



Department of Management Services  
Purchasing Division  
241 West South Street  
Kalamazoo, MI 49007-4796  
Phone: 269.337.8020  
Fax: 269.337.8500  
www.kalamazoocity.org  
purchasing@kalamazoocity.org

**PRE-BID MEETING**  
**Wednesday, May 31, 2023 at 11:00 a.m.**  
**Kalamazoo Water Reclamation Plant -1415 Harrison Street, Kalamazoo, MI 49007**  
**Conference Room A**

**INVITATION FOR BIDS (IFB)**

The City of Kalamazoo, Michigan is soliciting sealed bids for:

**Project Name: GPI Effluent Sewer Realignment**

**Bid Reference #: 91345-004.0**

**IFB ISSUE DATE: May 18, 2023**

**BID DUE/OPENING DATE: June 20, 2023 at 3:00 p.m. Local Time (ET)**

*Facsimile Bids Will Not Be Accepted.*

**MAILING ADDRESS & INSTRUCTIONS**

**Mail To:**

Purchasing Division  
241 W. South Street  
Kalamazoo, MI 49007

**Questions for this IFB should be directed to:**

Department Contact: Sohil Manjiyani, PE,  
Senior Civil Engineer at  
[manjiyanis@kalamazoocity.org](mailto:manjiyanis@kalamazoocity.org) or  
(269) 337-8595

***Include on the Envelope the Project Name and Bid Reference Number. All Envelopes Must Be Sealed.***

You are invited to submit a bid for this project. Specifications, terms, conditions and instructions for submitting bids are contained herein. This Invitation for Bids with all pages, documents and attachments contained herein, or subsequently added to and made a part hereof, submitted as a fully and properly executed bid shall constitute the contract between the City and the successful bidder when approved and accepted on behalf of the City by an authorized official or agent of the City. Please review the bid document as soon as possible and note the **DEADLINE FOR QUESTIONS** in the Instructions to Bidders.

All bidders shall complete and return the Bid and Award page(s) and submit all information requested herein in order for a bid to be responsive. The bid document shall be returned in its entirety, in a properly identified and sealed envelope to the Purchasing Division at the above address. **BIDS MUST BE RECEIVED BEFORE THE DUE DATE - LATE BIDS WILL NOT BE CONSIDERED.** The City reserves the right to postpone the bid opening for its own convenience.

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### STATEMENT OF NO BID

**NOTE: If you DO NOT intend to bid on this commodity or service, please complete and return this form immediately.** Your response will assist us in evaluating all responses for this important project and to improve our bid solicitation process.

The Purchasing Division of the City of Kalamazoo wishes to keep its bidders list file up-to-date. If, for any reason you cannot supply the commodity/service noted in this bid solicitation, this form must be completed and returned to remain on the particular bid list for future projects of this type.

**If you do not respond to this inquiry within the time set for the bid opening date and time noted, we will assume that you can no longer supply this commodity/service, and your name will be removed from this bid list.**

- \_\_\_\_\_ Specifications too "tight", i.e. geared toward one brand/ manufacturer only (explain below).
- \_\_\_\_\_ Specifications are unclear (explain below).
- \_\_\_\_\_ We are unable to meet specifications.
- \_\_\_\_\_ Insufficient time to respond to the Invitation for Bid.
- \_\_\_\_\_ Our schedule would not permit us to perform.
- \_\_\_\_\_ We are unable to meet bond requirements.
- \_\_\_\_\_ We are unable to meet insurance requirements.
- \_\_\_\_\_ We do not offer this product or service.
- \_\_\_\_\_ Remove us from your bidders list for this commodity or service.
- \_\_\_\_\_ Other (specify below).

REMARKS: \_\_\_\_\_

SIGNED: \_\_\_\_\_ NAME: \_\_\_\_\_  
(Type or Print)

TITLE: \_\_\_\_\_ DATE: \_\_\_\_\_

FIRM NAME: \_\_\_\_\_  
(if any)

ADDRESS: \_\_\_\_\_  
(Street address) (City) (State) (Zip)

PHONE: \_\_\_\_\_ FAX: \_\_\_\_\_

EMAIL: \_\_\_\_\_

## SECTION I INSTRUCTIONS FOR BIDDERS

### 1. EXAMINATION OF BID DOCUMENT

Before submitting a bid, bidders shall carefully examine the specifications and shall fully inform themselves as to all existing conditions and limitations. The bidder shall indicate in the bid the sum to cover the cost of all items included on the bid form.

### 2. PREPARATION OF BID

The bid shall be legibly prepared in ink or typed. If a unit price or extension already entered by the bidder on the Bid and Award form is to be altered, it shall be crossed out and the new unit price or extension entered above or below and initialed by the bidder with ink. The bid shall be legally signed and the complete address of the bidder given thereon.

All bids shall be tightly sealed in an envelope plainly marked SEALED BID and identified by project name, bid opening date and time. Bids opened by mistake, due to improper identification, will be so documented and resealed. The Purchasing Division will maintain and guarantee confidentiality of the contents until the specified opening date and time. Bids submitted by Fax machine will not be accepted.

### 3. EXPLANATION TO BIDDERS

Any binding explanation desired by a bidder regarding the meaning or interpretation of the Invitation for Bid (IFB) and attachments must be requested in writing, **at least 5 business days before the bid opening** so a reply may reach all prospective bidders before the submission of bids. Any information given to a prospective bidder concerning the IFB will be furnished to all prospective bidders as an amendment or addendum to the IFB if such information would be prejudicial to uninformed bidders. Receipt of amendments or addenda by a bidder must be acknowledged in the bid by attachment, or by letter or fax received before the time set for opening of bids. Oral explanation or instructions given prior to the opening will not be binding.

### 4. CASH DISCOUNTS

Discount offered for payment of less than thirty (30) days will not be considered in evaluating bids for award. Offered discounts of less than thirty (30) days will be taken if payment is made within the discount period, even though not considered in evaluation of the bid.

### 5. WITHDRAWAL OF BIDS

Bids may be withdrawn in person by a bidder or authorized representative, provided their identity is made known and a receipt is signed for the bid, but only if the withdrawal is made prior to the exact time set for receipt of bid. No bid may be withdrawn for at least ninety (90) days after bid opening.

### 6. ALTERNATE BIDS

bidders are cautioned that any alternate bid, unless specifically requested or any changes, insertions or omissions to the terms and conditions, specifications or any other requirement of this IFB may be considered non-responsive, and at the option of the City, result in rejection of the alternate bid.

## **7. LATE BIDS**

Any bid received at the office designated herein after the exact time specified for receipt will not be considered. (Note: The City reserves the right to consider bids that have been determined by the City to be received late due to mishandling by the City after receipt of the bid and no award has been made).

## **8. UNIT PRICES**

If there is a discrepancy between unit prices and their extension, unit prices shall prevail.

## **9. BID SUBMITTAL**

- 9.1. **Mail your bid**, to be received before the bid due date and time indicated in the bid document, to the City of Kalamazoo at the following address:

City of Kalamazoo  
Purchasing Division  
241 West South Street  
Kalamazoo, MI 49007

- 9.2. **Deliver your bid to City Hall In-Person** before the bid due date and time indicated in the bid document.
- 9.3. **Deliver your bid to the Treasurer’s Office Payment Drop Box** located in the northwest corner of City Hall (see photos on the following page) before the bid due date and time indicated in the bid document.

## **10. BID TABULATIONS**

The Purchasing Division makes an effort to post bid tabulations to the City of Kalamazoo website within 24 hours after the bid opening date and time at: <https://www.kalamazoocity.org/bidopportunities>. However, in certain cases the posting of the bid tabulation may extend beyond the 24-hour window.



1. Open drop box located at City Hall.

2. Insert SEALED BID here.





## SECTION II BID AND AWARD

The undersigned having become thoroughly familiar with all of the bid/contract documents incorporated herein, the project site and the location conditions affecting the work, hereby proposes to perform everything required to be performed in strict conformity with the requirements of these documents, and to provide and furnish all the equipment, labor and materials necessary to complete, in a professional manner, the furnishing and installing of all of the following, meeting or exceeding the specifications as set forth herein for the prices as stated below.

### GPI EFFLUENT SEWER REALIGNMENT – BASE BID

Item No.	Description	Plan Qty.	Unit	Unit Price	Extended Price
1	General Conditions/Mobilization, 10% Max	1	LS		
2	Audio/Video Recording	1	LS		
3	Tree and Stump Removal 6 inches to 18 inches	3	EA		
4	Clearing and Grubbing	.50	AC		
5	Reconstruct Industrial Diversion Chamber No. 1	1	LS		
6	Remove, Fill, and Abandon Existing Junction Chamber	1	LS		
7	Reconstruct Parshall Flume Structure	1	LS		
8	Meter Vault	1	LS		
9	5' Diameter Storm Manhole	2	EA		
10	30" Diameter HDPE Storm Sewer	258	LF		
11	30-inch Concrete Storm Sewer Outlet Headwall	1	EA		
12	6"-12" Rip Rap	15	SY		
13	12-inch Diameter Class 52 DI Sanitary Sewer (Labor Only)	14	LF		
14	24-inch Diameter Class 52 DI Sanitary Sewer (Labor Only)	641	LF		
15	24-inch Class 52 DI Flanged Tee (Labor Only)	3	EA		
16	24-inch x12-inch Class 52 DI MJ Tee (Labor Only)	1	EA		
17	24-inch Blind Flange (Labor Only)	3	EA		
18	24-inch Flanged 45 Degree Bend (Labor Only)	3	EA		
19	24-inch Flanged 11.25 Degree Bend (Labor Only)	2	EA		
20	24-inch Flanged 22.5 Degree Bend (Labor Only)	1	EA		
21	24-inch Mega-Flange Adapter (Labor Only)	9	EA		
22	24-inch Nut & Bolt Gasket Set (NLA 24 304 SS 150# RR FF 1/8 FLG P) (Labor Only)	9	EA		
23	24-inch MJ 90 Degree Bend (Labor Only)	1	EA		
24	24-inch Megalug F/DI (Labor Only)	6	EA		
25	24-inch MJ Bolt & Gasket Package Less Gland (Labor Only)	6	EA		
26	12-inch Megalug F/DI	5	EA		

27	12-inch MJ Bolt & Gasket Package Less Gland (Labor Only)	5	EA		
28	12-inch MJ 90 Degree Bend (Labor Only)	1	EA		
29	Type III Sanitary Sewer Manhole (8' Diameter)	3	EA		
30	CIPP 24-inch sanitary Sewer	641	LF		
31	Post-CCTV Inspection of Sewers	1	EA		
32	Restoration	1	EA		
33	Materials Testing	1	EA		
34	Construction Staking	1	EA		
<b>BASE BID PROJECT TOTAL</b>					

**GPI EFFLUENT SEWER REALIGNMENT – BID ALTERNATE 12-31-2024**  
**COMPLETION DATE**

<b>Item No.</b>	<b>Description</b>	<b>Plan Qty.</b>	<b>Unit</b>	<b>Unit Price</b>	<b>Extended Price</b>
1	General Conditions/Mobilization, 10% Max	1	LS		
2	Audio/Video Recording	1	LS		
3	Tree and Stump Removal 6 inches to 18 inches	3	EA		
4	Clearing and Grubbing	.50	AC		
5	Reconstruct Industrial Diversion Chamber No. 1	1	LS		
6	Remove, Fill, and Abandon Existing Junction Chamber	1	LS		
7	Reconstruct Parshall Flume Structure	1	LS		
8	Meter Vault	1	LS		
9	5' Diameter Storm Manhole	2	EA		
10	30" Diameter HDPE Storm Sewer	258	LF		
11	30-inch Concrete Storm Sewer Outlet Headwall	1	EA		
12	6"-12" Rip Rap	15	SY		
13	12-inch Diameter Class 52 DI Sanitary Sewer (Labor Only)	14	LF		
14	24-inch Diameter Class 52 DI Sanitary Sewer (Labor Only)	641	LF		
15	24-inch Class 52 DI Flanged Tee (Labor Only)	3	EA		

16	24-inch x12-inch Class 52 DI MJ Tee (Labor Only)	1	EA		
17	24-inch Blind Flange (Labor Only)	3	EA		
18	24-inch Flanged 45 Degree Bend (Labor Only)	3	EA		
19	24-inch Flanged 11.25 Degree Bend (Labor Only)	2	EA		
20	24-inch Flanged 22.5 Degree Bend (Labor Only)	1	EA		
21	24-inch Mega-Flange Adapter (Labor Only)	9	EA		
22	24-inch Nut & Bolt Gasket Set (NLA 24 304 SS 150# RR FF 1/8 FLG P) (Labor Only)	9	EA		
23	24-inch MJ 90 Degree Bend (Labor Only)	1	EA		
24	24-inch Megalug F/DI (Labor Only)	6	EA		
25	24-inch MJ Bolt & Gasket Package Less Gland (Labor Only)	6	EA		
26	12-inch Megalug F/DI	5	EA		
27	12-inch MJ Bolt & Gasket Package Less Gland (Labor Only)	5	EA		
28	12-inch MJ 90 Degree Bend (Labor Only)	1	EA		
29	Type III Sanitary Sewer Manhole (8' Diameter)	3	EA		
30	CIPP 24-inch sanitary Sewer	641	LF		
31	Post-CCTV Inspection of Sewers	1	EA		
32	Restoration	1	EA		
33	Materials Testing	1	EA		
34	Construction Staking	1	EA		
<b>BID ALTERNATE (12-31-2024 COMPLETION) PROJECT TOTAL</b>					

**PLEASE NOTE: The only difference between the Base Bid and the Bid Alternate is the extension of the project completion date to 12/31/2024 for the Bid Alternate.**

Bidder shall provide all of the information as requested herein with their bid. Failure to do so and/or failure to provide post-bid requested information may be cause for rejecting the bid as non-responsive.

After receipt of Notice to Proceed by Contractor, work shall start within 10 business days, unless otherwise agreed to by the Project Manager, and shall be completed by **December 31, 2023**. Bid alternate completion date will be December 31, 2024.

Bidder/Contractor has examined and carefully studied the bidding documents and attachments, and acknowledges receipt of the following addenda:

Addendum No: \_\_\_\_\_

Date: \_\_\_\_\_

By my signature below, I certify that the firm bidding on this contract, when making hiring decisions, does not use a past criminal conviction as a bar to or preclude a person with a criminal conviction from being considered for employment with the bidding firm unless otherwise precluded by federal or state law. I further certify that I have read and agree to be bound by the provisions of the City’s Non-Discrimination Clause found in Appendix A as updated by City Ordinance 1856.

Signed: \_\_\_\_\_ Name: \_\_\_\_\_

Title: \_\_\_\_\_

## CITY OF KALAMAZOO EX-OFFENDER POLICY CHECKLIST

As part of the City’s commitment to reducing unacceptable poverty, encouraging rehabilitation, reducing recidivism and strengthening families in Kalamazoo, the City has updated its Purchasing Policy to ensure that firms with whom the City does business share in this commitment by utilizing hiring practices that do not unfairly deny people with arrest and conviction records gainful employment. *(Important: This requirement also extends to any subcontractors the bidder intends to use to fulfill the contract for goods or services being sought from the City.)*

### Part I: Proof that the bidder does not inquire about an individual’s past arrest or criminal history on the bidder’s employment application form

- Attach a copy of the current application for employment being used by the bidder

### Part II: Certification that the bidder does not use an individual’s past arrest or criminal history to unlawfully discriminate against them by checking one or more of the following:

- That pursuant to federal or state law bidder is precluded from hiring persons with certain criminal records from holding particular positions or engaging in certain occupations by providing a cite to the applicable statute or regulation; if checking this box, provide a citation to the applicable statute or rule upon which the bidder is relying: \_\_\_\_\_
- That bidder conducts criminal history background checks only as necessary, and only after making a conditional offer of employment; that any withdrawal of an offer of employment to an individual because of a past criminal history is job-related and consistent with business necessity after the individual has been provided an individualized assessment opportunity to review and challenge or supplement the history of past criminal conduct being relied upon by the bidder.
- That the use by bidder of criminal history background checks complies with the U.S. Equal Employment Opportunity Commission’s Enforcement Guidance on the Consideration of Arrest and Conviction Records in Employment Decisions and that the bidder has not had a determination rendered against it in past 7 years that it discriminated against a person through the use of an individual’s arrest or criminal history

I CERTIFY THAT THE ABOVE STATEMENTS ARE TRUE.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Position

## **CITY OF KALAMAZOO LOCAL PREFERENCE POLICY AND CERTIFICATION**

The lowest responsive Kalamazoo County bidder whose bid is not low but falls within 2% of the lowest responsive bid is afforded the opportunity to become the successful bidder if it agrees to reduce its bid to match the lowest responsive bid. The City of Kalamazoo is the sole determiner whether a bidder is responsible, qualifies as a Kalamazoo County bidder, and if its bid is responsive to the City’s specifications, terms and conditions.

If the lowest Kalamazoo County bidder chooses not to match the lowest bid, the next lowest responsive Kalamazoo County bidder whose bid falls within 2% of the lowest bid, is given the opportunity to match the lowest responsive bid.

To qualify as a Kalamazoo County bidder, the bidder must meet both the following criteria:

1. Have a physical presence in Kalamazoo County by maintaining a permanent office, factory or other facility in Kalamazoo County with employees working in Kalamazoo County.
2. Have paid real or personal property taxes related to said business to the City of Kalamazoo, County of Kalamazoo or other municipal corporation within Kalamazoo County in the previous tax year, except that a non-profit entity need not meet this requirement.

This local preference policy applies only to purchases for materials, supplies, capital outlay, and services for maintenance, repair or operation of City facilities that are over \$25,000. If more than 50% of the contract is sub-contracted to firms located outside of Kalamazoo County that bid does not qualify for the local preference policy outlined above. The local preference policy will not apply if prohibited by law. The Purchasing Agent has the authority to finally determine if the bidder qualifies as a Kalamazoo County bidder as set forth herein. The Purchasing Agent may take into account the permanency of the business in Kalamazoo, and whether the business appears to be claiming to be a Kalamazoo County business solely or primarily to qualify as a Kalamazoo County business under this Resolution, and any other material factors.

### **CERTIFICATION**

If you qualify as a Kalamazoo County bidder and wish to be considered for the local preference provisions as provided above please certify that fact by providing the information requested below and attesting to its accuracy.

Firm Name: \_\_\_\_\_

Street Address of Business: \_\_\_\_\_

City, State, and Zip Code: \_\_\_\_\_

Number of employees working in Kalamazoo County: \_\_\_\_\_

Name the city or township to which business real and/or personal property taxes are paid or provide non-profit status: \_\_\_\_\_  
\_\_\_\_\_

The above information is accurate:

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

Revised April 2008





## REFERENCE QUESTIONNAIRE

Please answer the following questions completely.

1. Firm name: \_\_\_\_\_
2. Established: Year \_\_\_\_\_ Number of Employees: \_\_\_\_\_
3. Type of organization:
  - a. Individual: \_\_\_\_\_
  - b. Partnership: \_\_\_\_\_
  - c. Corporation: \_\_\_\_\_
  - d. Other: \_\_\_\_\_
4. Former firm name(s) if any, and year(s) in business:  
\_\_\_\_\_  
\_\_\_\_\_
5. Include at least 3 references of contracts for similar work performed over the last five (5) years. Include: owner, contact person and phone number and description of work performed.
  - a. Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Type of work or contract: \_\_\_\_\_
  - b. Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Type of work or contract: \_\_\_\_\_
  - c. Company Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Type of work or contract: \_\_\_\_\_

I hereby certify that all of the information provided is true and answered to the best of my ability.

Signed: \_\_\_\_\_ Name: \_\_\_\_\_  
(type or print)

Title: \_\_\_\_\_ Date: \_\_\_\_\_

I hereby state that all of the information I have provided is true, accurate and complete. I hereby state that I have the authority to submit this bid which will become a binding contract if accepted by the City of Kalamazoo. I hereby state that I have not communicated with nor otherwise colluded with any other bidder, nor have I made any agreement with nor offered/accepted anything of value to/from an official or employee of the City of Kalamazoo that would tend to destroy or hinder free competition.

The firm's identification information provided will be used by the City for purchase orders, payment and other contractual purposes. If the contractual relationship is with, or the payment made to, another firm please provide a complete explanation on your letterhead and attach to your bid. Please provide for accounts payable purposes:

Tax Identification Number (Federal ID): \_\_\_\_\_

Remittance Address: \_\_\_\_\_

Financial Contact Name: \_\_\_\_\_ Financial Contact Phone Number: \_\_\_\_\_

Financial Contact Email Address: \_\_\_\_\_

I hereby state that I have read, understand and agree to be bound by all terms and conditions of this bid document.

SIGNED: \_\_\_\_\_ NAME: \_\_\_\_\_  
(Type or Print)

TITLE: \_\_\_\_\_ DATE: \_\_\_\_\_

FIRM NAME: \_\_\_\_\_  
(if any)

ADDRESS: \_\_\_\_\_  
(Street address) (City) (State) (Zip)

PHONE: \_\_\_\_\_ FAX: \_\_\_\_\_

EMAIL ADDRESS: \_\_\_\_\_

---

**FOR CITY USE ONLY - DO NOT WRITE BELOW**

### SECTION III CITY OF KALAMAZOO INDEMNITY AND INSURANCE

Contractor, or any of their subcontractors, shall not commence work under this contract until they have obtained the insurance required under this paragraph, and shall keep such insurance in force during the entire life of this contract. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan and acceptable to the City of Kalamazoo within ten (10) days of the Notice of Award. The requirements below should not be interpreted to limit the liability of the Contractor. All deductibles and SIR's are the responsibility of the Contractor.

The Contractor shall procure and maintain the following insurance coverage:

Workers' Compensation Insurance including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than \$1,000,000 per occurrence and aggregate. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent, if not already included and (E) XCU coverage if the nature of the contract requires XC or U work.

Automobile Liability in accordance with all applicable statutes of the State of Michigan, with limits of liability not less than \$1,000,000 per occurrence, combined single limit for Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

Additional Insured: Commercial General Liability and Automobile Liability, as described above, shall include an endorsement stating that the following shall be *Additional Insureds*: The City of Kalamazoo, all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and board members, including employees and volunteers thereof. It is understood and agreed that by naming the City of Kalamazoo as additional insured, coverage afforded is considered to be primary and any other insurance the City of Kalamazoo may have in effect shall be considered secondary and/or excess.

To the fullest extent permitted by law the Contractor agrees to pay on behalf of, indemnify, and hold harmless the City of Kalamazoo, its elected and appointed officials, and employees against any claims, demands, suits, or loss, including all costs connected therewith, and for any damages which may be asserted, claimed, or recovered against or from the City of Kalamazoo, by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof, caused in whole or part by any negligent act or omission by the Contractor, its employees, agents, or officers which arises out of, or is in any way connected or associated with, this contract.

**INDEMNITY AND INSURANCE**

*Continued*

Cancellation Notice: All policies, as described above, shall include an endorsement stating that it is understood and agreed that thirty (30) days, or ten (10) days for non-payment of premium, Advance Written Notice of Cancellation, Non-Renewal, Reduction, and/or Material Change shall be sent to: City of Kalamazoo, Purchasing Division, 241 W. South Street, Kalamazoo, MI 49007.

Proof of Insurance Coverage: The Contractor shall provide the City of Kalamazoo at the time that the contracts are returned by him/her for execution, or within 10 days of Notice of Award, whichever is earlier, a Certificate of Insurance as well as the required endorsements. In lieu of required endorsements, if applicable, a copy of the policy sections where coverage is provided for additional insured and cancellation notice would be acceptable. Copies or certified copies of all policies mentioned above shall be furnished, if so requested. If any of the above coverages expire during the term of this contract, the Contractor shall deliver renewal certificates and/or policies to City of Kalamazoo at least ten (10) days prior to the expiration date.

Scope of Coverage: The above requirements and conditions shall not be interpreted to limit the liability of the Contractor under this Contract, but shall be interpreted to provide the greatest benefit to the City and its officers and employees. The above listed coverages shall protect the Contractor, its employees, agents, representatives and subcontractors against claims arising out of the work performed. It shall be the Contractor's responsibility to provide similar insurance for each subcontractor or to provide evidence that each subcontractor carries such insurance in like amount prior to the time such subcontractor proceeds to perform under the contract.

## SECTION IV SPECIAL REQUIREMENTS

### 1. BID BOND/GUARANTEE

The bid must be accompanied by a bid bond which shall not be less than five (5%) percent of the total amount of the bid. No bid will be considered unless it is accompanied by the required guarantee. The bid guarantee shall ensure the execution of the bid and award, and the furnishing of a performance bond and a labor and material bond (A and B below) by the successful bidder. (Contractors Note: A cashier's or certified check in lieu of a bid bond is **NOT** acceptable.)

#### A. PERFORMANCE BOND

A performance bond shall be furnished in the full amount of the contract ensuring the City of faithful performance of all the provisions of the contract, and the satisfactory performance of any equipment required hereunder. The bond shall also ensure the City against defective workmanship and/or materials.

#### B. LABOR AND MATERIAL (PAYMENT) BOND

A labor and material (payment) bond shall be furnished for the period covered by the contract, in the full amount of the contract for the protection of labor and material suppliers and sub-contractors.

Bonds shall be secured by a guaranty or a surety company listed in the latest issue of the U.S. Treasury, circular 570, and licensed to do business in the State of Michigan, and written in favor of the City of Kalamazoo. The amount of such bonds shall be within the maximum amount specified for such company in said circular 570. The bonds shall be accompanied by a power of attorney showing authority of the bonding agent to sign such bonds on behalf of the guaranty or surety company. The cost of the bonds shall be borne by the Contractor.

Failure of the Contractor to supply the required bonds within ten (10) days after Notice of Award, or within such extended period as the Purchasing Agent may agree to, shall constitute a default and the City of Kalamazoo may either award this contract to the next lowest bidder or re-advertise for bids and may charge against the Contractor for the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the City of Kalamazoo for a refund.

### 2. WAIVERS OF LIEN

Upon completion of all work and request for final payment, the Contractor shall furnish a 100% waiver of lien from each supplier and sub-contractor covering all items of the work. Failure to supply waivers of lien for the entire job upon completion and final payment request will be considered grounds for withholding final payment.

### **3. SUBCONTRACTORS**

- A. Contractors shall state on the Bid and Award page any and all subcontractors to be associated with their bid, including the type work to be performed. Any and all subcontractors shall be bound by all of the terms, conditions and requirements of the contract; however, the prime contractor shall be responsible for the performance of the total work requirements.
- B. The Contractor shall cooperate with the City of Kalamazoo in meeting its commitments and goals with regard to maximum utilization of minority and women business enterprise, and shall use its best efforts to ensure that minority and women business enterprises have maximum practicable opportunity to compete for subcontract work under this agreement.

### **4. PREVAILING WAGES**

The successful bidder will be required to comply with Section 2-125 of the Code of Ordinances of the City of Kalamazoo regarding prevailing wages and Appendix B attached, incorporated herein by reference. Special note: This provision applies only to projects in excess of \$100,000 for City (\$2,000 federal) funded projects.

The City's requirements as it relates to prevailing wages includes a meeting with the City's Purchasing Division **prior** to work and payroll and work monitoring during the duration of the contract. Please contact Purchasing at (269) 337-8020 if you have any questions regarding Davis-Bacon provisions.

## SECTION V SCOPE OF WORK & SPECIAL CONDITIONS

### 1. INTENT

It is the intent of these plans and specifications to provide for a general contractor who shall provide all labor, materials, tools and equipment necessary to perform in a professional manner for the GPI Effluent Sewer Realignment project as described in the specifications (*Appendix C*), Plans (*Appendix D*), Special Provisions (*Appendix E*), and bid document.

### 2. SCOPE OF WORK

The scope of work for this project shall consist of construction of a new proposed 641 linear feet 24” ductile iron pipe sanitary sewer on Graphic Packaging International (GPI) property to discharge to the existing municipal junction chamber on KWRP property, abandonment of an existing junction chamber on GPI property, concrete, chamber and flume restoration, cast in place pipe lining (CIPP) and other works and appurtenances, as described in this bid document and appendices.

All necessary traffic control, labor, materials, tools, equipment, and other items incidental to the work being performed shall be included in the Contractor’s unit price for this contract. Such items will not be bid or paid for separately but shall be included in the overall unit price.

The bidder shall furnish all labor, supervision, supplies, tools, equipment, and other means necessary or proper for performing and completing the work. The bidder shall be responsible for the cleaning up of the job site and shall repair or restore all structures and property that may be damaged or disturbed during performance of the work to the satisfaction of the Public Services Department for the City of Kalamazoo. Drainage structure covers shall be salvaged and reused if in usable condition; otherwise, they shall be replaced. Where needed, all traffic control used for such operations as defined by the MMUTCD will be the responsibility of the bidder.

**The bidder shall have all work completed by December 31, 2023. Bid alternate completion date will be December 31, 2024.**

**PLEASE NOTE: The only difference between the Base Bid and the Bid Alternate is the extension of the project completion date to 12/31/2024 for the Bid Alternate.**

### 3. UNIT PRICING

The unit price, including its pro rata share of overhead, multiplied by the quantity shown shall represent the total bid and shall be held firm for the life of this contract. Any bid not conforming to this requirement may be rejected as non-responsive.

### 4. TEMPORARY UTILITIES

- A. Temporary or construction water will NOT be available on the sites. The Contractor must provide for drinking water.
- B. Temporary toilets: To be supplied by the Contractor as may be necessary.

## 5. PROGRESS SCHEDULE

- 5.1 After receipt of notification by Contractor of Notice to Proceed work shall start within 10 business days, unless otherwise agreed to by the Project Manager.
- 5.2 Project shall have a final completion date of **December 31, 2023**. Bid alternate completion date will be December 31, 2024
- 5.3 Work of a similar nature may be added to this contract if agreed to by the City and the Contractor. In the event that work is added, the progress schedule for the existing work will remain unchanged. Any contract time added for additional work will be applied to that additional work only and cannot be added to items in the original contract. Any work done on the items in the original contract past the number of working days stated herein will be subject to liquidated damages regardless of any work that may be added at a later date.
- 5.4 The Contractor will be required to meet with the Public Services representatives to work out a detailed progress schedule. The schedule for this meeting will be within two weeks after contract award has been made.
- 5.5 The named sub-contractor(s) for all items shall also be present at the scheduled meeting and be required to sign the Progress Schedule to indicate their approval of the scheduled dates of work set forth in the Progress Schedule. If unable to attend the scheduled meeting, the sub-contractor shall, at a minimum, sign the Progress Schedule to indicate their approval of the dates of work. MDOT Form 1130 shall be used for schedule submission and signature of all parties.
- 5.6 The Progress Schedule shall include, as a minimum, the starting and completion dates for major items, and where specified in the bid document the date the project is to be opened to traffic as well as the final project completion date specified in the bid document. The Progress Schedule shall be coordinated with all aspects of the work occurring at the site.
- 5.7 Failure on the part of the Contractor to carry out the provisions of the Progress Schedule as established may be considered sufficient cause to prevent bidding future projects until a satisfactory rate of progress is again established.
- 5.8 The starting date and the contract time to the completion date for this project may be adjusted by Public Services without imposing liquidated damages upon the receipt of satisfactory documented evidence that unforeseen delayed delivery of critical materials will prevent the orderly prosecution of the work.
- 5.9 Any request extension of the completion date and satisfactory documented evidence of unforeseen delays shall be submitted via MDOT Form 1100A – Extension of Contract Time.
- 5.10 MDOT Standard Specifications for Construction Section 501.03.I.1, Weather Limitations, shall apply.

## 6. LIQUIDATED DAMAGES

Liquidated Damages will be assessed per Section 108.10C of the MDOT Standard Specifications for Construction.

## 7. MAINTAINING TRAFFIC

- 7.1 This work shall be in accordance with the requirements of Section 812 of the MDOT Standard Specifications for Construction, the Maintaining Traffic special provision, and as specified herein. The Contractor is advised that the current Michigan Manual of Uniform Traffic Control Devices (MMUTCD) is hereby established as governing



**MAINTAINING TRAFFIC (cont.)**

- all work in connection with traffic control devices, barricade lighting, etc. required on this project.
- 7.2 The Contractor shall furnish, erect, maintain and, upon completion of the work, remove all traffic control devices and barricade lights within the project and around the perimeter of the project for the safety and protection of through and local traffic. This includes, but is not limited to: Advance, regulatory and warning signs; barricades and channeling devices at intersecting streets on which traffic is to be maintained; barricades at the ends of the project and at right of way lines for intersecting streets which are to be closed with the first usable street on each side of the project. Traffic regulators, where required by the Engineer, are included.
- 7.3 Where the existing pavement or partial widths of new pavement are to be utilized for the maintenance of through and local traffic, channelizing devices will be required at 50' intervals or as directed by the Engineer for channeling and directing traffic through the construction area.
- 7.4 Through traffic shall be maintained utilizing sidewalk closures with detours and traffic shifts per MDOT traffic and safety details.
- 7.5 Protection of all pedestrian traffic shall be maintained at all times in accordance with the MMUTCD. Type II barricades and sidewalk detour signs shall be used in accordance with the MMUTCD at all intersections and ramps. Sidewalk detours shall direct pedestrians safely around closed sidewalk locations and shall be placed at the nearest pedestrian crossing locations still open to traffic.
- 7.6 Payment for furnishing and operating all temporary traffic control devices and traffic regulators shall be paid as pay items included in this contract and shall include all the temporary traffic control measures on all road segments.
- 7.7 Under Article 812.04.D "Operated Pay Items" the term 'Relocating' shall include the relocating of the item from any street covered by the contract to any other street covered by the contract.
- 7.8 No work shall be allowed on the following dates:
- |          |                        |
|----------|------------------------|
| 4/15/22  | Good Friday            |
| 5/30/22  | Memorial Day Holiday   |
| 6/19/22  | Juneteenth             |
| 7/4/22   | Fourth of July Holiday |
| 9/5/22   | Labor Day Holiday      |
| 11/11/22 | Veteran's Day          |
| 11/24/22 | Thanksgiving           |
| 12/25/22 | Christmas              |
| 1/1/23   | New Year's Day         |
- 7.9 Milled surfaces will not be allowed on travel lanes for longer than 72 hours unless approved by the Project Manager. Any traffic surface within the construction area containing a drop off at the edge of a pavement greater than two (2) inches shall not be allowed to be opened to the public without proper wedging of the edges according to the COK standard detail. Any areas not conforming to the road levelness and profile shall be signed appropriately in accordance with the MMUTCD and best management practices.
- 7.10 Once work is initiated that includes lane restrictions or detours, that work shall be continuous until complete. If work is suspended for more than three (3) continuous

**MAINTAINING TRAFFIC (*cont.*)**

working days all lane restrictions and detours shall be removed at the Contractor's expense.

Special Restrictions: Access to frontage properties shall be maintained as much as practical. Emergency access shall be maintained at all times. The Contractor shall maintain two way traffic with flag control as needed when the road is restricted to only one traffic lane.

**8. COORDINATING**

The Contractor's attention is called to Article 104.08 of the MDOT Standard Specifications for Construction entitled "Cooperation by Contractor" and the special provisions contained within this contract.

**9. WORK HOURS**

All work shall be done between the hours of 7 am to 7 pm (Monday – Saturday). Work done outside of these times will be at the discretion of the Project Manager.

No work shall be done on Sunday, unless otherwise approved by the Project Manager in writing.

The Contractor shall conduct their work in such a manner that no excavations are left open overnight. If this is not possible, the Contractor shall provide and install a temporary fence to protect the excavation, at the Contractor's expense.

**10. PRE-BID MEETING**

All prospective contractors and subcontractors are invited to attend a non-mandatory **Pre-Bid Meeting** with representatives from the City of Kalamazoo on **Wednesday, May 31, 2023 at 11:00 a.m. local time** at the Kalamazoo Water Reclamation Plant, 1415 Harrison Street, Kalamazoo, MI 49007. (Conference Room A)

## SECTION VI GENERAL CONDITIONS

### 1. PROJECT MANAGER'S STATUS

The City Engineer (Engineer) or his/her duly authorized representative shall be the City's Project Manager and shall have the duties and responsibilities as provided in the contract.

The Project Manager shall have the authority to reject any work or materials which do not conform to the contract and to decide questions or interpretations which may arise from the contract documents.

The Contractor shall immediately report to the Project Manager any questionable or obvious error or omission which may be apparent in the contract documents and shall not proceed with work until the Project Manager has resolved the error or omission.

### 2. CONSTRUCTION SCHEDULE AND COORDINATION

- 2.1 The Contractor shall supply the City with an agreeable construction schedule before commencing work on this contract. This schedule shall detail beginning and completion dates for each major component of the project.
- 2.2 The Contractor shall coordinate and cooperate with all other contractors who may be working on the site, to allow for the orderly progress of work being done.
- 2.3 The Contractor is required to keep the Project Manager fully informed of any proposed work which will tend to interfere with the existing operations at the site.
- 2.4 The Contractor shall schedule all work to accommodate the City's schedule. In the event the Contractor's schedule falls on weekends, nights or overtime work is required, no additional compensation will be allowed. All work shall be part of this contract without regard to when it is done.
- 2.5 The Contractor shall coordinate with other construction projects and contractors adjacent to the location of this project.
- 2.6 The Contractor shall notify, by door hanger/written flier (pre-approved by the Project Manager), affected residents and business of work and areas to be disturbed by construction at least 72 hours in advance. Work shall not commence until the affected residents/business have been notified and given advanced notice. The Contractor shall work to minimize impacts to those affected by the construction while still maintaining project schedule and objectives. For impacts to driveways or property access points that affect residents or businesses, resident/business shall be notified 24 hours in advance of the work taking place and coordinated with for parking and property access.

