint and one placed every 6 – 8 feet apart thereafter, or based on manufacturer’s recommendations, whichever results in closer spacing.

6. Casing spacers must be situated such that a minimum of 4-inches is present between the inner diameter of the casing pipe and the outer diameter of the carrier pipe. See carrier pipe and casing spacer drawings for details.

7. Manufacturers:

    a. PSI Products, Inc. (Vancouver, BC)

    b. Advance Product & System, Inc. (Lafayette, LA)

    c. Engineer Approved Equivalent

PART 3 - EXECUTION

3.01 GENERAL

A. Do not begin Work until:

1. Required submittals have been made and approved.

2. All monitoring and instrumentation has been installed and initial measurements have been obtained.

3. A pre-job means and method conference has been conducted. Arrange this conference and inform the Owner of the time and place of the conference at least seven days in advance.

4. The Casing Pipe has been Contact Grouted.

5. The line and grade of the tunnel has been surveyed and has been verified to allow for installation of the Carrier Pipes to the tolerances and clearances specified and shown.

6. The tunnel has been cleaned with removal of debris, dirt and deleterious materials resulting in clean bare inside face of the Casing Pipe.

B. Verify conditions prior to commencement of work including layout and field measurements and notify Engineer of discrepancies.

3.02 PIPE INSTALLATION AND SECURING

A. The Carrier Pipe shall be installed in the tunnel by jacking or pulling a pre-assembled string of completed Carrier Pipe into the tunnel. Joints for the Carrier Pipes shall be assembled incrementally in the Launching Shaft as the Casing Pipes are jacked or pulled into the tunnel.

B. The Carrier Pipes shall be secured in the tunnel with Pipe Supports.

C. Pipe Supports shall be spaced as necessary to prevent movement during all installation phases including but not limited to jacking in-place without backfill, backfilling, and completely immersed with wet backfill. Ensure that the Carrier Pipe and each pipe segment are firmly secured to prevent flotation, settlement, lateral and axial movement, and pipe deflection.

D. Pipe joints shall be mated and secured in accordance with the pipe manufacturer's requirements and the Contract Documents.

E. Use ballast in the Carrier Pipe in combination with limited backfill lifts as needed to stabilize the Carrier Pipes.

3.03 BACKFILL PLACEMENT

A. Remove all standing water from interior of casing prior to commencing backfill placement.

B. Backfill shall be introduced into the annulus at the shafts and with Backfill Delivery Lines.

C. Completely backfill the Annulus between the Carrier Pipe and the Casing Pipe with Annulus Backfill. Completely fill the spaces below and around the Carrier Pipes.

D. The injection points for Annulus Backfill shall be at intervals of 150 feet or less along the length of the tunnel. Closer spacing of discharge points shall be used as necessary to assure continuity of the Backfill.

E. The method of backfilling shall ensure that the annulus is completely filled between injection points and from the tunnel invert to the tunnel crown. Verification of satisfactory backfilling shall be determined as the difference between the calculated annulus volume and the actual volume of backfill placed being within 1 percent.

F. Place backfill in a continuously advancing front beginning at one end of the tunnel and advancing to the other end. The methods and sequence of placement shall advance a front of backfill from one end of the tunnel to the other assuring complete coverage and that there are no remaining voids or trapped air pockets.

G. Use the Backfill Delivery Lines to track the location of the front of the backfill by sensing with slight air pressure and/or return of Backfill through the lines. Sequentially use each of the Backfill Delivery Lines to place backfill at each injection point. Inject the Backfill only below the surface of the Backfill using methods similar to tremie placement.

3.04 TOLERANCES

A. The Carrier Pipe shall be installed in the Casing Pipe with the clearances of +/- 1-inch vertically and horizontally.

3.05 SURVEYING

A. Survey the invert of the Casing Pipe at intervals not exceeding 20 feet prior to installation of the Carrier Pipes.

B. The survey shall be for both line and grade to an accuracy of 0.01 feet or better.

3.06 BACKFILL TESTING

A. Test methods shall be in accordance with ASTM C 495. Cast the specimens into blocks made from a weak material such as polystyrene foam with cylindrical holes. Separate and remove the specimens for testing by cutting and trimming the block material surrounding the cylinders.

B. Cellular Concrete Mix Design: Two sets of compression test specimens shall be made. One set of specimens shall be tested at an age of 7 days and the other set shall be tested at an age of 28 days. The mix shall be tested for unit weight, viscosity, and air content at the time of cylinder casting.

C. Index Testing of Cellular Concrete: A set of index tests shall be made from the first batch of cellular concrete mixed each day, after a change in mix design, and from each batch of cellular concrete from which compression test specimens are made. Additionally, index tests shall be conducted within two hours to verify the concrete's properties. Index tests shall include as a minimum: the wet unit weight (wet density), viscosity, and air content at the time of placement.

D. Compression Testing of Cellular Concrete: A minimum of one set of specimens shall be made each day when up to 25 cubic yards of cellular concrete is placed. At least one additional set of specimens shall be made from each additional 50 cubic yards, or major fraction thereof, placed in any one day, but no more than three sets of specimens will be required for each day. Two specimens of each set shall be tested at an age of 7 days and two specimens shall be tested at an age of 28 days. One specimen shall be held in storage. For tests of Annulus Backfill and at the Contractor's option as an alternative to the 7-day tests, tests may be conducted at any time not exceeding 14 days.

3.07 QUALITY ASSURANCE AND QUALITY CONTROL

A. Monitor and record as a minimum all data necessary to complete the required Submittals.

B. Pressure gauges of appropriate diameters and ranges for monitoring the Annulus Backfill injection pressures shall be located as close as possible to the point of injection in the line transporting the Backfill.

C. The volume of Annulus Backfill injected shall be measured, recorded, and compared with the anticipated volume per foot of Annulus Backfill.

D. Before placement of Annulus Backfill in the tunnel, use trial mixes of the same design proposed for use with the same equipment proposed for placement, demonstrating the ability to produce cellular concrete of the required density and strength. Demonstrate the ability to pump the cellular concrete mix the distances proposed without loss of cellular concrete quality. This requirement may be satisfied by providing records from previous projects in which the same mix, water, cement sources, materials, and equipment were successfully used.

E. Samples of Annulus Backfill shall be obtained from the Backfill Delivery Lines at the tunnel portal, or alternatively, at a simulated point of discharge through the same or greater pumping distance.

F. In addition to the tests required to be performed by the Contractor, the Contractor shall take samples for the Owner and/or allow access for the Owner to obtain samples of the Backfill, as determined by the Owner.

3.08 CONSTRUCTION RECORDS

A. The Contractor shall maintain written Daily Logs for pipe installation and backfilling. The Daily Logs shall be signed by the Pipe Installation or Backfill Expert as appropriate, or the Superintendent or Foreman, and shall contain the following:

1. Crews and subcontractors onsite with their personnel and equipment, and the work performed. The reports shall be broken down into work time and down/standby time for each crew and subcontractor.

2. Record of Carrier Pipe installed and position of the leading edge of the Carrier Pipe.

3. Record of backfill quantity with the total for the day and quantity injected into each point, and the delivery pressures in each.

4. Records of the verification of Backfill advance from the air pressure and Backfill backflow through Backfill Delivery Lines and other methods.

5. Results of material property tests performed.

6. Problems or unusual conditions encountered and actions taken to address these situations.

3.09 CLEANUP AND RESTORATION

A. Following completion of work, remove all equipment, unused materials, and debris from the site.

END OF SECTION

SECTION 33 01 30

SEWER FLOW CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the minimum requirements for furnishing all labor, supervision, tools, equipment, appliances, materials, incidental items, and the installation, operation, and maintenance needed to perform all operations in connection with the diversion of flow and bypass pumping of sanitary sewage for the installation of new sewers and manholes. The purpose of which is to provide un-interrupted sewerage service at all times and to prevent sewage overflows.

B. It is the intent of this project to divert flow within the existing sanitary sewers around the work zone where the construction requires diversion. The flows from the various laterals and side connection sewers to the sanitary sewer interceptor in the work zone shall also be bypass pumped downstream of the work zone. The design, installation, and operation of the temporary sewer flow control system shall be the Contractor's sole responsibility.

C. When working inside manholes or sewer, the Contractor shall exercise caution and comply with Occupational Safety and Health Administration (OSHA) and City requirements for working in confined spaces.

D. The Contractor shall manage, plan, and execute their operations such that there will be no backups, leaks, or unauthorized discharges of sewerage. The Contractor shall be completely responsible for the proper clean-up and any environmental remediation as may be required by the City or the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for any backup, leak, spill, or sanitary sewerage overflow.

E. Contractor is responsible for procurement, installation, and monitoring of the required instrumentation.

1.02 SUBMITTALS

A. The Contractor shall provide a detailed Sewer Flow Control Plan to the Engineer for review and acceptance prior to the start of any flow control work. This plan must include descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing flow. The Sewer Flow Control Plan must be specific, including such items as schedules, locations, elevations, capacities of the equipment, materials, and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of existing structures and pipes, and compliance with the requirements and conditions specified in these Contract Documents. The flow control plan shall be submitted to the Engineer for review and approval in accordance with Section 104.02 of the 2020 edition of the Michigan Department of Transportation Standard Specifications for Construction. No construction shall begin until all provisions and requirements have been reviewed and accepted by the Engineer.

B. For each submittal and re-submittal, the Contractor shall allow at least 14 calendar days from the date of the submittal to receive the Engineer's acceptance or request for revisions. The Engineer's comments shall be incorporated into the re-submitted plans, calculations, and descriptions. The Engineer's acceptance of the plan is required before beginning the work. Re-submittals shall be reviewed and returned to the Contractor within 14 calendar days. Required revisions will not be a basis of payment for additional compensation, extra work, or an extension of contract time. The Contractor shall include time for this entire review process in their schedule.

C. Sewer Flow Control Plan submittal shall include at a minimum:

1. Overall flow control plan and sequence of construction;

2. Flow control schedule including times when the flow control system shall be temporarily shut down and flow allowed to return to normal operations;

3. Overall plan for removal of flow control system during wet weather events and/or emergency situations;

4. Plan for providing redundancy for all aspects of the system especially the plugs;

5. Plan for providing noise control of pumping and power generation equipment;

6. Safety Program for confined space entry and procedure for entering manholes and installing plugs under live flow conditions;

7. Emergency clean-up plan should a spill occur or backups in the system occur. The plan should include contact names and 24-hour phone numbers;

8. Procedure for continuous (24-hour) monitoring of system, including verifying that plugs are sealed and lateral bypass pumping system is operating. The plan is to include type and location of level sensors, method of installation, set elevations of sensors, and continuous monitoring system. Monitoring of the system shall be performed and documented at each installation. Records of the system monitoring shall be submitted to the Engineer;

9. Maintenance of traffic plan for plug installation and removal in public roadways;

10. Sewer plug types, method of installation and removal, anchors and restraints, and hydraulic head limits;

11. Lateral bypass pump sizes, capacities, power requirements, and number of each size to be provided at each manhole including redundancy;

12. Calculations giving flow capacity provided by each pump given the system's Total Dynamic Head (TDH), including the calculations that are used to derive the system TDH. This data should also include the calculations determining what the Net Positive Suction Head available is in comparison to the Net Positive Suction Head required by each pump. Pump curves shall be submitted;

13. Number, size, material, and location of lateral bypass pumping suction and discharge piping, procedure for protecting lines, and location of bypass pumping discharge manhole;

14. Lateral bypass pumping system flushing and drainage plan;

15. Buried bypass pipe locations and details;

16. Environment protection including pump containment and leak detection;

17. Method of protecting discharge manholes or structures from erosion and damage; and,

18. Method of noise control for each pump..

PART 2 - PRODUCTS

2.01 Flow Diversion Equipment

A. Provide materials and equipment suitable for, and known to be reliable to meet, the flow diversion requirements as shown on the Drawings and as needed for the Contractor's operations.

2.02 PLUGS

A. Plugs shall be temporary plugs that allows for quick removal in case of emergency or wet- weather situation. Plugs shall be capable of withstanding minimum static head pressure of 15 feet. Plugs shall include form or bracing, anchoring, or restraint to keep plugs properly installed. Plugs should be of the type capable of being installed under live flow conditions and in depths exceeding 35 feet as shown on the Drawings. Plugs should be able to be installed in either the incoming or outgoing pipe in a manhole and allow for quick removal under surcharged conditions. Plugs shall be clearly tagged with the Contractor's name and date of installation.

B. Pressure gages shall be installed with the plugs to continuously monitor the plugs and adjust the air pressure as needed to maintain full blockage of flow.

2.03 LEVEL SENSORS

A. Ultrasonic level sensors shall be installed, at a minimum, at each bypass pumping location. The Contractor may elect to install sensors in other locations at their expense if they so choose. The Contractor shall be responsible for the installation and maintenance of the sensors. The level sensors shall provide continuous level readings that the Contractor shall be able to review remotely to monitor the level in the system during flow diversion. The level sensors shall provide notifications and alarms to allow the Contractor time to remove the plugs should an emergency or a wet weather event occur.

2.04 PUMPING EQUIPMENT

A. The pumps must be capable of passing a minimum of a 3-inch solid. All pumps must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

B. Equipment used for bypass pumping shall be sufficient to handle anticipated average and peak flows from each sewer. The Contractor shall maintain sanitary sewer flows within their bypass pumping system, including all wet weather flows.

C. The locations and approximate flow rates for each of the sewer segments are as follows:

Facility ID	Location	Dry Weather Flow (cfs)	Wet Weather Peak Flows (cfs)
MH 71-70646	36" on First just north of Miller	4.7	33.0
Con 74-70683	10” on Washington between First and Ashley	1.2	1.4
Con 74-70703	30” on First just south of Washington	6.1	20.8
MH 71-70588	24" on Washington	0.8	5.2
MH 71-70522	18" on Washington	1.7	7.4

2.05 REDUNDANT EQUIPMENT:

A. The Contractor shall have redundant flow diversion equipment including, but not limited to, pumps, plugs and level sensors, available for immediate use at the job site at all times in the event of a failure.