### 3. PROTECTION OF WORK

The Contractor shall maintain adequate protection of all his/her work from damage and shall protect all public and private abutting property from injury or loss arising in connection with this contract.

#### **4. PROTECTION OF PROPERTY**

- 4.1 The Contractor shall confine his/her equipment and operations to those areas of the work site necessary for the completion of the work, or as authorized by the Project Manager. The Contractor shall protect and preserve from damage any facilities, utilities or features including trees, shrubs and turf which are not required to be disturbed by the requirements of the work.
- 4.2 The Contractor shall be responsible to determine the location of and to protect from damage any utilities or other improvements.

#### **5. REMOVAL OF RUBBISH**

The Contractor shall daily remove all rubbish and accumulated materials due to his/her construction.

#### **6. SALVAGING DRAINAGE STRUCTURE COVERS**

The City of Kalamazoo reserves the right to salvage any drainage structure covers or portions thereof which are to be removed as a result of work done under this contract. Any covers which are to be salvaged will be identified by the City. The contractor will set those items identified aside for pick up by City personnel.

#### **7. UNDERGROUND UTILITIES**

For protection of underground utilities, the Contractor shall dial Miss Dig at 1-800-482-7171 a minimum of 72 hours prior to excavating in the vicinity of utility lines. All “Miss Dig” participating members will thus be routinely notified. This does not relieve the Contractor of notifying utility owners who may not be part of the “Miss Dig” alert system.

#### **8. SITE SECURITY**

The Contractor shall be responsible for job site security of all materials and tools provided by him/her and no claim for loss or damage will be considered by the City.

#### **9. SITE ACCESS**

The City will provide fair and reasonable access to the job site within the working schedules of both parties.

#### **10. MATERIALS INSPECTION AND RESPONSIBILITY**

- 10.1 The Project Manager shall have the right to inspect any materials to be used in carrying out the terms of the contract.
- 10.2 The City does not assume any responsibility for the contracted quality and standard of all materials, equipment, components or completed work furnished under this contract.
- 10.3 Any materials, equipment, components or completed work which does not comply with contract specifications, MDOT, or state codes may be rejected by the City, and shall be replaced by the Contractor at no cost to the City.
- 10.4 Any materials, equipment or components rejected shall be removed within a reasonable period of time from the premises of the City at the entire expense of the Contractor after written notice has been mailed by the City to the Contractor that such materials, equipment or components have been rejected.

## **11. GUARANTEE**

The Contractor shall guarantee all of his/her work for a period of one (1) year following the date of final acceptance of the completed work and shall repair, replace or make good any materials or work which fail to function or perform or be found defective, without cost to the city.

## **12. SAFETY**

The Contractor shall comply with all applicable OSHA and MIOSHA regulations.

## **13. SPECIFICATIONS FOR CONSTRUCTION**

The items of work in this contract shall conform to the Michigan Department of Transportation (MDOT) 2020 Standard Specifications for Construction, MDOT Supplemental Specifications, and/or the City of Kalamazoo Standard Specifications unless superseded by a Special Provision contained in this document.

## **14. QUANTITIES**

The quantities shown on the Bid and Award pages are approximate only and may be subject to increase or decrease. No guarantee of maximum or minimum is given.

## **15. PRICE**

The unit price, including its pro rata share of overhead, multiplied by the quantity shown shall represent the total bid and shall be held firm for the life of this contract. Any bid not conforming to this requirement may be rejected as non-responsive. Special attention of all bidders is called to this provision since if conditions make it necessary to revise the quantities, no limit will be fixed for such increased or decreased quantities, nor extra compensation allowed; provided the net monetary value of all such additive and subtractive changes in quantities of such items of work, i.e., difference in cost, shall not increase or decrease the original contract price by more than twenty five (25) percent. Some items of work might be increased beyond the 25% limitations as spelled out previously, upon mutual agreement.

## **16. BASIS FOR PAYMENT**

Payment shall be based on the bid unit price for each work item and the approved constructed quantity for that work item. Due to potential differences in conditions between the plans and the field, final as built quantities may be different than contained in the bid document. The City does not guarantee quantities and will pay only for "as built" quantities approved by the Project Manager or his representative. Quantities in excess of those approved shall be at the Contractor's own expense, the City will not be responsible for excess quantities not approved. Should an item of work have to be redone, such as replacing new walk because the Contractor failed to adequately protect the wet concrete from rain or pedestrian or vehicular damage, such work shall be replaced at the Contractor's expense. Should changes in design result in the Project Manager directing the removal and reinstallation of already completed work prior to final completion and acceptance of the project, such removal and installation shall be paid for based on as-bid unit prices and the quantities removed and installed.

### **17. PAY ESTIMATES**

The Contractor shall be responsible for the generation of invoices for payment. Payment will be generated by the City based upon an approved invoice. Frequency of payment shall be monthly unless agreed to otherwise by the Project Manager, with the invoiced period ending on the last day of the month. However, if a different frequency is approved by the Project Manager, it shall not exceed bi-weekly invoicing.

### **18. PAYMENT TO CONTRACTOR**

The Project Manager will be responsible for approving all measured quantities of work. Once measured quantities are approved, the Contractor shall submit a pay invoice to the City of Kalamazoo Attn: Accounts Payable at 241 West South Street, Kalamazoo MI, 49007 or [apinvoice@kalamazoocity.org](mailto:apinvoice@kalamazoocity.org). The contractor is required to meet with the Project Manager to verify final constructed quantities within 60 days of project completion. In the event of a disagreement the Project Manager's measured quantities shall be considered final.

### **19. INSPECTION OF WORK**

The City may maintain inspectors on the job who shall, at all times, have access to work.

### **20. INSPECTION OF SITE**

Each bidder shall visit the site of the proposed work and fully acquaint himself/herself with the existing conditions relating to construction, labor, and shall fully inform himself/herself as to the facilities involved and the difficulties and restrictions attending the performance of this contract. The bidder shall thoroughly examine and become familiar with the drawings, specifications, and all other bid/contract documents. The Contractor, by the execution of this contract, shall in no way be relieved of any obligation under it due to his failure to receive or examine any form or legal instrument, or to visit the site and acquaint himself/herself with the conditions there existing. No allowance shall be made subsequently in this connection on behalf of the Contractor for any negligence of his/her part. For inspection call the Public Services Department, Wastewater Division.

### **21. LAYING OUT OF WORK**

Before submitting a bid, the Contractor shall verify all measurements and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of differences between actual dimensions and the measurements indicated on the drawings. Any difference that may be found shall be submitted to the City Engineer for consideration before proceeding.

### **22. SUPERVISION**

The Contractor shall employ an experienced superintendent or foreperson on the job at all times.

### **23. TARDINESS**

Construction delays resulting from tardiness on the part of the Contractor will be reviewed by the City in the event of any request for contract extension by the Contractor.

## **24. ADDITIONS**

Any modification to the contract shall be subject to prior approval by the Purchasing Agent. City Commission approval may also be required.

Prices for additional work required are not requested in the itemized listing contained herein for the base project. Should additional work be authorized, compensation shall be made on the basis of price or prices to be mutually agreed upon. Such additional work shall not begin until a Change Order has been approved.

## **25. INSPECTION AND TESTING**

The Contractor shall give the Project Manager timely notice of readiness of the work for all required inspections, tests or approvals, and shall cooperate with inspections and testing personnel to facilitate required inspections or tests.

## **26. QUESTIONS**

Bidders shall address questions regarding the specifications to Sohil Manjiyani, PE, Senior Civil Engineer at [manjiyanis@kalamazoo.org](mailto:manjiyanis@kalamazoo.org) and/or (269) 337-8595. (This does not relieve the requirements of Page 6, Item 3.) Questions regarding terms, conditions and other related bid requirements may be addressed to Craig Hull, Buyer, at (269) 337-8444.

## SECTION VII TERMS AND CONDITIONS

### 1. AWARD OF CONTRACT

- 1.1 This contract will be awarded to that responsible bidder whose bid, conforming to this solicitation, will be most advantageous to the City, price and other factors considered. The City reserves the right to accept or reject any or all bids and waive informalities and minor irregularities in bids received. Other factors include, as an example but not limited to, delivery time, conformance to specifications, incidental costs such as demurrage and deposits, etc.
- 1.2 Notification of award will be in writing by the Purchasing Manager. Upon notification, the Contractor shall submit to the Purchasing Division all required insurance certificates (if required) and such other documentation as may be requested or required hereunder. Upon their receipt and subsequent approval by the City, the Purchasing Manager will forward to the Contractor a written NOTICE TO PROCEED. Work shall NOT be started until such NOTICE TO PROCEED is received by the Contractor.
- 1.3 Unilateral changes in bid prices by the bidder shall not be allowed. However, the City, at its sole option, reserves the right to negotiate with bidders in the event of, but not limited to:
  - 1) No bids received;
  - 2) A single bid being received; or
  - 3) Prices quoted are over budget and/or unreasonable.

### 2. COMPLETE CONTRACT

This bid document together with its addenda, amendments, attachments and modifications, when executed, becomes the complete contract between the parties hereto, and no verbal or oral promises or representations made in conjunction with the negotiation of this contract shall be binding on either party.

### 3. SUBCONTRACTORS – NON-ASSIGNMENT

- 3.1 Bidders shall state in writing any and all sub-contractors to be associated with this bid, including the type of work to be performed. The Contractor shall cooperate with the City of Kalamazoo in meeting its commitments and goals with regard to maximum utilization of minority and women-owned business enterprises.
- 3.2 The Contractor hereby agrees and understands that the contract resulting from this solicitation shall not be transferred, assigned or sublet without prior written consent of the City of Kalamazoo.

### 4. TAXES

The City of Kalamazoo is exempt from all federal excise tax and state sales and use taxes.



## 5. INVOICING

All original invoice(s) will be sent to the Financial Services Division, 241 W. South Street, Kalamazoo, MI 49007 or via email at [apinvoice@kalamazoo-city.org](mailto:apinvoice@kalamazoo-city.org). The Finance Division processes payments after receipt of an original invoice from the Contractor and approval by the department. The City of Kalamazoo's policy is to pay invoice(s) within 30 days from the receipt of the original invoice, if the services or supplies are satisfactory and the proper paperwork and procedures have been followed. **In order to guarantee payment to the vendor on a timely basis, the vendor needs to receive a purchase order number before supplying the City of Kalamazoo with goods or services.** All original, and copies of original invoice(s), will clearly state which purchase order they are being billed against.

**The City of Kalamazoo is a government municipality and therefore is tax exempt from all sales tax.**

**The vendor is responsible for supplying the Finance Division with a copy of their W9 if they are providing a service to the City of Kalamazoo.**

## 6. PAYMENTS

- 6.1 Upon issuance of certificates of Payment by the Architect/Engineer for labor and material incorporated in the work and the materials suitably stored at the site payment shall be made up to ninety (90%) percent of the value thereof.
- 6.2 When the cumulative total of payment is equal to fifty (50%) percent of the contract sum, subsequent payments will be made in the full amount for labor and material certified by the Architect/Engineer.
- 6.3 The amount retained shall be held until final acceptance of the work, receipt of all payrolls, releases, and waiver of liens.

## 7. CHANGES AND/OR CONTRACT MODIFICATIONS

- 7.1 The City reserves the right to increase or decrease quantities, service or requirements, or make any changes necessary at any time during the term of this contract, or any negotiated extension thereof. Price adjustments due to any of the foregoing changes shall be negotiated and mutually agreed upon by the Contractor and the City.
- 7.2 Changes of any nature after contract award which reflect an increase or decrease in requirements or costs shall not be permitted without prior approval by the Purchasing Agent. City Commission approval may also be required.
- 7.3 ANY CHANGES PERFORMED IN ADVANCE OF PURCHASING AGENT APPROVAL, MAY BE SUBJECT TO DENIAL AND NON-PAYMENT.

## 8. LAWS, ORDINANCES, AND REGULATIONS

- 8.1 The Contractor shall keep himself/herself fully informed of all local, state and federal laws, ordinances and regulations in any manner affecting those engaged or employed in the work and the equipment used. Contractor and/or employees shall, at all times, serve and comply with such laws, ordinances and regulations.
- 8.2 Any permits, licenses, certificates, or fees required for the performance of the work shall be obtained and paid for by the Contractor.
- 8.3 This contract shall be governed by the laws of the State of Michigan.

## **9. RIGHT TO AUDIT**

The City or its designee shall be entitled to audit all of the Contractor's records, and shall be allowed to interview any of the Contractor's employees, throughout the term of this contract and for a period of three years after final payment or longer if required by law to the extent necessary to adequately permit evaluation and verification of:

- A. Contractor compliance with contract requirements,
- B. Compliance with provisions for pricing change orders, invoices or claims submitted by the Contractor or any of his payees.

## **10. HOLD HARMLESS**

If the negligent acts or omissions of the Contractor/Vendor or its employees, agents or officers, cause injury to person or property, the Contractor/Vendor shall indemnify and save harmless the City of Kalamazoo, its agents, officials, and employees against all claims, judgments, losses, damages, demands, and payments of any kind to persons or property to the extent occasioned from any claim or demand arising therefrom.

## **11. DEFAULT**

The City may at any time, by written notice to the Contractor, terminate this contract and the Contractor's right to proceed with the work, for just cause, which shall include, but is not limited to the following:

- A. Failure to provide insurance and bonds (when called for), in the exact amounts and within the time specified or any extension thereof.
- B. Failure to make delivery of the supplies, or to perform the services within the time specified herein, or any extension thereof.
- C. The unauthorized substitution of articles for those bid and specified.
- D. Failure to make progress if such failure endangers performance of the contract in accordance with its terms.
- E. Failure to perform in compliance with any provision of the contract.
- F. Standard of Performance
  - a. Contractor guarantees the performance of the commodities, goods or services rendered herein in accordance with the accepted standards of the industry or industries concerned herein, except that if this specification calls for higher standards, then such higher standards shall be provided.
  - b. Upon notice by the City of Contractor's failure to comply with such standards or to otherwise be in default of this contract in any manner following the Notice to Proceed, Contractor shall immediately remedy said defective performance in a manner acceptable to the City. Should Contractor fail to immediately correct said defective performance, said failure shall be considered a breach of this contract and grounds for termination of the same by the City.
  - c. In the event of any breach of this contract by Contractor, Contractor shall pay any cost to the City caused by said breach including but not limited to the replacement cost of such goods or services with another Contractor.
  - d. The City reserves the right to withhold any or all payments until any defects in performance have been satisfactorily corrected.
  - e. In the event the Contractor is in breach of this contract in any manner, and such breach has not been satisfactorily corrected, the City may bar the Contractor from being awarded any future City contracts.

- G. All remedies available to the City herein are cumulative and the election of one remedy by the City shall not be a waiver of any other remedy available to the City.

## **12. TERMINATION OF CONTRACT**

The City may, at any time and without cause, suspend the work of this contract for a period of not more than ninety days after providing notice in writing to the Contractor. The Contractor shall be allowed an adjustment in the contract price or an extension of the contract times, or both, directly attributable to the suspension if Contractor makes an approved claim.

The City may, without prejudice to any other right or remedy of the City, and with or without cause, terminate the contract by giving seven days written notice to the Contractor. In such case the Contractor shall be paid, without duplication, for the following items:

- A. Completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such work;
- B. Expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the contract documents in connection with uncompleted work, plus fair and reasonable sums for overhead and profit on such expenses;
- C. All documented claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and
- D. Reasonable expenses directly attributable to termination.

The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

## **13. INDEPENDENT CONTRACTOR**

At all times, the Contractor, any of his/her employees, or his/her sub-contractors and their subsequent employees shall be considered independent contractors and not as City employees. The Contractor shall exercise all supervisory control and general control over all workers' duties, payment of wages to Contractor's employees and the right to hire, fire and discipline their employees and workers. As an independent contractor, payment under this contract shall not be subject to any withholding for tax, social security or other purposes, nor shall the Contractor or his/her employees be entitled to sick leave, pension benefit, vacation, medical benefits, life insurance or workers' unemployment compensation or the like.

## **14. PROJECT SUPERVISOR**

The Contractor shall employ an individual to act as Project Supervisor. The Project Supervisor shall be available to the Contractor's workers and the Project Manager at all times by use of a mobile phone or other reliable means. The Project Supervisor shall prepare daily work plans for the employees, monitor employee performance, attendance and punctuality; and work closely with the City's Project Manager in assuring contract compliance.

## **15. MEETINGS**

The Contractor and/or Project Supervisor shall be available to meet with the Department Head or Project Manager at a mutually agreeable time to discuss problems, issues or concerns relative to the contract. Either party may call a meeting at any time. When such a request for a meeting is made, the meeting date shall, in no case exceed five (5) working days after the request; and, if in the sole opinion of the Department Head, the severity of the circumstance warrants, no more than one (1) working day.

## **16. INSPECTION OF WORKSITE**

Before submitting bids or quotes for work, the Contractor shall be responsible for examining the work site and satisfying himself/herself as to the existing conditions under which he/she will be obligated to operate, or that in any way affects the work under this contract. No allowance shall be made subsequently, in behalf of the Contractor, for any negligence on his/her part.

## **17. CONTRACT PERIOD, EXTENSIONS, CANCELLATION**

- 17.1 The contract shall be in effect for the term stated in the specifications.
- 17.2 The City may opt to extend this contract upon mutual agreement of both parties. The number of extensions shall be limited to that stated in the specifications.
- 17.3 The City may, from time to time, find it necessary to continue this contract on a month-to-month basis only, not to exceed a six (6) month period. Such month-to-month extended periods shall be by mutual agreement of both parties, with all provisions of the original contract or any extension thereof remaining in full force and effect.
- 17.4 All contracts, extensions and cost increases are subject to availability of funds and the approval of the City Commission (if required).
- 17.5 The City reserves the right to cancel the contract due to non-appropriation of funds by the City with thirty (30) days written notice.
- 17.6 Either party may terminate the contract (or any extension thereof) without cause at the end of any twelve (12) month term by giving written notice of such intent at least 60 days prior to the end of said twelve (12) month term.
- 17.7 All notices are in effect commencing with the date of mailing. Written notices may be delivered in person or sent by First Class mail; faxed or emailed to the last known address.
- 17.8 If cancellation is for default of contract due to non-performance, the contract may be canceled at any time (see Item 11, DEFAULT).

**APPENDIX A  
NON-DISCRIMINATION CLAUSE FOR ALL CITY OF  
KALAMAZOO CONTRACTS**

The Contractor agrees to comply with the Federal Civil Rights Act of 1964 as amended; the Federal Civil Rights Act of 1991 as amended; the Americans With Disabilities Act of 1990 as amended; the Elliott-Larson Civil Rights Act, Act. No. 453, Public Act of 1976 as amended; the Michigan Handicappers Civil Rights Act, Act No. 220, Public Act of 1976 as amended, City Ordinance 1856 and all other applicable Federal and State laws. The Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, sex, age, height, weight, marital status, physical or mental disability, family status, sexual orientation or gender identity that is unrelated to the individual's ability to perform the duties of the particular job or position. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment advertising, layoff or termination; rates of pay or other forms of compensations; and selection for training, including apprenticeship.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, sex, age, height, weight, marital status, physical or mental disability family status, sexual orientation or gender identity that is unrelated to the individual's ability to perform the duties of the particular job or position.
3. If requested by the City, the Contractor shall furnish information regarding practices, policies and programs and employment statistics for the Contractor and subcontractors. The Contractor and subcontractors shall permit access to all books, records and accounts regarding employment practices by agents and representatives of the City duly charged with investigative duties to assure compliance with this clause.
4. Breach of the covenants herein may be regarded as a material breach of the contract or purchasing agreement as provided in the Elliott-Larsen Civil Rights Act and City Ordinance 1856.
5. The Contractor will include or incorporate by reference the provisions of the foregoing paragraphs 1 through 4 in every subcontract or purchase order unless exempted by the rules, regulations or orders of the Michigan Civil Rights Commission\* and will provide in every subcontract or purchase order that said provision will be binding upon each subcontractor or seller.
6. The Contractor will not preclude a person with a criminal conviction from being considered for employment unless otherwise precluded by federal or state law. (for contracts over \$25,000)

The Elliott-Larson Civil Rights Act, Sec. 202 of Act. No. 453 of 1976 reads in part as follows:

Sec. 202. (1) An employer shall not:

- (a) Fail or refuse to hire, or recruit, or discharge or otherwise discriminate against an individual with respect to employment, compensation, or a term condition or privilege of employment because of religion, race, color, national origin, age, sex, height, weight or marital status.
- (b) Limit, segregate or classify an employee or applicant for employment in a way which deprives or tends to deprive the employee or applicant of an employment opportunity or otherwise adversely affects the status of an employee or applicant because of religion, race, color, national origin, age, sex, height, weight or marital status.
- (c) Segregate, classify or otherwise discriminate against a person on the basis of sex with respect to a term, condition or privilege of employment, including a benefit plan or system.

\* Except for contracts entered into with parties employing less than three employees.  
1-2010

## APPENDIX B PREVAILING WAGES

Prevailing wages are applicable to this contract, therefore, rates will apply as follows:

(XX) Project is funded by City of Kalamazoo monies and is estimated to be in excess of \$100,000.00. The applicable prevailing wage rates are attached.

Specifications for projects in which the City of Kalamazoo is party for construction, alterations and/or repair including painting and decorating of public buildings or public works in or for the City of Kalamazoo and which requires or involves the employment of mechanics and/or laborers shall contain the following provisions stating the minimum wages to be paid the various classes of laborers and mechanics for the project. Prevailing wage rates determined by the U.S. Department of Labor under Davis Bacon and related acts will be used for City of Kalamazoo construction projects.

By the incorporation of prevailing wage rates within this specification, the City of Kalamazoo stipulates that:

- ✓ Contractor or his/her subcontractor shall pay all mechanics and laborers employed directly upon the site of the work, unconditionally and not less than once a week and without subsequent deduction or rebate on any account the full amount, accrued at the time of payment, computed at wage rates as incorporated herein regardless of any contractual relationship which may be alleged to exist between the contractor or subcontractor and such laborers and mechanics;
- ✓ The scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work;
- ✓ The Prime Contractor and all subcontractors shall submit weekly certified payrolls documenting the hours worked and wages paid by work classification. NOTE: Contactor shall not include Social Security numbers of employees on certified payrolls.
- ✓ There may be withheld from the contractor's accrued payments the amount considered necessary by the City's Contracting Official to pay to laborers and mechanics employed by the contractor or any subcontractor on the work for the difference between the rates of wages required by the contract and the rates of wages received by such laborers and mechanics except those amounts properly deducted or refunded pursuant to the terms of the Davis-Bacon Act (USC, Title 40, Sec. 276a) and interpretations thereof.

Special Note: The City's requirements as it relates to prevailing wages includes a meeting with the City's Purchasing Agent prior to starting work and the submission of weekly certified payrolls by prime contractors and all subcontractors. The City will monitor certified payrolls, work progress, and conduct interviews with the mechanics and labors employed directly upon the site during the duration of the contract Please contact the Purchasing Department at (269) 337-8020 if you have any questions regarding prevailing wage provision.

The overtime pay to which a laborer or mechanic is entitled under this contract shall be that overtime pay to which he/she is entitled by any agreement made with the contractor or subcontractor or by any applicable provision of law; but in no event shall such amount be less than the prevailing wage in the Kalamazoo community for such overtime.

Revised 4-08



***PREVAILING WAGE RATES***

**GPI EFFLUENT SEWER  
REALIGNMENT**

**Bid Reference #: 91345-004.0**

**MAY 2023**



"General Decision Number: MI20230061 02/17/2023

Superseded General Decision Number: MI20220061

State: Michigan

Construction Type: Heavy

County: Kalamazoo County in Michigan.

Heavy, Includes Water, Sewer Lines and Excavation (Excludes Hazardous Waste Removal; Coal, Oil, Gas, Duct and other similar Pipeline Construction)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<p>. Executive Order 14026 generally applies to the contract.</p> <p>. The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.</p>
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<p>. Executive Order 13658 generally applies to the contract.</p> <p>. The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.</p>

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number      Publication Date  
 0                              01/06/2023

1 02/03/2023  
2 02/17/2023

CARP0525-006 06/01/2021

	Rates	Fringes
CARPENTER, Includes Form Work....	\$ 25.94	20.59

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ELEC0131-006 06/01/2022

	Rates	Fringes
ELECTRICIAN.....	\$ 37.66	8.95+27%

-----  
ENGI0325-009 09/01/2022

POWER EQUIPMENT OPERATORS: Underground Construction (Including Sewer)

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 37.67	24.85
GROUP 2.....	\$ 32.78	24.85
GROUP 3.....	\$ 32.28	24.85
GROUP 4.....	\$ 32.00	24.85

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Backhoe/ Excavator, Boring Machine, Bulldozer, Crane, Grader/ Blade, Loader, Roller, Scraper, Trencher (over 8 ft. digging capacity)

GROUP 2: Trencher (8-ft digging capacity and smaller)

GROUP 3: Boom Truck (non-swinging, non- powered type boom)

GROUP 4: Broom/ Sweeper, Fork Truck, Tractor, Bobcat/ Skid Steer /Skid Loader

-----  
ENGI0326-025 06/01/2022

EXCLUDES UNDERGROUND CONSTRUCTION

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	\$ 44.13	24.85
GROUP 2.....	\$ 40.83	24.85
GROUP 3.....	\$ 38.18	24.85
GROUP 4.....	\$ 36.47	24.85
GROUP 5.....	\$ 36.47	24.85
GROUP 6.....	\$ 30.61	24.85
GROUP 7.....	\$ 28.13	24.85

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Backhoe/Excavator; Boring Machine; Bulldozer; Crane; Grader/Blade; Loader; Roller; Scraper; Tractor; Trencher

GROUP 4: Bobcat/Skid Loader; Broom/Sweeper; Fork Truck (over 20' lift)

GROUP 5: Boom truck (non-swinging)

GROUP 6: Fork Truck (20' lift and under for masonry work)

GROUP 7: Oiler

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: \$1.50 per hour above the group 1 rate.

Crane operator with main boom and jib 400' or longer: \$3.00 per hour above the group 1 rate.

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IRON0025-011 06/01/2022

	Rates	Fringes
IRONWORKER (REINFORCING).....	\$ 31.43	34.77
IRONWORKER (STRUCTURAL).....	\$ 34.50	38.44

-----  
\* LABO0334-011 09/01/2022

SCOPE OF WORK:

OPEN CUT CONSTRUCTION: Excavation of earth and sewer, utilities, and improvements, including underground piping/conduit (including inspection, cleaning, restoration, and relining)

	Rates	Fringes
LABORER		
(1) Common or General.....	\$ 22.42	12.95
(2) Mason Tender- Cement/Concrete.....	\$ 22.55	12.95
(4) Grade Checker.....	\$ 22.73	12.95
(5) Pipelayer.....	\$ 22.85	12.95

-----  
LABO0355-010 06/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

	Rates	Fringes
LABORER		
Common or General; Grade Checker; Mason Tender - Cement/Concrete.....	\$ 26.70	12.95
Pipelayer.....	\$ 20.34	12.85

-----  
PAIN0312-014 06/12/2014

	Rates	Fringes
PAINTER		
Brush & Roller.....	\$ 21.75	11.94
Spray.....	\$ 22.75	11.94

-----  
PLAS0016-020 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 22.31	12.83

-----  
\* PLUM0333-026 06/01/2022

Fort Custer

	Rates	Fringes
PLUMBER.....	\$ 42.29	23.94

-----  
PLUM0357-012 07/01/2020

Excluding Fort Custer

	Rates	Fringes
PLUMBER.....	\$ 35.20	22.35

-----  
TEAM0007-011 06/01/2020

	Rates	Fringes
TRUCK DRIVER		
Lowboy/Semi-Trailer Truck...	\$ 28.05	.50 + a+b
Tractor Haul Truck.....	\$ 27.80	.50 + a+b

FOOTNOTE:

- a. \$470.70 per week.
- b. \$68.70 daily.

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\* SUMI2010-059 11/09/2010

	Rates	Fringes
LABORER: Landscape.....	\$ 12.25 **	0.00
TRUCK DRIVER: Dump Truck.....	\$ 18.00	6.43
TRUCK DRIVER: Off the Road Truck.....	\$ 20.82	3.69

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.  
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\*\* Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$16.20) or 13658 (\$12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

#### Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates

the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

#### Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor

200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

**APPENDIX C  
TECHNICAL SPECIFICATIONS**



**THE CITY OF KALAMAZOO  
DEPARTMENT OF PUBLIC SERVICES  
WASTEWATER DIVISION**

**TECHNICAL SPECIFICATIONS**

**GPI EFFLUENT SEWER  
REALIGNMENT**

**Bid Reference #: 91345-004.0**



# Technical Specifications

## Kalamazoo/GPI Effluent Sewer Realignment



City of Kalamazoo

2023



**Jones & Henry**  
ENGINEERS, LTD.



4791 Campus Drive  
Kalamazoo, MI 49008  
269.353.9650

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017-7982.001  
05/2023

Issue for Bid  
Kalamazoo, MI  
Kalamazoo/GPI Effluent Sewer Realignment

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**APPENDICES**

City of Kalamazoo - Standard Specifications for Water Main and Service Installation 2020

City of Kalamazoo - Standard Specifications for Wastewater Sewer Installation 2012

The *City of Kalamazoo - Standard Specifications for Water Main and Service Installation 2020* and the *City of Kalamazoo - Standard Specifications for Wastewater Sewer Installation 2012* shall supersede these Technical Specifications where conflicting information occurs.

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

END OF SECTION

**SECTION 01010**  
**DEFINITION OF CONTRACT ITEMS**

**PART 1 GENERAL**

**1.01 FOREWORD**

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

**1.02 WORK INCLUDED**

- A. Under each Item the Contractor shall furnish all labor, materials, tools, equipment, supplies, maintenance of equipment, heating, lighting and power, insurance and bonds, coordination, and all Work and in accordance with the Specifications Divisions 1 through 16 and the City of Kalamazoo *Standard Specifications for Wastewater Sewer Installation 2012* necessary to complete the Work in accordance with the obvious or expressed intent of the Contract Documents.

**1.03 WORKMANSHIP AND MATERIALS**

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

**1.04 PAYMENT**

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

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

**PART 4 SPECIAL PROVISIONS**

**4.01 CONTRACT ITEMS**

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

**ITEM 1**  
**GENERAL CONDITIONS/MOBILIZATION**

**1.01 DESCRIPTION**

- A. This Item is intended to pay non-recurring cost to the Contractor not recovered under other pay Items of the Contract.
- B. This Item shall include, but not be limited to, the cost for moving equipment in and out, performance and payment bonds, insurance, permits, utility connection cost, and other expenses associated with preparation for construction in accordance with the requirements of the Contract Documents.

**1.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**1.03 DEFINITION OF ITEM**

- A. Item 1 - Includes General Conditions/Mobilization.

**1.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 1.
- B. Mobilization for Contractor and any tier of subcontractor(s) shall be considered collectively and shall not exceed 10 percent of the Contract Price.
- C. Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup and demobilization. Mobilization does not include items such as contract negotiations and bid preparation.

**1.05 PAYMENT**

- A. General Conditions/Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup and demobilization.
- B. The Engineer may reduce the amount to be paid under Item 1 if the percentage requested is not represented by the actual amount performed.

**ITEM 2**  
**AUDIO/VIDEO RECORDING**

**2.01 DESCRIPTION**

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

**2.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**2.03 DEFINITION OF ITEMS**

- A. Item 2 – Audio/Video Recording includes audio-video recording of the Zone of Influence (Construction Limits).

**2.04 MEASUREMENT**

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

**2.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 2 shall be full compensation for audio-video recording production as specified and required.

**ITEM 3**  
**TREE AND STUMP REMOVAL 6 INCHES TO 18 INCHES**

**3.01 DESCRIPTION**

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

**3.02 WORK NOT INCLUDED**

- A. Any work specifically included under other Bid Items.

**3.03 DEFINITION OF ITEMS**

- A. Item 3 – Tree and Stump Removal, shall be the cutting of trees with trunk diameter greater than 6 inches to 18 inches, including the removal of tree cuttings and stumps.

**3.04 MEASUREMENT**

- A. The quantities to be paid for under Item 3 - Tree and Stump Removal shall be measured by the quantity of trees with trunk of specified diameter measured 4 feet above ground height removed.

**3.05 PAYMENT**

- A. The unit price stated in the bid for Item 3 – Tree and Stump, Rem, 6-inch to 18-inch shall be full compensation for each tree removed and disposed of as specified and required.

**ITEM 4  
CLEARING & GRUBBING**

**4.01 DESCRIPTION**

- A. This Item shall include all clearing and grubbing of lands required to complete the Work as specified, shown in the Contract Documents, and as directed by the Engineer. This Work shall include, but not limited to, the complete removal and cutting of trees including stumps regardless of the size to install the new storm sewer. Clearing and grubbing includes the complete removal and disposal of all vegetation including plants, shrubs, generated by the clearing and grubbing operation as specified and shown on the Drawings.

**4.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**4.03 DEFINITION OF ITEMS**

- A. Item 4 - Clearing and Grubbing includes the complete removal and disposal of all trees stumps and vegetation including plants, shrubs, generated by the clearing and grubbing operation.
  - 1. The wood generated by the clearing and grubbing operations shall become the property of the contractor to properly dispose of offsite.

**4.04 MEASUREMENT**

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

**4.05 PAYMENT**

- A. The unit price stated in the Bid for Item 4 shall be full compensation for each acre of clearing and grubbing within the prescribed limits as specified, so measured.

**ITEM 5  
RECONSTRUCT INDUSTRIAL DIVERSION CHAMBER NO. 1**

**5.01 DESCRIPTION**

- A. Under this item, the Contractor shall remove the existing electrical shed including its foundation, remove and replace the existing manhole steps outside the chamber, remove the existing slide gate and actuator, remove any necessary piping inside the structure, remove the diamond plat cover doors on top of the structure, infill the holes on top of the structure, install the new floor door with fall protection and new manhole steps inside the reconstructed structure.
- B. Bulkheading the existing 54" sewer and 12" vent pipe in the diversion chamber, install the new concrete sidewalk pad at the base of the new ladder, the new aluminum ladder section, railing, and two rail gate, install epoxy dowels and fill the structure with concrete as shown on the plans, install the new weir gate and weir gate actuator, connecting the new sewer to Industrial Diversion Chamber No. 1, constructing a new flow channel inside Industrial Diversion Chamber No. 1. The work also includes all electrical work including connecting to the 480V feeder breaker PC-00 inside the pilot building, removing the existing junction box, splicing the cables using an underground splice box and extending the conduit and wire to the new tap box, attaching conduits to the wall of the structure, connecting the existing light pole, installing the electrical equipment indicated on the electrical rack detail, and connecting the new weir gate actuator as shown on the plans.

**5.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**5.03 DEFINITION OF ITEMS**

- A. Item 5 – Remove and Reconstruct Industrial Diversion Chamber No. 1

**5.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 5 and as shown on the plans.



**5.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 5 shall be full compensation for remove and reconstruct Industrial Diversion Chamber No. 1 as specified and required, as shown on the plan drawings.

**ITEM 6  
REMOVE, FILL, AND ABANDON EXISTING JUNCTION CHAMBER**

**6.01 DESCRIPTION**

- A. Under this item, the Contractor shall brick off the existing 54" and 36" sewers in the Junction Chamber, fill the entire structure above the pipe crowns with MDOT flowable fill, fill the abandoned structure above the flowable fill with MDOT Class II sand, cut and cap the existing drain pipe, remove and salvage the existing valve operator for the City of Kalamazoo, saw cut the pavement around the existing structure, remove the top section of the structure 3 feet below grade, and restore the pavement surface in kind around the existing junction chamber upon completion of the removals.

**6.02 WORK NOT INCLUDED**

- A. Pavement damaged or destroyed beyond the specified limits shall be replaced at the Contractor's expense.
- B. Any Work specifically included under other Bid Items.

**6.03 DEFINITION OF ITEMS**

- A. Item 6 – Remove, Fill, Abandon Existing Junction Chamber.

**6.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 6.

**6.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 6 shall be full compensation for remove Fill and Abandon existing Junction chamber as specified and required, as shown on the plan drawings.

**ITEM 7**  
**RECONSTRUCT PARSHALL FLUME STRUCTURE**

**7.01 DESCRIPTION**

- A. Under this item, the Contractor shall perform all work necessary to remove the existing Parshall Flume and surrounding concrete to anchor, grout and install a new Fiberglass Parshall Flume with a new flow meter. Work includes coring and connecting the proposed 24" Ductile Iron sanitary sewer with a flexible boot to the existing Parshall Flume Structure, bricking off and plastering the existing 36" sanitary sewer exiting the structure, installing concrete around the 90-degree bend and 24-inch vertical pipe, forming the 24-inch diameter snout as shown on the plans. Work also includes coring and plastering the structure for the installation of the 12" vertical vent pipe as shown on the plans.

**7.02 WORK NOT INCLUDED**

- A. Pavement damaged or destroyed beyond the specified limits shall be replaced at the Contractor's expense.
- B. Piping items included under other Bid items.
- C. Any Work specifically included under other Bid Items.

**7.03 DEFINITION OF ITEMS**

- A. Item 7 – Reconstruct Parshall Flume Structure.

**7.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 7.

**7.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 7 shall be full compensation for all work necessary to Reconstruct the Parshall Flume Structure as specified, required, and as shown on the plans.

**ITEM 8**  
**METER VAULT**

**8.01 DESCRIPTION**

- A. Under this item, the Contractor shall furnish and install a 6' x 8' Meter Vault with a 24-inch Krohne Tidalux 2300 flow meter, 120V sump pump and a 1.5" sump pump discharge

line to the existing Industrial Diversion Chamber No. 1. The work includes all piping inside the meter vault, a 4-inch diameter vent stack with bug screen, core & link the sump pump discharge line into the meter vault, installing a 5' x 6' floor door in the meter vault with fall protection with manhole steps to the bottom of the structure.

- B. The work also includes all electrical work for meter power, sump pump power, alarm float, flow meter signal, and conduit to the new meter vault, as shown on the plans.

#### **8.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

#### **8.03 DEFINITION OF ITEMS**

- A. Item 8 – Meter Vault.

#### **8.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 8 and as shown on the plans.

#### **8.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 8 shall be full compensation for installing a fully functioning meter vault as specified and required, as shown on the plan drawings.

### **ITEM 9 STORM MANHOLES**

#### **9.01 DESCRIPTION**

- A. Under these Items, the Contractor shall construct manholes and drops in locations and of types shown and scheduled on the Drawings and in accordance with the Contract Documents.
- B. The modification and connection of existing drop sewers to connect new sewers to existing manholes shall be included under these Items.
- C. Work beyond the specified pay limits for the pipe trench, but necessary for the placement of the manholes, shall be included under this Item. Such Work shall include excavation of any material encountered, special backfill material, and pavement replacement.
- D. The temporary support of utilities as required to complete the Work, shall be included under these Items.

- E. The construction of shafts as needed to complete the Work is included under these Items.
- F. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under these Items.

**9.02 WORK NOT INCLUDED**

- A. Replacement of existing manholes or catch basins removed or damaged for Contractor convenience of construction and which were not planned to be removed shall be done at the Contractor's expense.
- B. The furnishing and placing of special backfill in areas specified under Section 02200, is included under other Items.

**9.03 DEFINITION OF ITEMS**

- A. Item 9 - Includes Type II Storm Sewer Manholes.

**9.04 MEASUREMENT**

- A. The quantities to be paid for under Item 8 shall be for each structure installed.

**9.05 PAYMENT**

- A. The unit price stated in the Bid for Item 9 shall be full compensation for each manhole complete as specified, so measured.

**ITEMS 10 AND 11  
30" HDPE STORM SEWER AND 30" CONCRETE OUTLET HEADWALL**

**10.01 DESCRIPTION**

- A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of the Outlet Headwall as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.
- B. These Items shall include all Work under the Contract unless specifically included for payment under other Items.
- C. These Items shall include all work to install the outlet headwall, including but not limited to the following: excavation; removal and replacement of fences including fabric and posts; hauling excess spoil material from Site; all necessary backfill; compaction; bedding; pipe materials including any necessary concrete encasement as shown on the plans; fittings; connections to sewers or manholes; construction maintenance and removal of temporary access to the Work area; and related Work such as performing material testing; deflection and infiltration tests.

- D. Connections of new sewers to the new headwall shall be included under this item.
- E. Sewer tap connection, for existing or new sewer pipe, to the new sewer shall be included under these Items.
- F. Maintaining existing sewers in operation and temporary flow stoppage, diversions and sewer flow by-pass connections shall be included under these Items.
- G. All Work required to dewater trenches is included under these Items.
- H. Temporary supporting existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer construction is included under these Items.
- I. Vertical pipe sections and riser pipes shall be included under these Items.
- J. No additional compensation shall be considered for sewers installed within 2 feet of the elevation shown on the Drawings.
- K. The placement, compaction and grading of fill required for backfilling drainage ways enclosed in pipes is included under this Item.

#### **10.02 WORK NOT INCLUDED**

- A. Pavement replacement within the Contract limits is included under other Items.
- B. Closed circuit television inspection of new sewers 8-inches in diameter and larger installed as part of the Work are included under other Items.
- C. Sewers installed to convey sewage around or through the Work during construction will not be measured for payment.
- D. Damage to existing utilities shall be the responsibility of the Contractor.
- E. The furnishing and placing of special backfill in areas specified under Section 02200, is included under other Items.

#### **10.03 DEFINITION OF ITEMS**

- A. Item 10 – Includes 30-inch HDPE Storm Sewer, All Depths.
- B. Item 11 – Includes 30-inch Concrete Storm Sewer Outlet Headwall

#### **10.04 MEASUREMENT**

- A. The quantities to be paid under Items 10 and 11 shall be the horizontal length of pipe measured parallel to the axis of the line along the surface of the ground, with no deduction for laying length of fittings for the specified sizes and trench detail. The quantity paid for in Item 11 shall be for each 30-inch Concrete Storm Sewer Outlet Headwall.

**10.05 PAYMENT**

- A. The unit prices stated in the Bid for Items 10 and 11 shall be full compensation for each linear foot of pipe of the sizes furnished and installed as specified, so measured. The unit prices stated in the Bid for Item 11 shall be full compensation for each Outlet Headwall installed.

**ITEM 12  
6"-12" RIP RAP**

**12.01 DESCRIPTION**

- A. Under this Item, the Contractor shall perform all Work necessary to install 6"-12" Rip Rap stones with filter fabric as specified and shown on the Drawings.
- B. This Item shall include the excavation grading and removal of excess spoil material for the installation on the proposed Rip Rap as specified and shown on the Drawings.

**12.02 WORK NOT INCLUDED**

- A. Any work specifically included under other Bid Items.

**12.03 DEFINITION OF ITEMS**

- A. Item 12 – shall include all Work necessary to install 6"-12" Rip Rap stones with filter fabric as specified and shown on the Drawings.

**12.04 MEASUREMENT**

- A. The quantities to be paid for under Item 12 shall be measured for each square yard of Rip Rap installed.

**12.05 PAYMENT**

- A. The unit price stated in the bid for Item 12 shall be full compensation for square yard of 6"-12" Rip Rap installed as specified and required.

**ITEMS 13 THROUGH 28  
SANITARY SEWERS**

**13.01 DESCRIPTION**

- A. Under these Items, the Contractor shall perform all Work necessary for the installation of the sewer pipe as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications. Due to current supply chain issues in

obtaining ductile iron pipe, fittings, and hardware, the City of Kalamazoo already purchased material items 13-28 including all gasket kits, mega-lugs, and stainless steel hardware necessary to construct the sewer pipe line.

- B. These Items shall include all Work under the Contract unless specifically included for payment under other Items.
- C. These Items shall include all Work to install the sewers, including but not limited to the following: excavation; removal and replacement of fences including fabric and posts; hauling excess spoil material from Site; all necessary backfill; compaction; bedding; pipe materials including any necessary concrete encasement as shown on plan SA-1.1; fittings; connections to existing sewers or manholes; construction maintenance and removal of temporary access to the Work area; and related Work such as performing material testing; deflection and infiltration tests.
- D. Connections of new sewers to new and existing manholes or to new and existing sewers shall be included under these Items, unless specifically included under other items.
- E. Sewer tap connection, for existing or new sewer pipe, to the new sewer shall be included under these Items.
- F. Maintaining existing sewers in operation and temporary flow stoppage, diversions and sewer flow by-pass connections shall be included under these Items.
- G. All Work required to dewater trenches is included under these Items.
- H. Temporary supporting existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer construction is included under these Items.
- I. Vertical pipe sections and riser pipes shall be included under these Items.
- J. No additional compensation shall be considered for sewers installed within 2 feet of the elevation shown on the Drawings.
- K. The placement, compaction and grading of fill required for backfilling drainage ways enclosed in pipes is included under this Item.

### **13.02 WORK NOT INCLUDED**

- A. Pavement replacement within the Contract limits is included under other Items.
- B. Closed circuit television inspection of new sewers 8-inches in diameter and larger installed as part of the Work are included under other Items.
- C. Sewers installed to convey sewage around or through the Work during construction will not be measured for payment.
- D. Damage to existing utilities shall be the responsibility of the Contractor.
- E. The furnishing and placing of special backfill in areas specified under Section 02200, is included under other Items.

### 13.03 DEFINITION OF ITEMS

- A. Item 13 – Includes 12-inch Class 52 Ductile Iron Sanitary Sewer (Labor Only)
- B. Item 14 – Includes 24-inch Class 52 Ductile Iron Sanitary Sewer (Labor Only)
- C. Item 15 – Includes 24-inch Class 52 Ductile Iron Flanged Tee (Labor Only)
- D. Item 16 - Includes 24-inch x 12-inch Class 52 Ductile Iron MJ Tee (Labor Only)
- E. Item 17 - Includes 24-inch Class 52 Ductile Iron Blind Flange (Labor Only)
- F. Item 18 - Includes 24-inch Class 52 Ductile Iron Flanged 45 Degree Bend (Labor Only)
- G. Item 19 - Includes 24-inch Class 52 Ductile Iron Flanged 11.25 Degree Bend (Labor Only)
- H. Item 20 – Includes 24-inch Class 52 Ductile Iron Flanged 22.5 Degree Bend (Labor Only)
- I. Item 21 – Includes 24-inch Mega-Flange Adapter (Labor Only)
- J. Item 22 – 24-inch Nut & Bolt Gasket Set (NLA 24 304 SS 150# RR FF 1/8 FLG P) (Labor Only)
- K. Item 23 – Includes 24-inch Class 52 Ductile Iron Mechanical Joint 90 Degree Bend (labor Only)
- L. Item 24 – Includes 24-inch Mega-lug F/DI (Labor Only)
- M. Item 25 – Includes 24-inch MJ Bolt & Gasket Package Less Gland (Labor Only)
- N. Item 26 – Includes 12-inch Mega-lug F/DI (Labor Only)
- O. Item 27 – Includes 12-inch MJ Bolt & Gasket Package Less Gland (Labor Only)
- P. Item 28 – Includes 12-inch Class 52 Ductile Iron Mechanical Joint 90 Degree Bend (Labor Only)

### 13.04 MEASUREMENT

- A. The quantities to be paid under Items 13 and 14 shall be the horizontal length of pipe installed measured parallel to the axis of the line along the surface of the ground installed for the specified sizes and trench detail. (Labor Only)
- B. The quantities to be paid under Item 15 shall be the measured quantity of each 24-inch Class 52 Ductile Iron Flanged Tee installed. The City of Kalamazoo has already purchased the tee. (Labor Only)
- C. The quantities to be paid under Item 16 shall be the measured quantity of each 24-inch x 12-inch Class 52 Ductile Iron Mechanical Joint Tee installed. The City of Kalamazoo has already purchased the tee. (Labor Only)
- D. The quantities to be paid under Item 17 shall be the measured quantity of each 24-inch Class 52 Ductile Iron Blind Flange installed. The City of Kalamazoo has already purchased the blind flanges. (Labor Only)



- E. The quantities to be paid under Item 18 shall be the measured quantity of each 24-inch Class 52 Ductile Iron Flanged 45 Degree Bend installed. The City of Kalamazoo has already purchased the bend. (Labor Only)
- F. The quantities to be paid under Item 19 shall be the measured quantity of each 24-inch Class 52 Ductile Iron Flanged 11.25 Degree Bend installed. The City of Kalamazoo has already purchased the bend. (Labor Only)
- G. The quantities to be paid under Item 20 shall be the measured quantity of each 24-inch Class 52 Ductile Iron Flanged 22.5 Degree Bend installed. The City of Kalamazoo has already purchased the bend. (Labor Only)
- H. The quantities to be paid under Item 21 shall be the measured quantity of each 24-inch Mega-Flange Adapter installed. The City of Kalamazoo has already purchased the adapter. (Labor Only)
- I. The quantities to be paid under Item 22 shall be the measured quantity of each 24-inch Nut & Bolt Gasket Set installed. The City of Kalamazoo has already purchased the nut & bolt gasket set. (Labor Only)
- J. The quantities to be paid under Item 23 shall be the measured quantity of each 24-inch Class 52 Ductile Iron Mechanical Joint 90 Degree Bend installed. The City of Kalamazoo has already purchased the bend. (Labor Only)
- K. The quantities to be paid under Item 24 shall be the measured quantity of each 24-inch Mega-lug installed. The City of Kalamazoo has already purchased the Mega-lug. (Labor Only)
- L. The quantities to be paid under Item 25 shall be the measured quantity of each 24-inch Mechanical Joint Bolt & Gasket Package installed. The City of Kalamazoo has already purchased the Bolt & Gasket Package. (Labor Only)
- M. The quantities to be paid under Item 26 shall be the measured quantity of each 12-inch Mega-lug installed. The City of Kalamazoo has already purchased the Mega-lug.
- N. The quantities to be paid under Item 27 shall be the measured quantity of each 12-inch Mechanical Joint Bolt & Gasket Package installed. The City of Kalamazoo has already purchased the Bolt & Gasket Package. (Labor Only)
- O. The quantities to be paid under Item 28 shall be the measured quantity of each 12-inch Class 52 Ductile Iron Mechanical Joint 90 Degree Bend installed. The City of Kalamazoo has already purchased the bend. (Labor Only)

### 13.05 PAYMENT

- A. The unit prices stated in the Bid for Items 13 and 14 shall be full compensation (Labor Only) for each linear foot of pipe sizes installed as specified, so measured. The unit prices stated in the Bid for Items 15-28 shall be full compensation (labor Only) for item installed. All pipe materials under items 15-28 shall be furnished by the City of Kalamazoo to the selected contractor to install.

**ITEM 29**  
**TYPE III SANITARY SEWER MANHOLE (8' DIAMETER)**

**29.01 DESCRIPTION**

- A. Under these Items, the Contractor shall construct manholes in locations and of types shown and scheduled on the Drawings and in accordance with the Contract Documents.
- B. The modification and connection of existing sewers to connect new sewers to existing manholes shall be included under these Items.
- C. Work beyond the specified pay limits for the pipe trench, but necessary for the placement of the manholes, shall be included under this Item. Such Work shall include excavation of any material encountered, backfill material, and pavement replacement.
- D. The temporary support of utilities as required to complete the Work, shall be included under these Items.
- E. The construction of shafts as needed to complete the Work is included under these Items.
- F. Restoration of landscape surface improvements including seeding, mulching, and fertilizing all disturbed lawn areas shall be included under other Items.

**29.02 WORK NOT INCLUDED**

- A. Replacement of existing manholes or catch basins removed or damaged for Contractor convenience of construction and which were not planned to be removed shall be done at the Contractor's expense.
- B. The furnishing and placing of special backfill in areas specified under Section 02200, is included under other Items.

**29.03 DEFINITION OF ITEMS**

- A. Item 29 - Includes Type III Sanitary Sewer Manhole (8' Diameter).

**29.04 MEASUREMENT**

- A. The quantities to be paid for under Items 29, shall be for each manhole installed regardless of the depth.

**29.05 PAYMENT**

- A. The unit price stated in the Bid for Item 29, shall be full compensation for each manhole complete as specified, so measured.

**ITEM 30**  
**CIPP 24-INCH SANITARY SEWER**

**30.01 DESCRIPTION**

- A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of all Cured-in-Place Pipe (CIPP) as specified in conformance with relevant Sections of the Specifications.
- B. These Items shall include all Work to install the CIPP, including but not limited to the following: CIPP materials, fittings, connections to existing sewers, removal of protrusions; hydrophilic end seals; reinstatement of sanitary laterals; removal of manhole casting; and related Work such as sewer cleaning, acceptance testing.
- C. Connections of new CIPP to existing or new manholes shall be paid for under these Items.
- D. Tap connection for existing or new sewer pipe and to re-establish existing service connections to the new CIPP sewer shall be paid for under these Items.
- E. Maintaining existing sewers in operation and bypass pumping operation and making connections to new CIPP is included under these Items.

**30.02 WORK NOT INCLUDED**

- A. Pavement, curb, walks, damaged or destroyed shall be replaced at the Contractor's expense.

**30.03 DEFINITION OF ITEMS**

- A. Item 30 – Includes CIPP 24-inch Class 52 Ductile Iron Sanitary Sewer

**30.04 MEASUREMENT**

- A. The quantities to be paid for under the respective Items shall be the measured length of sewers of the specified sizes.
- B. Sewers installed to bypass sewage during construction will not be measured for payment.
- C. No pipe will be included in these measurements if specifically included for payment under other Items.

**30.05 PAYMENT**

- A. The unit prices stated in the Bid for Item 30 shall be full compensation for each linear foot of pipe liner installed as specified, so measured.

**ITEM 31**  
**POST-CCTV INSPECTION OF SEWERS**

**31.01 DESCRIPTION**

- A. Under this Item, the Contractor shall perform closed circuit television inspection of the new 24-inch sewer, installed as part of the Work, as specified.
- B. Cleaning of the sewers prior to the CCTV inspection shall be included under this Item.
- C. The preparation and submittal of video records and submission to the Owner and Engineer shall be included under this Item.

**31.02 WORK NOT INCLUDED**

- A. Not used.

**31.03 DEFINITION OF ITEM**

- A. Item 31 - Includes CCTV of Sewers 24-inch.

**31.04 MEASUREMENT**

- A. The quantities to be paid for under Item 31 shall be the horizontal length of sewer inspected as measured, parallel to the axis of the sewer line along the surface of the ground from the center of manholes. No deduction shall be made for manholes along the length of the sewer inspected.

**31.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 31 shall be full compensation for Post-CCTV inspection of sewers, as specified, so measured.

**ITEM 32**  
**REMOVE CHAIN LINK FENCE**

**32.01 DESCRIPTION**

- A. Under this Item, the Contractor shall remove the existing 6-foot High Chain link fence and posts as shown on the plans.

**32.02 WORK NOT INCLUDED**

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

**32.03 DEFINITION OF ITEMS**

- A. Item 32 - Includes removing the existing fencing, posts and disposing off-site.

**32.04 MEASUREMENT**

- A. The quantities to be paid for under Item 32 shall be measured for each lineal foot of fencing removed.

**32.05 PAYMENT**

- A. The unit price stated in the bid for Item 32 shall be full compensation for each lineal foot of fencing removed as specified and required.

**ITEM 33  
CHAIN LINK FENCE**

**33.01 DESCRIPTION**

- A. Under this Item, the Contractor shall install a 6-foot chain link fence with a top rail and three strands of barb wire to match the existing fence in the locations shown on the plans. The contractor's surveyor shall stake the location for the City's review prior to relocating the existing fence.

**33.02 WORK NOT INCLUDED**

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

**33.03 DEFINITION OF ITEMS**

- A. Item 33 - Includes surveying the proposed location of the fencing. Installing a 6-foot high chain link fence with a top rail and three strands of barb wire.

**33.04 MEASUREMENT**

- A. The quantities to be paid for under Item 33 shall be measured for each lineal foot of new fencing installed.

**33.05 PAYMENT**

- A. The unit price stated in the bid for Item 33 shall be full compensation for each lineal foot of new fencing installed as specified and required.

**ITEM 34  
RESTORATION**

**34.06 DESCRIPTION**

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

**34.07 WORK NOT INCLUDED**

- A. All other landscape surface improvements disturbed or damaged by the Contractor without prior approval from the Engineer shall be repaired or replaced at the Contractor's expense.
- B. Wetland restoration is included under other Bid Items.

**34.08 DEFINITION OF ITEMS**

- A. Item 34 - Includes Restoration.

**34.09 MEASUREMENT**

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

**34.10 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 34 shall be full compensation for restoration as specified and required.

**ITEM 35  
MATERIALS TESTING**

**35.01 DESCRIPTION**

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

**35.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**35.03 DEFINITION OF ITEMS**

- A. Item 35 - Includes Materials Testing.

**35.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 35.

**35.05 PAYMENT**

- A. The unit price stated in the Bid for Item 35 shall be full compensation for materials testing as specified and required.

**ITEM 36  
CONSTRUCTION STAKING**

**36.01 DESCRIPTION**

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

**36.02 WORK NOT INCLUDED**

- A. Any Work specifically included under other Bid Items.

**36.03 DEFINITION OF ITEMS**

- A. Item 36 - Includes Construction Staking.

**36.04 MEASUREMENT**

- A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 36.

**36.05 PAYMENT**

- A. The lump sum unit price stated in the Bid for Item 36 shall be full compensation for construction staking as specified and required.

#### 4.02 DUCTILE IRON SEWER MATERIAL ADVANCE PURCHASE

A. Description

1. For the unit price per linear foot bid for the various sewer main, the Contractor shall do all work necessary to construct complete ready for service the sewer system and test the sewer as shown on the plans and as specified, except for work which is specifically included under other contract items. This project is a unique project. The sanitary sewer will be constructed similar to a water main project by using ductile iron pipe bends and fittings as shown on the plans. All work shall be done in accordance with section 823 of the 2020 MDOT Standard Specifications for Construction and City of Kalamazoo Standard Specifications for Water Main and Service Installation 2021 available at [kalamazoocity.org](http://kalamazoocity.org), unless otherwise specified herein.

B. Materials

1. Ductile Iron pipe, restrained joints, fittings, polyethylene encasement and associated appurtenances listed below shall be supplied new by the City of Kalamazoo from their selected supplier at no cost to the Contractor. The Contractor shall be responsible for coordinating delivery of materials by contacting the City's specified supplier a minimum of 10 working days prior to desired delivery. In advance of material delivery, a centralized delivery yard shall be established by the Contractor and agreed upon with the City and City's material supplier on or adjacent to the project site. The contractor shall supply any materials not explicitly listed below that are necessary to construct the project. These materials shall be incidental to construction. No second hand or salvaged materials shall be allowed or supplied. All supplied products shall be **"Buy American"** unless otherwise specified and shall comply with the conditions of this section.
2. Contractor shall review the plans and list of City supplied materials during bidding and throughout construction. If Contractor believes additional quantities will be required, Contractor shall immediately notify the City in writing, and the City shall provide the materials at no cost to the Contractor. City shall not be responsible for any downtime or construction delays associated with insufficient materials being available during construction as the Contractor shall notify the City of foreseen insufficient materials during the bid period. Contractor shall be responsible for all delays and downtime associated with Contractor supplied materials, and shall purchase, provide, and install materials not explicitly listed below that are necessary to construct the project as designed.
3. All City provided materials, not used during construction, shall be returned to the City within one week of sewer installation completion, unless otherwise directed by the City's project manager. The Contractor shall be responsible for transporting any excess material from the project site to 415 E. Stockbridge



Ave., Kalamazoo, MI. This includes, but is not limited to, partial and full sticks of pipe, partial and full rolls of copper (including tag ends of copper services), valves, fittings, gaskets, bolts, etc.

4. City provided materials shall be used efficiently and waste from cutting pipes, etc. shall be minimized. City provided materials shall be handled with care and protected from damage, vandalism and thievery. City shall not be responsible for providing additional materials due to theft or mishandling by Contractor.
5. Contractor shall provide 2 year warranty as described in the City of Kalamazoo Standard Specifications for Water Main and Service Installation. Warranty shall cover all City and Contractor provided parts and materials; and associated contractor labor costs.
6. Contractor and Engineer shall track City provided material delivery and usage on a daily basis.
7. Unit pricing is included below for the for the City's procurement of materials for the Contractor to account for sales and use tax per the Michigan Department of Treasury RAB 2016-18. Sales and use tax pricing shall be included in the major items of work.

Material Cost Item	Quantity	Unit	Unit Price	Extended Price
24-inch DIP Class 52	720	LF	\$171.25	\$123,300.00
24-inch DIP FLANGED TEE	3	EA	\$12,815.50	\$38,446.50
24-inch X 12-inch MJ TEE	1	EA	\$5,423.00	\$5,423.00
24-inch X BLIND FLANGE	3	EA	\$3,445.00	\$10,335.00
24-inch 45 DEGREE BEND	3	EA	\$8,808.00	\$26,424.00
24-inch 11.25 DEGREE BEND	2	EA	\$7,695.00	\$15,390.00
24-inch 22.5 DEGREE BEND	1	EA	\$5,719.00	\$5,719.00
24-inch MEGAFLANGE ADAPTER	9	EA	\$1,910.00	\$17,190.00
NLA 24 304 SS 150# RR FF 1/8 FLG P	9	EA	\$2,700.00	\$24,300.00
24-inch MJ 90 DEGREE BEND	1	EA	\$6,035.00	\$6,035.00
24-inch MEGALUG F/DI	6	EA	\$507.00	\$3,042.00
24-inch MJ BLT & GSKT PK L/GLAND	6	EA	\$96.25	\$577.50
12-inch MEGALUG F/DI	5	EA	\$98.50	\$492.50
12-inch MJ BLT & GSKT PK L/GLAND	5	EA	\$28.42	\$142.10
12-inch CLASS 52 TYTON JT PIPE	36	LF	\$71.90	\$2,588.40
12-inch MJ CLASS 153 90 DEG BEND L/A	1	EA	\$635.50	\$635.50
<b>TOTAL PRICE</b>				<b>\$ 280,040.50</b>

C. Measurement and Payment

1. Payment for sewers shall be measured based on the sizes and trench details required, along the centerline of the pipe, with no deductions for fittings. The unit price of sewer, DI, includes the cost of the following:
  - a. Excavation and backfill;
  - b. Dewatering operations (trench and/or pipe), including pretreatment to remove sediment;
  - c. Hydrostatic testing;
  - d. All material not supplied by the City, labor and equipment necessary to remedy an unsatisfactory hydrostatic test, including removing and replacing any backfill;
  - e. Installing fittings, gaskets, bracing or sheeting, blocking and miscellaneous items for installing pipe and reconnecting to the existing Municipal system
2. The City of Kalamazoo may withhold payment and/or final acceptance until the City of Kalamazoo accepts the as-built plans.
3. The cost of dewatering of trenches, pipe, or both associated with alterations to the Municipal sewer system, is included in the unit price for relevant items of work.
4. The cost of excavating, disposing of excess material, and providing, placing, and compacting the backfill, is included in the unit price for related items of work.
5. The cost of removing or abandoning existing water mains, gate valve boxes, and other appurtenances to provide clearance for the proposed sanitary sewer or roadway, is included in the unit price for relevant items of work.

<b>Labor Cost Pay Item</b>	<b>Pay Unit</b>
24-inch DIP CLASS 52	LF
24-inch DIP FLANGED TEE	EA
24-inch X 12-inch MJ TEE	EA
24-inch X BLIND FLANGE	EA
24-inch 45 DEGREE BEND	EA
24-inch 11.25 DEGREE BEND	EA
24-inch 22.5 DEGREE BEND	EA
24-inch MEGAFLANGE ADAPTER	EA
NLA 24 304 SS 150# RR FF 1/8 FLG P	EA
24-inch MJ 90 DEGREE BEND	EA
24-inch MEGALUG F/DI	EA
24-inch MJ BLT & GSKT PK L/GLAND	EA
12-inch MEGALUG F/DI	EA
12-inch MJ BLT & GSKT PK L/GLAND	EA
12-inch CLASS 52 TYTON JT PIPE	LF

12-inch MJ CLASS 153 90 DEG BEND L/A	EA
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- 6. The cost of excavating, disposing of excess material, and providing, placing and compacting the backfill, including concrete encasement is included in the unit price for related items of work.
- 7. The cost of removing or abandoning existing sewer to provide clearance for the proposed sewer, is included in the unit price for relevant items of work.
- 8. The cost for dewatering of trenches, pipe, or both associated with alterations to the Municipal Sewer System is included in the unit price for relevant items of work.

END OF SECTION

**SECTION 01043  
COORDINATION AND CONTROL OF THE WORK**

**PART 1 GENERAL**

**1.01 SCOPE**

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

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Haul routes to and from Site.
    - b. Plan and procedures for any shut-downs.

**1.03 LINES AND GRADES**

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

**1.04 EXISTING STRUCTURES SHOWN ON DRAWINGS**

- A. Where underground and surface structures are shown on the Drawings, the location, depth, and dimensions of such structures are believed to be reasonably correct but are not guaranteed.
- B. Such structures are shown for the information of the Contractor, but information so given is not to be construed as a representation that such structures will in all cases be found or encountered just where shown, or that they represent all the structures which may be encountered.

**1.05 COOPERATION OF CONTRACTOR**

- A. The Contractor shall conduct his operations so as to interfere as little as possible with those of the Owner, other contractors, utilities, or any public authority on or near the Work.
- B. The Owner reserves the right to perform other Work by contract or otherwise, and to permit other public bodies, public utility companies, and others to do Work on or near the project during progress of the Work. If a conflict arises, the Owner will determine when and how the Work shall proceed.

- C. Claims for delay or inconvenience due to operations of such other parties on Work specified, shown on the Drawings, as directed or which can be reasonably expected to be encountered by the nature and location of the Work will not be considered.
- D. Operations entailing the use of construction equipment and lights outside the hours of 8:00 am and 5:00 pm or outside the hours allowed for construction by local ordinances or regulations is prohibited unless otherwise authorized by the Owner or Engineer.
- E. Closing off clear access to any public alley, street, road, avenue or boulevard without the prior consent of municipal officials and the Engineer is prohibited.

**1.06 MAINTENANCE OF SANITARY SYSTEM DURING CONSTRUCTION**

- A. All construction which requires interruption of existing sanitary system flow shall be executed during periods designated by the Owner.
- B. Bypassing of untreated sanitary wastewater to any stream or body of water is prohibited.

**1.07 PERMANENT PAVEMENT AND FINAL RESTORATION**

- A. Permanent pavement and final restoration shall be completed prior to the close of the last paving season prior to the Contract's final completion.
- B. Pavement restoration shall include, but not limited to, replacement of pavement, driveways, and sidewalks

**1.08 RESERVED**

**1.09 TEMPORARY PARKING FACILITIES**

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

**1.10 TEMPORARY WATER, HEATING, LIGHTING AND POWER**

- A. The Contractor shall provide all water, heat, lighting, and power required to construct and protect the Work until Final Completion.

- B. The source for temporary power shall be from the electric utility or portable power source.
- C. The source for temporary water can be from the water utility if available. The Contractor shall furnish all backflow prevention devices, flow meter and appurtenances as may be required by the water utility. Should the water utility impose a charge for furnishing, to the Contractor, the meter or appurtenances the Contractor shall pay all the fees. The Contractor shall pay all charges for the water metered.
  - 1. If a water utility is not available, the Contractor shall be responsible for furnishing water and all cost associated including, but not limited to, procurement, hauling, pumping equipment, and appurtenances.
- D. The Contractor shall pay for all significant amounts of electric power utilized by the Contractor in the construction of the facility. All electric power used for such significant uses as pumping groundwater and heating shall be separately metered and paid for by the Contractor.
- E. The installation for electric power shall meet the requirements of federal, state, and local authorities and regulatory agencies.

#### **1.11 DISPOSAL OF DEBRIS**

- A. All debris resulting from construction operations, i.e., packaging, waste materials, damaged equipment, etc., shall be trucked from the Site by the Contractor and disposed of at spoil sites.
- B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely removed from public or private rights-of-way.
- C. All debris shall be disposed of in accordance with federal, state, and local laws and regulations.

#### **1.12 CONTROL OF NOISE**

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

#### **1.13 SMOKE PREVENTION**

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

**1.14 DEBRIS AND DUST CONTROL**

- A. The Contractor shall apply water, dust palliative, or both, for the alleviation or prevention of dust nuisance caused by his operations. Dust control operations shall be performed by the Contractor as site conditions dictate or as order by the Owner and Engineer.
- B. The Contractor shall utilize mechanical equipment to remove all debris from all streets, drives and walks to the satisfaction of the Owner and Engineer. Cleaning shall be performed at a minimum of daily and as directed by the Owner and Engineer.
- C. The cost of the all debris and dust control methods shall be the responsibility of the Contractor.

**1.15 SANITARY REGULATIONS**

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

**1.16 USE OF EXPLOSIVES**

- A. The use of explosives is prohibited.

**1.17 EMERGENCY MAINTENANCE SUPERVISOR**

- A. The Contractor shall submit to the Engineer the names, addresses, and telephone numbers of two employees responsible for performing emergency maintenance and repairs when the Contractor is not working. These employees shall be designated in writing by the Contractor to act as his representative and shall have full authority to act on his behalf.
- B. Contractor shall post at job Site, in a conspicuous location, the emergency numbers for the project.
- C. Contractor shall be responsible for contacting the local fire, police, and emergency response personnel and organizations in advance of the Work. The Contractor shall be responsible for the coordination and compliance with emergency response plans, whether developed by the governing agency, laws, or the Contractor for the project.
- D. At least one of the designated employees shall be available for a telephone call any time an emergency arises.

**1.18 PUBLIC SERVICE STRUCTURES**

- A. Public service structures shall be understood to include all poles, tracks, pipes, wires, conduits, house-service connections, vaults, manholes, and other appurtenances, whether owned or controlled by the Owner or other public bodies or by privately-owned corporations, used to supply the public with transportation, heating, electric, telephone, gas, water, sewer, or other services.
- B. At least a week in advance of breaking ground, the Contractor shall notify the registered underground protection service, all public bodies, and other owners of such facilities of the proposed location of his operations, advising them that their property may be affected and that such measures as they may deem necessary should be promptly taken to protect, adjust, remove, or build them.
- C. In developed residential and commercial areas, the Contractor shall assume each building and dwelling has water and sewer services and that they shall be protected and repaired as needed as part of the pipeline installation. No additional payment will be made for Work associated with supporting or repairs of such services.
- D. Three conditions which may be encountered will be dealt with as follows:
  - 1. Structures which are adjacent to but not included within the limits of an excavation required for performance of the Work shall be protected, supported, and maintained in service by the Contractor at his expense.
  - 2. Structures within the limits of the Work which can be satisfactorily supported and maintained in service and which do not require removal and rebuilding in the judgment of the Engineer shall be thus supported by the Contractor at his expense, including cost of repair of damage incident to his operations.
    - a. Supports for water and gas mains, sewers, conduits, and similar structures shall be constructed of timber or other acceptable materials; shall be supported from undisturbed foundations, and shall be sufficiently substantial to ensure against settlement when pipe trenches or other excavations are backfilled. In all cases where permits or inspection fees are required by utilities in connection with changes to or temporary support of their conduits, the Contractor shall secure such permits and pay all permit and inspection fees.
    - b. The Contractor shall assume full responsibility for maintaining all public service structures in service and shall support and protect, or remove and rebuild them at his own expense. Such services shall not be interrupted without permission of the owner of the public service structure.
  - 3. In case relocation of pipelines or other utility structures is required because of direct interference, as determined jointly by the Owner, Engineer, and Contractor, with the installation of the Work, the Contractor shall notify the Owners of the utility structure involved.



- a. The Contractor will not be reimbursed for the cost of the relocation if the interference is shown on the Drawings, described in the Specifications, apparent on visual inspection, or specifically included in the Work to be performed by the Contractor.
- b. The Contractor will not be paid for time lost because of such direct interference. Where it is the policy of any utility owner to perform such Work with his own forces, the Contractor shall cooperate to the fullest extent with such utility owner.

#### **1.19 UNAUTHORIZED WORK**

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

#### **1.20 RESERVED**

#### **PART 2 PRODUCTS**

Not used.

#### **PART 3 EXECUTION**

Not used.

#### **PART 4 SPECIAL PROVISIONS**

#### **4.01 MAINTAINING FLOW IN EXISTING SEWERS**

- A. Flow in existing storm, sanitary and private sewers shall be maintained at all times during construction of this project. The Contractor shall furnish and install all necessary temporary facilities required to maintain the flow in existing sewers including bulkheads, plugs, stop planks, flumes, coffer dams, pumping equipment, valves, etc. The contractor shall provide bypass pumping capable of handling 7500 gpm to accommodate and maintain GPI's sanitary sewer flow during the shutdown period when construction is taking place on the Parshall Flume structure.

#### **4.02 REQUIRED SAFETY DOCUMENTATION TO BE SUBMITTED**

- A. On all projects that require the Contractor's or subcontractor's personnel to occupy permitted confined spaces and/or hazardous atmospheres on the Site, the Contractor shall submit to the Owner, a written proposed safety program. The safety program shall comply with all Federal, State, and local requirements. If the Owner has a safety plan that is more stringent than the Federal and State requirements, it will be made available

to the Contractor for review. The submittal of the proposed safety program to the Owner shall be made well in advance of the start of construction at the Site. The submittal shall include a written Safety Management Plan including Confined Space Entry procedures. The Contractor shall be responsible to maintain documentation that anyone employed by the Contractor, subcontractors, or suppliers of any tier to the Contractor occupying such hazardous locations has received the appropriate confined space entry training and other applicable training. The Contractor is also responsible to maintain completed confined space entry permits.

**4.03 MAINTAINING CRITICAL OPERATIONS**

- A. The Contractor shall closely coordinate any needed equipment, or roadway shutdowns with the Owner, Engineer, and Graphic Packaging Inc.

END OF SECTION

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**SECTION 01090**  
**REFERENCE STANDARDS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes reference standards.

**1.02 DESIGNATION OF ASSOCIATIONS, INSTITUTIONS, SOCIETIES AND STANDARDS**

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

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

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

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

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

Not used.