B. The Contractor shall have redundant lateral bypass pumping equipment installed and ready for immediate operation and use in the event of an emergency or primary system breakdown or failure. The standby system shall be capable of pumping dry weather and peak flow. The standby pump(s) shall not be considered as any part of the primary system as designed for peak flow. The Contractor shall also furnish and have available onsite, and ready for operation, redundant pumping ancillary equipment in case of any failure of the pumping system including piping, electrical equipment, pipe appurtenances, etc. Redundant pumping facilities shall also include having a backup power generator in case the primary power source fails.

PART 3 - EXECUTION

3.01 FLOW DIVERSION

A. The Contractor shall install the flow control and test the system for a minimum of 48 hours prior to the start of any other work onsite. The Contractor, City, and Engineer shall review the flow diversion during the testing period, including flow levels in the manholes. The Contractor shall not start any other work onsite until acceptance of the flow control test.

B. Residential and commercial sewer lateral location data for the project area is limited. The Contractor shall verify and document any sewer lateral locations as part of the construction.

C. The Owner will not permit water use restrictions to be used to reduce bypassed flows. The Contractor shall develop a flow diversion plan that permits the work to be completed with the least disruption of service to those served by the sewer.

D. Service laterals that enter the mainline sewer shall be bypass pumped to the downstream bypass pumping manhole or blocked if a bypass is not available and the construction is for a short duration. If a lateral is plugged and/or blocked, the Contractor is responsible for coordination with the property owner to ensure flow is minimized and to prevent a sewer backup. The Contractor is responsible for all sewer backups that occur during all bypass work.

E. The Contractor shall construct and maintain bypass pumping facilities as needed that will pump at the required flow rates. The Contractor shall provide the City with a minimum of 7 days advance notice prior to initiating the sanitary sewer bypass pumping system.

F. The Contractor is responsible for obtaining any approvals for placement of the temporary equipment and/or piping within public ways from the Agency having jurisdiction.

G. The Contractor shall provide an adequate labor force and have designated personnel onsite for maintenance and operation, and emergency back-up service, of the bypass pumping facility 24 hours per day 7 days per week during bypass operations.

H. The Contractor is to arrange for and provide all necessary temporary power, electrical service, board switches, etc. as required by DTE Energy and the National Electrical Code (NEC) current edition to provide temporary bypass pumping.

I. All bypass pumping discharge pipes shall be protected from the pipe header to the discharge structure. The Contractor shall provide necessary fittings or deflection in pipe to route pipe as necessary to minimize environmental impact and conflict with pedestrian, construction, and emergency vehicle traffic. When the bypass pipeline crosses drives or trails, or when pipeline is within any Contractor work zone/staging area, the Contractor shall place the bypass pipeline in a casing pipe and bury in temporary trenches with compacted backfill as indicated on the Drawings, as required for the Contractor's operations, and as approved by the Engineer. All work associated with temporary bypass discharge pipe trench, including piping, fittings, deflections,

casing, spacers, trenching, and backfill shall be included in the contract pay item "Sewer Flow Control."

J. When flow in a sewer line is bypassed or plugged, sufficient precautions must be taken to protect the Contractor's operations from damage that might result from sewer surcharging. Further, precautions must be taken to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved. At no time shall sewage be pumped in or allowed to flow into a catch basin, storm sewer, or open watercourse

3.02 NOISE CONTROL

A. All noise generated by the bypass pumping operation shall not exceed the sound limits as required by City Code and shall follow necessary procedures as required for temporary exemptions.

B. The Contractor shall provide a secondary sound barrier for both the primary and back-up pumps and any power generating equipment.

3.03 FLOW DIVERSION COMPLETION

A. At the end of the flow control operation, and after receipt of written permission from the Engineer, the Contractor shall remove all flow diversion and bypass pumping equipment, including level control system, temporary power equipment, and suction/discharge piping in a manner that permits the sewage flow to return to normal without overflowing to the environment, surcharging, or causing other major disturbances downstream. The Contractor shall restore all disturbed areas and structures, and restore all pavement in accordance with the Contract, and as directed by the Engineer.

B. The duration of the bypass pumping shall be determined by the Contractor as needed to perform the work under this contract while maintaining un-interrupted sewage service.

END OF SECTION

SECTION 33 05 07.36

MICROTUNNELING

PART 1 - GENERAL

1.01 SUMMARY

A. The Work of this Section includes the construction of trenchless segments using microtunneling, as shown in the Contract Drawings.

B. This Section presents requirements for using a closed-face microtunnel boring machine (MTBM) with a pre-installed support system to excavate and install a reinforced concrete (RCP) Jacking pipe with fiberglass-reinforced (FRP) Carrier pipe in two passes along W. Washington St. and N. First St. in Ann Arbor, Michigan.

C. Within this Section, the terms “Tunnel” and “Tunneling” refer to the trenchless installation by microtunneling.

D. Within this Section, the term “Jacking Pipe” refers to the reinforced concrete casing pipe (RCP) installed via microtunneling as specified in Section 33 05 40 – Reinforced Concrete Jacking Pipe.

1.02 REFERENCES

A. Related Sections

1. 31 09 13 – Geotechnical Instrumentation and Monitoring

2. 31 41 00 – Shaft Construction and Support

3. 31 73 00 – Contact Grouting

4. 33 05 40 – Reinforced Concrete Jacking Pipe

B. Specifications, Codes, and Standards

1. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this Section and the listed references, the requirements of this Section shall prevail.

a. ASCE/CI 36-15 – Standard Design and Construction Guidelines for Microtunneling.

1.03 DEFINITIONS

A. Microtunnel Boring Machine (MTBM): Remote-controlled, guided, and steerable slurry shield that can provide continuous support to the excavation face. The MTBM is operated from a control container located on the ground surface. Soil excavation is achieved by a rotating cutterwheel. Excavated soil enters a slurry chamber, where it

is mixed with drilling fluid to form a slurry. Pumps cycle the slurry to the surface where a separation plant removes the solids from the slurry. The recycled fluid is returned to the face in a closed system of pumps and hoses. Drilling fluid used to convey spoil may be water; however, it may also contain acceptable additives such as bentonite that allow it to carry more solids, provide gel strength, and reduce permeability into the soils at the heading. The guidance system consists of a laser or theodolite and electronic distance measurement (EDM) device mounted in the jacking shaft communicating a reference line to a target mounted in the MTBM's articulated steering head. The target in the MTBM provides the operator with information about machine attitude and pitch and can allow for accurate steering control.

B. Intermediate Jacking Station (IJS): A fabricated steel cylinder fitted with hydraulic jacks spaced around the circumference which is incorporated into the pipeline between two specially fabricated casing or jacking pipe sections. The function of an intermediate jacking station is to distribute the jacking load along the pipe string during pipe installation. The hydraulic jacks are removed at the completion of a drive, and the gap between adjacent pipe sections is fully closed by pushing the pipes together with the main shaft jacks or another IJS. The steel cylinder remains as an extended sleeve or coupling.

C. Jacking (Casing) Pipe: Pipe jacked behind the MTBM to maintain the stability of the excavated tunnel. For one-pass microtunneling (direct jacking), the jacking pipe also acts as the product or carrier pipe. For two-pass microtunneling, the carrier pipe is later installed inside the jacking pipe.

D. Launch/Retrieval Seal or Entry/Exit Seal: A mechanical seal, usually comprised of one or more rubber flanges attached to a steel housing mounted to the jacking/receiving shaft wall. The microtunneling machine distends the flange seal as it passes through, reducing water, slurry, or lubricant inflows into the shaft during microtunneling operations.

E. Lubrication/Grout Port: A port located within the MTBM, or in the jacking pipes, fitted with a one-way valve to inject lubricant or grout into the annular space between the jacking pipe and the ground. Lubrication/grout ports within the jacking pipe are typically threaded to accept lubrication/grout fittings. Pipe plugs are inserted after grouting is completed.

F. Contact Grouting: Neat cement grout injected through grout ports into the annular space to fill voids and displace lubricant outside of the jacking pipe at completion of the microtunneling drive.

G. Obstruction: Objects located entirely or partially within the cross-section of the tunnel that prevents continued forward progress of the MTBM or jacking pipes along the design path and within allowable tolerances.

1.04 GENERAL REQUIREMENTS

H. The Contractor shall use a closed-face MTBM and jacking system to install the reinforced concrete jacking pipe as shown in the Drawings and in accordance with Section 33 05 40 – Reinforced Concrete Jacking Pipe.

A. The Contractor shall perform operations in accordance with ASCE/CI 36-15 – Standard Design and Construction Guidelines for Microtunneling and requirements stated in this Section.

B. The Contractor shall use an MTBM suitable for tunneling in the geotechnical conditions as described in the project Geotechnical Baseline Report.

C. The Contractor shall use exit and entry seals for the launch and retrieval shafts in accordance with Section 31 41 00 – Shaft Construction and Support and as specified herein.

D. Perform tunnel excavation in a manner that limits loss of ground and limits lateral movement and settlement of the ground, structures, and utilities in the vicinity of the tunnel alignment. Take all measures necessary to protect existing structures, utilities, and facilities, including performing field verification. As a minimum, abide by the ground movement limits and criteria presented in Section 31 09 13 – Geotechnical Instrumentation and Monitoring.

E. The overcut annulus and voids outside the jacking pipe shall be contact grouted in accordance with Section 31 73 00 – Contact Grouting.

F. Dewatering is not allowed for the trenchless drive or shaft excavation where microtunneling is required, except when Soldier Pile and Lagging shaft construction is used as stated in Section 31 41 00 – Shaft Construction and Support. Sumps are allowed in shafts to remove nuisance groundwater, rainwater, or slurry flows after breakthrough.

G. An instrumentation program shall be implemented in accordance with the Contract Drawings and Section 31 09 13 – Geotechnical Instrumentation and Monitoring.

H. The Contractor shall determine details and design of the MTBM equipment subject to the limitations specified herein and elsewhere in the Contract Documents.

I. A system of guidance and support is required for the trenchless drives as specified herein.

J. Upsizing the jacking pipe is allowed within the limits specified herein in Part 3 – Execution, and with the concurrence of the Engineer.

K. It is the responsibility of the Contractor to safely construct the trenchless drive and provide the finished product within the limitations specified herein and elsewhere in the Contract Documents.

L. The Contractor shall develop a Contingency Action Plan as specified herein to address unexpected conditions and situations that may be encountered during construction.

1.05 QUALIFICATIONS

A. The trenchless superintendent shall meet all of the following experience requirements:

1. At least five years of experience supervising microtunneling, tunneling, and underground construction with at least two of these projects being microtunnel construction similar to this project.

2. Successfully completed as the foreman or supervisor at least one project using a closed-face MTBM similar to the system proposed for this project and having a diameter of at least 60 inches and length of at least 1,000 ft.

B. The underground site safety officer shall meet all the following experience requirements:

1. At least seven years of site safety experience on heavy civil projects.

2. At least five years of site safety experience for excavations, with at least three years of site safety experience for underground work.

3. Specific training, certifications, and licenses as applicable for the work and in accordance with all regulations and standards.

C. The machine operator shall have at least five years of experience with the type of equipment proposed for the work and shall have successfully completed at least three microtunneling projects of similar dimensions and ground conditions within the past three years.

D. The surveyor proposed for the Work shall be a Licensed Surveyor in the State of Michigan and have a minimum of three years of experience surveying line and grade control on trenchless projects.

1.06 SUBMITTALS

A. The following pre-construction submittals shall be submitted at least 30 days prior to start of any shaft excavation unless stated otherwise:

1. Qualifications: Written documentation summarizing the qualifications and experience of the trenchless Superintendent, machine operator, Surveyor and Underground Site Safety Officer responsible for the microtunneling work. Required documentation shall be submitted no more than 30 days after Notice to Proceed with microtunneling construction.

2. Work area layout drawings: The Contractor shall submit scaled drawings showing work areas to be used for microtunneling operations, including layout of the launch and reception shafts, all major equipment, stored materials, and area for handling shaft and tunneling spoils. The Contractor's layout drawings shall show that all equipment and operations will be completely contained within the allowable work areas shown on the Contract Drawings.

3. Schedule: Submit the schedule for tunneling work identifying all major construction activities as independent items including the work hours and workdays for each activity. The schedule shall be updated and resubmitted by the Contractor every two (2) weeks, or more frequently if requested by the Engineer. The schedule shall include, as a minimum, the following activities:

a. Mobilization

b. Equipment inspection

c. Shaft construction

d. Thrust block construction

e. Jacking equipment setup

f. Portal opening, stabilization, and entry and exit seal installation for launch or retrieval of machine

g. Clean up and demobilization.

4. Contractor's underground work safety and accident prevention program for all underground work including the safety of workers and the public.

5. Permits: List of required permits and third-party approvals to perform the Work to be submitted no more than 30 days after Notice to Proceed with construction of the trenchless segments.

6. Procedure for hauling and disposal of spoils from shaft and tunneling excavation. The plan shall include disposal site, haul route, truck frequency and hours of spoil haulage. Environmental testing shall be performed in accordance with requirements of disposal sites, and local, state, or federal regulations.

7. Detailed microtunneling work plan with description and shop drawings of the complete system illustrating the design, layout, and operation of each system component including:

    a. Method of maintaining face stability including removing spoils while maintaining face stability.

    b. Procedures for measuring excavation quantities versus forward progress per length of pipe advanced and comparison of excavated volume versus theoretical volume. Include a calculation of the bulking factor for the material removed.

    c. Method of spoil transportation and removal from the face of the excavation to the shaft and from the shaft to the surface.

    d. Methods and materials used to manage sticky clays, if encountered in the bedrock, including at the face, transport system and separation plant.

    e. Monitoring and Instrumentation: methods, procedures, and frequencies for surveying the alignment and grade of each drive.

    f. Datalogger collection system used to collect MTBM parameters. The computer recorded data shall be referenced to time and distance and shall be recorded at time intervals of 30 seconds or less.

g. Guidance and Control: Equipment and procedures for guiding and controlling the alignment and grade of the MTBM. The submittal shall include the methods and equipment for tracking of the MTBM along the alignment.

h. Methods for personnel access and layout of utilities inside of the tunnel.

i. Equipment spreads, crew make-ups, and anticipated cycle times.

j. Equipment and methods for controlling friction, including overcut, annulus, and slurry outside the jacking pipe.

k. Lubrication system including port locations, fluid design and properties, supply pipe size and injection frequency.

l. Provisions for controlling groundwater.

8. Tunneling Equipment: Detailed description and shop drawings for the MTBM and system to be used including:

   a. The make and model number of the equipment along with any modifications.

   b. Scaled drawings and design for the equipment.

   c. Torque, rotation speed range, and no-load or “dry” torque reading.

   d. Cutterhead description, including types of tools, number and configuration (include photographs or drawings).

   e. Size of the overcut outside the jacking pipe.

   f. Articulation and steering capability

   g. Cutterhead jets/ports.

   h. Details of the Contractor’s proposed survey system including control points, equipment, methods, and frequencies.

9. Jacking System Design. The submittal shall include design of the entire pipe jacking system and, if utilized, intermediate jacking system including the pipe, jacking frame, and thrust restraint showing at a minimum:

   a. Capacity, number, and arrangement of main jacks.

   b. Details of the thrust ring, thrust block, jacking frame, jacking controls, pressure gages, and jack calibration data (pressure vs. force relationship for each stage of the jacks)

10. Lubrication System. Description of the system to reduce pipe friction including injection locations and frequency, pumping pressures, slurry design, and method for maintaining slurry in the annulus.

11. Calculations: Submit calculations in a neat, legible format. Assumptions used in calculations shall be clearly stated and shall be consistent with the ground conditions described in the Geotechnical Baseline Report, and conditions anticipated by the Contractor. All calculations shall be prepared by or under the direct supervision of a Professional Engineer licensed in the State of Michigan, who shall stamp and sign calculations.

    a. Provide an estimate of the maximum jacking force expected to complete each drive, accounting for lateral earth pressures at the tunnel face and frictional resistance along the pipe string.

    b. Calculations to confirm that the proposed jacking pipe can withstand the anticipated jacking forces while maintaining a minimum factor of safety of 2.0. Coordinate with the submittal required by Section 33 05 40 – Reinforced Concrete Jacking Pipe.

    c. Calculations demonstrating that the ground behind the thrust block can safely transfer the maximum planned jacking forces exerted by the main jacks to the ground during pipe installation with a factor of safety of at least 1.5 with consideration to the passive earth pressure of the ground and without excessive deflection or displacement of the thrust block and jacking frame or shaft excavation support system. Coordinate with the submittal required by Section 31 41 00 – Shaft Construction and Support. The thrust block capacity submittal shall be coordinated between the Contractor, shaft subcontractor, and pipe jacking subcontractor to ensure an adequate jacking system is provided to complete the work and to ensure the shoring system is designed to withstand the maximum planned jacking forces.

    d. Forces applied to the ground shall not exceed the allowable passive earth pressure, with an applicable minimum factor of safety of 2.0 for the regular condition and a minimum factor of safety of 1.5 for the maximum possible forces after delays (set-up).

12. Plan for personnel entry into the jacking pipe including provisions for ventilation, temperature control, lighting, electrical safeguards, monitoring, and warning systems. Include ventilation design, calculations and drawings stamped and signed by a Professional Engineer registered in the State of Michigan.

13. Material specifications and shop drawings of jacking pipe showing the pipe wall thickness, reinforced concrete type, and the maximum allowable axial force. A pipe certification of compliance shall be submitted. Descriptions and details of pipe joints and method of joining pipes. Coordinate with the submittal required by Section 33 05 40 – Reinforced Concrete Jacking Pipe.

14. Descriptions and details of pipe ports for lubrication, if applicable, including shop drawings showing locations, sizes, and plugs for abandonment. Coordinate with the submittal required by Section 33 05 40 – Reinforced Concrete Jacking Pipe and Section 31 73 00 – Contact Grouting.

15. Equipment and procedures for monitoring the jacking operation including jacking loads and loads on the jacking pipe.

16. Submit a description of surveying methods to be used to set the guidance system positions and a description of procedures to check and reset or realign the guidance system during construction.

17. Submit a description of methods to ensure that thrust block, shaft portal openings, and jacking frame are installed on proper line and grade. Submit results of line and grade survey stamped by a surveyor meeting the qualifications stated herein to ensure that the jacking setup is installed properly prior to launch of each drive. Submit results of all check surveys performed on surveying system, with check surveys to be performed a minimum of once per week. Confirm that these systems can achieve the required pipeline line and grade within the specified tolerances.

18. Contingency Plans: The following problem scenarios may be encountered during microtunneling operations. This list of scenarios is not comprehensive, and the Contractor shall include others that may be anticipated. The Contractor shall submit a contingency plan or plans providing courses of action for dealing with each problem scenario while satisfying the specifications. These plans shall include the observations and measurements required to clearly identify the cause of the problems, and state when Contractor shall implement actions stated in contingency plans. Contingency plans shall also identify specific measures to stop or modify the means, methods, equipment, and materials to immediately control and rectify the situation and continue Work.

    a. Jacking forces reaching the design capacity of the jacking pipe, tunneling equipment, frame, or anchorages. Contractor shall evaluate the use of a lubrication system, if not already implemented, for this scenario.

    b. Thrust block deforming excessively under loads due to inadequate ground support behind the thrust block.

    c. Tunnel face instability.

    d. Damaged or out of compliance jacking pipe during installation.

    e. Dramatic or sudden increase in torque due to large obstruction at heading.

    f. Excavated volumes significantly exceeding pipe volume installed.

    g. Evidence of subsidence, heaving, utility movement, or indications of excessive settlement or ground movement beyond specified limits.

    h. Damage to existing buildings, facilities or utilities.

    i. Line and/or grade exceeding tolerance.

    j. Inadvertent release of slurry to the ground surface or nearby waterways.

B. Construction Submittals

Manually recorded observations should be made at intervals of not less than one time per pipe, and whenever conditions change.

1. Daily jacking records: Submit jacking records to the Engineer by noon on the day following the shift for which the data or records were taken. These records shall include, at a minimum:

    a. The underground activities on site include excavation, ground support and grouting.

    b. The crews for each activity with number of people on the crew by craft.

    c. The date, starting time, and finish time for each activity and crew.

    d. Description of the ground encountered, position of different ground layers, and description of ground behavior.

    e. Any unusual conditions, breakdowns, and delays.

    f. Record of starting and ending stations.

    g. Any movement of the guidance system.

    h. Machine inclination and roll.

    i. Pressure, location, and volume of any lubricant pumped.

    j. Problems encountered with the tunneling machine or other components or equipment.

    k. Tunneling Logs: Operational parameters of the MTBM including torque and thrust, rotation rate, slurry pressure, circulation rates, and thrust for the jacking pipe.

    l. Volume of ground removed for each jacking pipe push or interval of five feet or less.

    m. Jacking logs:

        - Results of monitoring of the jacking force at the jacking frame and the jacking pipe.

        - Installed pipe number and corresponding tunnel length

        - Lubrication volume pumped and the lubrication ports opened

        - Downtime duration and reason for delay

        - Installed pipe number and corresponding length

        - Rate of advance

        - Cutterhead Speed and Torque

- Slurry Flow Rates and Pressures
- Bypass value position
- Use of any Cutting or High-Pressure Nozzles
- Earth and hydrostatic pressure
- Applied Face Pressure
- Steering Jack Positions
- Line and Grade Offsets

2. Results of all material tests specified herein. Test results shall be submitted within one week after completion of each test.

3. MTBM recorded data parameters recorded in 30-second intervals including:

    a. Deviation of the MTBM from the required line and grade of the pipeline, normally by reference to a laser beam.

    b. Grade and roll of the MTBM

    c. Pipe Number and corresponding total tunnel length

    d. Face pressure or method of calculating face pressure with other parameters

    e. Jacking load

    f. Torque and RPM of the cutter head

    g. Instantaneous jacking rate (rate of advance) and total distance jacked

    h. Indication of steering direction

    i. For slurry systems, the following is also required

        i. Volume of slurry flow in both the supply and return sides of the slurry loop

        ii. Indication of slurry bypass valve position

        iii. Indication of pressure of the slurry in the slurry chamber

4. Slurry Additives: The Contractor shall provide records of all slurry additives including any bentonite and polymers. The time and volume, or weight, of the additive shall be noted. Measurements of mud weights, specific gravity and viscosity will be made at the beginning, middle, and end of each shift, and submitted with the daily logs. Measurements will be made on slurry samples taken from the slurry tanks and noted accordingly.

C. Submit the following post-construction submittal no later than 7 days after the completion of trenchless construction for each tunnel drive:

1. Survey of the line and grade of the installed jacking pipe, manholes and other permanent facilities.

1.07 DESIGN CRITERIA

A. Tunneling Equipment:

1. Excavation and Face Support Equipment: The Contractor shall use a Closed-Face, remotely operated MTBM to excavate the tunnel, support the face, and support the tunnel perimeter in front of the jacked pipe. The equipment shall be designed and manufactured to effectively excavate the ground and provide ground control in the specific ground conditions present on this project and be compatible with the Contractor's means, methods, and materials.

a. The MTBM shall be closed-face slurry machine.

b. The MTBM shall be equipped with a system for continuous and controlled removal of cuttings from the cutting chamber while maintaining soil or slurry pressure at the face.

c. Slurry machines shall have the ability for removal of cuttings from the cutting chamber through the closed slurry system while maintaining continuous slurry pressure.

2. The machine shall have a watertight articulation joint between two segments of the shield. The shield shall be steerable in both the vertical and horizontal directions to allow the operator to maintain line and grade within the specified tolerances.

3. MTBM Monitoring: The MTBM shall have a guidance control system using a laser or optical system which is monitored continuously and accurately observes the MTBM's vertical and horizontal displacement from the laser beam or control line which has been accurately set to the required alignment and grade of the tunnel. The guidance system shall be designed to function at the maximum required drive length without loss of accuracy or reliability of function. A display showing the position of the machine in relation to design line-and-grade shall be provided at the control panel to allow the operator to continuously monitor line and grade deviations.

4. Face and Ground Control: The MTBM shall maintain face control at all times including during excavation and during shutdown periods. The equipment shall control the volume of excavated material removed at the tunnel face and shall coordinate excavation with the advance rate to avoid over excavation. The equipment shall prevent the loss of ground throughout the tunnel construction sequence, including at the face and the tail. The equipment shall prevent ground loss between the MTBM and the jacked pipe.

5. The cutterhead shall have a reversible drive system so that it can rotate in either direction and shall have other suitable provisions to minimize rotation or roll of the machine during installation.

6. The maximum radial overcut shall be limited to one (1) inch.

7. Fluid outside the jacking pipe: The MTBM shall have the means to inject fluid over and around the rear of the MTBM and along the pipe length of the jacking pipe to fill the overcut annulus, reduce ground movement onto the pipe, and lower the friction developed on the sides of the pipe during jacking. The injection system shall be such that it can automatically be controlled from the operator position.

8. Instrumentation and Monitoring: The MTBM shall be equipped with a computerized data acquisition system for collecting information as described herein, including but not limited to:

    a. line, grade, pitch and yaw

    b. torque

    c. jacking force

    d. lubrication/slurry delivery and pressure

    e. slurry or face pressure

9. Measurement of ground removed: Provide equipment and instrumentation to allow accurate measurement of the quantity of material removed from the tunnel excavation.

B. Jacking System:

1. Provide a total jacking system (main jacks and intermediate jacking stations) with a capacity that exceeds the maximum anticipated jacking force by at least 20 percent.

2. A thrust block shall be used to transfer jacking loads to the ground behind the jacking shaft. The thrust block face shall be constructed perpendicular to the proposed pipe alignment. The thrust block shall be designed to withstand the maximum jacking forces developed by the main jacks, without excessive deflection or displacement. The Contractor shall structurally connect shaft support components to achieve required thrust reaction capacity, and/or shall use grouting behind shaft walls to achieve sufficient thrust reaction capacity as necessary.

3. The jacking hydraulic circuit shall be set to relieve pressure at the maximum safe working capacity of the pipe as stipulated by the Contractor or the design load for the jacking pit thrust block, whichever is less. The jacking system shall exert a uniform load on the pipe ring and at a speed commensurate with the speed of excavation advance.

4. Provide the maximum anticipated construction loads, including the maximum anticipated jacking force, and incorporate the anticipated loads into the jacking pipe design.

5. Provide IJSs:

    f. When the maximum anticipated jacking force exceeds 80 percent of the maximum allowable jacking force.

    g. When the main jacks do not exceed the maximum anticipated jacking force by at least 20 percent.

C. Slurry Plant: The slurry separation plant shall be designed to achieve the rates of spoil separation and slurry cleaning required for planned production rates. The separation plant must fit within the allowable work areas shown on the Drawings. Excavated slurry pits or ponds will not be allowed. All excavated materials and slurry shall be discharged and completely contained in tanks, trucks, or other approved containers. Onsite disposal is not permitted.

D. Ancillary equipment: The Contractor shall determine the equipment used for all ancillary work, including but not limited to spoil removal, water control, material transfer, and underground utilities.

E. Entry/Exit Seals: Provide a watertight seal at the entry and exit locations designed to withstand the hydrostatic and earth pressures in addition to the slurry, lubrication, and ground improvement methods, if applicable. A sufficient length of jacking pipe shall be provided such that the seal remains engaged with the jacking pipe.

1.08 QUALITY CONTROL AND QUALITY ASSURANCE

A. Failure to meet the qualification requirements is failure to fulfill the Contract and the Contractor will be required to obtain a subcontractor that meets the qualification requirements.

B. In addition to the provision of operational data referred to elsewhere in this specification, the Contractor shall comply with the following:

1. The Contractor shall establish and maintain quality control for all underground work to assure compliance with the contract requirements and maintain records of quality control for materials, equipment, and construction operations.

2. The Contractor shall keep and maintain at the construction site a complete set of field drawings for recording as-built conditions. It shall have marked or noted thereon all field information, properly dated, recording as-built conditions. This set of field drawings shall be kept up to date during the course of the project.

C. The Contractor shall establish a quality assurance and quality control (QA/QC) plan for all materials used in tunneling. The QA/QC plan shall detail tests, testing frequency, and acceptance criteria. The Contractor shall maintain QA/QC records for materials, equipment, and construction operations.