## **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 01300  
SUBMITTALS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes requirements for submittals.
- B. Contractor shall adhere to the submittal schedule as submitted under the provisions of the General Conditions. Contractor shall modify the schedule as required to allow sufficient time for submittal review based on current construction schedule.

**1.02 COORDINATION OF SUBMITTALS**

- A. The Contractor shall be responsible for the coordination of submittals and field verifications as required for the various parts of the Work.
- B. All submittals to the Engineer, unless otherwise specified, shall be made only by the Contractor. Direct submittals from subcontractors or suppliers will not be accepted.
- C. All submittals shall reference the Specification item that it covers, the Contractor's name, the Contract title and location, and the date of submission. Submittal shall also indicate whether the information is for the Engineer's review and approval, for record purposes, or for the fulfillment of the operation and maintenance requirements.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Two categories of information are normally required:
  - 1. Shop Drawings for review.
  - 2. Information for Record:
    - a. Operation and maintenance manuals.

**2.02 SHOP DRAWINGS FOR REVIEW**

- A. Shop Drawings:
  - 1. The Contractor shall submit Shop Drawings in accordance with the General Conditions, as required by individual Sections, shown on the Drawings or as directed.
  - 2. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with the General Conditions.

3. The Contractor shall clearly indicate quantities and the exact intended use of the equipment or material contained in the submittal.
  4. All Submittals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or where applicable the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual material or equipment furnished. All options furnished shall be indicated. The Contractor shall highlight and cross out nonapplicable information in a color other than red. Red mark-ups shall be reserved strictly for the Engineer.
  5. Color charts or samples shall be included for all submittals where a color selection by the Owner is required. Original Color Charts (not Color Copies) and samples shall be delivered to the Site, Engineer's RPR or Owner as required. The Engineer shall be copied on the transmittal letter for record purposes.
- B. Samples shall be provided as required in the individual Sections. Samples shall be of the precise material proposed to be furnished. The number of samples and sample size shall be the industry standard unless otherwise stated in the individual Sections.

### **2.03 INFORMATION FOR RECORD**

- A. Material certificates shall be submitted for materials as indicated in the individual Sections. The certificate shall state that the products have been sampled and tested in accordance with the proper industrial and governmental standards and meet the requirements of the Specifications. Certificates shall be signed by an authorized agent of the manufacturer.
- B. Licenses and Permits - The Contractor shall submit copies of all licenses and permits required by Local, State, and Federal laws.
- C. Installation and calibration certificates shall be submitted for equipment as indicated in the individual Sections. These certificates shall indicate manufacturer's satisfaction with the installation, the accuracy of calibration and alignment, and the operation of the equipment. Such certificates must be signed by an authorized agent of the manufacturer.
- D. Progress Schedules shall be submitted in accordance with the General Conditions and Section 01310.
- E. Schedule of Shop Drawings and Sample Submittals shall be submitted in accordance with the General Conditions.
- F. Schedule of Values shall be submitted in accordance with the General Conditions.

### **2.04 OPERATION AND MAINTENANCE INFORMATION**

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

- B. Operation and maintenance manuals shall be submitted as electronic documents prior to the printing of the record copy.
  - 1. Contractor shall provide one electronic copy of the manuals for preliminary review.
  - 2. The final accepted manuals shall be provided as one electronic copy of the manual and one printed copy as specified below.
- C. Electronic manuals shall be in Portable Document Format (PDF) as generated by Adobe Professional Version 7.0 or newer. The PDF file shall be fully indexed using the table of contents, searchable with thumbnails generated. PDF documents shall have bookmark created in the navigation frame for each major entry (Section, Chapter, Tab) in the table of contents. PDF images shall be at a readable resolution typically 300 dpi or higher. Optical Character Recognition (OCR) capture shall be performed on these images text can be searched, selected and copied from the PDF file.
  - 1. The opening view of each PDF document shall be the bookmarks to the left and cover page or table of contents.
  - 2. The PDF file name shall include the Name of Owner, Project title, Contract Number, and Specification Section. Commonly used abbreviations acceptable to the Owner may be used to minimize length of file name.
  - 3. The Contractors Name shall be the electronic "Author" of the PDF document.
- D. This information will be reviewed only if properly identified with Specification Section numbers and only after revised, where necessary, to conform to the Engineer's notes on previous submittals that have been marked "Make Corrections Noted." Manuals shall be tailored to suit the specific equipment provided.
- E. Submittals shall include but not limited to the following:
  - 1. Descriptive literature, bulletins, or other data covering equipment or system.
  - 2. Complete list of equipment and appurtenances included with system, complete with manufacturer serial number and model number.
  - 3. Utility requirements.
  - 4. General arrangement drawing.
  - 5. Sectional assembly.
  - 6. Dimension print.
  - 7. Materials of construction.
  - 8. Certified performance curve.
  - 9. Parts list with assembly drawings.
  - 10. Recommended spare parts list with part and catalog number.
  - 11. Lubrication recommendations and instructions.



12. Schematic wiring diagrams.
  13. Schematic piping diagrams.
  14. Description of associated instrumentation.
  15. Drive dimensions and data.
  16. Operating instructions.
  17. Maintenance instructions including trouble-shooting guidelines, lubrication, and preventive maintenance instructions with task schedule.
  18. Special tools and equipment required for operation and maintenance.
  19. Description of equipment controls.
  20. Pump seal data.
  21. Assembly, installation, alignment, adjustment, and checking instructions.
  22. Confirmation of all corrections noted on Shop Drawings marked "Make Corrections Noted."
  23. Manufacturer's name, address, and telephone number along with manufacturers job number and Purchase Order number.
  24. Manufacturer's local sales representative, address, telephone number.
  25. All installation instructions that were provided to Contractor for use to install equipment.
- F. All manuals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual equipment furnished. All options furnished shall be indicated.
- G. Manuals shall be printed on 8-1/2 by 11-inch size with standard three-hole punching. Large manuals shall be submitted in three-ring binders. Small manuals shall be submitted in folders with metal fasteners. Index tabs shall be furnished for all manuals containing data for three or more items of equipment. All manuals shall have a title label on the cover stating the specification item number and item name. A table of contents shall be included in all manuals.
- H. Drawings shall be reduced to 8-1/2 by 11 inch or 11 by 17 inch. Where reduction is not possible, larger drawings shall be folded separately and placed in envelopes which are bound into the manual.
- I. Equipment installations shall not be considered substantially complete until all associated operation and maintenance manual submittals are accepted by the Engineer.
- J. Field modifications to equipment during installation shall be included in the manual so that the manual reflects as-built conditions. Revisions to the manual may be submitted

for incorporation into the manual where appropriate. However, the Engineer reserves the right to return all six manuals for revision to reflect as-built conditions.

### **PART 3 EXECUTION**

#### **3.01 IDENTIFICATION OF SUBMITTALS**

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

#### **3.02 PRINTING AND DISTRIBUTION**

- A. Contractor shall provide one printed copy of the approved operation and maintenance manual and the electronic copy on portable electronic media device to the Owner.
- B. Contractor shall provide printed copies of submittals, project information or documents required to satisfy the building permit and inspections as may be required by the governing agency.
  - 1. The Engineer will provide the stamped/sealed Contract Drawings for the initial filing of the building permit applications.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



**Submittal Identification & Approval**

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<b>Date:</b>	<b>Spec Section</b>
<b>Submittal No.</b>	<b>Drawing Sheet No.</b>
<b>Description:</b>	
<b>Manufacturer(s)</b>	

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**Contractor Comments/Deviations/Measurements**

<i>Contractor</i>	<i>Engineer</i>																
Contractor Name  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td><input type="checkbox"/></td><td>Approved</td></tr> <tr><td><input type="checkbox"/></td><td>Forwarded</td></tr> <tr><td><input type="checkbox"/></td><td>Checked</td></tr> </table> By: _____ Date: _____	<input type="checkbox"/>	Approved	<input type="checkbox"/>	Forwarded	<input type="checkbox"/>	Checked	<b>SHOP DRAWING REVIEW</b> <b>SUBJECT TO CONTRACT REQUIREMENTS</b> <b>Jones &amp; Henry Engineers, Ltd.</b> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td><input type="checkbox"/></td><td>Approved</td></tr> <tr><td><input type="checkbox"/></td><td>Approved—Make Corrections Noted</td></tr> <tr><td><input type="checkbox"/></td><td>Amend &amp; Resubmit</td></tr> <tr><td><input type="checkbox"/></td><td>Rejected—See Remarks</td></tr> <tr><td><input type="checkbox"/></td><td>Distribute for Information</td></tr> </table> <p style="font-size: small; color: red;">REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS</p> <p style="font-size: small; color: red;">Approval in no way relieves the Contractor of any responsibility for capacities, performance, functions, compliance with Federal, State, and Local Codes; accuracy of dimensions and details; or continuity and completeness of the Project nor does approval constitute or imply any increase in Contract Price.</p> By: _____	<input type="checkbox"/>	Approved	<input type="checkbox"/>	Approved—Make Corrections Noted	<input type="checkbox"/>	Amend & Resubmit	<input type="checkbox"/>	Rejected—See Remarks	<input type="checkbox"/>	Distribute for Information
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**Review Comments**

**SECTION 01310  
CONSTRUCTION SCHEDULES AND DOCUMENTATION**

**PART 1 GENERAL**

**1.01 SCOPE**

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

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Preliminary Construction Schedule.
    - b. Contractor's Construction Schedule and monthly updates.
    - c. Submittals Schedule.
- B. Contractor shall submit three copies of the 24-inch by 36-inch construction schedule, unless approved otherwise by the Engineer.

**1.03 QUALITY ASSURANCE**

- A. Scheduling conference shall be held prior to the commencement of the construction to discuss the following including, but not limited to:
  - 1. Construction sequencing.
  - 2. Contractor's coordination of subcontractors.
  - 3. Coordination with the Owner's operations.
  - 4. Coordination with other Contractor's or other Work.
  - 5. Project milestones.
  - 6. Owner's partial utilization.

## **PART 2 PRODUCTS**

### **2.01 PRELIMINARY CONSTRUCTION SCHEDULE**

- A. Preliminary construction schedule shall be completed in accordance with the General Conditions and prior to the scheduling conference.
- B. The preliminary schedule shall outline the Contractor's sequencing of tasks, activities, milestones, and all critical path items within the contract time.

### **2.02 CONSTRUCTION SCHEDULE**

- A. The Contractor's submission of the construction schedule will not change the contract completion date, whether reviewed by the Owner and Engineer or not. The Contractor shall incorporate all approved change orders that have resulted in a contract time extension.
- B. The Contractor shall require all subcontractors engaged in the Work to submit to the Contractor construction schedules, as specified herein, for incorporation into the Contractor's construction schedule.
- C. The construction schedule shall include, but not limited to, the following dates:
  - 1. Notice to Proceed.
  - 2. Substantial Completion and Final Completion.
  - 3. Commencement of on-site operations.
  - 4. Milestones as specified, shown on the Drawings, and as directed.
  - 5. Submittal schedule per the General Conditions.
- D. The Contractor shall incorporate into the construction schedule all constraints and work restrictions specified or otherwise required by the Contractor's operations, including, but not limited to, the following:
  - 1. Construction sequencing.
  - 2. Contractor's coordination of subcontractors.
  - 3. Coordination with the Owner's operations.
  - 4. Coordination with other Contractor's or other work.
  - 5. Project milestones.

### **2.03 UPDATING CONSTRUCTION SCHEDULE**

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

#### 2.04 WEEKLY CONSTRUCTION SCHEDULE

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

#### PART 3 EXECUTION

##### 3.01 COORDINATION

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

#### PART 4 SPECIAL PROVISIONS

##### 4.01 SCHEDULED NON-WORK DAYS

- A. The Contractor shall restrict Work to 8:00 am to 5:00 pm Monday through Friday unless otherwise authorized by the Owner or Engineer. Contractor shall consider the following list of holidays as mandatory non-work days (unless permitted, in writing, by the Owner), all of which shall be incorporated into the construction schedule:
1. New Year's Day.
  2. Martin Luther King Day.
  3. President's Day.
  4. Good Friday.
  5. Memorial Day.
  6. Fourth of July.
  7. Labor Day.
  8. Columbus Day.
  9. Veteran's Day.
  10. Thanksgiving Day.
  11. Day after Thanksgiving Day.
  12. Christmas Eve Day.
  13. Christmas Day.

END OF SECTION

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**SECTION 01350  
COMMON PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes general requirements for all materials, equipment and systems furnished or installed under this project.
- B. Additional specific requirements included under a particular Section shall take precedence.
- C. This Section includes, but is not limited to, the following procedural and administrative requirements:
  - 1. Product Delivery Storage and Handling.
  - 2. Warranties.
  - 3. Quality Assurance and Control.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and related specification sections.
- B. The specification sections and Drawings contain the specific submittal requirements.

**1.03 QUALITY ASSURANCE**

- A. Where Contractor is required to provide design services or certification of the design, the specified product, equipment or system shall comply with the specified criteria.
  - 1. Contractor shall submit a written request for clarification when specified criteria is incomplete or insufficient.
- B. Manufacturer's name, make, model number and other designations provided in the contract documents are to establish the significant characteristics, including but not limited to, type, function, dimensions and physical properties, performance, and appearance for the purpose of evaluating comparable products. Contractor shall verify product, equipment or system proposed meets or exceeds the requirements as specified or shown on the Drawings.

**1.04 PROJECT HANDLING**

- A. Schedule delivery to minimize the time goods are kept in storage.
- B. Deliver goods to Site in manufacturer's original packaging.



- C. Inspect the goods to determine if there is visible damage to the packaging.
  - 1. The packaging shall be removed in a manner that will allow resealing for storage.
  - 2. If packaging cannot be removed and reused, the goods shall be repackaged per the manufacturer's recommendations.
- D. Goods that are susceptible to damage by the environmental or project conditions, including but not limited to, switchgear, motor control centers, panelboards, instrument control panels, fixtures shall be stored in a controlled environment per the manufacturer's recommendations. If no such area is available at the time such equipment is received, such space shall be provided by the Contractor at no expense to the Owner.
- E. Where construction is in roads or streets, that portion of the right-of-way not required for public travel may be used for temporary storage purposes unless otherwise prohibited. Materials shall not be stored in areas where such storage creates a hazard. Any other additional space required for construction or storage of materials and equipment shall be obtained by the Contractor at his expense.
- F. The Contractor shall confine his equipment, the storage of materials and equipment, and the operations of his workers to areas permitted by law, ordinances, permits, and the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

#### **1.05 GUARANTEE**

- A. Manufacturer's warranty, extending beyond two-years after substantial completion for the specified product, equipment or system shall be provided to the Owner and endorsed by the manufacturer.
- B. Requirements for warranties extending beyond two-years after substantial completion are described in individual Sections of these specifications.
- C. Manufacturer's limitations and disclaimers shall not relieve the Contractor from warranty obligations under the Contract Documents.

### **PART 2 PRODUCTS**

#### **2.01 SHOP PAINTING**

- A. Non-galvanized ferrous surface shall be painted.
- B. Shop painting of ferrous surfaces shall be as follows:
  - 1. Surfaces shall be thoroughly cleaned of dirt, grease, oil, rust, scale, or other foreign substances. All metal surfaces shall, as a minimum, be abrasive blasted in accordance with SSPC-SP6, Commercial Blast Cleaning.

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

#### **2.02 GALVANIZING**

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

#### **2.03 REGULATORY REQUIREMENTS**

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

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Products shall be installed in accordance with the manufacturer's instructions and Contract Documents.
- B. Required appurtenances including but not limited to, anchors, grout, and leveling shims, shall be provided.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

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**SECTION 01410  
LABORATORY SERVICES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The Contractor shall retain an independent laboratory to perform testing and inspection(s) as required.
- B. The Owner shall perform required testing on water mains prior to placing new mains into service.
- C. The Owner has retained SME Engineering to perform required density testing, concrete, and asphalt testing.
- D. Testing, inspection(s) and quality control are required to certify compliance with the Contract Documents.
  - 1. The laboratory services do not relieve the Contractor from the responsibility of compliance with the Contract Documents
  - 2. Any test required by the Owner shall not relieve the Contractor from the responsibility of compliance with the Contract Documents.
  - 3. Any test required by the Owner shall not relieve the Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate compliance with the Specifications.
- E. Specific testing, inspection(s) and quality control requirements are specified in the individual Sections of the specifications.
- F. Specific testing, inspection(s) and quality control requirements of any Federal, State or Local authorities are specified in the related sections of Work.
- G. Testing of materials or equipment for compliance with various national or technical society standards and ordinarily performed by manufacturers, and shop and field tests of equipment are not included under this Section but shall be performed by the Contractor or his supplier as specified elsewhere.
- H. Contractor may conduct material or field test(s), inspection(s) and quality control as they deem necessary.
  - 1. Should the Contractor, at any time, desire the Owner to consider the results of such testing, inspection(s), and quality control, such results shall be certified by an independent testing laboratory acceptable to the Owner. Any testing of this nature shall be conducted at the Contractor's expense.

## 1.02 SUBMITTALS

- A. Submittals of all required field and laboratory test results shall be made by the independent laboratory as soon as they are available to the Owner and Engineer directly.
1. Statement of Compliance per 1.03

## 1.03 QUALITY ASSURANCE

1. The laboratory shall be a recognized and independent commercial laboratory with experience in conducting the required tests.
2. Laboratory shall certify compliance with ASTM E548, ASTM E329, and ASTM C1093 when masonry construction is part of the project scope. In lieu of ASTM certification, the laboratory may submit written documentation demonstrating experience and training relevant to the inspections to be performed. The documentation shall demonstrate experience with projects of similar complexity and quantity of inspections as the project herein.
3. Testing, inspection(s) and quality control shall be certified by a professional engineer specialized in the related field and in the state where the Site is located.

## PART 2 PRODUCTS

### 2.01 TESTS

- A. Aggregates, Bedding Material, and Special Backfill - For each type of material, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine compliance with the contract documents.
1. Retests shall be performed until the Specifications are met.
  2. Retest shall be performed each time the source of material is changed.
- B. Selected Backfill - At the discretion of the Engineer, but in no case, more than one test for each 1,000 cubic yards or portion thereof, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine whether the material is suitable for backfilling purposes.
- C. Mix Designs:
1. For each type of controlled density fill, concrete, and asphalt, the laboratory shall review, perform test(s).
  2. Review, perform test(s) and approve change in source of materials.
  3. The asphalt design shall be made in accordance with ASTM D1559, the Marshall Method of Mix Design and as specified.

4. Approved mix designs shall include sieve analyses and suppliers' certificates for materials incorporated in the mix.
- D. Compaction Tests:
1. For each type of backfill material, the laboratory shall determine the moisture-density curve according to ASTM D698.
  2. Using ASTM D2922 test methods, the laboratory shall determine the density of placed backfill.
  3. Retests shall be performed if the compaction requirements stated in the individual Sections are not met.
  4. The Engineer may at his discretion require the sand cone (ASTM D1556) or the balloon (ASTM D2167) tests for density and compaction to verify questionable results of the ASTM D2922 tests.
- E. The independent testing laboratory shall test and report the soil bearing capacity under all foundations and slabs on grade. The testing shall be conducted at regular intervals in all directions. The independent testing laboratory shall immediately notify both the Contractor and Engineer of any such test not meeting the presumed soil bearing capacity contained in the Structural Design Data on the Drawings.
- F. Asphalt and Concrete Quality Control Testing - Perform tests as indicated in Section 02600 and as required by the City of Kalamazoo.
- G. Miscellaneous Tests - Perform all other tests requested in the individual Sections of the Specifications.

## **2.02 PLANT INSPECTIONS**

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

## **2.03 EQUIPMENT**

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

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

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

- B. Contractor shall coordinate activities to accommodate the required quality assurance/control.
  - 1. Contractor shall not compromise the requirement for quality assurance /control in order to maintain the schedule.
- C. The laboratory shall conduct tests on materials and in locations as directed by the Resident Project Representative.
- D. All tests shall be performed in accordance with the proper test methods mentioned above and in the individual Sections. Results shall be compared to the required values included in the individual Sections.

### **3.02 PREPARATION**

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

### **3.03 PROTECTION**

- A. Contractor shall at the completion of testing, repair damage to construction in accordance with these specifications.
- B. Contractor shall be responsible for the protection regardless of the responsibility for quality assurance/control.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 01500  
MAINTAINING TRAFFIC**

**PART 1 GENERAL**

**1.01 SCOPE**

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

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. The Contractor shall submit the name, address, and telephone number of a local individual who will be responsible for maintaining traffic facilities when the Contractor is not working.
    - b. Traffic control or maintenance plans with govern authority(s) approval.
    - c. Detour routes with governing authority(s) approval.
    - d. Delivery and haul routes for contractor's activities outside the zone of influence.

**1.03 QUALITY ASSURANCE**

- A. The installation, maintenance, and operation of all traffic controls and traffic control devices shall conform to the requirements of the State Department of Transportation Manual of Uniform Traffic Control Devices for Streets and Highways, hereinafter called the MUTCD.
- B. If, in the opinion of the authority having jurisdiction over traffic in the affected thoroughfares, proper maintenance of traffic facilities and proper provisions for traffic control are not being provided by the Contractor, they may take the necessary steps to place them in proper condition, and the cost of such services will be deducted from any money which may be due or become due the Contractor.
- C. A traffic control conference, attended by Owner, Engineer, Contractor and governing authority, shall be held no later than 14 days prior to any traffic maintenance, placement of traffic control devices, lane closures, detouring of traffic or other activity that impedes the normal traffic flow.



## **PART 2 PRODUCTS**

### **2.01 TRAFFIC CONTROL DEVICES**

- A. Traffic control devices shall be provided with suitable supports of sufficient strength and stability.
- B. Faces of orange construction signs, barricades, vertical panels and drum bands shall be suitably reflectorized with sheeting.
- C. Traffic cones shall be a highly visible orange color.
- D. Pavement markings for traffic maintenance shall conform to the requirements of MDOT, the local authority and the MUTCD.

### **2.02 TEMPORARY TRAFFIC SIGNALS**

- A. The Contractor shall furnish, erect, maintain, and subsequently remove signal and signal controller equipment of a proper type and capacity to provide the required operation, and shall meet the general requirements of MDOT and the MUTCD.
  - 1. Any malfunctions or failures shall be corrected without delay. Temporary traffic signals not in use shall be covered or removed.
- B. The Contractor shall be responsible for the procurement of and payment for electric power for temporary traffic signals.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. The Contractor shall provide and maintain in safe condition such temporary facilities for vehicular and pedestrian traffic as may be necessary to provide safe vehicular and pedestrian ingress and egress for all property adjacent to the improvements. Such access shall be provided at all times unless workers or machinery are in the immediate area. Access shall be provided to all properties at the end of the Work day.
- B. When the street or highway under construction is being used by vehicular traffic including periods of suspension of the Work, the Contractor shall maintain that portion of the street or highway being used to ensure that it is smooth, free from holes, ruts, ridges, bumps, and dust.
- C. The Owner will enter upon that portion of a project, where the Contractor is responsible for maintaining through traffic on part or the entire project, to place abrasives at its own expense, as may be considered advisable.
  - 1. The Contractor shall be responsible for the removal of abrasives placed, for which no claim for additional compensation shall be allowed nor shall the Contractor be relieved in any way of his obligation for maintenance of traffic.

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

### 3.02 TRAFFIC CONTROL

- A. Barricades, vertical panels, and cones shall be protected by adequate advance warning construction signs.
- B. Equipment and material stored on the highway shall be marked at all times. At night, any such material or equipment stored within rights-of-way and easement(s) shall be clearly outlined with dependable lighted devices.
- C. Contractor shall provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic in all areas where materials are stored.
- D. Road Closed - When a highway is permitted to be closed to traffic, the Contractor shall provide, erect, maintain, and subsequently remove approved traffic control devices, barricades, and suitable and sufficient red or yellow lights.

### 3.03 TRAFFIC MAINTAINED

- A. Where the street or highway under construction is being used by vehicular traffic, including periods of suspension of the Work, the Contractor shall furnish and maintain pavement markings, lights, warning signs, road construction traffic maintained signs, and end construction signs, barricades, temporary guardrail, and such other traffic control devices, and flaggers as may be necessary to maintain safe traffic conditions within the Work limits.
- B. Existing signs and traffic control devices within the Work limits shall remain in use during the construction period. If the Contractor needs to relocate or modify permanent signs and other traffic control devices as a consequence of his work, he shall provide suitable supports and may modify the devices with prior approval of the Engineer and the concurrence of the maintaining agency. Routine maintenance of permanent traffic control devices will remain the responsibility of the maintaining agency.
- C. The function of existing Stop or Yield signs shall be retained at all times although their position may be adjusted. Existing signs that must be relocated laterally shall be placed in accordance with the MUTCD.
- D. When an existing signal operation must be interrupted for a period, the Contractor shall provide a temporary traffic control method.
- E. The Contractor shall obtain the approval of the Owner and Engineer before closing a traffic lane or establishing a one-way traffic operation.
- F. Flaggers:
  - 1. Whenever one-way traffic is established, at least two flaggers shall be used and signs, cones, barricades, and other traffic control devices shall be erected by the Contractor in accordance with the MUTCD. The Contractor shall maintain

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

2. Flaggers shall be equipped according to the standards for flagging traffic contained in the MUTCD. At night, flaggers' stations shall be adequately illuminated.
3. The Contractor may, in lieu of flaggers, or supplementing them, furnish, install, and operate a temporary traffic signal or signals, for the purpose of regulating traffic.

### **3.04 SNOW AND ICE REMOVAL**

- A. The state and local authority responsible for snow and ice removal will be responsible for removals during the construction provided the following:
  1. The project area is open to public access.
  2. In the opinion of the state and local authority the project area is accessible with their equipment.
  3. In the opinion of the state and local authority the street surface will not cause damage to their equipment or their equipment will not cause damage to the street.
- B. The Contractor shall be responsible for snow and ice removal during construction when:
  1. The project area is closed to public access.
  2. When Limited access is provided for local traffic but area is closed to through traffic.
  3. The project area pavement has removed or damaged to the extent that the state and local authority's equipment will no longer effectively remove snow and ice or will cause damage to project area.

## **PART 4 SPECIAL PROVISIONS**

### **4.01 RESTORATION OF PAVEMENT SURFACES OUTSIDE THE ZONE OF INFLUENCE**

- A. Contractor shall restore all damaged pavement surfaces in streets used by the Contractor for moving materials and equipment to and from the construction area and streets used for bypassing or detouring traffic around the construction area.
- B. Materials used in replacing damaged areas of the road shall be as specified in Section 02600 of these Specifications.
- C. The pavement shall be restored with pavement of the same type and thickness as the existing pavement, in accordance with Section 02600 of these Specifications.

END OF SECTION

**SECTION 01568  
POLLUTION CONTROL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the requirements for pollution control.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Dust palliatives shall conform to MDOT Item 922.08.

**PART 3 EXECUTION**

**3.01 MICHIGAN GENERAL REQUIREMENTS**

- A. The Contractor is responsible for following an erosion control plan in accordance with permits required under Act 451, Part 91, as amended (Soil Erosion and Sedimentation Control), Part 303 (Wetland Protection, formerly Act 203), Part 301 (Inland Lakes and Streams, formerly Act 346), Part 31, (Water Resources Protection, Floodplain Regulatory Authority, formerly Act 245 as amended by Act 167), and Part 31 (Water Resources Protection), National Pollutant Discharge Elimination System (NPDES). Secure Federal Section 404, Clean Water Act of 1972, permits, if required. Provide temporary and permanent erosion and sedimentation controls according to the permits.
- B. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- C. The Contractor shall perform Work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems, and to prevent dust attributable to his operations from entering the atmosphere.
- D. Water containing suspended material from any part of the Contractor's operations shall be clarified before discharging to drains or streams.
- E. No fill, topsoil, or heavy equipment shall be stored within 200-feet of a stream bank or within the drip line of a treed area.
- F. Excess soil that is stockpiled shall be removed or regraded within 15 days of the completion of construction.

### 3.02 STREETS, SIDEWALKS AND DRIVEWAYS

- A. Streets, haul roads, and detours and bypass roads shall be swept by automatic self-contained sweepers.
- B. Excessive dirt on pavements shall be removed by means of hand shoveling or appropriate mechanical equipment and the area swept as directed above.
- C. Sidewalks and driveways shall be cleaned by means of shovels and hand brooms or appropriate mechanical equipment.
- D. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with calcium chloride dust palliative.
- E. The Contractor shall comply with the above requirements on a daily basis. If the Contractor fails to perform the above Work in a satisfactory manner, all Work, except cleanup operations, shall be stopped until the Contractor has complied with the above requirement.

### 3.03 EROSION AND SEDIMENT CONTROL

- A. The Contractor shall initiate appropriate vegetative practices on all disturbed areas to remain dormant (undisturbed) for more than 45 days within seven days.
  - 1. Such practices may include: temporary seeding, permanent seeding, mulching, matting sod stabilization, vegetative buffer strips, phasing and protection of trees.
- B. Permanent or temporary soil stabilization shall be applied to disturbed areas within seven (7) days after final grade is reached on any portion of the Site.
- C. When seasonal conditions prohibit the application of temporary or permanent seeding, non-vegetative soil stabilization practices, such as mulching and matting, shall be used.
- D. A stabilization construction entrance shall be provided to reduce vehicle tracking of sediment. The paved street adjacent to the Site entrance shall be swept a minimum of daily, or as needed, to remove any excess mud, dirt, or rock being tracked from the Site.
  - 1. Dust and sediment along any street due to construction on this Site is to be swept a minimum of once at the end of the day or as necessary to prevent a build-up of dust and soil on the pavement surface.
- E. Dump trucks hauling from the construction site shall be covered with a tarpaulin.
- F. No more than 200-feet of trench shall be open at any given time. Trench opening, laying of pipe, and backfilling should occur so as to minimize the amount of disturbed area.
- G. The Contractor shall minimize the width of his work area.

- H. Existing trees, shrubs, and other ground cover vegetation shall be preserved where possible. Tree removal will be limited to that necessary for construction and will be limited further to the permanent easement wherever possible. No tree removal will be permitted outside the temporary easement.
- I. Storm water runoff and natural stream flow shall be intercepted or diverted when originating upgrade away from the construction site so as to minimize the amount of flow over the construction site.
- J. All dewatering flows are to be settled in siltation basins or directed through filters before discharge to stabilized sites, such as stream or storm sewers, and not onto exposed soils, stream banks, or any other sites where the flow could cause erosion.
- K. When construction occurs near storm sewer inlets, erosion control measures such as inlet filters or hay bales shall be used to prevent silt from entering the storm sewers.
- L. The clean-up and disposal of excess excavated material shall be done as soon as practical after laying of the pipe. However, clean-up work shall not fall behind the pipe laying more than 800-feet. Should the Contractor not keep his clean-up within the aforementioned distance, Work shall stop until the clean-up work is accomplished.

#### **3.04 MICHIGAN SEDIMENT CONTROL**

- A. Contractor shall control erosion and trap sediment from all sites remaining disturbed for more than 14 days. Such practices shall include among others, sediment traps, sediment basins, silt fences, and storm drain inlet protection. Silt Fence Fabric shall be in accordance with MDOT Item 910.04 Silt Fence Geotextile.
- B. Timing - Sediment control structures shall be functional throughout earth-disturbing activity. Sediment ponds and perimeter sediment barriers shall be implemented as the first step of grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is restabilized.
- C. Settling Ponds - Concentrated storm water runoff from disturbed areas flowing at rates which exceed the design capacity of sediment barriers shall pass through a sediment settling pond. The facility's storage capacity shall be 67 cubic yards per acre of drainage area.
- D. Sediment Barriers - Sheet flow from runoff from denuded area shall be intercepted by sediment barriers. Sediment barriers, such as sediment fences or diversions directing runoff to settling facilities, shall protect adjacent properties and water resources from sediment transported by sheet flow.
- E. Other erosion and sediment control practices shall prevent sediment-laden water from entering drain systems. Unless the storm drain system drains to a settling pond. These practices shall divert runoff from distributed areas and steep slopes where practicable and stabilize channels and outfalls from erosive flows.

### 3.05 CONSTRUCTION OF SLOPES

- A. The Contractor shall comply with the following requirements when working on slopes exceeding 4:1.
1. The pipeline shall be constructed during dry weather, low flow periods as determined by the Engineer. The construction time for this Work shall be limited to the shortest time possible in order to minimize environmental impacts.
  2. Construction equipment shall be limited to trenching equipment or rubber tired backhoes in order to prevent soil erosion and maintain slope stabilization.
  3. Biodegradable mesh shall be used for slope stabilization. The mesh shall cover the entire width of disturbed ground.
  4. The trench shall be backfilled immediately after installation of the pipe. The disturbed areas shall be graded, seeded, and mulched within 24 hours after backfilling. The Contractor shall maintain all seeded and mulched areas in accordance with the specifications until final acceptance of the Work.
  5. The Contractor shall place straw or hay bales at the base of the slopes for sedimentation control. The bales shall be placed prior to construction of the pipeline and shall remain until final seeding has germinated and become established.

### 3.06 RESERVED

### 3.07 PROHIBITED CONSTRUCTION ACTIVITIES

- A. Disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.
- B. Locating stockpile storage areas in environmentally sensitive areas.
- C. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the easement limits.
- D. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.
- E. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or man-made channels leading thereto.
- F. Permanent or unspecified alteration of the flow line of any stream.
- G. Damaging vegetation outside of the construction area.

- H. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.
- I. Open burning of project debris without a permit.
- J. Discharging injurious silica dust concentrations into the atmosphere resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or places of human occupation.
- K. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously specified on the Drawings or not authorized by the Owner or Engineer for such purpose.
- L. Running well point or pump discharge lines through private property or public property and rights-of-way without the written permission of the property owner and the consent of the Engineer.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION



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**SECTION 01800  
CONSTRUCTION SURVEY WORK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing of all labor, materials, equipment, and services necessary for the completion of Construction Survey Work in accordance with the Contract Documents.
- B. This Work consists of the layout of all lines and grades shown on the Drawings or as altered or modified by the Engineer, control survey and of miscellaneous survey work related to construction of the project.

**1.02 PROJECTION**

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

**1.03 REPLACEMENT OF LOST SURVEY POINTS**

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

**1.04 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Layout Sheets including, but not limited to, Benchmarks both temporary and permanent and Pipeline layout staking.
    - b. Field Notes and survey log.
- B. Contractor shall provide the Engineer and Resident Project Representative, no later than five working days prior to installation, all Logs, reports, field notes, drawings and documentation as specified shown on the Drawings or directed.

- C. No pipeline or related Work shall be considered for payment until all logs, reports field notes drawings and documentation as specified, shown on the Drawings or directed has been submitted to the Engineer or Engineers representative.

## **PART 2 PRODUCTS**

### **2.01 CONSTRUCTION STAKING**

- A. All construction points shall be marked with a wooden hub and nail or a PK nails in concrete and asphalt pavements and walks.
- B. All points located in areas of heavy underbrush, inaccessible or limited site distance shall be identified with a wood lath extending a minimum of 3 feet above the ground.
- C. All points located in paved surfaces shall be clearly marked with paint. Contractor shall obtain written permission from owner to use paint for marking.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. The Contractor shall provide field forces necessary to lay out the location, alignment, elevation, and grade of the Work shown on the Drawings and in conformance with the control points and benchmarks shown on the Drawings.
- B. The Contractor shall use competent personnel and suitable equipment for the layout of the Work required. If the layout Work involves more than a few simple distance and elevations from established reference points, the Contractor shall employ a Registered Surveyor to supervise the layout Work.
- C. Contractor shall furnish the necessary labor to assist the Engineer in checking the installation, if required.

### **3.02 EXISTING CONNECTION POINTS**

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

### **3.03 RIGHTS-OF-WAY AND EASEMENTS**

- A. Rights-of-way or easement(s) shall be staked at points along the boundaries so that at least two stakes can be seen distinctly from any point along the boundary line. The staking shall not exceed 200-feet in any direction. All points of change in width or direction of the rights-of-way or easement(s) boundary line shall be staked.
- B. When the Contractor performs construction and the zone of influence is within 10-feet of a rights-of-way or easement(s) boundary line, they shall place stakes properly

identifying points of change in width or direction of the boundary line and at points along the boundary line not to exceed 25-feet.

### 3.04 PAVEMENT

- A. The Contractor shall establish a layout for location and grade on both sides of the road and 5-feet off the edge of the pavement or back of curb. Layout line shall consist of stakes set at station intervals necessary for the topography and environment to assure conformance to planned line and grade. Stakes shall be set at a minimum every 50-feet, at all vertical and horizontal points of curvature and points of tangent, and at all vertical high or low points.
- B. Stakes for line and grade of pavement and curb shall be set at station intervals necessary for the topography and environment, not to exceed 50-feet, and at low and high points of vertical curves to assure conformance to planned line and grade.