D. In addition to the tests required to be performed by the Contractor, the Contractor shall take samples and/or allow access to obtain samples of the grout and grout materials, as determined by the Owner.

E. Provide access to the Engineer and furnish all necessary assistance and cooperation to aid the Engineer in observations, measurements, data, and sample collection, including, but not limited to the following:

1. The Engineer shall have full access to the launch and reception shafts prior to, during, and following all microtunneling operations. This shall include, but not be limited to, visual inspection of installed pipes, and verification of line and grade. Provide safe access in accordance with all safety regulations.

2. The Engineer shall have full access to the bentonite lubrication plant prior to, during, and following all microtunneling operations. This shall include but not be limited to full access to visually inspect storage and mixing tanks, lubricant pressures and pumping rates, and the amount and type of lubricants on site.

F. The Contractor shall immediately notify the Owner, in writing, if any problems that would cause a schedule delay or a change to the submitted process/procedure are encountered with equipment or materials.

G. All drawings and submittals requiring any civil or structural design shall be signed by a professional civil or structural engineer registered in the State of Michigan.

H. Dewatering outside of the shaft shoring is prohibited for the construction of permanent structures, except for Soldier Pile and Lagging application as stated in Section 31 41 00 – Shaft Construction and Support. Maintain the existing groundwater levels while constructing both temporary and permanent structures and pipeline connections.

1.09 SAFETY

A. The Contractor shall stop work, stabilize the excavation, and notify the Engineer in the event that construction activities result in any of the following conditions:

1. Potentially dangerous.

2. May damage existing facilities and structures.

3. Obstructions or ground conditions that substantially impede the construction.

B. Following initial activities to stabilize the excavation, the Contractor shall perform explorations as necessary to determine the extent and nature of the conditions. The explorations shall be submitted to the Engineer for approval prior to starting the Work.

C. Following the explorations, the Contractor shall develop an action plan to continue the Work in a safe and controlled manner while protecting existing facilities and structures. The action plan shall be submitted to the Engineer for approval prior to starting the Work.

D. No gasoline powered equipment shall be permitted in jacking and receiving shafts. Diesel, electrical, hydraulic, and air-powered equipment is acceptable, subject to applicable local, state, and federal regulations.

E. If personnel will enter the pipe, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe. Keep all equipment required for emergency response on-site, in accordance with the jurisdictional agency.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The jacking pipe shall be designed by the Contractor for all loading conditions experienced during construction. The jacking pipe shall be in accordance with Section 33 05 40 – Reinforced Concrete Jacking Pipe.

B. Lubrication outside the jacking pipe used during jacking to reduce friction and control the ground shall be designed by the Contractor. The lubrication shall be non-toxic and shall not release environmental contaminants into the ground or groundwater either directly or from degradation over time.

C. Contact grouting used to fill gaps outside of the jacking pipe at the completion of the microtunneling drive shall be non-toxic and in compliance with Section 31 73 00 – Contact Grouting.

PART 3 - EXECUTION

3.01 GENERAL

A. Set the MTBM to be jacked on the planned alignment and grade, properly braced to support the jacking pipe, and direct it in the proper line and grade required on the Contract Drawings. Line up the jacking assembly in the direction and grade of the jacking pipe.

B. Do not begin underground work until:

1. Required submittals have been provided, reviewed, and approved or accepted.

2. Shaft excavations, stabilization, and shoring have been satisfactorily completed.

3. The jacking frame and thrust block have been properly set in place to match the line and grade required in the Drawings.

4. The required ground stabilization methods outside of the entry and exit seals have been implemented.

5. All required geotechnical instrumentation has been installed and initial measurements have been obtained.

6. A pre-construction conference presenting the proposed means and methods has been conducted. Arrange this conference and inform the Owner of the time and

place of the conference in advance of shaft construction, as specified in Section 31 41 00 – Shaft Construction and Support.

7. All pre-construction surveys have been completed.

8. Survey control has been established for the jacking pipe and has been verified by the Engineer.

C. Perform underground work in a manner that limits loss of ground and limits settlement of the ground surface, structures, and utilities above and adjacent to excavations. Take measures as necessary to protect existing structures, utilities, and facilities. The Contractor shall be responsible for verifying the locations of all underground facilities in the vicinity of the shafts and tunnel.

D. Maintain clean working conditions at all times at the job site. All excavated material, slush, grout spills, water, and any excess material shall be removed from the excavation in a timely manner.

E. Provide safe access for the Engineer at all times during active underground work. Access shall be for, but not be limited to, the following: to inspect and observe the work, perform independent line and grade surveys, monitor instrumentation, and install additional instrumentation. Access shall include the use of transportation facilities used by the Contractor's personnel within the shafts and jacking pipe.

F. Perform all underground work in accordance with all current applicable regulations and codes of federal, state, and local agencies. In the event of a conflict, comply with the strictest or most restrictive applicable requirements.

G. Verify field conditions prior to commencement of Work, including layout and field measurements, and notify the Engineer of discrepancies.

H. Furnish all necessary equipment, power, water, and utilities for the Work, including pipe lubricant mixing and pumping, conveyance and disposal of spoil, and other associated work consistent with the methods of construction.

I. During construction operations, and until the work shafts are backfilled and the fill material is compacted, traffic barricades and warning lights to safeguard traffic and pedestrians shall be furnished and maintained by the Contractor.

J. Tolerances: Excavate to the lines and grades designated on the Drawings and as indicated below:

1. The Microtunnel alignment shall be within one (1) inch of the planned line and grade requirements shown on the Contract Drawings.

2. The jacking pipe alignment shall not change by more than one (1) inch per 25 ft.

3. If the line and/or grade of the jacking pipe is offset by more than the specified tolerances, the Contractor shall adjust, repair, and make changes as necessary to achieve the specified tolerances. Should the jacking pipe be outside the above

tolerance requirements, then the leading edge of the pipe, shall be returned to the plan line and/or grade at a rate of not more than one (1) inch per 25 ft of advance.

4. Steering corrections made to the jacking pipe shall be carried out in such a manner that the joint angle of any two adjacent pipes or segments does not exceed allowable limits as defined by the Manufacturer.

K. If the jacking pipe is off-line and/or grade so as to require redesign of structures for connections, acquisition of easements, or backfilling and re-excavation, the Contractor shall be responsible for doing all additional work without additional cost to the Owner. If the jacking pipe does not meet the specified tolerances for line and/or grade and, in the opinion of the Engineer, re-design of the tunnel or any structure is required, the Contractor shall be responsible for all redesign and any increase in construction at no additional cost to the Owner.

3.02 TUNNELING, JACKING AND EXCAVATION

A. Tunneling shall be conducted to minimize movement of the ground in front of and surrounding the jacking pipe and to control the loss of ground, surface settlement, and heave of the ground surface. Control the advance rate and volume of material excavated to avoid over-excavation, loss of ground, and heave of the ground surface.

B. Carefully control and monitor the volume of excavated material removed. Compare theoretical and actual volumes of excavated material removed. Adjust the advance rate and excavation rate to avoid over-excavation. Investigate potential voids created by over-excavation.

C. During shutdowns or any other interruptions in the work, provide complete positive support for the face by positioning the head firmly against the face. Exercise the machine daily to prevent the buildup of jacking forces when restart is required. Exercise daily if the shutdown or interruption is greater than 72 hours.

D. Each pipe section shall be jacked forward as the excavation progresses in such a way as to provide complete and adequate support to the surrounding ground at all times.

E. Avoid damage to pipe sections and joints during transport, handling, and jacking. In the event of damage to a pipe section or pipe joint, the Contractor shall notify the Engineer within the day of observation of the damage. Damaged jacking pipe shall not be used unless permitted in writing by the Engineer prior to installation.

F. The Contractor shall limit the jacking force to stay at or below the safe jacking capacity of the jacking pipe to provide the minimum factor of safety, as indicated in Section 33 05 40 – Reinforced Concrete Jacking Pipe.

G. The jacking loads shall be continuously monitored and recorded at the jacking frame.

H. Lubricant shall be applied to the external surface of the pipe to fill the overcut annulus, support the ground, and reduce skin friction. The fluid shall be suitable for the particular ground conditions described in the Geotechnical Report.

I. The Contractor shall, at all times, monitor and record the volumes, pressures, and location of lubricant pumping to ensure that the annulus around the pipe is completely filled with lubricant.

J. The MTBM shall be operated in Closed Mode at all times and locations. Operate the MTBM such that there is continuous, full-face support of the ground at the tunnel face, and isolation of the excavation chamber.

1. To be in Closed Mode a slurry machine shall have full slurry filling the chamber and in contact with the ground in front of the cutter head, and the slurry shall be pressurized to counteract ground and groundwater loads to stabilize the ground.

2. Maintain slurry pressure to stabilize the ground, and to prevent ground heave and hydrofracturing.

3.03 GROUND STABILIZATION

A. Use methods and equipment that stabilize and support the ground at all times for shafts, tunneling, and all excavation work.

B. During periods of work stoppage, such as, but not limited to nights and weekends, stabilize the working face with the head to prevent ground loss and movement of ground into the jacking pipe and excavations.

3.04 WATER AND GROUNDWATER CONTROL

A. The Contractor shall control the inflow of water into the jacking pipe and MTBM during construction.

3.05 JACKING PIPE AND MTBM SIZE

A. The Contractor may oversize the jacking pipe upon approval of the Engineer. If the jacking pipe is oversized:

1. The jacking pipe crown shall be as shown on the Contract Drawings with the invert lowered as necessary for the chosen diameter.

2. The Contractor shall bear all costs for the larger pipe and completing the project with the larger pipe.

3. The Contractor shall be responsible and shall bear all costs for design and construction of affected project components including but not limited to manholes and connections.

3.06 EXCAVATED MATERIAL HANDLING AND DISPOSAL

A. The Contractor shall identify a spoil disposal site and shall be responsible for all transportation and disposal costs of the spoils.

B. Hauling and disposal of materials shall be in accordance with all Federal, State, and local laws, regulations, and ordinances.

C. All roads used for hauling shall be kept free of debris and open for use by others. Spillage and obstructions on the road resulting from hauling shall be immediately removed.

3.07 GROUTING AND FINISHING

A. Any overcut annulus and voids outside the Jacking Pipe shall be contact grouted as specified in Section 31 73 00 – Contact Grouting following completion of tunneling. Contact grouting shall be completed within three days of the completion of tunneling.

3.08 INSTRUMENTATION

A. The Contractor shall develop and implement an instrumentation program as shown on the Contract Drawings and as specified in Section 31 09 13 – Geotechnical Instrumentation and Monitoring.

3.09 SURVEY

A. Following completion, survey the horizontal position and elevation of the jacking pipe invert at intervals of 20 ft or less.

B. After installation of the jacking pipe, provide the Engineer with access to the pipe for visual inspection and for verification of the line and grade.

3.010 GROUND MOVEMENTS

A. Ground movements shall be limited to prevent damage to all structures, facilities, and utilities. The Contractor shall be responsible for and bear all costs associated with ground movements. As a minimum, the Contractor shall not exceed the ground movements specified in Section 31 09 13 – Geotechnical Instrumentation and Monitoring.

B. In the event that the ground movement criteria are exceeded, the Contractor shall, in accordance with requirements of Section 31 09 13 – Geotechnical Instrumentation and Monitoring and the submitted Contingency Plan, immediately adjust work procedures and perform necessary ground improvements to reduce settlement to within specified limits.

C. The Contractor shall be responsible for and bear the cost for all damages to all facilities caused by underground construction, including but not limited to bores, shafts, grouting, and associated phenomena including but not limited to settlement, heave, grout contamination, and hydrofracturing. The liability for damages shall include, but not be limited to, direct costs of repair or replacement and loss of use.

3.011 WRITTEN DAILY LOGS.

A. Maintain and submit written daily logs as required in paragraph 1.06.B.

3.012 CLEANUP AND RESTORATION

A. Following completion of work, remove all equipment, unused materials, and debris from the site.

B. Clean the inside of the jacking pipe leaving an interior free of soil, debris, and other deleterious materials.

C. Repair all damages and deficient conditions.

END OF SECTION

SECTION 33 05 16

PRECAST CONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary vaults and appurtenances with:
   1. Pre-cast concrete structures.
   2. Water-proofing.
   3. Pipe Penetration Seals.
   4. Anchor bolts and anchors.

1.2 REFERENCES

A. Where applicable, the latest editions of the following standards shall be considered a part of these specifications. In case of conflict, these specifications shall take precedence over the listed standard.
   1. American Association of State Highway and Transportation Officials (AASHTO)
   2. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete
   3. ACI 318 - Building Code Requirements for Reinforced Concrete
   4. ASTM C478 - Specification for Precast Reinforced Concrete Manholes Sections
   5. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
   6. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures
   7. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
   8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures
   9. ASTM C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
   10. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
   11. CRSI Manual of Standard Practice

1.3 QUALITY ASSURANCE

A. Pre-cast vaults shall conform to appropriate reference standards stated herein and to the standards set forth in the National Precast Concrete Association (NPCA) Quality Control Manual. The manufacturer of the pre-cast concrete structures shall be certified by NPCA's Plant Certification Program.

B. Water-Proofing Manufacturer: Minimum 10 years experience in the production and sales of self-adhesive sheet membrane water proofing.

C. Water-Proofing Installer: Minimum 3 years experience specializing in performing the Work of this Section.

1.4 SUBMITTALS

A. For standard precast concrete units, the precast concrete producer will supply cut sheets showing conformance to project drawings and requirements and to applicable ASTM

specifications listed in this specification. The Precast concrete producer shall certify that such products will meet the ASTM specifications.

B. For proprietary precast concrete units, the precast concrete producer may supply standard plans or informative literature. Supporting calculations and design details shall be submitted. The Precast concrete producer shall warrant that such products will perform the intended task.

C. The calculations and submittal drawings shall be sealed and signed by a PE licensed in Michigan.

1.5 SHOP DRAWINGS

A. The plans for custom-made precast concrete units shall be shop drawings furnished by the precast concrete producer for approval by the Engineer. These drawings shall show complete design, installation, and construction information in such detail as to enable the Engineer to determine the adequacy of the proposed units for the intended purpose. Details of steel reinforcement size and placement as well as supporting design calculations, if appropriate, shall be included. The drawings shall include a schedule, which will list the size and type of precast concrete units at each location where they are to be used. The precast concrete units shall be produced in accordance with the approved drawings.

B. The manufacturer of the pre-cast structures shall provide the design of any poured-in-place concrete base for manholes.

C. The pre-cast concrete products shop drawings shall be sealed and signed by a PE licensed in Michigan.

D. Provide shop drawings for vault appurtenances identified in Section 1.

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE STRUCTURES

A. Work includes proposed structures and modifications to existing precast structures; along with precast riser sections for either type of work.

B. Design Criteria - Design units in accordance with:
1. ACI 304 and 318
2. AASHTO H-20 loading
3. CRSI Manual of Standard Practice
4. Applicable ASTM Standard(s).
5. Design Soil Bearing = 2,000 psf.

C. Concrete
1. Minimum compressive strength 5,000 psi at 28 days; air entrainment of 6 percent, +2 percent.
2. Materials - Portland Cement: ASTM C150, Type I - Normal, II - Moderate, or III – High Early Strength. Aggregates - ASTM C33 or C330.
3. Reinforced steel meeting ASTM A615 or A616; certified Grade 60.
4. Welded wire fabric conforming to ASTM A185.
5. Admixtures Air-entraining: ASTM C260, Master Builders Micro-Air, or as approved.
6. Chemical: ASTM C494 Type A - Water-Reducing, Type B - Retarding, Type C - Accelerating, Type D - Water-Reducing and Retarding, Type E - Water-Reducing and Accelerating, Type F - Water-Reducing, High Range, Type G - Water-Reducing, High

Range and Retarding; containing no chlorides; Master Builders, W.R. Grace, or as approved.

7. Fly Ash: ASTM C618 Class F or C with loss on ignition less than 3 percent.
8. Joints with tongue-and-groove design; sealed water-tight with polyurethane, butyl rope mastic or equal sealant.
9. Plastic Adhesive Waterstop: Federal Specification SS-SS-210A; single- component, self-sealing plastic adhesive type, extruded rope form between two protective silicone treated papers, 1 inch square cross section, 1 inch lap splice, furnish with primer; Synko-Flex Products Synko-Flex, or as approved.
10. Minimum Wall Thickness: 6".

2.2 WATER-PROOFING

A. Type: Elastomeric sheet membrane water-proofing with protective cover.

B. Manufacturers: W.R. Grace & Co. - Conn., Bituthene System 3000, or Engineer approved equal.

C. Location: All concrete joints and penetrations shall be covered with membrane.

D. Membrane:
   1. Self-adhesive, cold-applied composite sheet consisting of rubberized asphalt and cross-laminated, high density polyethylene film.
   2. Membrane Characteristics:

PROPERTY	TYPICAL VALUE	TEST METHOD
Thickness	60 mils	ASTM D3767 Method A
Tensile Strength, membrane	325 psi (minimum)	ASTM D412
Tensile Strength, film	5000 psi (minimum)	ASTM D412
Elongation, ultimate failure of rubberized asphalt	300% (minimum)	ASTM D412
Peel Strength	9.0 lbs/in width	ASTM D903
Puncture Resistance, membrane	50 lbs (minimum)	ASTM E154
Resistance to Hydrostatic Head	200ft of water	ASTM D5485
Exposure to Fungi in Soil, 16 weeks	Unaffected	GSA-PBS 07115
Permeance	0.05 grain/sq ft/hr/in Hg	ASTM E96, Section 12 – water method
Water Absorption	0.1% maximum	ASTM D570

E. Accessories: Provide surface conditioner, tape and other accessories required for a complete and proper installation.

F. Protective Cover:
   1. Protection Board: 1-inch thick extruded polystyrene with plastic film laminate on both sides, with a minimum compressive strength of 10 psi.
   2. Manufacturers:
      a. Dow Chemical Co., Styrofoam Brand Protection Board.
      b. Tenneco Building Products, Amocor PB4 Waterproofing Protection Board.
      c. Or as approved.

2.3 CASTINGS

A. All castings shall meet the requirements for the City of Ann Arbor sanitary sewer frame and cover.

2.4 ANCHORS BOLTS AND ANCHORS

A. Anchor Bolts Cast-In-Concrete:
   1. Comply with Type 316 stainless steel.
   2. 4 inch minimum hook.

B. Anchors:
   1. General Requirements:
      a. Type 316 stainless steel for anchors exposed to weather, in contact with aluminum components, or in submerged conditions.
      b. Zinc-plated, ASTM B633, for anchors in all other conditions.
   2. Expansion Anchors:
      a. Manufacturers:
         1) Hilti Corporation, Kwik Bolt II.
         2) ITW Ramset/Red Head, Trubolt Wedge Anchor.
         3) The Powers Rawl Company, Inc., Power-Stud.
         4) Or as approved.
      b. Comply with Federal Specification FF-S-325 Group II, Type 4, Class I.
      c. Minimum Embedment: 4 inches, unless otherwise indicated.
   3. Sleeve Anchors:
      a. Manufacturers:
         1) Hilti Corporation, Sleeve Anchor.
         2) ITW Ramset/Red Head, Dynabolt Sleeve Anchor.
         3) The Powers Rawl Company, Inc., Lok/Bolt.
         4) Or as approved.
      b. Comply with Federal Specification FF-S-325 Group II, Type 3, Class 3.

PART 3 - EXECUTION

3.1 GENERAL

A. Install materials and equipment in accordance with manufacturer's instructions.

3.2 VAULT

A. Set vault level.

B. Interior floor of vault shall slope to sump with minimum 0.25 inch per foot slope. If interior floor slope cannot be achieved, when setting vault apply topping material to slope floor 1% to 2% (1/8 to 1/4 inch per foot) to sump with a minimum topping thickness of 1". Apply SikaDur 32, Hi-Mod bonding agent to existing substrate; roughen and clean surface of concrete per manufacturer guidelines. Concrete shall be finished with steel trowel equal to existing floor, apply concrete curing compound as required.

3.3 WATER-PROOFING

A. Install membrane water-proofing and protective cover on the exterior surfaces from grade level down to footer, and terminating 6 inches out onto the top of the footer, unless otherwise directed on the Drawings. Exposed surfaces shall not be waterproofed.

B. Roll out membrane. Minimize wrinkles and bubbles.

C. Remove release paper layer. Roll out on substrate with a mechanical roller to encourage full contact bond.

D. Lap sides and ends in accordance with membrane manufacturer's instructions.

E. Reinforce membrane with multiple thickness of membrane material over joints whether joints are static or moving.

F. Seal membrane and flashings to adjoining surfaces.

G. Seal items penetrating membrane and install counter flashing membrane material.

H. Protect membrane from damage by adhering protection board over membrane surface. Scribe and cut boards around projections and interruptions.

3.4 EQUIPMENT MOUNTING

A. Install plumb and level, free from distortion or defects, and at the elevations indicated.

B. Anchor all equipment securely

C. Coordinate locations with ENGINEER in field

3.5 ANCHOR BOLTS AND ANCHORS

A. Use expansion anchors in precast or cast-in-place concrete.

B. Use sleeve anchors in masonry work.

END OF SECTION 33 05 17

SECTION 33 05 36

FIBERGLASS-REINFORCED CARRIER PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Work specified in this Section includes the requirements for furnishing and installation of all Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe (CCFRPM), gaskets, and accessories as designated in the Contract.

B. In general, the Work of this Section shall include furnishing the pipe and fittings; the installation of permanent (Carrier) pipe inside a casing pipe installed using trenchless methods at locations shown in the Drawings, laying, jointing and jacking the pipe; connecting to manholes, inlets, and other structures; furnishing and placing of all accessories, appurtenant materials, stoppers, and markers; and the furnishing of all drawings, testing, samples, and all labor, materials and equipment necessary to complete the Work as specified, shown, ordered, and directed.

1.02 REFERENCES

A. Related Sections

1. 31 73 01 – Carrier Pipe Installation and Backfill

B. Reference Specifications, Codes, And Standards

The publications and standards listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the abbreviation only. Unless otherwise stated, the most recent version or edition of each publication or standard is implied.

1. American Society for Testing and Materials (ASTM):

a. D638 – Test Method for Tensile Properties of Plastics.

b. D790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

c. D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel- Plate Loading.

d. D3262 - Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

e. D3681 - Test Method for Chemical Resistance of Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe in a Deflected Condition

f. D4161 - Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

g. F477 - Specifications for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

2. American Water Works Association (AWWA):

a. M45 – Fiberglass Pipe Design.

1.03 SUBMITTALS

A. Product Data: The Contractor shall submit shop drawings showing pipe details, size, thickness, length, joint details, gasket, grout bushings if applicable, and other pertinent product data including manufacturers catalog cuts with printed specifications.

B. Material properties and strength of pipe and gaskets.

C. Manufacturer's certification that the proposed piping system, including internal resin liner and gasket material, are appropriate for the intended service.

D. Pipe design analysis: If computer calculations are used, include example calculations to show the logic employed.

E. Manufacturer's written instructions for handling transporting, storage, and installation of pipe.

F. Pipeline layout and profile drawings showing location, station, and invert elevation of pipe sections, fittings, closure pieces, and test closures.

G. Contractors proposed backfill mix, in accordance with Section 31 73 01 – Carrier Pipe Installation and Backfill.

H. Contractor's plan for the backfill operation, in accordance with Section 31 73 01 – Carrier Pipe Installation and Backfill.

I. Quality Control:

1. Quality control program for pipe manufacturer, including names and qualifications of quality control personnel for acceptance by the Engineer.

2. Description of procedures for maintaining and checking tolerances for pipe dimensions.

3. The Contractor shall submit test results with respect to the physical characteristics of the CCFRPMP. These tests shall be done at no additional cost to the Owner and shall include the following:

a. Tests performed in accordance with ASTM D3262.

b. Tests performed on joints in accordance with ASTM D4161.

c. Pipe stiffness tests in accordance with ASTM D2412. Submit material safety data sheets to the Engineer for each chemical grout used.

d. Submit demonstration pipe test program results prior to pipe production.

1.04 DESIGN CRITERIA

A. The Contractor is fully responsible for the design of CCFRPM that meets or exceeds the design requirements of this Specification and that is specifically designed for Carrier pipe installation, in accordance with Section 31 73 01 Carrier Pipe Installation and Backfill.

B. The CCFRPM shall be designed to withstand the maximum jacking loads that the Contractor anticipates will be exerted on the CCFRPM, including buoyant force(s) generated during backfilling of each state, the stresses on the Carrier pipe from pipe supports, the bending stresses on the Carrier pipe between pipe supports, and the jacking force on the pipe during Carrier pipe installation.

1.05 QUALITY ASSURANCE

A. The Owner or other designated representative shall be entitled to inspect pipes or witness the pipe manufacturing.

B. Manufacturer's Notification to Customer: Should the Owner request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.

1.06 TESTING

A. Pipe shall be inspected at the point of manufacture by an independent testing laboratory engaged by the Owner, at no cost to the Contractor. Pipe without marking as specified herein and tested pipe without the testing laboratory's mark of acceptance shall not be delivered to the site of the Work. The pipe manufacturer shall keep the laboratory informed as to when pipe is to be made and ready for inspection.

B. Provide test results for the following tests:

1. Pipes: Pipes shall be manufactured and tested in accordance with ASTM D3262.

2. Joints: Joints shall meet the requirements of ASTM D4161.

3. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 140 psi.

4. Stain Corrosion: The extrapolated 50-year strain corrosion value shall not be less than 0.9% as determined in accordance with ASTM D3681 and ASTM D3262

C. Pipe for testing shall be furnished and tested by the Contractor at no cost to the Owner or the testing laboratory. Centrifugally cast fiberglass reinforced polymer mortar pipe for microtunneling shall be tested and witnessed by the testing laboratory observer engaged by the Owner. Acceptance of centrifugally cast fiberglass reinforced polymer mortar pipe shall be made on the basis of material tests and inspection of the manufactured pipe for visual defects and imperfections. The number of specimens of pipe sections required for the basis of acceptance shall be a minimum of one percent of the length furnished, but not less than 3 specimens of pipe of each size furnished

unless otherwise permitted by the Engineer. Material tests shall include hydrostatic and permeability tests.

D. In-plant hydrostatic tests shall be performed on pipe produced for this project in accordance with the hydrostatic test for “Fiberglass” pipe joints using flexible elastomeric seals, ASTM D4161. The hydrostatic tests shall be performed at a frequency of at least 1 test in every 50 consecutive pipes produced, with a minimum of 50 pipes produced between each test. The pipe and joints for this project shall be tested to 2 bar (29 psi test pressure).

E. Failure of the joints and pipe to meet test requirements as specified under ASTM D4161 and ASTM F477 shall, at the discretion of the Owner, cause the pipe to be rejected.

F. All pipes used for hydrostatic testing shall not be used for installation for this project and shall be furnished by the Contractor at no additional cost to the Owner.

G. All expenses relative to inspection, including any travel costs, shall be paid by the Owner. All expenses relative to testing shall be paid by the Contractor.

1.07 DELIVERY AND STORAGE

A. Packaging, handling, and shipping shall be done in accordance with the manufacturer’s instructions.

B. Acceptance at Site:

1. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture, or on the site after delivery, or at both places, and the pipes shall be subject to rejection at any time on account of failure to meet the specification requirements, even though sample sections may have been previously accepted. Sections rejected after delivery to the job shall be visibly and clearly marked for identification and shall be removed from the job in a timely manner. All sections that have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted by the Engineer, or removed and replaced, at no additional cost to the Owner.

2. At the time of inspection, the sections shall be carefully examined for compliance with ASTM designations specified herein and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, tolerance, blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

3. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that a strong and permanent repair is achievable. The pipe shall be repaired by an authorized representative of the pipe manufacturer. Repairs shall be carefully inspected by the Engineer before final approval.

1.08 STORAGE AND PROTECTION:

A. Care shall be exercised in handling, transporting, and placing pipe to prevent damage to the pipe. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable forklift.

B. Pipes shall be stored in an orderly manner so that there will be a minimum of rehandling from the storage area to the final position in the tunnel and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed. Storage of pipe shall be restricted to the staging areas as shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.