### 3.05 PIPE IN OPEN CUT

- A. The Contractor shall utilize a laser beam for establishing line and grade when installing pipeline in open-cut construction. In order to maintain control during pipeline installation and to obtain the required field data for the record documents (G.C. 6.19) the Contractor shall establish construction and layout stakes. These stakes shall be based on the contract documents and the survey control data as provided by the Engineer.
- B. The construction staking shall be placed along the pipeline route at and at location of new manholes, valves, deflections both vertical and horizontal and as specified, shown on the Drawings or as directed. All construction layout stakes shall be offset at a minimum of 10-feet and at a right angle to the pipe line route. Layout shall be referenced to the downstream manhole or valve, in addition it may reference survey of baseline stationing.
- C. Contractor shall provide to the Engineer, no later than five working days prior to the installation of the pipeline, all information of the completed construction layout staking. This information shall include but not be limited to stationing, elevations, control points, project coordinates, offset direction and distance for all deflections both horizontal and vertical, manholes and all other points as specified, shown on the Drawings and directed by the Engineer.
- D. The grade of pipe in open-cut, whether placed by laser beam or other approved methods, shall be checked using surveying equipment. The Contractor shall have a surveyor's level and level rod on the Site at all times when pipeline and appurtenances are being installed. The level rod shall be equipped with an attached "shoe" extension on the bottom for placing on the pipe invert. The pipe invert elevation shall be checked at a maximum of 50-feet intervals or more often as directed by the Engineer. Checks will be performed by the Contractor and results, including but not limited to layout station shall be recorded in contractor's field log.

- E. The Contractor shall furnish all equipment and labor and check his alignment from the offset stakes. Contractor shall record all information in the log.
- F. Any inspection or checking of the Contractor's layout by the Engineer shall not relieve the Contractor of his responsibility to secure the proper dimensions, grades, and elevations of the Work.

**3.06 RESERVED**

**3.07 RESERVED**

**3.08 LOCATION OF STRUCTURES AND UNDERGROUND PIPING**

- A. The location of new structures and underground utilities shall be based on the dimensions, coordinates, and requirements shown on the Drawings or specified.
- B. If it is stated on the Drawings or specified that the location and/or elevation of the new structure or underground piping shall depend on the location of existing underground or otherwise hidden facilities, those existing underground or hidden facilities shall be located by the Contractor prior to his determination of the location and/or elevation of the new facilities. This requirement shall override any other specific location dimensions or coordinates shown on the Drawings for that structure or piping.
- C. If the location or elevation determined by the Contractor, in accordance with the above requirements, appears to cause conflicts with existing structures or utilities or appears to potentially cause functional issues with either the existing or new structures or utilities, the Contractor shall notify the Engineer immediately.
- D. In no case, shall coordinates or other location information be extracted or interpolated from the electronic CAD files that may be provided to the Contractor by the Owner or Engineer without the specific approval of the Engineer.

**3.09 CURB AND GUTTER ELEVATIONS**

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

**3.10 BENCHMARKS/VERTICAL CONTROL**

- A. Benchmarks have been set for survey and construction reference purposes.
- B. The Contractor shall protect and transfer these benchmarks as needed to complete the Work.

**3.11 HORIZONTAL CONTROL**

- A. The centerline stationing provided is not based upon physical control points found or established as part of the design.
- B. The Contractor shall establish horizontal control as necessary.

**PART 4 SPECIAL PROVISIONS**

**4.01 REGISTERED SURVEYOR**

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

END OF SECTION

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**SECTION 01810  
VIDEO RECORDING**

**PART 1 GENERAL**

**1.01 SCOPE**

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

**1.02 SCHEDULE OF WORK**

- A. Unless otherwise directed in writing by the Engineer, video recording shall be scheduled in conformance with the following:
  - 1. No recording shall be started on any portion of the Work until that portion of the Work is under Contract unless otherwise directed by the Owner.
  - 2. Recording shall not precede excavation for construction by more than three months.
  - 3. Video recording shall be performed only when foliage is visible on trees, except as authorized by the Engineer.
  - 4. Video recording shall not be performed when more than 10% of the ground is covered with snow or leaves, unless authorized by the Owner.
- B. Before proceeding with the Work, the video recording Contractor shall consult with the Engineer concerning the following:
  - 1. Scheduling recording to precede construction.
- C. All recording shall be completed on a section of Contract before the Contractor starts excavation or places material or equipment in that section.
- D. In areas where public utilities are to be relocated or replaced, a second video recording shall be made after the public utility has concluded their work but before the Contractor commences operations.
- E. The Owner shall obtain permission for the recording crew to enter private property not included in an easement. The Contractor shall give the Owner sufficient prior notice to obtain the permission.

**1.03 DEFINITIONS**

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



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

- B. Video Recording of Buildings - Entering - Shall include moving video equipment into buildings or residences (including attached or separate garages) designated by the Engineer for the purpose of recording existing conditions therein.
- C. Video Recording of Building - Panels - Shall include video recording of designated panels of buildings. Panel as used herein shall mean the full surface of a room wall, ceiling, or floor or the outer side of a building not viewable in any zone of influence recording.

#### 1.04 SUBMITTALS

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Provide a minimum of four copies of the video.

### PART 2 PRODUCTS

#### 2.01 VIDEO RECORDING

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

#### 2.02 VIDEO OUTPUTTING

- A. Video recording shall be a digital file format such as MPEG, MP3, MP4, Wave or WMV or other current standard file formats as approved by Engineer.
- B. The electronic file organization shall reasonably match the project stationing with file names including the station number and street names.
- C. The electronic files shall be stored on a single solid-state memory device, such as a DVD disc or jump/thumb drive, external hard drive. Solid state memory devices shall have a USB for connection to a computer. The memory volume on the storage device shall be adequate to store the electronic video files in an unzipped capacity along with any associated or embedded data files.

## 2.03 AUXILIARY LIGHTING

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

## PART 3 EXECUTION

### 3.01 PERSONNEL

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

### 3.02 PRODUCTION

- A. Recording shall be composed in such a manner that filming shall, in general, proceed in the direction of the project stationing.
- B. Recorded Contents:
  - 1. All houses or buildings and other readily recognizable objects as required shall be identified visually in such a manner that they can be referenced to the stationing of the project. Objects selected shall be at intervals not exceeding 100 lineal feet and shall include all houses and buildings identified by house numbers.
  - 2. Within the zone of influence, the recording shall include but not be limited to all sidewalks, driveways, ditches, parkways, lawns, inlets, culvert pipe ends, trees, shrubs, fences, houses, and buildings that could conceivably be affected by the Contractor's operations. The video shall call attention to existing cracks or uneven areas in walks and driveways, damaged lawns, trees or shrubbery, broken or missing inlet castings, deteriorated fences, and, where feasible, broken or plugged culvert pipes.
  - 3. Within street rights-of-way, the recording shall include but not be limited to all pavement, curbs and inlets, mailboxes, traffic signs, and street signs. The video shall call attention to damaged mailboxes, signs, curbs and inlet castings. Damaged areas in pavements over proposed project or in pavements scheduled for resurfacing need not be referred to in the video.
  - 4. Video recording for designated residences shall include documentation of surface conditions inside and outside of the building prior to starting project construction.
- C. Control of Picture Quality - The camera carrier shall travel at a low speed to ensure against blur or distortion of the recorded pictures. A maximum rate of 48-feet per minute is recommended.

**3.03 OWNER REVIEW**

- A. As the video recording work progresses, the Contractor shall deliver completed sections to the Owner and Engineer. The Owner and Engineer will review the recordings and determine if they are acceptable for clarity and coverage. The recording may be rejected if the picture is of poor quality (i.e., blurred, distorted, too light, too dark, improper color), insufficient coverage, or does not meet specified requirements.
- B. The area of rejected recording shall be rerecorded by the Contractor and reinserted in the electronic file in the proper sequence.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 02100  
CLEARING AND GRUBBING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes grubbing, scalping, and otherwise clearing of the construction site in accordance with the Drawings and as specified herein or ordered.
- B. This Work includes the removing and disposing of all trees, stumps, vegetation, and debris as necessary to accommodate new construction or to recontour the Site, and the preservation of all vegetation and other objects designated to remain.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Information for the Record:
    - a. Spoil Site Permit - When the material and debris resulting from the clearing and grubbing operations are disposed of at locations off the project, the Contractor shall obtain and submit as specified written permission from the owner of the property upon which the material and debris are to be placed.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

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

**PART 3 EXECUTION**

**3.01 COORDINATION**

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

**3.02 PREPARATION**

- A. The Contractor shall protect and preserve all land survey monuments or property corners along the line of his work.
  - 1. Where monuments, irons, or property corners are disturbed or removed due to operations under this Contract, the Contractor, at his own expense, shall

employ the services of a registered land surveyor to establish, reset or replace such monuments, irons, or property corners.

- B. The Contractor shall not damage or destroy trees or shrubs nor remove or cut them without authorization by the Owner. All trees and shrubs except those ordered to be removed shall be adequately protected by the Contractor. No excavated material shall be placed so as to damage such trees and shrubs.
  - 1. Trees and shrubs damaged by the Contractor shall be replaced with new stock of similar size and age, or with other stock size and age satisfactory to the Owner, at the proper season, and at the sole expense of the Contractor. Scarred surfaces shall be treated as indicated in Part 2.
- C. When or where any direct or indirect damage is done to public or private property resulting from Contractor's operations, such property shall be restored by the Contractor, at his expense, to a condition equal or better than that existing before such damage was done or the Contractor shall make good such damage in manner acceptable to the owner of the property.
- D. Prior to clearing and grubbing operation, the Owner, Contractor, and Engineer shall walk the site to designate the trees to be removed or to be protected. Trees shall be marked with paint and a universally accepted designation.

### **3.03 CLEARING AND GRUBBING**

- A. Only those trees and shrubs shall be removed that are in actual interference with excavation or grading work and such removal shall be subject to approval by the Owner. The Owner reserves the right to order additional trees or shrubs removed at no additional cost if, in his opinion, they cannot be maintained or have been damaged by the Contractor's operations.
- B. All trees, stumps, vegetation, and debris not designated to remain shall be cleared and/or grubbed.
- C. In locations to be seeded, stumps, roots, and other protruding obstructions shall be removed to a minimum of 6 inches below the final ground surface.
- D. At all times, the Contractor shall remain within the property lines and/or easement areas.
- E. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with Section 02200.

### **3.04 SCALPING**

- A. Areas of excavation or embankment shall be scalped of brush, roots, sod, grass, crop residue, decayed vegetable matters, and other organic materials.
- B. Scalping depth shall be only as required to remove the above. Scalping of topsoil is not included under this Section.

**3.05 DISPOSAL OF DEBRIS**

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

**3.06 TREE AND VEGITATION REPAIR**

- A. The Contractor shall employ an arborist where necessary for the repair and protection of a tree and vegetation
- B. Contractor shall repair injuries to bark, trunks, limbs, and roots of remaining vegetation by properly dressing, cutting, pruning, bracing and painting utilizing tree surgery methods, tools and materials recommended by the Arborist.

**PART 4 SPECIAL PROVISIONS**

**4.01 TREE REMOVAL**

- A. A tree is defined as a live, dying or dead plant with a minimum diameter of 3 inches with snags at 4-feet above the ground surface and a minimum height of 12-feet above the ground surface.

END OF SECTION

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**SECTION 02110**  
**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

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

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Information for the Record:
    - a. The Contractor shall submit, as specified, a copy of a signed permit from the owner of the property upon which the debris, removed under this Section, will be disposed.
    - b. Dust and noise control measures
    - c. Record documents, in accordance with the General Conditions, and photograph or video recording indicating the location of, but not limited to, the following existing, new, and abandoned:
      - 1) Utilities.
      - 2) Mechanical.
      - 3) Electrical.
      - 4) Structural.
      - 5) Any embedded items.
    - d. Inventory and documentation list for removed and salvaged materials for the Owner.

**1.03 QUALITY ASSURANCE**

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



**1.04 PROTECTION**

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

**PART 2 PRODUCTS**

**2.01 FILL MATERIAL**

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

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Demolition work extending beyond the limits as specified, shown on the Drawings, or as required, will be considered unauthorized. The Contractor, at no additional cost to the Owner, shall repair said damage to a condition equal to or better than existed prior to commencement of the Work.
- B. Existing structures and equipment which are damaged in appearance or function by performance of demolition work shall be replaced or repaired, at Owner's discretion and to an approved condition, by the Contractor at no increase in Contract Price.

**3.02 PAVEMENTS, SIDEWALKS, CURBING AND SIMILAR STRUCTURES**

- A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat, and free from chipped or damaged edges.
- B. For removal of non-reinforced concrete, the minimum depth of saw cut shall be 3 inches.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel unless specified otherwise.
- D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

**3.03 RESERVED**

**3.04 MANHOLES, CATCH BASINS, INLETS AND SIMILAR STRUCTURES**

- A. Existing manholes, catch basins, inlets, and similar structures designated to be removed shall be completely removed.
- B. Manholes, catch basins, inlets, and similar structures designated to be abandoned shall be removed to an elevation of at least 3 feet below the finished subgrade or ground surface. The remaining void shall be filled with special backfill material compacted to

100% optimum density per ASTM D698 or controlled density fill, CDF if permitted by the Engineer. All sewer openings in manholes located on sewer lines that are not to be filled, shall be plugged with 8-inch minimum thickness masonry plug.

- C. Sewers designated to remain in service and connected to structures indicated to be removed or abandoned shall be rebuilt through the area with new pipe. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.
- D. All castings or hydrants salvaged from abandoned or removed structures shall remain the property of the Owner, if requested by the Owner, and shall be cleaned and transported by the Contractor to a site designated by the Owner or incorporated in the Work where called for on the Drawings, scheduled, or so directed. If Owner decides salvaged materials are not wanted, the Contractor shall dispose of them at no additional cost to the Owner.

**3.05 ABANDONMENT OF PIPE, CONDUIT AND SIMILAR STRUCTURES**

- A. Ends of pipe designated to be abandoned shall be sealed with approved masonry bulkheads or factory caps and plugs.
- B. Sites disturbed by the abandonment work shall be restored as part of this Work.

**3.06 GUARDRAIL AND FENCE**

- A. Where so required by the Drawings, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.
- B. Wood posts and other materials not considered salvageable by the Owner shall be disposed of by the Contractor.

**3.07 RESERVED**

**3.08 RESERVED**

**3.09 PRIVATE SIGNS**

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

**3.10 DISPOSAL OF DEBRIS**

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

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

### **3.11 BACKFILLING**

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

### **3.12 RESERVED**

### **3.13 USE OF EXPLOSIVES**

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

### **3.14 PIPING REMOVAL**

- A. At the location where pipe removal stops, the remaining pipe end shall be capped. The cap must be pressure tight and restrained from movement due to pressures inside the pipe.
- B. Piping removal includes, but not limited to, all hangers, stands, and anchoring devices.

### **3.15 RESERVED**

## **PART 4 SPECIAL PROVISIONS**

### **4.01 SCHEDULE OF REMOVALS**

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

### **4.02 BURIED SANITARY SEWER AND WATER MAIN REMOVAL**

- A. As shown on the Drawings, existing water main or sanitary sewer main piping, accessories, and appurtenances shall be removed within limits shown on the Drawings or as specified.
- B. The removal shall include removal and disposal, aggregate backfill, pipe bedding and control density backfill.
- C. Existing pipe removed shall become the property of the Contractor and shall be properly disposed of in accordance with the requirements of this Section.

- D. At locations where the pipe removal is terminated, a water-tight sewer plug shall be placed in the end of the pipe to remain.
- E. Manholes shall be fully removed. Castings to be salvaged and returned to the Owner unless otherwise directed by the Engineer or Owner.

**4.03 VALVES, BOXES AND VALVE STRUCTURES ABANDONED**

- A. Manholes and valve box castings to be abandoned in place shall be removed to 18 inches below final grade and filled with low-strength mortar backfill in accordance to the bottom of the pavement typical section or to 12 inches below final grade in non-paved areas. The pavement section shall be removed and replace an additional 18 inches horizontally outside of the casting area. The void created by the removal of the casting, structure and valve box shall be backfilled to match the surrounding pavement section or as specified for non-pavement areas.
- B. Valve boxes shown on the plans may also have existing manhole castings, frames, manhole structures around the existing valves. The abandonment of valves shall include the removal of all existing manhole casting, frame, and structure walls to be specified depths as associated with that particular valve.
- C. Valve shall be abandoned in the off position when possible.

**4.04 VALVES AND STRUCTURES REMOVED**

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

END OF SECTION

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**SECTION 02200  
EXCAVATION AND BACKFILL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes all excavations and related Work for the construction of the designated structures, pipelines, and other incidental Work.
- B. Excavation includes the Work of making all necessary excavations for the construction of all Contract Work; of furnishing, placing, and use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the Work and workers; of doing all pumping and fluming necessary to keep the excavation free from water; of providing for uninterrupted flow of existing drains and sewers; of supporting and protecting existing structures, pipes, conduits, sewers, culverts of all types of materials of construction, of supporting and protecting railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the Work; of removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary; of removing after completion of the Work all sheeting and shoring not necessary to support the sides of excavations; of removing and disposing of all surplus excavated material or material under structures that does not meet the soil design bearing capacities; of doing all backfilling, of compacting backfill to limits specified or ordered by the Engineer; and restoring all property damaged as a result of the Work involved in this Contract.
- C. The Work includes obtaining and transporting suitable fill material from off-site when on-site material is not available.
- D. The Work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, or disposal of all surplus on other sites selected by the Owner.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Sieve Analysis (ASTM C136) - One test for each material source.
    - b. Submit a moisture density curve (ASTM D698) for each type of material used for backfill. Test shall be referenced to appropriate sieve analysis test. The maximum dry weight and optimum moisture content shall be indicated.
    - c. Controlled Density Fill Material - Design Mix and Certified Test Results.

- d. Test results for conformance with specified "Compaction Requirements":
  - 1) Retests shall be referenced to the corresponding failing test.
- 2. Information for the Record:
  - a. When excess excavated material is disposed at locations off the Site, the Contractor shall obtain and submit written permission from the Owner of the property upon which the material is to be placed.

## **PART 2 PRODUCTS**

### **2.01 TOPSOIL**

- A. Soil stripped from the Site shall consist of loose, friable, loamy topsoil without admixture of subsoil or refuse. It shall be reasonably free from peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The stockpiled soil shall be subject to the approval of the Engineer.
- B. Topsoil provided shall be in accordance with MDOT 816 and be loose, friable, loamy soil without admixture of subsoil or refuse. In order for the topsoil to be considered loamy the fraction of topsoil, passing a No. 10 sieve, shall contain not more than 40% clay. Topsoil shall contain not less than 4% nor more than 20% organic matter as determined by loss on ignition of oven-dried samples to constant weight at 212 degrees F.
- C. Excess material shall be removed from Site, unless directed otherwise by Owner or Engineer.

### **2.02 SELECTED BACKFILL**

- A. Selected backfill shall be clean excavated soil. It shall be free of rock and foreign debris of any kind and shall be tested in accordance with ASTM C136 sieve screen analysis and ASTM D2487 soil classification. The material's use as selected backfill shall be approved by the Engineer.
- B. Engineer may waive material testing of selected backfill. Such waiver shall apply only to the designated location and the source of the selected backfill. Such waiver shall not apply to excavated soil from locations not so designated.

### **2.03 SPECIAL BACKFILL MATERIAL**

- A. Special backfill material shall conform to MDOT 902.08 and shall meet the grading requirements of Table 902-3, Class II.

### **2.04 AGGREGATE BEDDING MATERIAL**

- A. Aggregate bedding material shall be well-graded durable crushed gravel, crushed stone or meeting the graduation requirements of MDOT Table 902-1, Class 17A. Bedding

material containing a greater percentage of larger sized aggregate shall be furnished at the direction of the Engineer.

**2.05 RESERVED**

**2.06 RESERVED**

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Construction Through Highways:
  - 1. Permits - The Owner will obtain permits required for open cut construction through highways. Contractor shall be responsible for compliance with and furnishing any item required by permit such as Bond Security.
  - 2. Notification - The Contractor shall give written notice to appropriate officials of the affected Department of Transportation, City, or County at least five days, not including weekends and holidays, before starting construction under highways and as required under other roadways.
  - 3. Contractor shall comply with standard permit conditions of controlling authority and special provisions noted in Part 4 of this Section.
- B. Test Pits:
  - 1. The Contractor shall perform exploratory test pits as may be necessary or ordered by Engineer in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation. Vacuum excavation (pot hole) may be used if adequate information can be obtained by such method. No additional payment shall be made for test pits.
  - 2. Conflicts with existing utilities not located, as specified, far enough in advance of construction, shall not be considered as a basis for delay claims or additional payment.

**3.02 REMOVING AND REPLACING TOPSOIL**

- A. Removal
  - 1. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed: The Contractor may elect to strip soil and stockpile unless the Contract Documents direct stripping and stockpiling prior to excavation.
  - 2. General excavation, other than trench excavation: The Contractor shall remove, and stockpile the top 12 inches of the existing soils from all areas of



construction including, but not limited to, excavation and embankment areas, stockpile sites, construction yard, storage areas, etc.

- B. Replacing stockpiled soil and topsoil
  - 1. Trench excavation areas disturbed as a result of trenching operations and which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The surface shall be mechanically conditioned after removal of debris. After surface is prepared, it shall be covered with topsoil or stockpiled soil material to a minimum depth of 4 inches. Topsoils and stockpiled soil material shall meet the requirements specified herein and be tested.
  - 2. General excavation areas which are to be restored with grass or other plantings shall be free of peak, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris, wood products and construction debris including loose stone. The surface shall be mechanically conditioned after removal of debris. After surface is prepared it shall be covered with stockpiled soil and then have a minimum of 4 inches of topsoil placed.
- C. The Work shall be in accordance with applicable portions of MDOT 205.03A.1 and 816.03A.

### 3.03 GENERAL EXCAVATION

- A. All necessary excavation shall be performed to accommodate the completion of all Contract Work.
- B. The Drawings show the horizontal and the lower limits of structures, pipelines, sewers and other utilities. The methods and equipment used by the Contractor when approaching the bottom limits of excavation and when trimming the bottom of the excavation to a smooth surface shall be selected to prevent disturbing the soil below the bottom limits of excavation.
- C. Excavation which is carried below the bottom limits shall be classified as Unauthorized Excavation, unless said excavation has been authorized by the Engineer prior to each occurrence.
- D. Unauthorized excavation shall be filled with CDF material to the bottom limits. Under circumstances where structural integrity is not a factor, the Engineer may allow the filling of unauthorized excavation with pipe bedding material or special backfill material compacted to 100% density, as specified under compaction requirements.

- E. Sheeting, Shoring, and Bracing:
1. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all existing adjacent and neighboring structures and utilities from damage by settlement.
  2. Sheeting, shoring and bracing shall be arranged so as not to place a strain on portions of completed Work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built Work and adjacent and neighboring structures and utilities.
  3. Sheeting, shoring and bracing shall be removed or cut-off at the time of backfilling to avoid problems with finish grade or future excavation.
- F. Removal of Water:
1. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein are completed. No water shall be allowed to rise over or come in contact with concrete or masonry until the concrete and mortar has attained a satisfactory set, except in cases where the concrete has been tremied into place with the approval of the Engineer. Water shall not be allowed to rise above the bottom of the bedding stone prior to placing pipe. In waterbearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.
  2. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

### 3.04 TRENCH EXCAVATION

- A. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed shall provide adequate space for workers to place and joint the pipe properly. The trench shall be kept to a minimum width. The width of trench at the top of the pipe shall comply with the limits specified or shown on the Drawings.
- B. Excavation shall be to the depth necessary for placing aggregate bedding material under the pipeline, sewer, conduits and other utilities as shown on the Drawings. If over excavation occurs, the trench bottom shall be filled to grade with compacted aggregate bedding material.
- C. The amount of trench open at any one time in advance of completed Work shall be limited to the minimum necessary for conducting laying operations.

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

### **3.05 EXCAVATION OF UNSUITABLE MATERIAL**

- A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as required by the Engineer. The Engineer may rely upon the independent laboratory retained on this Project when determining unsuitable soil conditions, removal and backfill. Such excavation shall be conducted at a time when the Engineer and independent laboratory are present and shall not exceed the vertical and lateral limits prescribed by both.
- B. The voids left by removal of unsuitable material shall be filled with special backfill, pipe bedding material, or CDF material as listed in Part 4 or as prescribed by the independent laboratory and as approved and ordered by the Engineer. Special backfill or pipe bedding shall be installed as described in this Section and in general shall be compacted to 100% density as specified under compaction requirements.

### **3.06 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL**

- A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments as shown on the Drawings, shall be disposed of by the Contractor at his expense and at sites provided by him as may be required, except that the Owner reserves the right to require the Contractor to deposit such surplus at locations designated by the Owner within a five-mile radius of the Work.
- B. No surplus excavated material of any class shall be deposited in any stream or watercourse or be dumped on public property without the consent of the Owner. All spoil areas shall be left smooth, level, with drainage to a water course and proper erosion and runoff control shall be used.

### **3.07 BACKFILL AND COMPACTION**

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

- C. Backfilling with Selected Backfill - Unless otherwise specified or directed, material excavated in connection with the Work may be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification for selected backfill. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12 inches, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry shall be deposited closer than 24 inches from the completed outside surface of any structure or pipe.
- D. Backfill Immediately - All trenches and excavations shall be backfilled immediately after completion of construction therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in unbackfilled excavation during construction or after pipe has been placed.
- E. Backfilling around and over structures, pipelines, conduits and other utilities comprising the Work shall be carefully done by hand and tamped with suitable tools of approved weight when within 2 feet of structures, pipeline, conduit and other utilities. Selected backfill or, where specified, shown on Drawings, or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6 inches in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.
- F. Backfilling may be done by machinery after the backfill has been placed and compacted beyond 2 feet horizontally of structures, pipelines, conduits and other utilities and to a minimum depth of 1 foot above the tops of any buried structures, pipelines, conduits, and other utilities. The backfill material shall be deposited in horizontal layers, not thicker than one foot, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case, will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.
- G. Backfilling Under Pavement and Walks - Where existing or new pavement, driveway, parking lot, curb and gutter, or walk is over an excavation, special backfill material shall be used to backfill the entire excavation from the bedding to surface. The material shall be placed and compacted to the required density in accordance with one of the following methods:
  - 1. The backfill material shall be deposited in 6-inch horizontal layers and each layer shall be thoroughly compacted to the proper density by approved compaction method before a succeeding layer is placed.
  - 2. No method of compaction which alters the gradation of the special backfill material or prevents compaction testing by standard testing methods shall be used.

### 3.08 COMPACTION REQUIREMENTS

- A. In areas to be filled, after the top 12-inches of soil is stripped, then the undisturbed subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D698 (Standard Proctor) prior to placing of fill.
- B. Backfill placed under areas receiving concrete slabs, mats, footings, or within the interior of buildings shall be compacted to not less than 100% of maximum dry density per ASTM D698.
- C. Backfill placed around structures where other structures, pipelines, or slabs are to be constructed shall be compacted to not less than 100% of maximum dry density per ASTM D698.
- D. The material used to construct embankments and fills in locations other than under pavements, walks, structures, or slabs and around and over pipelines, shall be compacted to not less than 95% of maximum dry density per ASTM D698.
- E. All other backfill, including backfill around and over pipelines, and backfill around structures not covered in Paragraphs B. and C. above, shall be compacted to not less than 95% of maximum dry density per ASTM D698.
- F. The bottom of excavations upon which concrete slabs or structures are to be placed shall be compacted to obtain 100% maximum dry density per ASTM D698 in the top 12 inches.
- G. All soil subgrade which will provide bearing support for pavements or curbs, shall be compacted to a width of 6 inches beyond the back of curb and to a depth of 12 inches below the bottom of excavation to a density of not less than 100% of maximum dry density per ASTM D698. All fill below the subgrade shall be compacted to not less than 98% of maximum dry density, unless specified otherwise.
- H. Subgrade under the driveways and walks shall be compacted to a depth of 6 inches below the subgrade surface to density of not less than 100% of the maximum dry density determined by ASTM D698.
- I. Subgrade under structures shall be compacted to a depth of 12 inches below bottom of excavation surface to a density of not less than 100% of the maximum dry density determined by ASTM D698.

### 3.09 COMPACTION TESTS

- A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.
- B. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.

- C. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

**3.10 RESERVED**

**3.11 RESERVED**

**3.12 RESERVED**

**PART 4 SPECIAL PROVISIONS**

**4.01 FIELD TESTING (MINIMUM REQUIREMENTS)**

- A. The laboratory shall perform the following field tests:
  - 1. Trench Backfill - One test for every 200 cubic yards of backfill material.
  - 2. Subgrade Compaction - One test for every 300 square yards of subgrade.
  - 3. If directed by the Engineer, additional tests shall be performed for any of the above.

END OF SECTION

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**SECTION 02550  
SANITARY SEWERS AND STORM SEWERS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing sanitary sewers.
- B. Reconstruction of existing sewers, house connections, and catch basin leads shall be in conformance with requirements of this Section.
- C. This Section shall include furnishing and installing all required pipe, bends or beveled pipe, tees, wyes, tee manhole base pipes, bulkheads and stoppers, jointing material, granular material for pipe bedding, concrete used for encasement or bedding, making watertight connections to existing and new sewers and existing manholes, catch basins and inlets, cleaning and testing sewers, removing temporary bulkheads, and other work incidental to the sewer installation unless specifically included under other Items.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating pipe and joint materials, physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project compliance with specified standards.
  - 2. Information for the Record:
    - a. Manufacturer's certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

**PART 2 PRODUCTS**

**2.01 SOLID WALLED PIPES**

- A. Polyvinyl Chloride (PVC) Sewer Pipe Specifications:
  - 1. For pipe 15-inch diameter and smaller: Pipe, fittings, and jointing systems shall conform to ASTM D3034, except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall not exceed 26.



2. Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F-477 requirements. Joint materials and testing shall conform to ASTM D3212 requirements.
3. All service connections shall be made using a wye and a bend. Tees shall be used only as directed by the Engineer. Tees and wyes shall be die cast or factory fabricated. All service pipe shall be SDR 26.

## 2.02 COMPOSITE AND PROFILED WALL PIPES

- A. High-Density Polyethylene (PE) Profile Wall Sewer Pipe:
  1. Pipe shall have a smooth interior with a profile wall. Pipe, fittings, and jointing systems shall conform to ASTM F894. Pipe and fittings shall be made of high density, high molecular weight polyethylene material meeting the requirements of ASTM F2306. Pipe for storm drainage applications shall be ADS N-12 (WT) or approved equal.
  2. Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F477 requirements. Joint materials and testing shall conform to ASTM D3212 requirements. Joints shall be able to pass an ASTM D3212 test at 10.8 psi for 10 minutes with no leakage.
  3. Fittings shall include couplings, tees, wyes, elbows, plugs, and adapters. Tees and wyes shall be die cast or factory-fabricated.
  4. Manhole adapters shall have a smooth exterior surface to ensure a watertight joint with "Flexible Joints" as specified in Section 02552.

## 2.03 ACCESSORIES

- A. Flexible Pipe Repair Couplings:
  1. Flexible repair couplings shall be made of elastomeric polyvinyl chloride boot with series 300 stainless steel shield and clamps. Couplings shall be Strong Back RC series as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Logan Clay Pipe Co., Logan, Ohio; Mission Clay Products Corp., or equal.
- B. Granular Pipe Bedding Material:
  1. Granular pipe bedding material shall be as specified in Section 02200.

## 2.04 REPLACEMENT DRAINS, SEWERS AND APPURTENANCES

- A. Vitrified clay pipe sanitary sewers removed or damaged in completing the Work shall be replaced using pipe and joints as specified in this Section. Connections to existing sewers shall be as specified in this Section.
- B. Manholes, catch basins, and inlets removed or damaged under these Items shall be replaced in conformance with applicable Drawings and Specifications.

## 2.05 SOURCE QUALITY CONTROL

- A. Pipe Manufacturer's Certification:
1. The pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.
  2. A test results report shall accompany that manufacturer's certificate. The report shall compare test results to Specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

## PART 3 EXECUTION

### 3.01 CONSTRUCTION IN HIGHWAY PROPERTIES

- A. Construction in Highway properties shall conform to the requirements of Section 02200.

### 3.02 PREPARATION OF TRENCH

- A. Trench excavation shall conform to requirements of Section 02200.
- B. Unless otherwise indicated minimum trench widths for flexible pipes shall meet the requirements of ASTM D2321 and the Trench Detail shown on the Drawings.
- C. Unless otherwise indicated all sewer trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of bedding material as shown on the Drawings and specified herein.

### 3.03 RESERVED

### 3.04 FLEXIBLE PIPE INSTALLATION

- A. Flexible pipe shall be installed in accordance with ASTM D2321. Bedding, backfill, and compaction shall meet the requirements of this Section and Section 02200.
- B. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. Pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.
- C. Pipe shall be laid to lines and grades and checked in conformance with Section 01800. Pipes installed more than 0.04-feet above or below specified elevation shall be removed and reinstalled to grade.

- D. Temporary internal supports shall be used as recommended by the pipe manufacturer.

### 3.05 PIPE JOINTS

- A. O-Ring and Chemically Welded Joints - Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.
- B. Flexible Plastic Gasket Joints - Materials used for gaskets shall be as specified in this Section. Cross section size of gaskets and method of installation shall conform to the manufacturer's recommendations.

### 3.06 CONNECTIONS TO EXISTING SEWERS

- A. Unless indicated otherwise new pipe connections through the side of existing sewers shall be made as follows:
  - 1. Vitrified clay pipe, plain concrete pipe, and asbestos cement pipe, 15-inch diameter and smaller, and larger diameter at the option of the Contractor, shall be connected by removing a section of the existing sewer and inserting connecting fittings using specified flexible repair couplings.
  - 2. Polyvinyl chloride pipe, HDPE pipe, ABS pipe, and ABS truss pipe shall be connected in conformance with the manufacturer's recommendations as approved by the Engineer.
  - 3. Connections shall be made in conformance with the jointing materials manufacturer's recommendations and as directed by the Resident Project Representative.

### 3.07 FIELD QUALITY CONTROL

- A. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the Contractor's laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. The Contractor shall pay for tests on the first sample. Should the sample fail to meet specifications, retests shall be conducted by the Contractor's laboratory in conformance with the specifications and shall be at no additional expense to Owner.
- B. Field Inspection:

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05/2023

Issue for Bid  
Kalamazoo, MI  
Kalamazoo/GPI Effluent Sewer Realignment

1. Individual sections of pipe may be rejected at any time because of defective joints, dimension variations, fractures, cracks, chips, or blisters exceeding the permissible tolerances.
2. Rejected pipe shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.

**3.08 RESERVED**

**3.09 RESERVED**

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

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**SECTION 02552  
PRECAST CONCRETE MANHOLES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing precast concrete manholes, including manhole stacks of types and at locations shown on the Drawings and scheduled.
- B. This Section includes additional excavation to widen and deepen trenches for manhole construction, furnishing and installing concrete of classes called for, portland cement mortar, reinforcing steel, flat slab tops and grade rings, flexible manhole connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, joint wrap installing, , and other work incidental to manhole construction and testing.
- C. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, pipe openings, precast section arrangement, adjusting rings, castings, and joint details for each size and type of manhole components furnished for the project. Shop Drawing shall incorporate the planned elevations and details.
    - b. Manufacturer's certification indicating that the manhole components and joints meet specifications for each production run for each size and type furnished.
  - 2. Information for the Record:
    - a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Type of Manhole Sections:
  - 1. Type I Manholes - Type I manholes shall mean 4-foot diameter manholes with either precast integral base sections or precast bottoms for air release

manholes. Pipe connections to manholes shall be made with flexible water tight joints. Type I manholes are intended for installation of pipes 18-inch diameter and smaller unless noted otherwise.

2. Type S Manholes - S following manhole type shall mean the designated type manhole constructed with a precast flat slab top in lieu of a precast cone.
- B. Precast concrete pipe manhole sections, integral base sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM C 478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.
  - C. Joints shall be tongue and groove type with a gasketed seal type conforming to ASTM C443.
  - D. The standard length of riser sections shall be 48-inch. Lengths of 32-inch or 16-inch shall be used to meet required dimensions and as specified.
  - E. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be pre-formed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form.
  - F. Precast integral base sections shall be of monolithic construction. Base flat slab floors or integral floors shall have a minimum thickness of 6-inch for risers up to and including 48-inch in diameter. A layer of reinforcement shall be placed above the midpoint and shall have a minimum area of 0.12 square inch/linear feet in both directions.
  - G. Manhole sections shall be constructed with no pipe connection within 6 inches of a joint in the structure.
  - H. Manhole sections shall be clearly marked and identified with the manhole number, section placement order, casting date, trademark, name of the manufacturer, and location of the production plant.

## 2.02 ACCESSORIES

- A. Manhole Steps - Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.
  1. Specified manhole steps shall be factory installed to provide a continuous ladder of 16-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with non-shrinking mortar to ensure a watertight joint. Manhole step installation shall be in compliance with OSHA regulations. If the outer surface of the pipe wall is pierced the patch shall be completely covered with a bituminous sealer.
- B. Manhole frames and covers shall be as shown on the Drawings and in conformance with requirements of Section 05540.

- C. Mortar:
  - 1. Mortar used for the structures herein specified shall conform to ASTM C270 Type S, containing no masonry cement. The mortar shall be composed of one-part portland cement to two parts sand by volume.
  - 2. Non-shrinking Mortar - Materials for non-shrinking mortar shall be Sauereisen F-100, Five-Star, or equal.
- D. Cast-in-Place Concrete:
  - 1. All cast-in-place concrete shall be according to MDOT Specification Division 7.
- E. Flexible Joints - Joints for precast pipe openings shall be "A-LOK X-CEL" as manufactured by A-LOK Products, Inc., "Kor-n-seal" as manufactured by National Pollution Control Systems, Inc., or equal in accordance with ASTM C923.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Location and type of manholes installed shall be as shown on the Drawings or directed.
- B. Construction shall be in conformance with details shown on the Drawings and as specified.
- C. Excavation for manhole construction shall be prepared as directed in applicable paragraphs of Section 02200.