B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of the highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

C. Silica Sand: Sand shall be a minimum of 98% silica with a maximum moisture content of 0.2%.

D. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally affect the performance of the product.

E. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufacturers and be suitable for the service intended.

F. Epoxy Cement: Epoxy cement for grout hole PVC plugs shall be LOCTITE EA E-00CL by Henkel, or equivalent, and approved by the CCFRPM manufacturer.

2.02 DIMENSIONS

A. Diameters:

1. The actual outside diameter shall be in accordance with ASTM D3262 and the size requirements as indicated on the Contract Drawings.

2. The nominal pipe diameter shall be 36 inches.

3. All measurements shall have a tolerance of $\pm$ 0.1%.

B. Lengths: Pipe shall be supplied in nominal lengths of 10 or 20 feet. Actual supplied length shall be determined by the Contractor consistent with the means and methods of construction, and shall nominally be +1, -4 inches. At least 90% of the total footage

of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.

C. Roundness: The CCFRPM shall be round within 0.1% of the outside diameter.

D. Wall Thickness: The minimum wall thickness, measured at the bottom of the spigot gasket groove where the wall cross-section has been reduced, is to be determined from the maximum jacking load. The minimum factor of safety against jacking force is 2.0 based on straight alignment.

E. End Squareness: Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/16 inch.

2.03 MANUFACTURE

A. Pipes: Manufacture pipe by the centrifugal casting process to result in a dense, nonporous, corrosion-resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow shall provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a sand and resin layer, which provides UV protection to the exterior. Pipes shall be Type 1, Liner 2, Grade 3 per ASTM D3262.

B. Joints: The CCFRPM shall be connected by gasket-sealed flush bell and spigot joints that do not materially increase the CCFRPM outside diameter or decrease the CCFRPM inside diameter. The bell (banding collars) shall be physically bonded to a pipe end using a fiberglass resin wrap. Gluing alone is insufficient. The gasket(s) shall meet the requirements of ASTM F477. Unless otherwise specified, the pipe shall be field connected with stainless steel couplings or bell-spigot joints that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness. The joints must meet the performance requirements of ASTM D4161. The joint shall have approximately the same O.D. as the pipe, so when the pipes are assembled, the joints are essentially flush with the pipe's outside surface. Joints at tie-ins, when needed, may utilize gasket-sealed closure couplings. The joints shall be leak-free under the following conditions:

1. External pressures up to 2 bars (200 kPa) from bentonite or other lubricant, injection, slurry system operation or groundwater head.

2. Gaps between the pipe ends shall not exceed 1/2 inch.

3. Joints between pipes shall be protected by the installation of a fiber board or plywood compression ring to distribute jacking loads evenly. The maximum thickness of the compression ring shall be 1/2 inch.

~~C. Grout Holes: The CCFRPM shall be supplied with factory-installed grout connections of diameter, quantity, and orientation compatible with the microtunneling lubrication operation. Grout holes shall be fitted with either countersunk threaded corrosion-resistant steel plugs or PVC plugs fastened securely with epoxy to prevent infiltration of displaced earth during the jacking process. As a minimum, each pipe shall be supplied with 2-inch diameter grout holes spaced at 60 degrees (staggered at 10, 12,~~

~~and 2 o'clock) on center, regularly spaced between 6-8 feet along the length of the pipe.~~

D. Fittings: Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion- bonded epoxy- coated steel and stainless-steel fittings may also be used.

E. Acceptable Manufacturer: Hobas Pipe USA, Flowtite Technology, or approved equivalent.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Pipe Installation: The installation of pipe and fittings shall be in accordance with the project plans and specifications and the manufacturer's requirements.

B. Pipe Handling: Unloading, handling, and installation of pipe and fittings shall be in accordance with the project plans and specs and the manufacturer's requirements. CCFRPM shall be handled without the use of hooks or devices which might damage the tongue or groove or inside of the pipe. Use textile slings, other suitable materials or a forklift. Use of chains or cables is not recommended.

C. Before pipe is lowered into the launching shaft, it shall be checked for roundness and shape so that joints can be properly made. Any pipe unduly out of round or out of shape will be rejected.

D. When the pipe is ready for installation, the joint surfaces shall be thoroughly clean of all dirt and foreign material. Care shall be used in entering the tongue into the groove so that the gasket will not be deformed or displaced. The joint components and the pipe ends shall be clean.

E. Jointing:

1. Clean ends of pipe and joint components.

2. Apply joint lubricant to the bell interior surface and the elastomeric seals. Use only lubricants approved by the pipe manufacturer.

3. Use suitable equipment and end protection to push the pipes together.

4. Do not exceed forces recommended by the manufacturer for joining or pushing pipe.

F. Carrier pipe installation shall be performed in accordance with Section 31 73 01 – Carrier Pipe Installation and Backfill.

G. The pipes shall be installed without sliding or dragging in a manner that would damage the pipes or coat. Lubricant such as flax soap or drilling mud may be used to ease pipe

installation. Do not use petroleum products, oil, or grease for this purpose. Installation methods shall not damage or puncture interior lining.

H. Each CCFRPM pipe section shall be jacked in such a way that the joints maintain their integrity and the continuity of the CCFRPM train is maintained.

I. The CCFRPM pipe shall be secured in the tunnel with pipe supports. Pipe support frequency and spacing shall be in accordance with Section 31 73 01 – Carrier Pipe Installation and Backfill.

J. Any pipe, which has been damaged or delaminated during installation, shall be pushed or pulled out and replaced, or repaired in-place using glass fiber fabrics and suitable thermoset resins in accordance with repair requirements by the manufacturer or to the satisfaction of Engineer. The cost of replacement, repairing, or installation of a new pipe length shall be at no additional cost to the Owner.

K. Field Tests:

1. Infiltration / Exfiltration Test: maximum allowable leakage shall be per local specifications requirements.

2. Low Pressure Air Test: Each reach may be tested with air pressure (max 5 psi). The system passes the test if the pressure drop due to leakage through the pipe or pipe joints is less than or equal to the specified amount over the prescribed time period.

3. Deflection: Maximum allowable long-term deflection is typically 3% of the initial diameter.

3.02 PIPE ACCEPTANCE INSPECTION AND TESTING

A. After installation, inspect pipelines for obstructions and clean pipe. Provide all the necessary facilities for the inspection and cleaning. Dispose of all waste, including water.

B. Acceptance Inspection: Inspect the pipeline and repair any visual damage, defects, or leakage in the pipeline, manholes, and special structures. Leakage is defined as visible free movement of fluid into or out of the pipeline. Provide all labor and equipment to perform the remedial work. Submit a Repair Plan to the Engineer for approval prior to performing remedy and repair work.

C. Test pipelines by either joint method:

1. Individual Joint Tests - Hydrostatic: Provide all labor, materials, and equipment to perform the tests and retest as necessary. Provide equipment that is capable of accurately monitoring and recording the requested test information. Perform testing on all joints that experience a minimum static groundwater pressure of 3.5 psi or less measured at the crown of the pipe unless additional testing is required by the Engineer.

a. Perform the pipe joint test by placing a portable bulkhead or other sealing device at the joint and then introducing water under pressure into the annular space between the bulkhead and the joint gasket.

b. Pressurize the joint and test for a minimum of 15 minutes, maintaining the required hydrostatic head at the crown of the pipe throughout the duration of the test. The hydrostatic head for test purposes shall exceed the maximum estimated groundwater level at the joint being tested by at least 72 inches. Record the test duration and resulting leakage of each joint. Determine the allowable leakage at a joint according to the following formula:

$$\textit{Allowable Leakage} = 0.0004 \times D \times L$$

Where:

Allowable Leakage = Allowable leakage in gallons per hour per joint.

D = Nominal pipe diameter in inches.
L = Average of the lengths of the two abutting segments in feet.

2. When actual leakage exceeds the allowable, determine the cause and remedy it before the pipeline is accepted. Correct any visible leaks in the pipeline, manholes and special structures.

END OF SECTION

SECTION 33 05 40

REINFORCED CONCRETE JACKING PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Work specified in this Section includes the requirements for furnishing and installation of all reinforced concrete pipe (RCP), gaskets and accessories as designated in the Contract for use with the microtunneling methodology described in Section 33 05 07.36 – Microtunneling.

B. In general, the Work of this Section shall include furnishing the pipe and fittings; the laying, jointing and jacking of the pipe; connecting to manholes, inlets, and other structures; furnishing and placing of all accessories, appurtenant materials, stoppers, and markers; and the furnishing of all designs, testing, samples, tools, equipment, materials, and supplies; and perform all labor required to complete the Work, as indicated on the Contract Drawings and specified herein.

C. This is a performance specification. The Contractor shall develop the means and methods and complete the trenchless construction work for the tunneled crossing subject to the limitations specified herein. The performance requirements are as follows:

1. Design the pipe to meet the requirements specified and shown in the Contract Documents and to be compatible with the jacking system and trenchless methods used.

2. Develop and implement a Quality Control/Quality Assurance (QA/QC) program to monitor the work and verify that the requirements have been achieved.

1.02 REFERENCES

A. Related Sections

1. 33 05 07.36 – Microtunneling

B. Reference Specifications, Codes, And Standards

The publications and standards listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the abbreviation only. Unless otherwise stated, the most recent version or edition of each publication or standard is implied.

1. American Society for Testing and Materials (ASTM):

    a. A36 – Standard Specification for Carbon Structural Steel

    b. A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

c. A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

d. A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

e. A497 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

f. A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

g. C33 – Standard Specification for Concrete Aggregates

h. C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

i. C94 – Standard Specification for Ready Mixed Concrete

j. C150 – Standard Specification for Portland Cement

k. C260 – Standard Specification for Air-Entraining Admixtures for Concrete

l. C361 – Standard Specification for Reinforced Concrete Low-Head Pressure Pipe

m. C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

n. C494 – Standard Specification for Chemical Admixtures for Concrete

o. C497 – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile

p. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

q. C655 – Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe

r. C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

2. American Concrete Institute (ACI):

a. ACI-211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete

b. ACI-301 – Structural Concrete Specifications

c. ACI-305 – Hot Weather Concreting

d. ACI-306 – Cold Weather Concreting

e. ACI-350 – Code Requirement for Environmental Engineering Concrete Structures

f. ACI-517 – Accelerated Curing at Atmospheric Pressure

3. American Society of Civil Engineers (ASCE):

a. ASCE 27-00 – Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction

b. ASCE 36-15 – Standard Design and Construction Guidelines for Microtunneling

1.03 QUALIFICATIONS

A. The designer shall have at least five years of experience, all in the last ten years, in the design of RCP for jacking. The design shall be stamped and sealed by a Professional Engineer registered in the State of Michigan.

1.04 SUBMITTALS

A. Product Data: The Contractor shall submit shop drawings showing pipe dimensions, joint details, grout hole details and other pertinent product data including manufacturers catalog cuts with printed specifications.

B. Fabrication Drawing: Prior to manufacturing, submit fabrication drawings that illustrate details of wall thickness, pipe joint, joint gasket, joint cushioning materials, grout ports and reinforcement including tolerances. Provide reinforcement details that include the type of cage, the location of the cages in the pipe wall, the size and spacing of circumferential and longitudinal reinforcing steel, and the cross-sectional area of reinforcing steel in each cage per linear foot of pipe. Provide joint design details that include the details of the cross section and the circumferential length on Standard Owner joint data form as provided by the Engineer. Submit complete pipe laying drawing showing all manholes, closures, connections and other applicable details. Number pipe lengths and joints.

1. All shop drawings shall be legible with dimensions accurately shown and clearly marked in English.

C. Calculations: The Contractor shall submit design calculations for the proposed RCP pipe and joints. Provide estimated pipe friction and maximum jacking loads to be applied to the pipe. Calculations for the joints shall demonstrate that the axial jacking forces with the required factor of safety as stated in Section 33 05 07.36 – Microtunneling necessary to complete the work required for this project can be transmitted through the joints within tolerance limits of misalignment. For pipe alignment tolerance limits, refer to specification Section 33 05 07.36 – Microtunneling.

D. Concrete Mix Design: Should admixtures be proposed by the manufacturer, submit admixture data sheets for approval by the Engineer.

E. Quality Control: Quality control program for pipe manufacturer, including names and qualifications of quality control personnel for acceptance by the Engineer.

1. Description of procedures for maintaining and checking tolerances for reinforcement placement and pipe dimensions.

2. Description of record keeping procedures for recording the following information:

    a. Mill test for reinforcement and cement

    b. Aggregate tests

    c. Concrete compression tests

    d. All loading test results

    e. Date of casting

    f. Reinforcing steel inspection

    g. Final finish inspection

F. Certification: Provide certified copies of laboratory test reports showing conformance with the specified requirements for each of the following:

1. Product

2. Cement

3. Pozzolan

4. Admixtures

5. Joint Gaskets

6. Aggregate

7. Steel Reinforcement

G. Prepare and submit a table of allowable leakage for each pipe diameter for the range of average abutting pipe lengths being provided. Determine allowable joint leakage in accordance with Subsection 3.02.

H. Submit material safety data sheets (MSDS) to the Engineer for each chemical additive used.

I. Submit demonstration pipe test program results prior to pipe production.

1.05 DESIGN CRITERIA

A. The Contractor is fully responsible for the design of RCP that meets or exceeds the design requirements of this Specification and that is specifically designed for installation by microtunneling.

B. Design pipe to sustain ground, hydrostatic and live loads, and maximum compressive stresses applied during installation including eccentric jacking loads due to steering, with a factor of at least 2.0.

C. Design loads in accordance with ASCE 27-00, Standard Practice for Direct Design of Precast Concrete Pipe for Jacking Loads in Trenchless Construction.

D. Design pipe joints in accordance with ASCE 27-00, Standard Practice for Direct Design of Precast Concrete Pipe for Jacking Loads in Trenchless Construction.

E. The jacking pipe shall be designed to carry the full weight of the soil above it, all applicable surcharge loads, as well as the external water pressure. For geotechnical information, the Contractor is referred to the Geotechnical Baseline Report and Supplemental [Geotechnical] Data Package.

F. Pipe design shall be stamped, signed, and dated by a licensed Civil Engineer registered in the State of Michigan.

1.06 QUALITY ASSURANCE

A. The Owner or other designated representative shall be entitled to inspect pipes or witness the pipe manufacturing.

B. Manufacturer’s Notification to Customer: Should the Owner request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.

C. The Contractor shall:

1. Record all changes and modifications to the Contract work as required by site conditions and inspections in accordance with the Contract Documents.

2. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

3. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the Owner.

4. Use potable water for soil compaction, dust control and other construction activities when human contact and exposure exists.

5. Submit a written statement of pipe fabricator’s qualifications for acceptance by the Engineer.

6. All work in the factory shall be performed under the review of the quality control personnel submitted under Section 1.04. Quality control personnel should have a minimum of 5 years' experience with similar work and meet minimum certification requirements listed in Owner - Manufacturing Standards for Precast Concrete Pipe, or as approved by the Engineer.

1.07 TESTING

A. Provide test results for the following tests:

1. D-Load

2. Pipe Joint

3. Demonstration Pipe Tests

4. Pipe Acceptance Tests

1.08 DELIVERY AND STORAGE

A. Do not transport concrete pipe from manufacturing facility until a minimum of 14 days since cast for steam cured pipe and a minimum of 28 days since cast for non-steam cured pipe.

B. Do not transport pipe to site until acceptable test results are achieved in accordance with the requirements specified herein and the required compressive strengths as provided in ASTM C76, Tables 1 – 5, are attained.

C. Store concrete pipe in an orderly fashion that does not pose a risk to public safety or traffic.

D. Cure, store, and handle pipe in such a manner that no deformation, spiderweb cracking, crazing or other damage is caused.

E. Pipe transported to site with repairable damage or damaged on site will be returned to the manufacturer for repair.

F. Install stulling in RCP pipes 60-inch and larger in diameter during storage and handling. Stulling can be removed for transportation to the work site. Use minimum 4-inch by 4-inch posts for stulling. Install stulling at each end of pipe or more frequently if recommended by the manufacturer.

1.09 STORAGE AND PROTECTION:

A. Care shall be exercised in handling, transporting, and placing pipe to prevent damage to the pipe. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable forklift.

B. Store concrete pipes in an orderly manner that does not pose a risk to public safety, so there is a minimum of obstruction and inconvenience to any kind of traffic, and so there will be a minimum of rehandling from the storage area to the final position in the tunnel. Deliveries shall be scheduled so that the progress of the work is at no time

delayed. Storage of pipe shall be restricted to the staging areas as shown on the Drawings.

PART 2 - PRODUCTS

2.01 CEMENT

A. Use cement that conforms to ASTM C150, Type I/II, Type II or Type V. Type V sulfate resisting cement is an acceptable alternative to Type II cement with fly ash. Store cement in a dry, well-ventilated location protected from the weather.

2.02 POZZOLAN

A. Use pozzolan that conforms to the requirements of ASTM C618, Class F.

2.03 ADMIXTURES

A. Admixtures shall conform to the requirements of ASTM C494, Type A, D, F or G or ASTM C1017 for water reduction or ASTM C260 if air entrainment is required.

B. May be used, as approved by submittal, to improve to pumping ability, to control set time, to hold sand in suspension, and to prevent segregation and bleeding.

2.04 JOINT GASKETS

A. Gasket stock is a synthetic rubber compound in which the elastomer is neoprene. The compound shall contain no less than 50% by volume neoprene and shall be free from reclaimed rubber and other deleterious substances. The stock shall be extruded or molded with smooth surfaces to the required diameter or section with a tolerance of +1/32 inch at any cross section. The gaskets shall conform to the physical requirements of ASTM C443, Section 6.

B. Furnish certified copies of laboratory reports from the gasket supplier indicating conformance with the above requirements for each shipment of gaskets. Submit three gaskets for each pipe size to the Engineer for confirmation of cut length, volume, diameter, and durometer.

2.05 AGGREGATE

A. Use aggregate that conforms to the requirements of ASTM C33.

2.06 STEEL REINFORCEMENT

A. Use steel reinforcement that conforms to ASTM A615 Grade 60, ASTM A82 or ASTM A496. Use either plain or deformed bars. Use wire fabric that conforms to ASTM A185 or A497.

2.07 REINFORCED CONCRETE PIPE DESIGN AND CONTROL

A. Use steel bell and reinforced concrete spigot type manufactured in accordance with ASTM C76, except as otherwise specified in this Section. Pipe shall be Wall C or greater in thickness.

B. Jacking Pipe Design

1. D-Load pipe refers to pipe designed and fabricated in accordance with ASTM C76, except as modified herein.

2. Pipe shall be designed by the Contractor, but shall as a minimum, meet the minimum standards for Class V pipe.

3. Modify the requirements of ASTM C76 described below:

    a. The maximum variation in the position of the reinforcement is 10% of the wall thickness or + 1/2-inch, whichever is less. Reject pipe having variations in the position of the reinforcement exceeding those specified above.

    b. Do not vary the wall thickness by more than + 5% or 3/16-inch, whichever is less.

    c. The criteria for acceptance of pipe is both the D-Load required to produce a 0.01-inch crack and the ultimate strength of the pipe.

    d. Require the pipe manufacturer to include measurements to assure dimensional criteria are met on a routine basis as part of the in- plant quality control program. Measurements will be taken of each pipe piece, or as indicated by the Engineer, and provided to the Engineer. The measurements are to be taken on the inside wall of the pipe:

        i. Diagonal measurement 6 (invert) to 12 (crown) from bell to spigot.

        ii. Diagonal measurement 12 to 6 from bell to spigot.

        iii. Diagonal measurement 9 to 3 from bell to spigot.

        iv. Diagonal measurement 3 to 9 from bell to spigot.

        v. Bell measurement, 6 to 12.

        vi. Bell measurement, 9 to 3.

        vii. Spigot measurement, 6 to 12.

        viii. Spigot measurement, 9 to 3.

        ix. Length of pipe from bell to spigot at 12, 3, 6 and 9.

    e. Require the pipe manufacturer to include measurements to assure dimensional criteria are met on a routine basis as part of the in-plant quality control program. Measurements will be taken on each pipe piece and provided to the Engineer.

f. Outside circumference shall be measured 2 feet from each pipe end and at the midpoint of the pipe. Each of the three circumferential measurements per pipe shall be within 0.5 percent of the theoretical circumference as calculated using pipe dimensions from the Manufacturer's Joint Data Sheet.

g. Roundness shall be measured at both ends of pipe, one end by two perpendicular measurements on the outside of the spigot and the other end by two perpendicular measurements on the inside of bell. Each of the four measurements per pipe shall be within 0.5 percent of theoretical diameter as established by the Manufacturer's Joint Data Sheet.

h. End squareness/planeness shall be measured using a plumb line or other suitable means to be within 0.125- inch tolerance at each pipe end.

4. Provide the data to the Engineer in electronic format on an Excel spreadsheet provided by the Engineer within two weeks of the measurements being taken.

5. Perform measurement confirmation on a random 5% sample for each batch of pipe.

    a. The pipe samples to be remeasured are chosen on-site by the Engineer. The Engineer will be present during measurement confirmation activities.

    b. This requirement will remain in effect unless it is found the resampled pipes fail to meet the previously reported dimensions. If resampled pipe measurements fail to meet reported dimensions, resampling frequency will increase, possibly to 100% at the discretion of the Engineer.

6. The Engineer may make additional independent quality assurance measurements.

7. Use concrete with a minimum 28-day strength of 5,000 psi, or greater if required by ASTM C76, Table 1-5. Include a pozzolan content between 10% and 25% by weight in the cementitious material, except as noted in 02.02 A.1.

8. Reinforcement

    a. Provide pipe with reinforcement as required in ASCE 27-00.

9. Joints

    a. Except as otherwise shown or specified, provide joints of the round rubber gasket type, using a steel bell and reinforced concrete spigot. Design joints so the spigot and gasket will readily enter the bell or sleeve and, when assembled, will compress the gasket to form a watertight seal. Confine the gasket in a groove on the spigot so that movement of the pipe or hydrostatic pressure cannot displace the gasket. Design the joint so that the gasket will not be required to support the weight of the pipe but will keep the joint tight under all normal conditions of service including expansion, contraction and normal earth settlement. Provide means to ensure gasket is held in place during pipe joint assembly. Submit joints for pipe and bell thickness used to the Engineer for acceptance before fabricating the pipe. Galvanize steel bell after fabrication with zinc rich paint, applied to inside diameter of steel bell in

final finishing of product, MC-Aroshield manufactured by Wasser High-Tech Coatings. Epoxy coating or approved equivalent, shall be applied to outside surface of steel bell in final finishing of product. Apply primer to ring prior to applying coating per manufacturer's recommendations for ferrous metal surfaces.

b. Provide joint gaskets that conform to the requirements of Subsection 02.04. Do not stretch the gasket more than 30% when placed on the spigot. Use a gasket of such size that when the joint is off center, the deformation in the stretched gasket will not exceed 50% at the point of contact nor will it be less than 15% at the point of maximum clearance between bell-and-spigot surfaces. Compute gasket deformation as a percentage of the stretched gasket diameter. The stretched gasket diameter is the gasket's nominal diameter reduced by 0.5% for each 1% of stretch actually used. Centroid of stretched gasket shall be less than the depth of gasket groove.

c. Manufacture to tolerances in accordance with ASTM C443, except as modified in this Section.

d. The Engineer will utilize the joint data to determine an allowable joint gap for the particular joint design submitted. The allowable joint gap is established to be less than or equal to ½ inch.

10. Marking

a. Mark all pipe at the place of manufacture in accordance with ASCE 27.

11. Finish

a. Provide pipe which presents a finished, smooth, uniform, continuous surface. Ensure all surfaces of the pipe are free from honeycombing, grout leaks, sand bleeds and sand or rock pockets other than surficial air bubbles or voids. Occasional occurrence of these defects, defined as no more than a single blemish occurring on no more than one percent of the pipe produced, may be repaired at the discretion of the Engineer.

b. When permitted by the Engineer, rough sections and surface imperfections may be repaired by cutting back to solid concrete and patching with cement mortar fill which meets or exceeds the compressive strength requirements submitted to the Engineer and has been accepted for this use. Apply the mortar immediately following the application of any epoxy bonding compound.

12. In-Plant Testing and Inspection

a. Provide testing and inspection that includes testing of concrete cylinders, pipe cores and material specimens, application of D-load tests, application of joint tests and visual inspection, reinforcing placement, and of the finished pipe to determine its conformance with the accepted design and its freedom from defects. Provide quality control technician during all operations.

b. Require the pipe manufacturer to conduct pipe testing, in-plant inspection and other quality control procedures. Maintain records of testing performed for each piece of pipe and submit to the Engineer. The Owner may conduct periodic in-plant testing to complement the manufacturer's quality control program. In addition, the Owner will conduct field inspection of the pipeline. Final acceptance of any portion of the pipe is governed by the field inspection and testing.

c. Prior to the manufacture of any pipe, submit a quality control plan for review by the Engineer. No pipe is manufactured until the plan has been determined to be satisfactory by the Engineer. The plan shall include but not necessarily be limited to the following:

    i. Name, designation, and qualification of individual in charge of quality control.

    ii. Listing of all items of testing equipment and copies of most recent calibration reports. Indicate frequency of calibration.

    iii. Listing of tests to be run and frequency of testing.

    iv. Description of procedures for maintaining and checking tolerances for reinforcement placement and pipe dimensions.

    v. Description of recordkeeping procedures for recording the following information.

        1. Mill test for reinforcement, cement and pozzolan.

        2. Aggregate tests.

        3. Concrete compression tests.

        4. D-load test results.

        5. Joint shear test results.

        6. Date of casting.

        7. Reinforcing steel inspection.

        8. Final finish inspection.

        9. Batch reports.

        10. Curing records, including set time and temperature change through the curing process

d. D-Load Pipe Tests

    i. Test D-load pipes and determine acceptability in accordance with Section 5.1.1 of ASTM C76 and Section 4 of ASTM C497.

ii. Test one to three finished pipe sections of each diameter and strength classification by the three-edge bearing method in accordance with Section 11.3, ASTM C76 for testing for the load to produce a 0.01-inch crack and ultimate load. The Engineer will select the pipe sections to be tested. A break of greater than three (3) days in production shall also constitute a break in batches. Use pipe of uniform manufacture (steel configuration, concrete design, etc.).

iii. Pipe of a given batch is considered acceptable when its representative test specimens conform to these test specifications. Should any specimen fail to meet the test requirement, the manufacturer is allowed to retest two additional specimens from the same batch. If either of these pipes fail, then all pipe in the batch is rejected.

iv. Notify the Engineer a minimum of 24 hours in advance of any scheduled D-load tests so that the Engineer or the Owner approved testing laboratory can witness the tests.

e. Joint Shear Test: For each batch of pipe, apply a test load and determine acceptability on one joint per ASTM C497. If the joint tested should fail, test an additional joint. Failure of any additional joint so tested is cause for the rejection of the entire pipe batch represented.

f. Pipe Leakage Test: Perform in-plant pipe barrel and joint leakage tests for each size, design, and class of pipe. Pipe barrel and joint leakage tests may be conducted concurrently. However, each test criteria shall apply individually.

i. Perform hydrostatic testing and determine acceptance on reinforced concrete pipe as defined in ASTM C 361, with an assumed head of 25 feet, except include the test for “maximum deflected position” as described in ASTM C 443.

ii. Test the pipe joint for leakage in accordance with ASTM C443, except that when testing in straight alignment, connect the pipe with a joint gap equal to the manufacturer’s recommended and approved maximum allowable joint gap. Moisture or beads of leakage appearing on the surface of the joint are not considered as leakage. Drops which collect and run are defined as leakage and cause for rejection. Modify the design or method of manufacture of pipe joints that leak when tested in accordance with the above as required to correct the leakage and retest.

g. Lengths

i. Manufacture pipe sections in nominal lengths of at least 7 feet - 6 inches, except where shorter lengths are required to meet special conditions. Use shorter lengths only where shown or accepted.