#### **3.02 INSTALLATION OF INTEGRAL BASE SECTIONS**

- A. The manhole base may be placed on 6 inches compacted granular bedding material.

#### **3.03 RESERVED**

#### **3.04 RESERVED**

#### **3.05 RESERVED**

#### **3.06 INSTALLATION OF MANHOLE FRAMES**

- A. Manhole frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of manhole castings shall be made using specified precast grade rings and portland cement mortar joints or preferred bitumen seals.
- C. Each manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.



- D. The maximum depth of adjustment below any manhole casting shall be 16 inches and the minimum depth of adjustment shall be 4 inches.

**3.07 RESERVED**

**3.08 RESERVED**

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 02554  
CATCH BASINS AND INLETS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing precast, cast-in-place, and masonry inlets and catch basins of designated types and at locations shown on the Drawings and scheduled.
- B. This Section includes all necessary excavation, removing existing structures, furnishing and installing concrete of classes called for, reinforcing steel, brick, precast solid concrete block, portland cement mortar, precast concrete inlet structures, flexible joints where specified, inlet castings, making watertight connections to new and existing sewers, and other incidental work.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for review:
    - a. Manufacturer's certification indicating the manhole components and joints, for each production run for each size and type furnished meet specifications.
    - b. General assembly drawings, identifying catch basin and inlet components, physical dimensions and compliance with Specifications.

**PART 2 PRODUCTS**

**2.01 TYPES OF CATCH BASINS AND INLETS**

- A. Types of inlets and catch basins included under this Section shall be as designed and detailed on the Drawings and as specified by the City of Kalamazoo.
- B. The terms catch basins and inlets as used herein refer to nomenclature of standard drawings for specified structures and of details shown on the Drawings.

**2.02 MATERIALS**

- A. Brick - Brick used for catch basins and inlet construction shall conform to ASTM C32, and shall be "Grade MS" unless otherwise specified.
- B. Precast Solid Concrete Block - Precast solid concrete block shall conform to ASTM C139.

- C. Mortar - Mortar used for the structures herein specified shall conform to ASTM C-70 Type S containing no masonry cement. The mortar shall be composed of one-part portland cement to two parts sand by volume.
- D. Precast concrete inlet structures shall conform to ASTM C913.
- E. Cast-in-place concrete shall comply with requirements of Section 03300.
- F. All joints in the walls and bottom of precast catch basins and inlets shall be tongue and groove type with a preformed butyl rubber joint sealant placed in the joint prior to assembly of the joint. This joint material shall provide a permanent flexible non-shrinking watertight seal and shall meet the requirements of ASTM C990. After assembly of the joint, a 12-inch-wide band of permanent flexible water barrier wrap shall be applied to the exterior surfaces centered on all wall joints and any buried top slab joints. This barrier wrap shall meet the requirements of ASTM E1745, C877, and C990. The barrier wrap shall be bonded to the concrete with a brush or roller applied adhesive surface primer formulated for use with the barrier wrap material.

### 2.03 ACCESSORIES

- A. Flexible Joints - Joints for precast pipe openings shall be "A-LOK X-CEL" as manufactured by A-LOK Products, Inc., "Kor-n-seal" as manufactured by National Pollution Control Systems, Inc., or equal.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Location and type of inlets and catch basins installed shall be as shown on the Drawings, scheduled, and specified by the City of Kalamazoo.

### 3.02 INSTALLATION

- A. Installation shall be in conformance with relevant portions of the following:
  - 1. Section 02200.
  - 2. Section 02552.
  - 3. Details shown on the Drawings.
  - 4. Specified standards.
- B. Brick, concrete block, etc., having a temperature of 40 degrees F or less shall not be set with mortar until heated for a sufficient period to insure a temperature of at least 50 degrees F throughout the entire mass of the material.
- C. The construction of these structures shall be done in strict conformance with the details shown on the Drawings and as specified by the City of Kalamazoo.

- D. Unless otherwise noted on the Drawings, catch basin leads shall be placed at 1.00% grade.

**PART 4 SPECIAL PROVISIONS**

**4.01 EXISTING CATCH BASINS TO REMAIN**

- A. In locations where new sewer or catch basin lead has been installed to connect an existing catch basin or manhole, the connection shall be done by either of the following methods:
1. A flexible connection as specified in Section 02552 and shown on the Drawings.
  2. Concrete Encasement - Concrete encasement, 6-inch minimum shall be carried to the first pipe joint.

END OF SECTION

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**SECTION 02600  
PAVEMENTS, CURBING, AND WALKS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the construction of sidewalks, curbing, pavements, and berms of various designated types as shown or scheduled on the Drawings, specified or directed.
- B. This Section includes preparation of the base and subgrade construction of walks, curbs, pavements and base courses, adjustment of manhole castings, and valve boxes to conform to new pavement courses, and other work and materials incidental to the construction of pavements, curbing and walks.
- C. Existing curbs and walks of stone or concrete shall be replaced using concrete.
- D. This Section includes temporary and restoration of permanent pavement markings as they exist at the time of bidding unless otherwise shown on the Drawings, specified or directed.

**1.02 OWNER'S STANDARDS AND SPECIFICATIONS**

- A. Sidewalks, curbs, driveways, parking areas, and street pavement, and berms disturbed by construction shall be restored in accordance with the Owner's present standards and specifications.

**1.03 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturers' and suppliers' material certificates.
    - b. A sieve analysis (ASTM C136) shall be furnished for each soil material source.
  - 2. Information for the Record:
    - a. Delivery tickets from the asphalt and aggregate suppliers shall be given to the inspector at the unloading site. Tickets shall include (as a minimum) name of source, date, type of material, and weight.

## PART 2 PRODUCTS

### 2.01 AGGREGATE BASE AND SURFACE

- A. The aggregate shall be crushed natural stone meeting the requirements of MDOT Table 902-1, Class 21AA.

### 2.02 RESERVED

### 2.03 ASPHALT EMULSIONS

- A. The bond coat material shall be SS-1h or CSS-1h and shall meet the requirements of MDOT Table 904-4 and 904-5.
- B. The prime coat material, if required, shall be MS-Op and shall meet the requirements of MDOT Table 903-4.

### 2.04 BITUMINOUS AGGREGATE BASE AND ASPHALT CONCRETE

- A. Bituminous Material - The asphalt cement shall be PG 58-28 performance grade (Design Temperature) and shall meet the requirements of MDOT Table 904-2.
- B. Design Mix - Refer to MDOT Section 501.
  - 1. The base course shall meet the requirements of MDOT Mixture 13A, Modified
  - 2. The wearing course shall meet the requirements of MDOT Mixture 36A, Modified.

### 2.05 CONCRETE (CAST-IN-PLACE)

- A. All concrete used shall be Grade P1 as specified in MDOT Table 601-2.
- B. Reinforcing steel and dowel bars shall be as specified in MDOT Section 905 and 906.
- C. Other materials required for placing concrete shall be as follows:
  - 1. Joint Sealer:
    - a. Hot Applied Sealer - MDOT Section 914.04A.
    - b. Backer Rod - MDOT Section 914.04B.
  - 2. Preformed Fiber Joint Filler - MDOT Section 914.03.
  - 3. Curing Materials:
    - a. Burlap Cloth - AASHTO M182, Class 2.
    - b. Sheet Materials - ASTM C171.
    - c. White Membrane Curing Compound - ASTM C309, Type 2, Class B.

- d. Transparent Membrane Curing Compound - ASTM C309, Type 1, Class B.
- 4. Stamped and Colored Concrete:
  - a. See Part 4.

## **2.06 PAVEMENT MARKING**

- A. Contractor shall provide temporary and permanent pavement markings equal to those markings that are removed from existing paved surfaces prior to commencement of the Work unless scheduled on the drawings, specified, or as directed.
- B. Pavement markings shall be in accordance with the requirements of MDOT Item 811.
- C. Pavement markings shall match existing or adjoining pavement markings.
- D. Pavement markings partially disturbed by construction shall be replaced entirely.

## **PART 3 EXECUTION**

### **3.01 COORDINATION**

- A. All soil subgrade under pavements, driveways, curbs, curb and gutter, and walks shall be compacted in accordance with Section 02200.
- B. All service boxes, manholes, inlets and other structures shall be adjusted or reconstructed to the required grades in both new and resurfacing pavement areas.

### **3.02 PAVEMENT INSTALLATION**

- A. All construction shall be in conformance with applicable portions of MDOT Specifications, except as otherwise specified or called for herein.
- B. Unless otherwise directed by Engineer all aggregate bases which are to receive bituminous courses shall be primed as specified.
- C. A tack coat at a rate as specified shall be applied to all existing pavements which are to be overlaid, and between subsequent courses when directed by the Engineer.

### **3.03 TRANSITION JOINTS FOR BITUMINOUS CONCRETE PAVEMENT OVERLAY**

- A. Types of Transition Joints:
  - 1. Transition joints shall be either butt type or feathered type as directed by the Engineer.
  - 2. Butt joints shall be used on State and Federal roads and main thoroughfares and feathered joints used elsewhere unless otherwise specified.



3. Butt Joints:
  - a. When a butt joint is called for on the Drawings or specified, the old surface shall be cut back for at least 3 feet to a depth of at least 1 inch for the full width of the joint and pavement installed.
  - b. A bituminous seal shall be placed on the finished surface at the junction of the new and old pavements.
4. Feathered Joint:
  - a. Feathered joints shall be constructed by manually raking the paving material to a smooth transition from the full depth material to the existing pavement surface.
  - b. Existing pavement surface shall be bond-coated to include the transition area.
  - c. Feathering shall be done by a workman skilled in the operation and shall be approved by the Resident Project Representative.

#### **3.04 CURBING**

- A. Curbing shall be constructed in conformance with applicable portions of MDOT Section 802 and MDOT Standard Construction Drawings.
- B. Place 1-inch dowelled expansion joints at inlets and at spring lines of street and driveway returns. If intersecting streets and driveways are more than 300-feet apart, place expansion joints at 300-foot intervals.
- C. Contraction joints shall be placed at approximately 10-foot intervals.

#### **3.05 CONCRETE SIDEWALK**

- A. Sidewalk shall be constructed in conformance with applicable portions of MDOT Section 803.
- B. Unless otherwise indicated on the Drawings, concrete sidewalks shall be a minimum of 5-feet-0-inch wide and 4-inch thickness of concrete. Concrete sidewalks crossing driveways shall be a minimum of 5-feet-0-inch wide and 6-inch thickness of concrete. Concrete walk removed and replaced shall be equal to the section removed.
- C. The surface of the walks shall be divided into equally spaced blocks at approximately 5-foot intervals. Expansion joint filler 1/2-inch thick shall be installed between the walk and any fixed structure, at all changes in direction or shape and at intervals of 20-foot maximum. The expansion joint filler shall be 1-inch thick where the walk is installed against the back of curb. The filler shall be recessed 1/2-inch from top of finished surface.
- D. Surface of new sidewalks shall be broomed to slightly roughen surface. On sections of sidewalk to be replaced, the surface texture shall match the adjoining.

**3.06 CONCRETE DRIVEWAYS**

- A. Concrete driveways shall be constructed in conformance with applicable portions of MDOT Section 801.
- B. Dowelled contraction joints shall be placed at a maximum spacing of 20-feet. Lesser spacing shall be used on irregular areas as directed by the Engineer.
- C. Expansion joint filler 1/2-inch thick shall be installed at intervals of 24-feet maximum. One-inch expansion joint filler shall be installed between the driveway and any fixed structure.

**3.07 BITUMINOUS AND AGGREGATE DRIVEWAYS**

- A. Bituminous driveways and parking lots shall be constructed as shown on the Drawings using materials specified for asphalt concrete pavements. Placement shall be in accordance with MDOT Section 501.
- B. Aggregate driveways and parking lots shall be constructed as shown on the Drawings using base aggregate meeting the requirements of MDOT Item 302.
- C. Replacement of bituminous or aggregate driveways and parking lots shall conform to this Section but in no case, be inferior to that being replaced.

**3.08 RESERVED**

**3.09 INSPECTION**

- A. Laboratory services shall be in accordance with the requirements of Section 01410 and shall include:
  - 1. A compaction test on the subgrade, aggregate base, and each layer of asphalt shall be performed for every 300 square yards of material placed.
  - 2. Asphalt Concrete:
    - a. Plant Certification - The laboratory shall certify or furnish recent certification (within one year) from January 1, 2019 that the plant meets State requirements.
    - b. Plant Inspection - For the first day of production and for every day when more than 100 cubic yards of material is being delivered to the project, the laboratory shall provide a representative at the plant who will inspect the plant, make mix design adjustments, check the temperature, and take the required samples.
    - c. Quality Control Testing - A sample of the mix shall be taken for each 200-cubic yard of bituminous material or fraction thereof delivered to the project. An extraction test AASHTO T164-70 and a mechanical analysis AASHTO T30-70 shall be performed on the mix samples.

- d. Bituminous Material - Provide a satisfactory certificate furnished by the manufacturer stating that the materials conform to MDOT Specifications, Table 904-2, 904-3, or 904-4 as required.
  - e. Aggregate - A sieve analysis (ASTM C136) shall be performed on each aggregate to be used in the plant mix design.
  - f. Mix Designs - The supplier shall design the plant mixes in accordance with the Marshall Method of Mix Design (ASTM D1559) and shall make all mix design adjustments.
3. Cast-in-Place Concrete:
- a. Concrete materials and operations shall be tested as the Work progresses.
  - b. Duties of testing laboratory shall be as follows:
    - 1) Review, check, and test proposed materials for compliance with Specifications before the start of the Work.
    - 2) Sample aggregates from concrete production stockpiles, at least once a month, during the placement of concrete and test for compliance with the specifications. The moisture content of each sample shall be measured and recorded.
    - 3) Review and test proposed mixture design when required by Engineer.
    - 4) Randomly sample concrete during construction in accordance with ASTM C172 and perform scheduled tests.
    - 5) Measure and report surface profile of slabs in accordance with ASTM E1155. Surface profile shall be determined for first trowel finish slab and first float finish slab on project and other slabs specified.
  - c. Test Schedule:
    - Strength:
      - 1) One strength test shall be made for each 50 cubic yards, or fraction thereof, of each class of concrete placed on any one day. Frequency of testing shall not provide less than 5 strength tests for each class of concrete.
      - 2) Concrete strength test shall consist of three specimens from each sample molded and cured in accordance with the section of ASTM C31, "Curing Specimens for Checking the Adequacy of Mixture Proportions for Strength or as the Basis for Acceptance or Quality Control".

- 3) Specimens shall be tested in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. Strength test result shall be average of strengths of 28-day specimens. If one specimen shows evidence of improper molding, handling, or testing, it shall be discarded and remaining specimen shall be considered as strength test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.  
  
Cold Weather Concreting and Form Removal:
  - 1) When cold weather concreting procedures apply or when form removal provisions of Section 03100 apply, field cured specimens shall be made to determine when protection procedures may be terminated or when forms may be removed. These field cured specimens shall be in addition to strength tests and shall be made at same time as strength specimens.
  - 2) Specimens shall be molded and cured in accordance with the section of ASTM C31, "Curing for Determining Form Removal Time or When a Structure May be Put into Service". Contractor shall determine number of specimens required, but number of specimens shall not be less than three.
  - 3) Specimens shall be tested in accordance with ASTM C39. Age-at-test of specimens shall be selected by Contractor.
- d. Slump shall be measured for first batch of each concrete class delivered in morning and afternoon, for each strength test, and whenever consistency of concrete appears to vary. Slump shall be measured in accordance with ASTM C143. In the event that a batch fails to comply with specified requirements, the slump shall be measured on each successive batch until three batches meet the specified requirements.
- e. Air content shall be determined for first batch of each concrete class delivered in morning and afternoon, for each strength test, and as required by field representative. Air content shall be measured in accordance with ASTM C231, ASTM C173, or ASTM C138. When concrete is placed by pumping, air content and slump shall be measured before pump and also at pump discharge. In the event that a batch fails to comply with specified requirements, the air content shall be measured on each successive batch until three batches meet the specified requirements.
- f. Temperature of concrete sample shall be measured for each strength test.

- g. If the measured slump or air content falls outside the specified limits, make additional tests immediately. Test all succeeding trucks for both slump and air until three in succession pass the slump and air tests.

### 3.10 PROTECTION

- A. No heavy construction vehicle shall operate on any pavement, curbing or walk after it has been installed.
- B. Traffic shall be prohibited on newly installed asphalt pavement until it has cooled sufficiently to avoid marking.
- C. Asphalt Pavements:
  - 1. Bituminous mixtures shall be transported and placed in accordance with MDOT Section 501.03.
- D. Concrete Pavements, Curbing and Walks:
  - 1. Concrete shall be mixed, transported, placed, and finished only within the temperature limitations specified in MDOT Sections 601.03F and 602.03T.
  - 2. No concrete shall be mixed, transported, placed, or finished when the temperature of the base, subgrade, or air is below 40 degrees F or whenever, in the opinion of the Engineer, the temperature may fall below 40 degrees F within 24 hours after the concrete has been placed.
  - 3. The Contractor shall take such precautions as are necessary to protect the concrete from rain.
  - 4. The Contractor shall protect the concrete from freezing for no less than seven days or until such time that specimen beams have attained a modulus of rupture of at least 600 psi.

### PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

**SECTION 02710  
FENCING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes the furnishing of all materials, equipment, labor, and supervision necessary for the installation of new fencing as shown on the Drawings and to replace fencing damaged during construction in accordance with the Contract Documents.
- B. All Work performed under this Section shall comply and be in accordance with all approved trade practices and manufacturers' recommendations.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's product literature.
    - b. Materials of Construction.

**1.03 PROJECT HANDLING**

- A. Materials, including but not limited to post, barb wire, and fence fabric, shall be handled and stored in accordance with the manufacturer's recommendations and in such a manner as to prevent any damage to the finish coating.

**PART 2 PRODUCTS**

**2.01 FENCE FABRIC**

- A. Fence fabric shall be 2-inch mesh of carbon steel wire and shall be galvanized after weaving in accordance with ASTM A392 Class II or aluminum-clad in accordance with ASTM A491 Class II.
- B. Wire shall be 6 gauge on 6-foot fabric and 9 gauge on 4-foot fabric.
- C. PVC-coated fences shall be galvanized materials and chemically cleaned. A phosphate conversion treatment shall be applied to prepare the zinc coating to receive the polyvinyl chloride coating.
  - 1. A minimum of 7 mils of green color compound shall be applied to the materials. Coating application shall be as recommended by the manufacturer.
- D. Fence fabric shall be attached to all post rails and tension wires with 12-gauge tie wire at a maximum of 15-inch centers. Tie wire shall be aluminum or galvanized steel.

## 2.02 FENCE POST AND RAILS

- A. Line posts shall be galvanized 2-3/8-inch OD Standard Schedule 40 Steel pipe with a PVC coating.
- B. Fencing 4 feet in height or less shall be provided with a top rail.
  - 1. Top rails shall be galvanized 1-5/8-inch OD Standard Schedule 40 Steel pipe.
- C. Fencing greater than 4 feet in height shall be provided with a tension wire, in lieu of the top rail, unless otherwise specified in Part 4.
  - 1. Tension wire shall be 9-gauge braided wire rope stainless steel or galvanized. Tension wire shall support fence fabric taut to prevent fabric from sagging.
- D. Tension wire shall be provided at the bottom of the fence fabric on all fence systems, unless bottom rail is provided.
  - 1. Tension wire shall be 9-gauge braided wire rope stainless steel or galvanized.
  - 2. Bottom rails shall be identical to the top rails.
- E. Ends, corners, and pull posts shall be galvanized 2-7/8-inch OD Standard Schedule 40 Steel pipe.
- F. Posts for swing gates shall be sized by fence gate manufacturer for the gate width specified.
- G. All terminal, corner, and gate posts shall be braced to the next post using a brace rail and a galvanized 3/8-inch truss rod with tightener.

## 2.03 RESERVED

## 2.04 ACCESSORIES

- A. Three rows of barbed wire shall be provided. Each barbed wire row shall consist of two strands of twisted 12-1/2-gauge wire with 14-gauge, 4 point barbs spaced on 5 inch centers.
  - 1. Extension arms for supporting barbed wire shall be galvanized, inclined at 45 degrees, and shall be capable of supporting a weight of 250 pounds applied vertically at the tip.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Permanent fencing may be installed for convenience of the Contractor prior to completion of Work.
  - 1. Contractor shall be responsible for maintenance and repairs to keep the fence system like new during construction. The fencing system is subject to the Owner

and Engineers approval at project completion and the entire system or any part thereof may be required to be replaced.

### 3.02 PREPARATION

- A. Final grading shall be completed prior to the installation of the permanent fence system.

### 3.03 INSTALLATION

- A. The Contractor shall erect the fence, gates, and fence posts level and plumb as required, in accordance with manufacturer's recommendations and as shown on the Drawings.
- B. Line posts shall be spaced at intervals not exceeding 10-feet.
- C. Fence fabric shall be stretched taut, securely fastened to the posts, tension wire and top rail as specified and shown on the Drawings.
  - 1. Fence fabric shall be installed approximately 1 inch above the top rail.
  - 2. Fence fabric shall be installed approximately 2 inches above finish grade. Fence fabric when lifted shall not allow an opening greater than 5 inches.
  - 3. Fence fabric shall be stretched at a maximum of 30 feet and all terminal posts.
- D. All changes in fence alignment of 30 degree or more and all abrupt changes in grade shall be made with corner posts.
- E. Foundations for post shall be sized by fence manufacturer.
  - 1. Foundations shall extend a minimum of 36 inches below finish grade.
  - 2. Concrete foundation shall have a minimum outside diameter of 3 times the embedded post OD and not less than 9 inches.
  - 3. Concrete foundation shall be crowned to shed water way from the embedded post.
  - 4. Concrete foundation shall be belled at the bottom.

## PART 4 SPECIAL PROVISIONS

### 4.01 FENCE SYSTEM

Location	Height	Fence Fabric	Accessories
See Drawings	6 ft	Galv	1, 2, and 4

#### ABBREVIATIONS

##### Fence Fabric

PVC	PVC Coated
Galv	Galvanized
AL	Aluminum Clad



**Accessories**

1. Barb Wire
2. Top Rail
3. Top Tension Wire
4. Latch/Lock
5. Bottom Rail

END OF SECTION

**SECTION 02766  
CURED IN PLACE SEWER LINING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Under this Section the Contractor shall hire Corby Energy Services, Inc., located at 6001 Schooner Drive, P.O. Box 970, Belleville, MI 48112, phone (734) 547-9237 to furnish all labor, materials, and equipment necessary to line the 24-inch DIP sewer as noted on the Drawings.
- B. This Section shall include diverting sewer flow around Work areas, as needed, cleaning and video-taped inspection of the existing sewers, field verification of sewer diameter, clearing obstructions, rehabilitation of the sewer by the lining process, televising and video taping of completed sewer line sections, and other work incidental to the lining operation.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's product literature for each product used.
    - b. Technical Data sheet for each product used.
    - c. Verification of compliance with reference standards.
    - d. Verification of compliance with the specified requirements including but not limited to independent testing reports.
  - 2. Information for the Record:
    - a. Design calculations including but not limited to, wall thickness, and structural capacity, signed and sealed by a licensed Engineer in the state of the project.
    - b. Cleaning procedures including the water pressure.
    - c. Installation procedures and sequence of cleaning and installation operation.
    - d. Qualifications of installing contractors, including experience and references.
    - e. Manufacturer's current certification of installing contractor.
    - f. Recommended installation procedures.

- g. Bypass pumping plan.
- h. Traffic control procedures and plan.

### 1.03 QUALITY ASSURANCE

- A. The manufacturer of the products specified herein shall have a minimum of 10-years experience in the research, development and production of the products specified.
- B. The installing contractor shall have a minimum of 5 years of experience working with and installing the specified products and shall be certified by manufacturer.
- C. The installing contractor shall be responsible for the liner system, including but not limited to, preparation, installation, and inspection of system.
- D. The products specified herein shall comply with the listed ASTM standards.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Liner:
  - 1. The liner shall be a resin impregnated flexible felt tube which, when cured, will be abrasion resistant and chemically resistant to withstand internal exposure to sewage gases containing normal levels for domestic sewage of hydrogen sulfide, carbon monoxide, carbon dioxide, methane, traces of mercaptans, saturation with moisture, dilute sulfuric acid, and external exposure to soil bacteria.
  - 2. The liner shall be designed by the manufacturer to provide full pipe strength for the rehabilitated section using, as a basis of design, the existing field conditions and assuming no strength imparted by the existing pipe. The basis of design shall be in accordance with ASTM F1216 and Appendix X1.2.2.
  - 3. The liner shall be properly sized to the diameter of the host pipe and the length of to be rehabilitated and be able to stretch to fit irregular pipe sections.
  - 4. The reinforcing material of the liner shall be a felt formed into sheets of required thickness. Thickness of the cured liner shall be within plus 10% and minus 5% of the required thickness determined by the manufacturer and shall not include the thickness of the polyurethane inner liner.
  - 5. The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the conduit to be lined. Allowance for longitudinal and circumferential stretching of the liner during insertion shall be made by the manufacturer. The length of the liner shall be that deemed necessary by the manufacturer to effectively carry out the insertion and seal the liner at the inlet and outlet of the respective manholes or chambers. The Contractor shall verify the lengths in the field before cutting the liner to length.

- B. Resin:
  - 1. The resin shall be a polyester or vinyl ester resin system, including but not limited to all catalysts initiators required for curing within the liner. The resin content of the impregnated liner shall have a volume ratio with the felt of 85% resin to 15% felt.
  - 2. The resin must be able to cure in the presence of water and the initialization temperature for cure shall be less than 180 degrees F (82.2 degrees C).
- C. The lining system shall be continuous over the entire length of an insertion run between two or more manholes. The liner end, at each manhole, shall be sealed.
- D. Liner system shall be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall be impervious and free of any infiltration or exfiltration.
  - 1. The inner surface shall be free of cracks and crazing with smooth finish and with an average of not over two pits per square foot and all pits shall be less than 3-millimeter diameter and not over 1 millimeter deep and are covered with sufficient resin to avoid exposure to the inner fabric.
- E. Hydrophilic strip for sealing shall be as manufactured by Sika Hydrotit CJ-Type, or equal.
- F. End seal sleeves shall be Insigna Hydrophilic End Sleeve, or equal.

**2.02 PERFORMANCE REQUIREMENTS**

- A. The liner system shall provide a uniform smooth, interior wall surface and will have at least 100% of the flow capacity of the original pipe before rehabilitation. In lieu of measurements, calculated capacities may be derived using a Manning “n” coefficient of 0.013 for the original pipe material and a Manning “n” coefficient of 0.010 for a joint-less smooth wall cured-in-place pipe liner.
- B. The structural performance of the cured-in-place pipe liner system must be adequate to accommodate all internal and external loads (live and dead) over its service life. Unless otherwise approved by the Engineer in writing, the liner system shall be designed considering the host pipe is fully deteriorated, a prism loading, and meeting the following:

Soil Loading	130 pcf, w/2.0 factor of safety
Ovality	3 %
Deflection	5 %, maximum
Modulus of Soil Reaction	1,000 psi
Flexural Strength	4,500 psi
Mean Diameter	24 inches
Minimum Diameter	23.06 inches
Minimum Design Thickness	0.47 inches
Tensile Strength	3,000 psi
Lining Enhancement Factor (K)	7 maximum

Live Loads	20,000 lbs
Modulus Reduction Factor (Long-Term)	50 %
Hydrostatic Load	Beginning at the surface

- C. Liner system shall meet the requirements of the following ASTM:
1. ASTM F1216
  2. ASTM F1743
  3. ASTM D5813
  4. For horizontal, elliptical pipes and pipes with ovality greater than 2%, use Water Research Center (WRC) and Sewage Rehabilitation Manual (SRM) for design.

D. The chemical corrosion resistance of the actual resin system (neat plus modifications) selected shall be tested by the resin manufacturer in accordance with ASTM 1216.

E. The cured impregnated liner shall meet the following minimum strength requirements.

Property	Test Method	Value
Tensile Strength at Yield 20 degrees C:	ASTM D638	3,000 psi
Ultimate Elongation at Yield:	ASTM D638	2 %
Flexural Strength:	ASTM D790	4,500 psi
Flexural Modulus:	ASTM D790	450,000 psi (short term)
Hardness:	ASTM D2583	Barcol 22
Heat Distortion Temperature:	ASTM D648	200 degrees F

F. The proposed cured-in-place pipe liner to be used shall be designed for a minimum 50-year service life under continuous loading conditions. Design of the liner shall be based on the condition of the existing pipe which shall be classified as fully deteriorated based upon the definitions thereof contained in ASTM F1216 Appendix X1. The liner shall be designed to withstand all imposed loads, including live loads if applicable and hydrostatic pressure. The liner shall have sufficient wall thickness to withstand the anticipated internal and external pressures and loads which may be imposed after installation. The design of the liner shall follow the guidelines in ASTM F1216 Appendix A1. Calculations which determine wall thickness requirements of the liner to be used shall be submitted to the Engineer for approval prior to fabrication of the tube.

G. Where applicable, design for non-round pipes shall be based on the bending stress and deflection equations detailed in the WRC Sewerage Rehabilitation Manual (SRM), Type II on-circular linings. When following the guidelines of the WRC SRM, two conditions must be satisfied when the lining is subjected to external loading:

1. The calculated extreme fiber bending stress in the flat or "straight" sections of the non-round pipe shall not exceed the allowable long term flexural (bending) strength for the CIPP.
2. Deflection of the CIPP should not be excessive. The calculated deflection shall be less than 3% of the flat or "straight" section length. This analysis is a

serviceability requirement, with the lining still performing its function if the limit is exceeded.

- H. Additional, non-round pipes with crowns that are effectively shaped like round pipe (crowns of eggs, arches, etc.) shall also be cross-checked utilizing the standard flexible pipe equations as detailed in ASTM F1216 Appendix X1.
- I. The minimum thickness for the installed CIPP after curing shall be calculated based on the following design assumptions:
  - 1. The existing sewer is considered fully deteriorated. For the invert of non-round CIPP, design thickness shall be assuming only groundwater loading. For the crown and side wall analysis of the non-round CIPP, design thickness shall be assuming groundwater, soil loads and any live loads. Soil loads and live loads acting on side walls shall be taken as 1/3 of the loads acting on the crown of the CIPP.
  - 2. The SRM critical length "L" is the length of the flat or "straight" section(s) of the CIPP.
  - 3. The existing crown of non-circular sewers is considered to have an ovality of 6% when analyzing the crown with round pipe design equations.
  - 4. An "R" factor of 0.50 shall be utilized in deflection analysis.
  - 5. A safety factor of 2.0 is to be utilized in the bending stress analysis. No safety factor is required in deflection analysis.

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Contractor shall coordinate liner system installation with Owner's operation of the collection system.
- B. Contractor shall be responsible for coordinating with the Owner the notification of the residents in the location of the lining. This includes, but is not limited to, preparing the written notice, delivering notices and addressing any concerns raised.

#### **3.02 PREPARATION**

- A. Prior to lining of a sewer, it shall be the responsibility of the Contractor to clean debris out of the sewer line in accordance with National Association of Sewer Service Companies (NASSCO) Specifications for Sewer Collection System Rehabilitation Section III "Sewer Line Cleaning".
- B. The Contractor shall inspect by closed circuit TV the section of sewer to be lined and shall record the location of all obstructions and service taps.

- C. It shall be the responsibility of the Contractor to clear the line of obstructions, solids, dropped joints, protruding services, or collapsed pipe that will prevent the insertion of the liner. If inspection reveals an obstruction that cannot be repaired without excavation, the Owner and Engineer shall be notified to make the final determination. Excavation to repair a sewer is not included in this Section.
  - 1. Contractor shall be responsible for disposal of all debris removed from the cleaning operation in accordance with the specifications, local, state and federal regulations.
  - 2. Contactor may separate the solids and liquid contents from the cleaning and the liquids may be discharge into the sanitary sewer, in a controlled rate, with Owner's approval.
- D. The Contractor shall provide for the flow of sewage around the sections of line that are to be lined. This includes any pumping that may be required. Pumps and bypass lines shall be of adequate capacity and size to handle the flow.

### 3.03 INSTALLATION

- A. The installation shall be done in accordance with ASTM F1216 and F1743 and in accordance with the lining manufacturer's recommended procedure.
- B. Resin impregnation shall be in a quantity sufficient to fill the volume of air voids in the liner material with allowances for shrinkage and loss of resin.
- C. The resin impregnated liner shall be inserted into position in the host pipe using the inversion method of pull-in method per the manufacturer's recommendations and as defined by the relevant ASTM sections. Care shall be exercised so as to not damage the Owner's infrastructure and the liner system during the installation.
- D. Curing shall utilize hot water under pressure or steam pressure in accordance with the manufacturer's recommendations and relevant ASTM.
  - 1. The temperature of the incoming and outgoing water used for curing shall be monitored. A temperature gauge shall be placed between the host pipe and the liner, at the invert, at both ends of the section being lined, to monitor the temperature during the curing.
  - 2. Curing water temperature shall be between 150 degrees F and no more than 200 degrees F, measured at the return.
- E. Cool down shall be in accordance with the manufacturer's recommendations. The liner shall be cooled to 100 degrees F before relieving the pressure. Care shall be taken to prevent a vacuum on the newly installed liner.

### 3.04 SERVICE CONNECTIONS

- A. After the liner, has been cured and tested, all existing services shall be reconnected, unless directed otherwise by the Owner.

- B. Reconnection of services shall be done from the interior of the pipeline unless otherwise specified, by means of a television camera directed device. Location of the services shall be from the inspection done prior to the liner installation.

### 3.05 INSPECTION

- A. After the Work is completed, the Contractor shall supply the Owner with video tapes showing the lined sections including service connections.
- B. The water tightness of the liner shall be gauged while curing and under a positive head. The minimum test head shall be fifteen feet. The maximum allowable leakage shall be 200 gallons per inch pipe diameter per mile of pipe in 24 hours.

## PART 4 SPECIAL PROVISIONS

### 4.01 SCHEDULE

- A. The sewers to be lined in accordance with this Section are as shown and scheduled on the Drawings.

### 4.02 MATERIAL ACCEPTANCE LIST

- A. Chain of custody shall be in place before specimens (two flat-plate samples) are taken.
- B. Contractor shall provide third-party testing.
- C. Third-party testing shall be performed to ensure cured-in-place liner meets specifications for:
  - 1. Flexural Modulus.
  - 2. Flexural Strength.
  - 3. Wall Thickness.
- D. One test per each installed section of CIPP liner is required.
- E. Contractor shall video record the sewer upon completion of the CIPP lining and submit the recording to the engineer and the City of Kalamazoo for review.

END OF SECTION



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**SECTION 02800  
SEEDING AND MULCHING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes fine grading, and seeding and mulching areas designated on the Drawings, specified, or ordered.
- B. The Work consists of fine grading, furnishing and placing topsoil; seed; mulching material; and fertilizer; and watering seeded areas until growth is established.
- C. The Contractor shall restore all grass areas damaged by his operations.
- D. Unless otherwise specified herein or directed, Work shall be in conformance with MDOT Section 816, Turf Establishment.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's project information for materials.
  - 2. Information for the Record:
    - a. Submit to Resident Project Representative:
      - 1) Invoices indicating the weight, brand, and composite analysis of fertilizer used on the project.
      - 2) Bag tickets indicating weight and composition of all seed used on the project.

**PART 2 PRODUCTS**

**2.01 SEED**

- A. Seed mixtures shall be in conformance with the requirements of MDOT Tables 816-1 and 917-1, Mixture TUF, unless otherwise specified in Part 4.

**2.02 FERTILIZER**

- A. Commercial fertilizers shall be from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Michigan, Department of Agriculture. The content of nutrients shall be 12-12-12, unless otherwise approved by Engineer.

### 2.03 MULCHING MATERIAL

- A. Mulching material shall be straw, wood fiber or compost reasonably free of weed seed, and other foreign materials, conforming to MDOT Section 917.15A.

### 2.04 MATTING MATERIAL

- A. Matting material shall be in conformance with the requirements of MDOT Section 917.14B, unless otherwise specified in the Special Provisions.

### 2.05 TOPSOIL

- A. Topsoil furnished by the Contractor shall be as specified in Section 02200.

## PART 3 EXECUTION

### 3.01 FURNISHING AND PLACING TOPSOIL

- A. Areas from which the top layer of soil has been removed or disturbed shall be recovered with a minimum of 4 inches of recompact topsoil placed in conformance with Section 02200 or MDOT Section 816.03A.