13. Demonstration Pipe Test Program

a. All concrete jacking pipe will require proof of design per ASTM C 655.

b. Fabricate a minimum of three pipe sections with proposed joint and pipe design prior to further pipe production. Assembled joints shall include proposed cushion material between pipe joints.

c. Apply a test load on three joints to determine the structural adequacy of the joints for each pipe type. Use test loads and the method of applying the load as indicated in ASTM C497.

d. Use the demonstration pipe test program to demonstrate that all required pipe loading, pipe joint and leakage tests, tolerances, and criteria satisfy the proposed design prior to further pipe production.

e. Manufacturing of production pipe will not begin until the demonstration pipe test program has been successfully completed.

C. Grout Port for Jacking Pipe

1. Furnish pipe with grout ports at a minimum 2-inches in diameter. Provide one set of 3 grout ports per pipe section or 5 feet on center, which results in closer spacing. Grout ports shall alternate between the 12 o'clock, 4 o'clock, and 8 o'clock positions. Grout ports shall not be used to pick pipes.

2. Use preinstalled threaded metal grout pipe sleeves for grout ports or approved PVC grout ports with integral waterstops. Coat metal surfaces remaining exposed after casting of pipe with an approved epoxy paint system.

3. Provide grout pipe so that no metal remains closer than 1 inch to the interior finished concrete surface. Patch grout port flush with interior wall of pipe at completion of grouting activities.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

A. Pipe jacking includes the installation and jointing of the pipe. Install and join pipe to assure uniform bearing under the full length of the barrel of the pipe on guide rails for jacking system with concentric alignment of successive pipe sections.

B. Do not deviate more than allowed by Section 33 05 07.36 – Microtunneling.

C. Sling and support pipe during handling in a manner that will not cause damage, excessive deformation, or stress to any of its component structural parts.

D. Do not use mortar or buttering compound on either the exterior or interior of the joints, except as shown and specified on the Drawings.

E. Do not exceed the allowable joint gap requirements previously described in this Section that takes into account the settlement allowance for the various pipe sizes.

Install, readjust, or remove and replace pipe as necessary, to comply with the allowable joint gap requirements.

F. Comply with additional related requirements in Section 33 05 07.36 – Microtunneling.

3.02 PIPE ACCEPTANCE AND TESTING

A. After installation, inspect pipelines for obstructions and clean pipe. Provide all the necessary facilities for the inspection and cleaning. Dispose of all waste, including water.

B. Acceptance Inspection: Inspect the pipeline and repair any visual damage, defects or leakage in the pipeline, manholes and special structures. Leakage is defined as visible free movement of fluid into or out of the pipeline. Provide all labor and equipment to perform the remedy work. Submit a Repair Plan to the Engineer for approval prior to preforming remedy and repair work.

END OF SECTION

SECTION 33 05 76

FIBERGLASS MANHOLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the minimum requirements for furnishing all labor, supervision, tools, equipment, appliances, materials, incidental items, and the installation of closed bottom glass-fiber-reinforced polyester (fiberglass) sanitary sewer manholes.

1.02 REFERENCES

A. American Society for Testing Materials (ASTM):

1. ASTM D3753 - Standard Specification for Glass-Fiber Reinforced Polyester Manholes

2. ASTM C581 - Practice for Determining Chemical Resistance of Chemical Thermosetting Resins Used in Glass-Fiber Reinforced Structures Intended for Liquid Service

3. ASTM D2412 - Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading

4. ASTM D695 - Test Methods for Compressive Properties of Rigid Plastics

5. ASTM D2584 - Test Method for Ignition Loss of Cured Reinforced Resins

6. ASTM D790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and electrical Insulating Materials

7. ASTM D2583 - Test Method for Indentation Hardness of Rigid Plastics by means of a Barcol Impressor

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO H-20 - Axle Loading

1.03 SUBMITTALS

A. Shop Drawings:

1. Details of all manhole system components confirming that the manholes conform to the specified requirements.

2. Fabrication Drawings showing:

3. Manhole elevations.

4. Wall thickness.

5. Pipe layout including invert elevations and size.

6. Gasket details for tee riser connection.

7. Concrete base details including concrete mix design and reinforcement layout.

8. Design of pipe connection assemblies and any additional products utilized to make the connection.

9. Details of manhole ladders, attachments and supports.

10. Drop connection details.

11. Chimney riser details.

12. Castings.

B. For each submittal and re-submittal, the Contractor shall allow at least 14 calendar days from the date of the submittal to receive the Engineer's acceptance or request for revisions. The Engineer's comments shall be incorporated into the re-submitted plans, calculations, and descriptions. The Engineer's acceptance of the plan is required before beginning the work. Re-submittals shall be reviewed and returned to the Contractor within 14 calendar days. Required revisions will not be a basis of payment for additional compensation, extra work, or an extension of contract time. The Contractor shall include time for this entire review process in their schedule.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not drop or impact the fiberglass manholes.

B. Lift manhole with two slings on spreader bar in horizontal position or an appropriately sized timer or steel beam, 8-inches longer than the cone top opening, inserted crosswise inside the manhole to the underside of the collar with a rope or chain attached to backhoe or other lifting device.

C. Use of chains or cables in contact with manhole surface is prohibited

PART 2 - PRODUCTS

2.01 FIBERGLASS MANHOLES

A. Manufacturers

1. L.F. Manufacturing, Inc.

2. Containment Solutions, Inc.

3. Or approved equal.

B. Description

1. Fiberglass reinforced polyester manhole riser shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins with fiberglass reinforcements. Unless otherwise approved, manhole risers shall be one-piece units manufactured to meet or exceed all Specifications of ASTM D3753.

2. The resins used shall be a commercial grade unsaturated polyester resin or other suitable polyester or vinyl ester resin.

3. The fiberglass manhole and all related components shall be fabricated from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection system.

4. The reinforcing materials shall be commercial Grade “E” type glass in the form of continuous roving and chop roving, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.

5. The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010- to 0.020- inch thickness. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5-inch (13 mm) to maximum length of 2.0-inch (50.8 mm) and shall be applied uniformly to an equivalent weight of 3-oz/ft. Each pass of chopped roving shall be well rolled prior to the application of additional reinforcement. The combined thickness of the inner surface and interior layer shall not be less than 0.10-inch (2.5 mm).

6. After the inner layer has been applied the manhole wall shall be constructed with chop and continuous strand filament wound manufacturing process, which insures continuous reinforcement and uniform strength and composition. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one-piece unit. Seams shall be fiberglassed on the inside and the outside using the same glass-resin jointing procedure. Field joints are not approved.

7. For a UV inhibitor the resin on the exterior surface of the manhole shall have gray pigment added to a minimum thickness 0.125-inches.

8. Fiberglass manholes must have the ability to be height adjustable with the use of a height adjustment ring. Height adjustment can be made as a field operation without the use of uncured resins or fiberglass lay-ups. Fiberglass manholes must maintain all load and soundness characteristics required by A.S.T.M. D3753 after height adjustment has occurred.

C. Configuration

1. Manway reducers shall be concentric with respect to the larger portion of the manhole diameters through 72-inches.

2. Manway openings shall accommodate standard ring and cover as required by the Owner. The manhole shall provide an area from which a typical ring and cover plate can be supported without damage to the manhole.

D. Stubouts and Connections

1. All proposed connection details shall be submitted and approved by the Engineer.

2. For the mainline sewer connections, install plain end pipe stubouts to the manhole with resin and glass-fiber reinforced lay-up. Belled fittings (if required) shall meet the same performance requirements of the sewer pipe to be installed unless otherwise directed by the Engineer. Resin and fiberglass shall be of the same type and grade as used in the fabrication of the fiberglass manhole.

3. Joints for side sewer and drop connections, sizes 4-inch to 12-inch, shall be made by means of Inserta-Tee watertight compression connection or Kor-N-Seal boots. Side connections larger than 12-inch shall be by integral stubouts.

4. Inserta-Tee installation shall be in strict accordance with manufacturer's written instructions utilizing installation equipment approved for use by the manufacturer of the Inserta-Tee fitting. Use of equipment that does not meet this requirement is expressly prohibited.

5. Kor-N-Seal boots shall be installed by the manhole riser manufacturer using fiberglass reinforced pipe stubouts for the Kor-N-Seal boot sealing surface..

6. Manway openings shall accommodate standard ring and cover as required by the Owner. The manhole shall provide an area from which a typical ring and cover plate can be supported without damage to the manhole.

E. Tee Based Manholes

1. Tee based fiberglass manhole risers will be required to have resin fiber-reinforced bottom flange. All fiberglass manhole risers manufactured with a fiberglass bottom flange will have a minimum width of 3-inches. The manhole riser bottom flange shall be a minimum of ½-inch thick. An appropriate coupling shall be installed into the manhole riser bottom to facilitate connection to a fiberglass tee base. The coupling shall be sealed with a fiberglass lay-up and shall have an integral rubber gasket.

2. A fiberglass sloped bench area shall be installed in the manhole riser by the manufacturer. The invert will be formed using a non-corrosive material and completely enclosed in a minimum 1/4-inch layer of fiberglass chop and shall be sloped toward the coupling in the bottom of the manhole riser.

3. Manhole riser shall be fully compatible with the pipe tee and Contractor is responsible for all coordination between the manhole riser and pipe manufacturers.

F. Closed Bottom Manholes

1. Closed bottom fiberglass manholes will be required to have resin fiber-reinforced bottom. Manholes greater than 15 feet deep shall include a minimum of two fiberglass channel stiffening supports. Manholes manufactured with a fiberglass bottom shall have a minimum 3-inch-wide anti-flotation ring. The manhole bottom shall be a minimum of ½-inch thick.

2. A fiberglass enclosed invert and bench area shall be installed at the factory in the manhole by the manufacturer. The invert will be formed using a non-corrosive material and completely enclosed in a minimum 1/4-inch layer of fiberglass chop.

G. Fabrication Tolerances

1. Manhole riser lengths shall be in 6-inch increments +/- 2-inches.

2. Tolerance of inside diameter shall be +/- 1 percent of required manhole riser diameter.

H. Load Rating

1. The complete manhole riser shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM D3753 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25-inch at the point of load application when loaded to 24,000 lbs.

I. Physical Properties

1. All fiberglass manholes shall meet the following physical properties:

Physical Property	**Hoop Direction**	**Axial Direction**
Tensile Strength (psi)	18,000	5,000
Tensile Modules (psi)	0.6×10^6	0.7×10^6
Flexural Strength (psi)	26,000	4,500
Flexural Modules (psi)	1.4×10^6	0.7×10^6
Compressive (psi)	18,000	5,000

J. Soundness

1. In order to determine soundness, the manufacturer shall apply an air or water pressure test to the manhole test sample. Test pressure shall not be less than 3-psig or greater than 5-psig. While holding at the established pressure, inspect the entire manhole for leaks. Any leakage through the laminate is cause for failure of the test. Refer to A.S.T.M. 3753 8.6.

K. Stiffness

1. The manhole riser cylinder shall have the minimum pipe-stiffness values shown in the table below when tested in accordance with ASTM D3753 8.5 (note 1).

LENGTH – FT	F/AY – PSI
3 – 6.5	0.72
7 – 12.5	1.26
13 – 20.5 5	2.01
21 – 25.5	3.02
26 – 35	5.24

2.02 ACCESSORIES

A. Ladders: No ladders shall be installed in the manholes.

2.03 SOURCE QUALITY CONTROL

A. Each completed manhole shall be examined by the manufacturer for dimensional requirements, hardness, and workmanship. All required ASTM D3753 testing shall be completed, and records of all testing shall be kept, and copies of test records shall be presented to the Owner upon formal written request within a reasonable time period.

B. All tests shall be performed as specified in ASTM D3753, Section 8, Titled “Test Methods”. See ASTM D3753, Section 8, Note 5, for test method D790 and test method D695.

C. As a basis of acceptance, the manufacturer shall provide an independent certification which consists of a copy of the manufacturer’s test report and accompanied by a copy of the test results stating the manhole has been sampled, tested, and inspected in accordance with the provisions of this Specification and meets all requirements.

2.04 IDENTIFICATION

A. Each manhole shall be marked on the inside and outside with the following information:

1. Manufacturer’s name or trademark.

2. Manufacturer’s serial number.

3. Manhole Length.

4. ASTM Designation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Excavation at manhole location should be at least wide enough to accommodate the concrete slab specified and to provide working room around manhole. Verify the depth of manhole is sufficient to allow at least one course of brick or one concrete ring for

adjustment of ring and cover at top of final grade. Pipe cut-outs at the flowline are made in manhole prior to setting manhole in place over pipe in trench. Quarter marks have been provided on barrel to facilitate alignment of cut-outs.

B. Lift manhole per manufacturer's recommendations.

3.02 TEE BASED MANHOLE INSTALLATION

A. Shall be installed onto a fiberglass tee base. Manhole riser bottom shall rest on concrete encasement of tee base to prevent point loading gasketed coupling installed in bottom of manhole riser.

B. Installation details of the tee base shall be coordinated with the fiberglass pipe manufacturer.

3.03 CLOSED BOTTOM MANHOLE INSTALLATION

A. Manholes shall have a poured reinforced concrete base at least one foot deep and at least two feet larger than the fiberglass manhole outside diameter. The fiberglass manhole shall be lowered into the wet concrete and brought to plumb. Pour reinforced concrete over the anti-flotation flange. The concrete shall be a minimum of one foot deep and two feet from outside wall of the manhole.

3.04 BACKFILL

A. Unless shown otherwise on Drawings and approved by the Engineer, sand, crushed stone, or pea gravel shall be used for backfill around the manhole for a minimum distance of one foot from the outside surface and extending from the bottom of the excavation to the top of the reducer section. Suitable material chosen from the excavation may be used for the remainder of the backfill. The material chosen shall be free of large lumps or clods, which will not readily break down under compaction. This material will be subject to approval by the Engineer.

B. Backfill shall be placed in layers of not more than 12 loose measure inches and mechanically tamped to 95 percent Standard Proctor Density, unless otherwise approved by the Engineer. Backfill shall be placed in such a manner as to prevent any wedging action against the fiberglass manhole riser structure.

3.05 SITE QUALITY CONTROL

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer. Such inspections shall be made at the place of manufacture, or at site of delivery, and the sections shall be subject to rejection on account of failure to meet any of the Specification requirements. Sections rejected after delivery to the job site shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected, and if already installed shall be acceptable if repaired or removed and replaced at the Contractor's expense.

END OF SECTION