### 3.02 PREPARATION

- A. The operating of finish grading and sowing shall not be performed when the ground is frozen or muddy.
- B. Areas to be Seeded:
  - 1. Unless otherwise shown on the Drawings or specified in Part 4, all areas of disturbed soil on the Site shall be seeded.
  - 2. The area to be seeded shall be prepared in accordance with Section 02200.
  - 3. Fertilizer shall be applied at a rate which will provide 240 pounds per acre of chemical fertilizer nutrients in equal proportions of Nitrogen, Phosphoric Acid, and Potash. Either dry or liquid fertilizer may be used and shall be distributed in an even pattern over the specified area, then thoroughly disked, harrowed, or raked into the soil to a depth of not less than 1 inch.

### 3.03 INSTALLATION

- A. Seeding:
  - 1. The seed shall be mixed thoroughly and sown evenly at a rate specified by MDOT. The seed mixture may be sown dry or hydraulically unless directed otherwise in Part 4 of this Section.
  - 2. The seed mixture shall be applied when the soil is in a workable condition and shall be raked into a depth of approximately 1/4 inch.

3. Seed shall be sown only between the dates of May 1 and October 15, unless otherwise permitted by the Engineer.
- B. Mulching:
1. Within 24 hours after an area has been seeded it shall be mulched in conformance with one of the following specified methods as designated in Part 4:
    2. Mulch:
      - a. Mulching with hay or straw shall be in conformance with mulching requirements of MDOT Sections 816.03E, F, and G except that in front of residences the mulching material shall be kept in place by an approved non-tracking adhesive or other approved method in lieu of the specified asphalt emulsion.
      - b. Matting shall be used on all slopes greater than 10:1. Matting used for mulching shall be placed in conformance with MDOT Section 816.03H.
- C. Seeded areas shall be watered and maintained as specified below until they are established.
1. The seed bed shall be thoroughly watered, as soon as the seed is covered.
  2. Water shall be applied by a hydro-seeder or water tank under pressure with a nozzle producing a spray that will not dislodge the mulching material.
  3. Water applications shall be made at least once a week, provided significant rainfall has not occurred within the weekly period.
  4. The rate of application shall be 240 gallons per 1,000 square feet
  5. Mulch and matting areas shall be maintained until all Work on the Contract has been completed and accepted.
  6. The seeded area shall be mowed once at an approximate height of 6 inch as directed by the Engineer to control excess growth, including weeds.
  7. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. The soil in these damaged seeded areas shall be restored to the condition and grade existing prior to application of mulch or matting, and restored areas shall be relimed, refertilized, and reseeded. Where necessary, the mulch or matting shall be completely replaced.

#### **PART 4 SPECIAL PROVISIONS**

None

END OF SECTION

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**SECTION 03305  
CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes cast-in-place concrete along with formwork, joint systems, reinforcing, mix design, placement procedures, and finishes as indicated on the Drawings and as specified herein.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Concrete mix designs including substantiating data and test records.
    - b. Product literature for admixtures, curing compounds, and miscellaneous materials.
    - c. Locations of construction and control joints not shown on Drawings, and proposed changes in locations.
    - d. Material certifications.
    - e. Aggregate gradation and percentages of deleterious substances.
    - f. Batch plant certification.
    - g. Placing drawings shall indicate:
      - 1) Construction joints, splice locations, and splice lengths.
      - 2) Bending schedules.
      - 3) Accessories.
  2. Information for the Record:
    - a. Manufacturer's application instructions for miscellaneous materials.
    - b. Quality control test reports.
    - c. Slab profile report.
- B. Copy of concrete delivery ticket shall be presented to Resident Project Representative for each batch. Delivery ticket shall indicate:
1. Name of ready-mixed company and plant designation.
  2. Truck number.

3. Concrete class.
4. Quantity of concrete.
5. Date.
6. Time when batch was loaded.
7. Type and name of admixtures.
8. Actual batch weights of cement, fly ash, aggregates, and water.
9. Location of pour and time of unloading shall be added to the ticket at Site.

### 1.03 QUALITY ASSURANCE

- A. Concrete work shall comply with provisions of the current editions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.
  1. ACI American Concrete Institute.
  2. CRSI "Manual of Standard Practice".
  3. AWS "Code for Welding in Building Construction".
- B. Concrete Manufacturer Qualifications - Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
- C. Concrete Testing Service - A qualified independent testing agency shall perform material evaluation tests and shall design concrete mixes.
- D. Maintain adequate supervision and control of dewatering operation to ensure that stability of excavated and constructed slopes are not adversely affected by water, erosion is controlled, and flooding of excavation or damage to structures does not occur.
- E. Batch Plant:
  1. Batch Plant shall be central batch plant with automatic or semi-automatic control. Concrete may be mixed using either central-mixed, shrink-mixed, or truck-mixed methods. If concrete is shrink-mixed or truck-mixed, the truck and concrete producer shall conform to ASTM C94.
  2. Batch plant shall be certified by the Department of Transportation, National Ready Mixed Concrete Association (NRMCA) or an independent certification using NRMCA "Check list for Certification of Ready Mixed Concrete Production Facilities" executed and certified by independent Professional Engineer registered in state of Site. Evidence of current certification shall be submitted.

- F. Pre-Installation Conferences:
1. Before beginning concrete work, Contractor shall hold a meeting to review detailed requirements for preparing concrete mix designs and to determine proper procedures for concrete construction.
  2. A representative of Contractor, testing laboratory, concrete producer, and Engineer shall be in attendance.

#### 1.04 DELIVERY AND HANDLING

- A. Concrete shall be delivered in accordance with ASTM C94, except concrete shall be completely discharged within one hour after introduction of mixing water to cement.
- B. Concrete shall be delivered in agitating trucks or in mixing trucks operating at agitating speed.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS - Materials used in concrete construction shall meet all the requirements of applicable ASTM and other industry standards.

- A. Portland cement - ASTM C150, Type I or II unless indicated otherwise.
- B. Air-entraining Agent - ASTM C260, chloride ion free.
- C. Chemical Admixtures (Water Reducing Agents, Superplasticizers, Accelerator) - ASTM C494, chloride ion free.
- D. Pozzolan (Fly ASN) (Fly Ash) (GGBF Slag) - ASTM C618, Class F. ASTM C989 grade 100 or low and shall contain less than 12% alumina (C34).
- E. Aggregates - ASTM C33.
- F. Reinforcing Steel - ASTM A615, Grade 60, deformed.
- G. Water - ASTM C94, clean and potable.
- H. Membrane Curing Compound - ASTM C309, minimum 30% solids content, non-yellowing, moisture loss not to exceed .039 grams per square cm in 72 hours when applied at a coverage rate of 250 square feet per gallon, VOC compliant, water-based acrylic polymer resin. "Safe Cure & Seal – 30% by Dayton Superior or equal.
- I. Sheet Curing Compound - ASTM C171.
- J. Formwork - ACI 301 and ACI 347R.
- K. Form Coating - Non-staining.
- L. Preformed Expansion Joint Filler:
1. Exterior Walks and Pavements - "Fibre Expansion Joint" by W. R. Meadows or equal; asphalt impregnated cellular fibers securely bonded together in conformance with ASTM D1751.



2. Other Location - "Sealtight Self-Expanding Cork" by W. R. Meadows or equal: self-expanding cork type expansion joint filler in conformance to ASTM D1752, Type III.
  3. Isolation Joints - "Ceramar Flexible Foam" by W. R. Meadows or equal; flexible foam expansion joint filler.
- M. Joint Sealer, Vertical - ASTM C920, Type M, Cass 25, Grade NS, Dymeric 240, by Tremco or Sikaflex-2c NS by Sika Corp. or equal.
- N. Joint Sealer, Horizontal - ASTM C920: THC-900 by Tremco or "Sikaflex - 2C SL" by Sika Corp. or equal.
- O. Miscellaneous Metals - ASTM A36.
- P. Anchor Bolts - ASTM A307.
- Q. Expansion Bolts - Hilti Kwik Bolt 3 or equal.
- R. Bonding Agent for New to Existing Concrete - "Sika Armatec 110 Epocem" by Sika or equal. (Epoxy modified cementitious product.)
- S. Galvanizing - ASTM A123 or A153.
- T. Epoxy Adhesive for Embedding Dowels into Existing Structures – 100% solids, 100% reactive epoxy conforming to ASTM C881, Type IV, Grade 3, Class B and C. The minimum bond strength per ASTM C882 shall be 1800 psi at 7 days. The adhesive shall be formulated to withstand the maximum allowable published loads permanently without creep or failure. The adhesive shall be Hilti "HIT-RE 500 V3" or equal. Power/Rawl "Power-Fast" epoxy with "Fast Set" formulation shall not be used.
- U. Epoxy Coating for Protection of Exposed Reinforcing Steel Bars at Concrete Saw Cut and Removal Locations - MasterEmaco P124 by Master Builders, or equal. "Sika Armatec 110 Epocem" by Sika Corp. or equal.
- V. Joint Dowel Bars - Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.
- W. Include spacers, chairs, bolsters, ties, and other devices that conform to CRSI specifications necessary for properly placing, supporting and fastening reinforcement in place. Metal accessories shall be plastic coated, galvanized or stainless steel where legs will be exposed in finished concrete surfaces. For slabs-on-grade, use supports with sand plates or horizontal runners for any areas where the base material will not support chair legs. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
- X. Use one brand of cement throughout the entire project, unless otherwise approved by the Engineer.

**2.02 CONCRETE MIX DESIGN**

- A. Mixture proportioning for concrete structures shall be in accordance with ACI 301, 318, and 211.1 but subject to the following requirements.
- B. Two normal weight concrete mixes are generally required; Class A and Class B. Concrete mixes shall be as follows. Batch in accordance with ASTM C94 and the following:

	Class A	Class B
Type of Portland Cement:	I	I
28 Day Compressive Strength (psi):	4500	3000
Slump (inches) +/- 1 inch:	2-4	2-4
Air Content (%) +/- 1%:	6.0	(Not req'd)
Minimum Aggregate Size (inches):	1 (size #57)	1 (size #57)
Water Reducing Agent:	Yes	(Not req'd)
Minimum Cementitious Content (lbs) (Cement and Fly Ash):	550	480
Minimum Portland Cement Content	80% by weight of total Cementitious material.	
Maximum Fly Ash Content:	20% by weight of total cementitious material	
Maximum GGBF Slag Content	20% by weight of local cementitious material.	
Maximum Water/Cementitious Ratio:	0.44	0.66

- C. Contractor shall design and be responsible for the performance of all concrete mixes of specified quality, consistency, and workability to permit concrete to be worked readily into forms and around reinforcement without segregation or excessive bleeding. Hardened concrete shall develop all characteristics required by contract documents.
- D. Concrete mixes shall be proportioned to maximize durability and water tightness and to minimize shrinkage. To this end, total water content shall be kept to the lowest possible amount consistent with placing and consolidation methods. Water reducing and high range water reducing admixtures shall be used as required to maintain workability. Specified water/cementitious ratio shall not be exceeded.
- E. Concrete proportions shall be established on the basis of previous field experience, or laboratory trial batches in accordance with ACI 301, ACI 211.1 and ACI 318. Proposed mix design shall be accompanied by complete standard deviation analysis or trial mixture test data.
- F. Concrete proportions shall be subject to Engineer's approval. Substantiating data and test records shall be submitted.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Reinforcement, sleeves, inserts, anchors, waterstops, and other embedded items shall be accurately placed, supported, and tied prior to concrete placement. Other trades and

contractors required to furnish embedded items shall be given ample notice of concrete placement. Reinforcement and embedded items shall be subject to review of Resident Project Representative prior to placing concrete.

- B. Contractor shall notify Resident Project Representative a minimum of 48 hours before placing concrete, excluding nonworking days.
- C. Concrete shall be placed only between hours of 8:00 a.m. and 6:00 p.m., unless otherwise permitted. Concreting shall not be placed after 12:00 noon on the last working day of the week.

### 3.02 PREPARATION

- A. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow, or when inclement weather is imminent.
- B. Cold Weather - When the average temperature of surrounding air is expected to be below 40 degrees F during placing or within 24 hours thereafter, cold weather concreting in accordance with ACI 306R "Standard Specification for Cold Weather Concreting" shall apply.
- C. Concrete shall be protected from extremes in temperature as specified. During periods not defined as cold weather, but when freezing outdoor temperatures are foreseen or occur, concrete surfaces shall be protected against freezing for the first 24 hours, minimum, after placement.
- D. Hot Weather- When the ambient temperature is 90 degrees F. or above, or when conditions of concrete temperature, air temperature, wind velocity, and relative humidity combine to cause flash set, excessively low slump, cold joints, plastic shrinkage cracking, or otherwise impair the quality of concrete, hot weather concreting procedures in accordance with "Hot Weather Concreting - ACI 305R," shall apply.
- E. When the evaporation rates of bleed water exceed 0.1 pounds per square feet per hour, steps shall be taken to prevent plastic shrinkage cracking. Evaporation rate shall be determined by method shown in "Hot Weather Concreting - ACI 305R."

### 3.03 INSPECTION, STARTUP, AND TESTING

- A. Notify Engineer 48 hours prior to placement of concrete.
- B. Engineer's approval is required for subgrade, formwork, and reinforcing prior to starting each placement.
- C. Submit proposed concrete mix design to Engineer for review prior to commencement of any Work. Do not begin concrete production until the proposed mix design has been approved by the Engineer.

- D. The following tests shall be performed by an independent testing laboratory acceptable to the Engineer during progress of the Work:
  - 1. Compression Tests Cylinders - Strength test shall consist of three cylinders molded and cured. Cast three cylinders for each 50 cubic yards, or fraction thereof, for each class of concrete placed on any one day, but at least three for each day. Test one cylinder at seven days and two at 28 days in accordance with ASTM C39.
  - 2. Slump Tests - ASTM C143. Slump shall be measured for first batch of each concrete class delivered in morning and afternoon, for each strength test, and whenever consistency of concrete appears to vary.
  - 3. Air Entrainment - ASTM C173 or C231. Perform one test for every second ready-mix truck load.
  - 4. Temperature ASTM C1064. Perform with each slump test.
- E. If the measured slump or air content fall outside the specified limits, make an additional test immediately and on each successive batch until the specified requirements are met by two consecutive batches.
- F. Materials and installed Work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed work shall be done at Contractor's expense.
- G. Test Reports:
  - 1. The testing laboratory shall submit test reports directly to the Contractor, the concrete supplier, and Engineer. Reports shall be identified by the project name and number, and the portion of the structure represented. Reports shall include the dates of casting and testing, air and concrete temperatures, specified strength and mix design, actual strength and mix design, slump, air content, and the name of individual making the test.
  - 2. The testing laboratory shall notify the Engineer immediately by telephone when a low strength break occurs or specifications are not met.

### 3.04 FORMWORK

- A. Formwork shall conform to ACI 347R.
- B. Formwork shall be designed to safely support vertical and lateral loads, until such loads can be safely supported by concrete structure. Loads shall be carried to ground by formwork and in-place construction of adequate strength.
- C. Formwork shall be designed for dead and live loads, weight of concrete, wind, construction loads including impact, and other loads which act or might act on formwork.

- D. Formwork shall be designed for pressure of concrete giving due consideration to rate of concrete placement, methods of placement, method of consolidation, concrete mix design, temperature, and other factors pertinent to formwork design.
- E. Forms shall have sufficient strength and rigidity to maintain specified tolerances.
- F. Formwork shall be securely braced and anchored against deflection and displacement.
- G. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood insets shall be used for forming keyways, reglets, recesses, and the like for easy removal.
- H. Form ties shall be adjustable in length to permit tightening of the forms and so made that no metal remains nearer than 1-1/2 inch to the concrete surface after the ends are removed. Spreader devices shall leave holes no greater than 7/8 inch in diameter. Washers or buttons leaving shallow depressions in the surface will not be permitted. Twist type ties may be used only for unexposed concrete.
- I. Provide holes in the form for insertion of vibrators to properly consolidate concrete.
- J. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- K. Chamfer exposed corners and edges using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- L. The maximum allowable tolerance in either the horizontal or vertical planes shall be 1/4 inch in 10 feet.
- M. Provisions for Other Trades - Provide openings in concrete formwork to accommodate Work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- N. Oil temporary forms with non-staining form oil.
- O. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

### **3.05 DOWELING TO EXISTING STRUCTURE**

- A. Dowels shall be embedded into existing concrete where shown on Drawings. Unsound concrete shall be reported to Engineer.

- B. Adhesive dowels shall be placed in holes larger than the reinforcement diameter using a rotary percussion hammer and carbide bit. Hole diameters shall be as recommended by manufacturer for each specific reinforcing diameter.
1. Unless indicated otherwise, adhesive dowels shall be embedded as follows:

Stud Diameter	Minimum Embedment
#3	3-1/4 inches
#4	4-3/8 inches
#5	5-3/4 inches
#6	6 inches
#7	7-1/4 inches
#8	8-7/8 inches

- C. Hole shall be cleaned of dust and residue by blowing the hole with dry and oil-free compressed air. Air nozzle shall be inserted to bottom of hole. The holes should also be brushed using a nylon brush to remove dust and other debris which may have been pressed into the walls of the hole.
- D. Standing water and frost shall be removed immediately prior to injecting adhesive.
- E. Adhesive shall be injected from bulk-loading caulking gun, disposable caulking tubes, or pneumatic dispenser. Adhesive shall be injected using extension on nozzle to reach bottom of hole. Adhesive shall be injected to pre-determined depth which will cause hole to be completely filled after bar is inserted.
- F. Bar shall be inserted and slightly rotated to ensure adhesive completely surrounds bar.
- G. Adhesive displaced from hole shall be removed immediately.
- H. The manufacturer's installation guidelines for the specific adhesive chosen shall be strictly followed.

### 3.06 REINFORCEMENT

- A. Place reinforcing to ACI recommended tolerances.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by the Engineer.
- D. Unless shown otherwise in drawings, place reinforcement to maintain minimum coverages conforming to ACI standard practice for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- E. Unless otherwise specified on Drawings, reinforcing steel splices shall be lapped conforming to ACI 318, Class B splices.

### 3.07 INSERTS

- A. Metal inserts such as anchor bolts, sleeves, embedded metals, etc. shall be free of scale, loose rust, oil, grease and other coatings. Remove protective film from cast iron with flame.
- B. Ensure that items are accurately positioned and rigidly supported against displacement before placing concrete.
- C. The location of anchor and foundation bolts must not vary from the dimensions shown on the Contract Drawings by more than the following:
  - 1. 1/8-inch center to center of any two bolts within an anchor bolt group, where such group is defined as the set of anchor bolts which receives a single fabricated steel shipping piece.
  - 2. 1/4-inch center to center of adjacent bolt groups.
- D. Field weld joints in waterstops using indirect heating element.

### 3.08 JOINTS

- A. Joints not shown on Drawings shall be made at locations that will least impair strength of structure, and shall be approved by the Engineer prior to construction.
- B. Construction Joints:
  - 1. Keyways at least 1-1/2-inch-deep by width, which is equal to 1/3-member thickness, shall be provided in all construction joints in walls, supported slabs, and between walls and foundation systems.
  - 2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints. Do not continue reinforcement through sides of strip placements.
  - 3. Concrete slabs on grade shall be poured in strip pattern shown on the Drawings.
  - 4. Roughen surfaces of set concrete at all joints. Clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly. Apply approved bonding adhesive or cement grout. Bonding cement grout shall be evenly spread and shall consist of 1-part cement and two parts fine aggregate. Fresh concrete shall be placed before grout or bonding adhesive has obtained initial set. Grout shall be approximately 2-inch-thick in walls.
- C. Unless otherwise shown, provide isolation joints in slabs on grade at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, equipment bases and elsewhere as indicated.

- D. Expansion Joints:
  - 1. Provide preformed expansion joints as shown on Drawings or otherwise required.
  - 2. Expansion joint material shall be 1/2 inch in thickness, unless otherwise indicated.
  - 3. Concrete edges at expansion joints subject to vehicular traffic shall be tooled to a 1/8-inch radius.
  - 4. When sealed expansion joints are called for on the Drawings, pourable approved joint sealants shall be placed along top edges of expansion joints per manufacturer's instructions.
- E. Control Joints for Slabs:
  - 1. Control joints shall be located and constructed as shown on the Drawings.
  - 2. Within 24 hours of finishing concrete, cut joints to a depth of 1/4 slab thickness when it is firm enough to resist raveling, tearing, or dislodging of aggregates.
- F. Clean joints thoroughly with compressed air, wire brushing, or sandblasting.
- G. Fill joints with specified joint filler.

### 3.09 CONCRETE SCHEDULES

- A. Unless indicated otherwise, concrete shall be furnished as follows:
  - Class A: For all structures not defined under Class B concrete.
  - Class B: For pipe saddle supports, Pipe pier supports, buried electrical duck banks, equipment pads, housekeeping pads and mudmats, unless noted otherwise. The above items shall not be exposed to weather and shall not be submerged in liquids; otherwise, they shall be of Class A concrete as specified above.

### 3.10 PLACING CONCRETE

- A. General - Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- B. Do not place concrete on frozen ground, mud, or debris. Dampen subgrade prior to placing concrete slabs on grade where vapor barrier is not required.
- C. Inspection - Before placing concrete, inspect, and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Where necessary, notify other trades to permit installation of their work.



- D. Convey concrete from the mixer to the place of final deposit by methods which will prevent the loss or separation of the materials:
  - 1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
- E. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Avoid unplanned cold joints. Alternate equipment shall be immediately available for use in the event that primary placing equipment or system breaks down.
- F. Use internal vibration to consolidate. Size at least one vibrator to work around closely spaced reinforcing. Provide a standby vibrator whenever working less than three vibrators in the pour. All equipment and procedures used to consolidate concrete shall comply with ACI 309R.
- G. Concrete shall be thoroughly consolidated by vibrating, spading, rodding, or forking so that concrete is thoroughly worked around reinforcement and embedded items, and into corners, angles of forms, eliminating air and stone pockets.
- H. Hot Weather Concreting – Follow recommendations of ACI 305R for preparation, placing, protection and curing during hot weather.
- I. Cold Weather Concreting – Follow recommendations of ACI 306R for preparation, placing, protection and curing during cold weather.
- J. Contractor shall keep good thermometer at Site for monitoring air or concrete surface temperature.
- K. Where saw cutting and removal of existing concrete walls, slabs, etc. exposes the ends of reinforcing steel bars, the Contractor shall coat the exposed concrete surface with the specified epoxy coating.
  - 1. Prior to application of the epoxy coating, the concrete surface to be coated shall be roughened and cleaned of all loose materials and dust.
  - 2. Epoxy coating shall be water based rebar coating agent, moisture insensitive, 3-component, epoxy-modified cementitious product.
  - 3. Application methods and thickness of coating shall be as recommended by the manufacturer.
- L. Apply the specified bonding agent per the manufacturer's instructions at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 1. Prior to application of the bonding agent, the existing concrete surfaces to be coated shall be roughened and cleaned of all loose materials and dust, thus exposing the aggregate to provide a mechanical bond in addition to the chemical bond provided by the bonding agent.

2. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

### 3.11 DEFECTIVE CONCRETE

- A. Defective concrete is defined as concrete in place which does not conform to specified design strength, required percent air, shapes, alignments and elevations, as shown on the Drawings and/or which presents faulty surface areas. Evaluation and acceptance of concrete shall conform to ACI 318, ACI 301, and ACI 350 as applicable.
- B. All defective concrete shall be removed and replaced in a manner meeting with the Engineer's approval, or should surface imperfections only occur, may be patched at the discretion of, and in a manner satisfactory to the Engineer; however, permission to patch the Work shall not be considered as a waiver of the Engineer's right to require complete removal and replacement of such defective Work should the patching fail to satisfactorily restore the required quality and appearance of the Work. All such Work shall be performed at the Contractor's expense, without extension of time.
- C. If for any reason, in the opinion of the Engineer, the testing of any section of the completed structure is necessary, a superimposed load shall be applied by the Contractor and the test conducted in accordance with the current Building Code at the Contractor's expense irrespective of the results of the tests. In cases where failure is declared, the Engineer shall have the authority to order the defective construction removed. All expense of removing such defective construction and substituting new construction, including expense of removing and replacing the Work of others, or protecting and repairing the Work of others, shall be borne by the Contractor.

### 3.12 CURING

- A. General - Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface in accordance with ACI 308 "Standard Practice for Curing Concrete" subject to the requirements specified herein.
- C. Cure concrete at least five days at concrete temperatures above 70 degrees F or at least seven days at concrete temperatures between 50 degrees F and 70 degrees F. Maintain concrete temperature above 50 degrees F during the curing period. Tanks and other liquid retaining structures shall be cured for a minimum of 10 days.
- D. For exposed surfaces, utilize one of the following methods:
  1. Membrane Curing Compound - Apply in two coats at right angles to each other upon completion of the Work - each one in accordance with the manufacturer's

instructions. Compounds must not be used on surfaces when surface treatments, such as tile, additional concrete, paint, liquid hardeners, and adhesive coatings are specified unless the compound is known not to interfere with adhesion.

2. Sheet Curing Materials - Place materials upon completion of the finishing work. Lap edges 6 inches and seal to create a moisture barrier that must remain intact for the duration of the curing period.
  3. Sprinkling, Soaking, or Ponding - Maintain surfaces continuously wet for the duration of the curing period as described above.
- E. If formed surface is exposed during the curing period, treat the surface as an exposed surface for the remaining duration of the curing period.

### 3.13 FINISHING SURFACES

- A. Formed Surfaces - Finishing of formed surfaces shall be in accordance with the requirements of Section 5, ACI 301 subject to the following provisions specified herein:
1. Do not remove forms and shoring until the concrete has cured sufficiently to carry its own weight and remain in place without deformation. Remove forms with care to prevent spalling. Reshore concrete carrying superimposed load until the concrete has attained design strength.
  2. Inspect honeycombed areas. Replace areas as directed by the Engineer.
  3. On exposed vertical unpainted surfaces, building interior, and to 6 inches below grade on building exterior, remove fins and projections, fill holes, and produce smooth-rubbed finish per ACI 301 by wetting and rubbing surfaces with carborundum brick or other abrasive until uniform color and texture are produced.
  4. Horizontal surfaces, such as at tops of walls, pedestals, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, shall be struck off smooth and finished with a texture matching the adjacent formed surfaces.
- B. Slabs and Horizontal Surfaces - Finishing of unformed surfaces shall be done in accordance with the requirements of Section 5 of ACI 301 and Chapter 8 of ACI 302:
1. All slabs, whether receiving additional finishes or not, shall receive a float finish when concrete has stiffened sufficiently to permit the operation of a power drive float and all surface water has disappeared. Check and level slab surface to obtain a Class A finishing tolerance per ACI 117.
  2. Interior slabs not receiving tile shall be given a hard trowel finish as follows:
    - a. Follow initial finishing with a steel trowel worked flat to produce a fine, non-slip, sandy texture.

- b. Follow the first steel troweling with a second steel troweling to produce a dense, smooth surface after the surface has become hard enough to give a ringing sound from the trowel.
    - c. Retool joints and edges as required.
  3. Exterior slabs and concrete stair treads shall be given a non-slip broom finish with scored texture perpendicular to main traffic route. Retool joints and edges.
- C. Roadway Repairs and Walkways:
  1. Float Finish - Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
  2. Final Tooling - Tool edges of paving and joints formed in fresh concrete with a jointing tool to a radius of 1/4-inch Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
- D. Tanks and Other Liquid Retaining Structures: Finishing for exposed surface shall be in accordance with the requirements of ACI 350, ACI 301 and ACI 302 subject to the following requirements:
  1. Slabs - Floated finish.
  2. Interior Formed Surfaces - Grout-cleaned finish.
  3. Exterior Formed Surfaces - Grout-cleaned finish to 6 inches below grade.
  4. Other Formed Surfaces - As-cast finish.

### 3.14 REMOVING FORMS

- A. General - Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the Work, may be removed after curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 80% of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimen's representative of concrete location or members. Construction loads shall not exceed 80% of design live load until 28 days after concrete placement.

- C. Form-facing material may be removed four days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

### 3.15 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to the Engineer.

### 3.16 CONCRETE REPAIRS AND REPLACEMENT

- A. Remove and replace, at Contractor's expense, any concrete that was part of the Work and that is broken, damaged, or defective, or does not meet the requirements of this Section.
- B. Protect concrete from damage. Exclude traffic from slabs-on-grade and roadway/walkway paving for at least 14 days after placement. When construction traffic is permitted, maintain slabs and paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Patching Defective Areas - Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to the Engineer.
- D. Mix dry-pack mortar, consisting of one-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
  - 1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
  - 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- E. Repaired Formed Surfaces - Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of the Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be

removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- F. Repairing Unformed Surfaces - The Contractor shall test unformed surfaces such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01-inch-wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
  2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
  3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- G. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

#### **PART 4 SPECIAL PROVISIONS**

- A. None.

END OF SECTION

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**SECTION 03710  
CONCRETE RESTORATION**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section covers the furnishing of all labor, equipment, and materials required to repair, rehabilitate or reconstruct spalled, deteriorated or structurally damaged concrete. Depth of repairs shall be adequate to restore concrete member or slab to original dimensions after proper preparation to sound concrete.
- B. Additional product requirements are specified in Section 01350 and Section 03305.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Concrete mix design.
    - b. Product literature for proprietary patching materials, admixtures, bonding adhesive, and anchors.
  - 2. Information for the Record:
    - a. Material certifications.
    - b. Contractor qualification certification.
    - c. Product manufacturer's surface preparation, mixing, application, and curing instructions.
    - d. Cold weather and hot weather procedures.
    - e. Test reports.

**1.03 REFERENCES**

- A. "Guide to Repair of Concrete" - ACI 546R-96.
- B. "Specifications for Repairing Concrete with Epoxy Mortars" - ACI 503.4-92.

**1.04 PREBID INSPECTION**

- A. The repair areas shown on the Drawings or specified for repair are based on a general survey. The Contractor shall visit the Site prior to Bid submittal to determine the extent of the required repairs.



### 1.05 QUALITY ASSURANCE

- A. Pre-installation Conference - Before beginning restoration work, Contractor shall hold job site meeting to review detailed requirements and procedures for concrete restoration. Representatives of Contractor, testing laboratory, patching material supplier, and Engineer shall be in attendance.
- B. Contractor Qualifications - Contractor shall have experience and proficiency specific to the repair type and shall be approved by the manufacturer of repair material. Certification from manufacturer shall be submitted.

### 1.06 ENVIRONMENTAL CONDITIONS

- A. Unless adequate protection is provided, patches shall not be placed during rain, sleet, or snow, or when inclement weather is imminent. When temperature is less than 40 degrees F or when the temperature is expected to fall below 40 degrees F during the curing period, cold weather procedures shall apply. Patching material shall not be applied to frozen surfaces.
- B. When conditions of material temperature, air temperature, wind velocity, and relative humidity combine to cause plastic shrinkage cracking, flash set, or otherwise impair the quality of patch, hot weather procedures shall apply.
- C. All materials used for the repair work must be VOC compliant.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Product shall be delivered in original, unopened containers with manufacturer's name, labels, product identification, and batch numbers clearly discernible.
- B. Materials shall be stored and conditioned in accordance with manufacturer's written instructions.

## PART 2 PRODUCTS

### 2.01 POLYMER-MODIFIED MORTAR - For repairs 1/8 inch to 3 inch deep.

- A. Patching mortars shall be latex-modified cementitious mortar. Material shall be thermally compatible with base substrate and shall not produce vapor barrier.
- B. 28-day compressive strength (ASTM C109) -6000 psi minimum  
28-day flexural strength (ASTM C348) - 1500 psi minimum  
28-day bond strength (ASTM C882) - 2000 psi minimum
- C. Material shall not contain asbestos, chlorides, nitrates, added gypsum, added lime, or high aluminum cements and shall be suitable for wet environments.
- D. Material shall be supplied in factory proportioned unit.
- E. Color of cured material shall be concrete-gray.

- F. Coefficient of thermal expansion of patching mortar shall be compatible with coefficient of thermal expansion of concrete.
- G. Schedule:
1. Horizontal Repairs 1/8-inch to 1-inch Deep - Material shall be trowel grade. Sika Corporation "SikaTop 122 Plus" neat, or equal.
  2. Horizontal Repairs 1-inch to 3-inches Deep – Material shall be polymer-modified, cementitious, screed mortar. Sika Corporation "SikaTop 111 Plus" extended with 3/8-inch aggregate, or equal.
  3. Unformed Vertical/Overhead Repairs 1/8-inch to 3-inches Deep (Lifts not to exceed 1-1/2 inches) – Material shall be fast-setting and non-sagging. Sika Corporation "SikaTop 123 Plus", or equal.
  4. Formed Vertical/Overhead Repairs 1/8-inch to 1-inch Deep – Material shall be fast-setting and free-flowing mortar suitable for pouring or pumping. Sika Corporation "SikaTop 111 Plus" neat, or equal.
  5. Formed Vertical/Overhead Repairs 1-inch to 3-inches Deep – Material shall be fast-setting and free-flowing mortar suitable for pouring or pumping. Sika Corporation "SikaTop 111 Plus" extended with 3/8-inch aggregate, or equal.
- H. Mixing:
1. Materials shall be mixed in accordance with manufacturer's written instructions.
  2. Material shall be mechanically mixed to uniform consistency, but shall not be overmixed.
  3. Aggregate may be added for thick patches when approved by manufacturer. Quantity, type, size, and gradation of aggregate shall be in accordance with manufacturer's written instructions.
  4. The temperature of latex modified mortar as placed shall be between 55 degrees F and 85 degrees F.

**2.02 LOW-SLUMP CONCRETE - For repairs greater than 3 inches deep, or repairs over large areas.**

- A. Materials:
1. Cement - ASTM C150 Type I/II
  2. Aggregate - ASTM C33, Class 4S.
  3. Fly Ash - ASTM C618, Class F.
  4. Ground Granulated Blast Furnace (GGBF), ASTM C989 Grade 100 or 120.
  5. Admixtures:
    - a. Air Entraining - ASTM C260

- b. Only admixtures certified by their manufacturer as chloride ion-free shall be used.
  - 6. Water shall conform to ASTM C94.
- B. Mix Proportions:
  - 1. Concrete shall be proportioned to maximize durability and to minimize shrinkage.
  - 2. Water/Cement Ratio - 0.40 maximum, minimum 28-days compressive strength equals 5,000 psi.
  - 3. Slump - Horizontal patches - 1-inch maximum.
  - 4. Formed vertical/overhead patches - 3-inch maximum.
  - 5. Concrete exposed to freezing while in moist condition shall be air entrained for severe exposure.
  - 6. Nominal maximum aggregate size shall not be more than 1/3 of patch depth, nor 3/4 of minimum clear spacing between reinforcing bars.
- C. Mixing - Concrete shall be mixed in batch mixer capable of thoroughly combining aggregates, cement, and water. Concrete shall be mixed until uniform consistency is obtained.

### **2.03 BONDING ADHESIVE**

- A. Bonding adhesive shall be polyamine epoxy/portland cement adhesive and shall not form vapor barrier.
- B. Bonding adhesive shall be Sika Corporation "Armatec 110", or equal.

### **2.04 REINFORCEMENT**

- A. Reinforcing bars shall be grade 60 deformed bars conforming to ASTM A615 or ASTM A616 including supplementary requirements S1.

### **2.05 ANCHORS**

- A. Anchors shall be 1/4-inch diameter T-shaped rods of 304 stainless steel. Hohmann & Barnard, Inc. "#423 Stone Anchors" or equal.

## **PART 3 EXECUTION**

### **3.01 TEMPORARY SHORING**

- A. Temporary shoring shall be installed when shown or when otherwise required to prevent deflection, cracking, and other damage to structure. Shoring shall be

maintained in-place until patches have gained sufficient strength. Design of temporary shoring shall be responsibility of Contractor.

- B. Construction loads shall be minimized on members requiring patching so that structural damage is prevented.
- C. Engineer shall be notified immediately when:
  - 1. Patch depth exceeds 15% of least dimension of column or beam.
  - 2. Patch depth exceeds 15% of thickness of wall or slab and patch width exceeds 4 times wall or slab thickness.

### 3.02 FORMWORK

- A. Formwork shall comply with pertinent provisions of "Guide to Formwork for Concrete (ACI 347R)," American Concrete Institute, and shall comply with requirements of governmental agencies having jurisdiction.
- B. Forms shall be provided on under or back side of full-depth patches and shall be provided on face of overhead or vertical patches in excess of 4-feet wide.
- C. Forms shall be mortar-tight and shall be clean. Release agent shall be applied to forms before they are positioned. Prepared concrete surface shall not be contaminated with form release agent.
- D. Forms may be removed as soon as patch has hardened sufficiently to resist damage from removal operations.

### 3.03 PREPARATION

- A. Perimeter:
  - 1. Perimeter of patch shall be approximately rectangular and shall be within limits determined by Resident Project Representative. Resident Project Representative shall be notified when unsound concrete is discovered beyond predesignated limits of patch.
  - 2. Perimeter of patch shall be undercut slightly to a minimum depth of 1/2 inch, but reinforcement shall not be cut. Saw kerf shall not extend past perimeter of patch. Avoid feather edges.
- B. Selective Removal and Surface Preparation:
  - 1. Loose and deteriorated concrete shall be removed to sound substrate. Depth of patch shall be approximately uniform.
  - 2. Where more than half of diameter of reinforcing bar is exposed or if bar with active corrosion is encountered, concrete behind bar shall be chipped out to depth of 3 times maximum aggregate size, but not less than 3/4 inch.

3. Concrete substrate shall be chipped to surface profile of 1/8 inch with new-fractured aggregate surface.
  4. Chipping hammers shall be hand-held type weighing not more than 30 pounds and shall use gad point. Chisel points are prohibited. Use of scabbler is not permitted. Scarifier shall be of type which cuts on up-stroke.
- C. Contaminated surfaces shall be detergent washed or steam cleaned in accordance with ASTM D4258. Water used in detergent washing shall be approximately 180 degrees F.
  - D. Surface shall be sweep blasted with coarse, hard, and angular abrasive. Abrasive shall be Black Beauty High Grade Sand. Air stream shall be free of oil.
  - E. Acid etching is not permitted.
  - F. Cracks in substrate in area of patch shall be repaired as directed by Engineer.
  - G. Control and expansion joints in existing structure shall be extended through patch.
  - H. Immediately prior to applying patch, surface shall be vacuum cleaned with heavy-duty industrial vacuum.

#### **3.04 REINFORCEMENT**

- A. Reinforcement with active corrosion shall be uncovered to point where bar is well bonded to concrete.
- B. Corrosion product shall be removed by abrasive blasting.
- C. Engineer shall be notified if any one bar has lost more than 15% of its original cross-section. Engineer will specify method of repairing corroded reinforcement.

#### **3.05 ANCHORS**

- A. Anchors shall be placed where depth of patch exceeds 3 inches or where shown on drawings. Anchors shall be spaced at 12-inch center to center, each way, unless noted otherwise. Anchors shall have 1-1/2-inch minimum concrete cover.
- B. Anchors shall be epoxied 3 inches into existing concrete. Epoxy shall be Hilti HIT Re-500 or equal.

#### **3.06 PATCHING**

- A. Substrate shall be saturated for one hour prior to patching. At time of patching, substrate shall be saturated surface dry (SSD), with no standing water.
- B. Patches more than 3 inches deep shall be made with low-slump concrete. Patches less than 3 inches deep shall be made with latex-modified patching mortar, unless noted otherwise.

- C. Bonding adhesive shall be applied to substrate when patch is made with low-slump concrete. Bonding adhesive shall be applied in accordance with manufacturer's recommendations.
- D. Unformed Patch:
  - 1. Mortar shall be scrubbed into substrate and previous lifts to fill pores and voids.
  - 2. While scrub coat is still plastic, patching material shall be pressed onto substrate with trowel. Patching shall start at edges of patch and work towards center.
  - 3. Material shall be compacted into corners and around reinforcement and other embedments by tamping and internal vibration.
  - 4. Vertical/overhead patching shall be performed in lifts approximately 1-1/2 inches thick. Surface of each lift shall be intentionally roughened. Preceding lift shall reach final set before additional material is applied.
- E. Formed Patch:
  - 1. Material shall be pumped or poured into form in manner to prevent air entrapment.
  - 2. Form shall be vibrated during placement to achieve flow and compaction. Internal vibration shall be used in thick patches when practicable.
- F. Patch shall be finished to match surrounding concrete.

### 3.07 CURING

- A. Latex-modified material shall be cured in accordance with manufacturer's written instructions.
- B. Low-slump concrete shall be cured minimum of 7-days. Concrete shall be cured by wet burlap covered with plastic sheeting conforming to ASTM C171 unless specified otherwise. Burlap shall be dampened during curing period as required.

### 3.08 COLD WEATHER

- A. Snow, ice, and frost shall be removed from reinforcement and substrate against which patch is to be placed. Patch shall not be applied to frozen substrate.
- B. Temperature of patching material shall be within 50 degrees and 85 degrees F, but shall not vary more than 10 degrees F from substrate temperature.
- C. Patch shall be protected by heated enclosure for minimum of 3 days, beginning immediately after placement. Air temperature within enclosure shall be 50 degrees - 70 degrees F.
- D. Low-slump Concrete shall not be cured by wet curing methods.

**3.09 HOT WEATHER**

- A. Substrate shall be cooled by saturating with water two-hours prior to patching. Temperature of patching material shall not vary more than 10 degrees F from substrate temperature.
- B. Wind and sun screens shall be erected during and after patching to prevent plastic shrinkage cracking.
- C. Latex-modified patching material and low-slump concrete shall be cured by wet curing method as specified.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 05500  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, shop detailing, shop coating, fabricating, delivering, and installing all miscellaneous metals and accessories needed to complete installations as shown on the Drawings, whether or not specifically listed herein, except those items specified in other sections. This section includes design engineering where specifically called for by this Section.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Shop Drawings shall indicate:
      - 1) Types of materials with ASTM designations.
      - 2) Plan layouts, elevations and sections.
      - 3) Connection details.
      - 4) AWS weld designations and welding procedure.
      - 5) Surface preparation and shop coatings.
      - 6) Accessory materials.
    - b. Product literature for all materials and accessories required to complete the installation of the items covered in this Section.
    - c. Samples representative of materials and finished products .
    - d. Design and calculations shall be sealed by a professional structural engineer registered in the state where the Project resides on items where a design engineer is specified.
  2. Information for the Record:
    - a. Welder qualification certificates.
    - b. Inspection Reports and test certificates.
    - c. Required field measurements.
    - d. Manufacturer's installation instructions.



### 1.03 QUALITY ASSURANCE

- A. Standards - Metal fabrications shall be designed, fabricated, and installed in accordance with following standards.
1. "Structural Welding Codes", American Welding Society.
  2. "Specifications for Structural Steel Buildings" as approved by American Institute of Steel Construction.
  3. "Specifications for the Design of Cold-Formed Steel Structural Members", American Iron and Steel Institute.
  4. "Specification for the Design of Cold-Formed Stainless Steel Structural Members", ASCE 8.
  5. "Code of Standard Practice for Steel Buildings and Bridges", as approved by American Institute of Steel Construction.
  6. "Specification for Aluminum Structures", Aluminum Association.
  7. "Specification for Structural Joints Using High Strength Bolts" as approved by the Research Council on Structural Connections of the Engineering Foundation.
  8. "Surface Preparation Specification," Steel Structures Painting Council (SSPC).
- B. Welders, welding operators, and tack welders shall be qualified by tests as prescribed in AWS Structural Welding Code.

### 1.04 PERFORMANCE REQUIREMENTS

- A. Contractor is responsible for employing Design Engineer for the items listed by this Article. Design engineer shall follow the performance requirements provided in the pertinent parts of this Section.
1. Ladders

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall exercise particular care in handling materials to prevent damage to shop applied finishes and coatings.
- B. Material shall be stored in a manner to prevent bending or warping. Material shall be stored away from uncured concrete and masonry.
- C. Fastening materials shall be delivered and stored in unopened boxes with labels clearly identifying fastener material, grade, and manufacturer. Only those fasteners which can be installed in same day shall be removed from storage.

### 1.06 PROJECT CONDITIONS

- A. Prior to fabrication, Contractor shall field measure new and existing structures when required for proper fit.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Steel (Carbon Steel):
  - 1. Wide Flange Shapes (W) - ASTM A992.
  - 2. Other Rolled Shapes, Plate, and Bar - ASTM A36 or ASTM A572, Grade 50 as indicated on the Drawings. Where no indication is given, use ASTM A36.
  - 3. Sheets - ASTM A570, Grade 36.
  - 4. Hollow Structural Sections (HSS), tube and pipe - ASTM A500, Grade B.
  - 5. Pipe - ASTM A53, type E or S, Grade B.
  - 6. Floor and Tread Plate - ASTM A786 using ASTM A36 steel.
- B. Stainless Steel:
  - 1. Unless indicated otherwise stainless steel shall be AISI Type 304, except AISI Type 304L shall be used for welded construction. The minimum yield strength shall be 30,000 ksi.
  - 2. Sheet, Strip, Plate, and Flat Bar - ASTM A666, annealed.
  - 3. Round Bar and Structural Shape - ASTM A276, condition A.
  - 4. Pipe and Tube - ASTM A312 or ASTM A554, annealed.
  - 5. Floor and Tread Plate - ASTM A793.
- C. Aluminum:
  - 1. Unless specified otherwise aluminum shall be alloy 6061-T6.
  - 2. Sheet and Plate - ASTM B209.
  - 3. Rod and Bar - ASTM B211 or B221.
  - 4. Pipe and Tube - ASTM B210 or ASTM B429.
  - 5. Floor and Tread Plate - ASTM B632.

### **2.02 ASSEMBLY AND ERECTION FASTENERS**

- A. Bolts and Nuts:
  - 1. High strength bolts - ASTM A325, Type 1 or ASTM A490, Type 1. When no indication is given, ASTM A325 shall be used.
  - 2. Stainless Steel - ASTM F593, AISI Type 304.
  - 3. High strength and stainless-steel bolts shall bear a distinctive head marking identifying bolt grade or material.

4. Nuts - Heavy hex style, ASTM A563, Grade C, for plain A325 high-strength fasteners and DH for galvanized bolts. For A490 bolts, heavy hex nuts conforming to ASTM A194 for Grade 2H, or ASTM A563 Grades DH or DH3.
- B. Lock Nut - Prevailing torque type, IFI 100, Grade A.
- C. Carbon Steel Washers - ASTM F436 plain with plain bolts and galvanized with galvanized bolts.
- D. Lock Washer - Spring type of same material and coating as bolt.
- E. Headed Studs - ASTM A108, Grade 1010 through 1020, and AWS D1.1, Section IV.
- F. Screws:
  1. Carbon Steel - SAE Grade 2, zinc plated.
  2. Stainless Steel - IFI 104, Grade 304.
- G. Nuts and washers of same finish and material as bolts shall be furnished

## 2.03 ANCHOR BOLTS

- A. General Requirements:
  1. Bolt and Stud Material:
    2. Carbon Steel - ASTM F1554 Grade 36, unless noted otherwise.
    3. Stainless Steel - ASTM F593, AISI Type 304.
    4. Heavy hex nuts and washers of same material and coating as anchor shall be furnished. Where lock nut is indicated, prevailing torque type lock nut shall be furnished in addition to standard nut.
  5. Anchor Bolt Sleeves:
    6. Steel Pipe - ASTM A501, ASTM A120, or ASTM A53.
    7. Plastic - Wilson "Ankor Shield" or equal.
- B. Cast-In Anchor Bolt (Type A):
  1. Sufficient thread length shall be provided to permit installation of nuts on both sides of concrete form or template.
  2. Anchor embedment, and hook dimension shall be as shown on Drawings.
  3. Where sleeve is shown, sleeve shall be fabricated from material indicated above.
- C. Adhesive Anchor (Type B):
  1. Adhesive – 100% solids, 100% reactive epoxy (ester-based resins are not permitted) in conformance with ASTM C881, Type IV, Grade 3, Class B and C. Minimum bond strength to concrete, per ASTM C882, shall be 1800 psi at 7

- days. Adhesive shall be mixed in accordance with manufacturer's recommendations. The adhesive shall be formulated to withstand the maximum allowable published load permanently without creep or failure.
2. Where adhesive anchor is installed in hollow masonry, stainless steel screen tubes shall be furnished to contain adhesive until stud is inserted.
  3. The anchor rods shall be threaded for entire length. Carbon steel rods shall conform to ASTM A193 B7 (high strength) and stainless-steel rods shall conform to AISI 304.
  4. Stud shall be threaded full length.
  5. Adhesive anchors shall be type "HIT-RE-500-V3" manufactured by Hilti, or equal. All formulations of the "Power-Fast Epoxy" as manufactured by Powers/Rawl shall not be used.
- D. Expansion Anchor (Type C):
1. Wedge Type Anchors - FS A-A 1923A, Type 4.
  2. All components shall be of same material.
  3. Expansion anchors shall be type "Kwik Bolt TZ" manufactured by Hilti, or equal.
- E. Sleeve Masonry Anchor (Type D):
1. Sleeve Type Anchors - FS FF-S-325, Group II, Type 3, zinc plated carbon steel.

## 2.04 FABRICATION

- A. Work shall be fabricated straight and true, free from warpage or other defects and assembled in a first-class workmanlike manner. Joints, copes, miters, and corners shall be accurately cut, machined, filed, and fitted with best methods as required for fabrication.
- B. Work shall be fabricated as shown on approved Shop Drawings. Removable parts or members shall be carefully fitted and secured by screw fastenings or other methods as may be required.
- C. Work shall be fabricated in as large as sections as practicable to minimize field connections. Field connections shall be designed and constructed in most practical locations for strength, appearance, and ease of installation. Field connections shall be mechanically fastened unless field welding is shown, specified, or permitted by Engineer.
- D. Holes and other provisions for field connections shall be accurately located. Connections shall be shop checked for proper fit. Connection materials shall be match-marked when required for proper installation.
- E. Holes produced by flame cutting shall be ground smooth.

- F. Sharp edges of flame cut or sheared carbon steel fabrications shall be removed by power grinding.
- G. Carbon steel surfaces to be coated or galvanized shall have gouges, handling marks, deep scratches, metal stamp marks, slivered steel and other surface flaws repaired. Surface flaws shall be repaired by welding and grinding as required.

## 2.05 SHOP COATING

- A. Aluminum:
  - 1. Anodizing - Where specified, provide Architectural Class I anodic coating, applied after fabrication.
  - 2. Surfaces which will be in contact with concrete, masonry, or dissimilar metals shall receive a heavy coat of coal tar paint, Bitumastic Super Service Black, or equal.
- B. Carbon Steel:
  - 1. Steel fabrications wholly embedded in concrete or masonry and with a minimum of 2 inches of concrete cover shall be abrasive blasted in accordance with SSPC SP-6, but shall not be coated. Exposed portions of partially embedded steel shall be shop coated to a point 4 inches below the concrete surface.
  - 2. Galvanizing - Component shall be hot dip galvanized after fabrication in conformance with ASTM A123. Threaded parts and hardware shall be galvanized in conformance with ASTM A153 or zinc-plated in conformance with ASTM B695.
  - 3. Painting - Unless specified otherwise, non-galvanized fabrications shall be shop primed per Section 09900.
    - a. Surfaces which will be inaccessible for field painting after installation shall receive two coats of primer.
    - b. Contractor shall ensure primer is compatible with specified field coatings.

## 2.06 LADDERS

- A. Design Engineer shall design framing and wall connections. Minimum requirements are provided on Drawings and specified.
- B. Ladders shall be fabricated from material indicated on Drawings using all-welded construction. Safety cages shall be furnished when shown or otherwise required. Ladders shall meet requirements of MIOSHA and governing building code.
- C. Edges of stringers shall be ground to remove burrs and sharp edges.

- D. Rungs shall be spaced not less than 10 inches or more than 12 inches apart. Rungs shall have skid resistance top surface such as knurled, dimpled or skid resistant coating. Adhesive grit tape is not acceptable.
- E. Where bottom landing is a roof, bottom of ladder shall be supported off wall, unless noted otherwise. Bottom rail floor connections shall have minimum 1-inch adjustment for sloped and uneven surfaces.
- F. Ladder system shall be capable of supporting its own weight plus 300 pounds of allowable live load for every 10 feet of ladder height. Each rung shall support an allowable live load of 300 pounds located at the center of rung. Where ladder rails extend above the landing the rails shall be designed to support 100 pounds of lateral load in any direction located at the top of the rail.
- G. The design of ladder bracket connections to substrate shall be included. New substrate material strengths shall be taken from the Contract Documents. The makeup of existing substrate materials shall be field determined by the contractor and strength tested as deemed necessary by the Design Engineer. Size and locations of removed materials for substrate verification, or to be strength tested shall receive prior approval by the Owner and Engineer.

### **PART 3 EXECUTION**

#### **3.01 ERECTION**

- A. Metal fabrications shall be installed in accordance with manufacturer's instructions and as shown on Drawings.
- B. Fabrications shall be installed level and plumb or as otherwise shown on Drawings. Shims shall be furnished when required.
- C. Components shall be assembled as indicated on Drawings. Light drifting is permitted to draw parts together, but drifting to match unfair holes is not permitted. Where holes do not match, holes may be reamed slightly using a tapered reamer. Enlarging holes by burning is prohibited.
- D. Contact surfaces between members and areas adjacent to bolt holes shall be free of dirt, oil, loose scale, burrs, pits, and other defects that would prevent proper seating and connection of the members.
- E. Galvanized or anodized material shall not be field bent, cut, welded, or otherwise altered. Material so altered will be considered defective.
- F. Aluminum beam and column connection components shall be stainless steel.

**3.02 ASSEMBLY AND ERECTION FASTENER INSTALLATION**

- A. Washers shall be installed under turned element of bolts. Hardened washers shall be used for high strength and alloy bolts. Beveled washers shall be installed when bearing surface of the bolted parts have a slope of 1:20 or greater with respect to the bolt axis.
- B. Fastener threads which have been contaminated with dirt shall be cleaned and lubricated.
- C. Stainless Steel - Anti-seizing lubricant shall be applied to threads prior to installation.
- D. Bolts shall be tightened progressing systematically from stiffest part of connection toward free edges.
- E. Bolted connections shall be snug-tightened-joints, unless noted otherwise. All connected steel plies shall be free of dirt, oil, lacquer and burrs, and shall be in firm contact prior to bolting.
- F. High strength and alloy bolts shall not be reused once tightened beyond snug-tight.
- G. For bolted connections, at least one full thread shall project beyond the nut when tightened.

**3.03 ANCHOR BOLT INSTALLATION**

- A. Non-cast-in type anchors shall be installed in predrilled holes of size specified or as recommended by manufacturer. Anchors shall be embedded to depth indicated below unless shown otherwise on the Drawings.
- B. Anchor bolted connections shall be snug-tightened- in accordance with “Specification for Structural Joints Using ASTM A325 or A490 Bolts” as approved by the Research Council on Structural Connections of the Engineering Foundation or as otherwise specified by anchor manufacturer.
- C. Expansion Anchor:
  - 1. Unless indicated otherwise, expansion anchors shall have an effective embedment as follows:

Stud Diameter	Minimum Embedment
1/4 inch	2 inches
3/8 inch	2 inches
1/2 inch	3-1/4 inches
5/8 inch	4 inches
3/4 inch	4-3/4 inches
1 inch	6 inches

- 2. Unless indicated otherwise, expansion anchors shall be spaced as follows:
  - Minimum center to center spacing: 2 times embedment.
  - Minimum edge distance: 3 times embedment.

3. Unsound concrete shall be reported to Engineer.

D. Adhesive Anchor:

1. Adhesive anchors shall be placed in holes larger than stud diameter using a rotary percussion hammer and carbide bit. Hole diameters shall be as recommended by manufacturer for each specific anchor diameter.
2. Unless indicated otherwise, Adhesive anchors shall have an effective embedment as follows:

Stud Diameter	Minimum Embedment
3/8 inch	3-3/8 inches
1/2 inch	4-1/2 inches
5/8 inch	5 5/8 inches
3/4 inch	6-3/4 inches
7/8 inch	7-7/8 inches
1 inch	9 inches

3. Preparation Procedure:
  - a. Hole shall be cleaned of dust and residue by blasting with dry and oil-free compressed air. Air nozzle shall be inserted to bottom of hole.
  - b. Sides of hole shall be cleaned with a nylon bristle brush.
  - c. Compressed air blast shall be repeated.
4. Standing water and frost shall be removed immediately prior to injecting adhesive.
5. Adhesive shall be injected from bulk-loading caulking gun, disposable caulking tubes, or pneumatic dispenser. Adhesive shall be injected using extension on nozzle to reach bottom of drilled hole.
  - a. Anchoring to Concrete - Nozzle shall be inserted to back of hole and adhesive dispensed while slowly withdrawing nozzle. Hole shall be filled to pre-determined depth which will cause hole to be completely filled after stud is inserted.
  - b. Anchoring to Masonry - Screen tube shall be filled with adhesive while slowly withdrawing nozzle. Screen tube shall be carefully inserted into drilled hole.
6. Stud shall be pushed into adhesive with gentle, uniform pressure while slightly rotated to ensure adhesive completely surrounds stud. Stud shall be inserted to full depth of hole.
7. Adhesive displaced from hole shall be removed immediately. Adhesive which has hardened on projecting portion of stud or on concrete surfaces shall be removed.



8. Nut shall not be tightened nor load applied until adhesive has fully cured as recommended by manufacturer.
9. Threaded anchors shall have at least one full thread projecting beyond the nut when tightened.

**3.04 FASTENER AND ANCHOR SCHEDULE**

A. Unless shown or specified otherwise, fasteners and anchors shall be as follows:

Base Metal	Fastener Metal and Coating
Stainless steel	Stainless Steel
Aluminum	Stainless Steel
Galvanized steel	Galvanized or zinc plated carbon steel
Field painted or uncoated carbon steel	Unfinished or zinc plated carbon steel

- B. Where a connection involves dissimilar base metals, fastener shall be as required for most corrosion resistant base metal in connection, or dielectric material shall be installed.
- C. Anchors bolts and fasteners in submerged applications shall be stainless steel.
- D. Where anchor type is not shown or specified, anchor furnished shall be suitable for substrate material and specific application. Adhesive anchors are not permitted for anchoring to vertical or overhead surfaces inside of buildings or other fire rated locations.

Substrate Material	Suitable Anchor Type
Concrete	A, B, C
Solid or Grouted Masonry	A, B, D
Hollow Masonry	B, D

**3.05 FIELD WELDING**

- A. Field welding when shown, specified, or otherwise permitted by Engineer shall be performed in accordance with the requirements specified for shop welding.
- B. Areas adjacent to field welds shall not be shop primed. Primer shall be applied after welding.

**3.06 COATING REPAIR**

- A. Welds, bolts, and damage to shop applied coatings shall be touched-up with same or equivalent materials used in original coating.
- B. Minor scratches or defects in galvanized coating may be repaired with zinc-rich paint in accordance with ASTM A780 at Engineer’s discretion.
- C. Repair of anodized coatings in field is not permitted. Damaged materials shall be removed and re-anodized.

### 3.07 CLEANING

- A. Metal fabrications shall be cleaned with mild detergents prior to final acceptance. Steel wool, harsh abrasives, or alkaline or acid cleaners are not permitted.

### 3.08 QUALITY CONTROL INSPECTION AND TESTING

- A. The Contractor shall employ a laboratory to perform the following inspections and testing verifications: Where pretensioned or slip critical connections are indicated refer to Section 05120 for additional inspection requirements.
  - 1. At the start of Work, the inspector at the Site of the project shall:
    - a. Verify that the material identification markings for structural members, high strength bolts, nuts and washers correspond to the appropriate ASTM designations.
  - 2. If inspections determine that a specific item does not comply with the Contract Documents the contractor shall make corrections until the item passes the inspection. The cost of corrections and additional inspections shall be paid for by the Contractor.

## PART 4 SPECIAL PROVISIONS

### 4.01 DISSIMILAR MATERIALS

- A. Where dissimilar materials come into contact, use neoprene washers, spacers, gaskets or other Engineer approved materials between them to provide insulation against electrolytic action.

### 4.02 CRITERIA FOR BASE METAL REPAIR OF STRUCTURAL STEEL

- A. This criteria shall cover damage induced to existing structural steel during or subsequent to installation of steel. Injurious imperfections, such as voids and gouges, shall herein be defined as a base metal discontinuity which results in a reduction of the cross-sectional area of a member, and which exceeds the limiting depths specified below for various thicknesses of material. Except for discontinuities of 1/32-inch and less in depth which are acceptable without any repair, base metal shall be conditioned for the removal of discontinuities by chipping or grinding. Weld repair is not required, provided the excavated area is well faired without abrupt changes in contour and the depression does not extend below the rolled surface by more than:
  - 1. 1/32 inch for material less than 3/8 inch thick.
  - 2. 1/16 inch for material 3/8 inch to 2 inches (inclusive) thick.
  - 3. 1/8 inch for material over 2 inches thick.
- B. Voids and gouges greater in depth than the limits given above and all cracks and tears are considered injurious and shall be weld repaired using the methods given below;

however, in no case shall the depth of excavations exceed 30% of the base metal thickness without written approval of the Engineers. Prior to welding, the excavations shall be visually (and for cracks and tears, magnetic particle or liquid penetrant) examined to insure complete removal of defects. Excavations shall have a minimum root radius of 1/8 inch, a minimum included angle of 45 degrees F on the cross section, and shall be gradually tapered up to the base metal surface at the ends. Repair welding shall be performed in accordance with the parameters of an AWS D1.1 qualified backing bar weld procedure. Completed surfaces of all repair welds shall be visually examined to the acceptance criteria of AWS D1.1 Section 8.15.

#### **4.03 FABRICATOR APPROVAL**

- A. The fabricator of structural load bearing members and assemblies furnished under this Section, shall be registered and approved to fabricate these products without special inspections per the requirements of the current Building Code Section 1704. The approved fabricator shall submit evidence of such registration at the time that Shop Drawings are submitted. At the completion of production, the approved fabricator shall submit a certificate of compliance to the local building code official stating that the fabrication was performed in accordance with the Contract Documents and the approved Shop Drawings.

END OF SECTION

**SECTION 05520  
METAL PIPE RAILING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, engineering, shop detailing, fabricating, shop coating, and installing of metal pipe railing systems and appurtenances.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
1. Shop Drawings for Review:
    - a. Shop Drawings shall include:
      - 1) Plan layouts, elevations and typical sections.
      - 2) Materials of construction.
      - 3) Connection details.
      - 4) AWS weld designations and welding procedure.
      - 5) Surface preparation and shop coatings.
      - 6) Accessory materials.
      - 7) Required field measurements.
      - 8) Design certification for connection of mechanically connected railing systems.
      - 9) Seal of professional structural engineer registered in the state where the Project resides.
    - b. Product literature.
    - c. Sample of railing showing typical welds and required finish.
  2. Information for the Record:
    - a. Welding qualifications.
    - b. Material certification.
    - c. Manufacturer's installation instructions.

### 1.03 QUALITY ASSURANCE

- A. Standards - Railing shall be fabricated, and erected in accordance with following standards.
  - 1. "Pipe Railing Systems Manual", National Association of Architectural Metal Manufacturers, AMP 521.
  - 2. "Specifications for Structural Steel Buildings", American Institute of Steel Construction.
  - 3. "Specification for Aluminum Structures", Aluminum Association.
  - 4. "Structural Welding Codes", American Welding Society.
- B. Regulatory Requirements - Railing shall be fabricated, and erected to comply with MIOSHA and applicable Building Code where Project resides.
- C. Welders, Welding Operators, and Tack Welders shall be qualified by tests as prescribed in AWS Structural Welding Code.

### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Railing shall be handled in manner to prevent damage to shop applied coatings.
- B. Railing shall be stored in manner to prevent bending or warping. Material shall be stored away from uncured concrete and masonry.
- C. Materials to be embedded in concrete or masonry shall be delivered in sufficient time to permit proper placement.

## PART 2 PRODUCTS

### 2.01 ALUMINUM RAILING

- A. Plate - ASTM B209, alloy 6061-T6.
- B. Structural Shape - ASTM B308, alloy 6061-T6.
- C. Rod and Bar - ASTM B211 or B221, alloy 6061-T6.
- D. Pipe and Tube - ASTM B429, alloy 6005-T5, 6061-T6, or 6105-T5.
- E. Connector Fitting for Mechanical Railing System:
  - 1. Fitting shall be cast aluminum magnesium alloy conforming to ASTM B26 with minimum ultimate strength of 40 ksi, and minimum yield strength of 20 ksi.
  - 2. Fitting shall be internal double tang type activated by 3/8-inch stainless steel knurled cup socket setscrew, externally connected to rail or post by means of aluminum tubular rivet nut and stainless-steel socket head cap screw.
  - 3. Railing system shall be Internal-Rail as manufactured by The Hollaender Mfg. Co., or equal.

- F. Railing Post Base Support Fittings:
1. All aluminum railing post support fittings, fascia brackets, wall brackets, floor flanges, etc. shall be cast, extruded, or fabricated using aluminum alloys as follows:
    - a. Extruded aluminum fittings shall be made of 6063-T6 alloy.
    - b. Cast fittings shall be made from aluminum-magnesium alloy conforming to ASTM B26 with minimum ultimate strength of 40 ksi and minimum yield strength of 20 ksi.
    - c. Railing post base support fittings shall be as manufactured by the Hollaender Mfg. Co., or equal.

## 2.02 FASTENERS AND ANCHOR BOLTS

- A. Fasteners and anchor bolts shall be furnished and installed in accordance with Section 05500.
- B. Hardware for aluminum and stainless-steel railing shall be stainless steel. Hardware for carbon steel railing shall be galvanized or zinc-plated carbon steel.

## 2.03 RAILING SYSTEM

- A. Railings shall be shop fabricated using mechanical connections in as large of sections as practicable. Holes required for field erection shall be shop drilled.
- B. Field splices shall be made with an internal sleeve and steel screws. Splices shall be located within 6 inches of post.
- C. Expansion Joints:
  1. Expansion joints shall be provided in straight runs of railing in excess of 40-feet and at structural expansion joints.
  2. Expansion joints shall have internal sleeve extending 2-inch beyond joint on each side.
- D. Unless otherwise specified on the Drawings, posts and rails shall be 1-1/2-inch pipe, schedule 40 minimum. Railing system shall consist of top rail, intermediate rail or rails and posts with 4-inch high toe plate stiff enough to resist warping due to temperature changes.
- E. Posts shall be 1 1/2-inch nominal diameter and reinforced with internal metal stud as required by design; however, where top of post connections are more than 9-inches below the walking surface, a 2-inch nominal maximum diameter post shall be used. Top

and intermediate rails shall match the diameter of the posts. Balusters shall be 5/8-inch diameter minimum and provided when indicated on Drawings.

- F. Provide internal reinforcing and stud where necessary to meet strength requirements.
- G. Post spacing shall not exceed the maximum spacing of 5 feet.
- H. Handrail bracket spacing for wall mounted railings shall not exceed 5-feet.
- I. Access openings in railings shall be provided where shown on the Drawings
- J. Handrails shall be 1 1/2-inch nominal diameter and continuous between flights of stairs or runs of ramp, and shall return to railing post at top and bottom terminations. Wall mounted handrail shall be furnished with returns to wall.
- K. Self-closing swing gates shall be provided where indicated on plan. Furnish 180-degree heavy duty spring hinges, closure stops, top rail, bottom rail, intermediate rail or balusters that match the encompassing railing system

#### **2.04 PERFORMANCE REQUIREMENTS**

- A. Railing systems and their connections shall be designed by a professional engineer registered in the state where the project resides. Contractor is responsible for employing Design engineer
- B. Contract Documents indicated minimum standards, shop drawings shall stipulate more stringent requirements where required by the Design engineer to meet the performance criteria.
- C. The design of railing post connections to substrate shall be included. New substrate material strengths shall be taken from the Contract Documents. The makeup of existing substrate materials shall be field determined by the contractor and strength tested as deemed necessary by the Design engineer. Size and locations of removed materials for substrate verification or to be strength tested shall receive prior approval by the Engineer.
- D. Railing system shall be detailed and installed as shown on Drawings and capable of supporting the following loads without exceeding the allowable design working stresses of the materials, anchorages, and connecting devices utilized. The allowable working stresses shall be as defined by the applicable building codes and material standards. Each load shall be applied so as to produce the maximum stress in each of the respective components and post base connections. The following load cases shall be considered separately.
  - 1. Top rail of guardrail and handrails.
    - a. 200 pounds concentrated load applied in any direction at any point along the rail.
    - b. 50 pounds per linear feet applied in any direction along the rail.
  - 2. Intermediate rail:

- a. 50 pounds per linear feet applied in any direction along the rail.
3. Panel Fillers, Spindles and balusters
  - a. 150 pounds per one square foot applied in any direction where load produces the maximum stress on the panel, spindles or balusters.
4. Maximum 2-inch deflection at top of railings.

## 2.05 FABRICATION

- A. The railing system shall be fabricated as specified herein and as shown on the Drawings.
- B. Rail-to-end post and rail-to-corner post connections shall be formed with accurately mitered joints. Other changes in rail direction shall be formed by radius bends.
- C. Elbow bends and wall returns shall be formed to uniform radius, free from buckles and twists, with smooth finished surfaces.
- D. Exposed ends of pipe and tube shall be closed with welded metal closures or prefabricated fittings.
- E. Burrs, sharp edges, and other projections shall be removed. Exposed cut edges shall be blunted by grinder.
- F. Joints shall be fabricated so as to exclude water. Weep holes shall be provided in locations where water may accumulate.

## 2.06 SHOP COATING

- A. Aluminum:
  1. Aluminum railing shall have Architectural Class I, anodic coating applied after fabrication.
  2. Surfaces which will be in contact with concrete or masonry or dissimilar metals shall receive heavy coat of coal tar paint, Bitumastic Super Service Black, or equal.
- B. Carbon steel railing shall be hot dip galvanized after fabrication in conformance with ASTM A123.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Prior to fabrication, Contractor shall field measure structures to which railing is attached.



### 3.02 INSTALLATION

- A. Railing shall be installed in accordance with manufacturer's instructions. Railing shall be installed straight and level or parallel to rake of steps and ramps as required.
- B. Railing shall be placed on both sides of stairs and ramps. All ramps higher than 6-inches shall be provided with railings.
- C. Type V handrail shall be installed 34 inches above the leading edge of the stair treads or ramp surface. Type V handrail shall be provided along interior and exterior stairs and ramps that run along walls, unless noted otherwise on the Drawings.
- D. Components shall be assembled as indicated on Drawings. Light drifting is permitted to draw parts together, but drifting to match unfair holes is not permitted. Enlarging holes by burning is prohibited.
- E. Field bending, cutting, welding, or other altering of galvanized or anodized material is not permitted. Railing so altered will be considered defective.

### 3.03 COATING REPAIR

- A. Welds, bolts, and damage to shop applied coatings shall be touched-up with same or equivalent materials used in original coating.
- B. Minor scratches or defects in galvanized coating may be repaired with zinc-rich paint in accordance with ASTM A780 at Engineer's discretion.
- C. Repair of anodized coatings in the field is not permitted. Damaged railing shall be removed and re-anodized.

### 3.04 CLEANING

- A. Railing shall be cleaned as it is installed using ordinary wax cleaners, soaps, or mild detergents. Steel wool, harsh abrasives, or alkaline or acid cleaners are not permitted.

## PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION

**SECTION 05540  
IRON CASTINGS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes manhole covers and frames, and other iron castings shown on Drawings.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Product literature that shall be included; General Specifications, Surface Coating, Anchor Bolts, Machine Bearing Surface.
    - b. Independent Shop Drawings shall be submitted for the frame and the cover.
    - c. A submittal of a casting schedule that clearly notes either the structure number or in what circumstances the casting is intended to be installed, shall be included, i.e., roadway.
    - d. All dimensions for both the frame and the cover/grate shall be included.
  - 2. Information for the Record:
    - a. Material certification.
    - b. Proof-load test data.
    - c. Manufacturer's installation instructions.
    - d. Manufacturing Capabilities and Quality Control Measures.

**1.03 PRODUCT HANDLING**

- A. Castings shall be delivered in sufficient time to permit proper placement in pavement and slabs.
- B. Castings shall be stored in such a way as to prevent warping prior to installation.
- C. Additional product handling requirements are specified in Section 01350.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Castings shall be manufactured by East Jordan Iron Works, Inc., or approved equal.

### 2.02 MANHOLE COVER AND FRAME

- A. Castings located in roadways, driveways, or other areas subject to vehicular traffic shall be suitable for heavy-duty service. Other castings shall be suitable for light-duty service.
- B. Unless indicated otherwise, sewer manhole shall have a minimum access opening of 24 inches.
- C. Unless indicated otherwise, heavy duty manhole cover and frame shall be East Jordan No. 1045, Product 00104510.

### 2.03 INLET GRATE AND FRAME

- A. Castings shall be suitable for heavy duty service.
- B. Unless indicated otherwise, inlet grate and frame shall be East Jordan No. 7045.

### 2.04 RESERVED

### 2.05 PERFORMANCE REQUIREMENTS

- A. Castings shall be gray iron conforming to ASTM A48, Class 35.

### 2.06 FABRICATION

- A. Castings shall be free from pouring faults, sponginess, cracks, blowholes, blisters, shrinkage strains, and other defects. Plugging of defective castings is not permitted.
- B. Castings shall be true to pattern in form and dimension. Weight of castings shall not vary by more than 5% from published weight. Contractor shall submit invoices showing actual weight of casting as certified by manufacturer.
- C. Castings shall have machined bearing surfaces.
- D. All castings shall be coated with a non-toxic, nonflammable, water-based, asphalt paint.
- E. Lettering shall be cast on covers. Unless indicated otherwise, the manufacturer's name shall be cast in cover.
- F. Covers for water line manholes shall be solid lids and labeled "WATER".
- G. Covers for sanitary sewer manholes shall be solid lids and labeled "SANITARY".
- H. Covers for storm sewer manholes shall be solid lids and labeled "STORM".

- I. Covers shall be furnished with bolts, locks, hinges, perforations, lifting rings, and pick holes as specified, shown on Drawings, or as directed.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION**

- A. Contractor shall examine surfaces to receive castings and shall report unacceptable conditions to Engineer before proceeding with the Work.

#### **3.02 ERECTION AND INSTALLATION**

- A. Castings shall be accurately set, aligned, and anchored as shown on Drawings.
- B. Castings shall be installed in accordance with manufacturer's instructions or shown on the drawings. If any discrepancies exist, then the more stringent requirements shall take precedence.
- C. Stop plank grooves shall be square, set plumb, and securely anchored as shown. Grooves that are buckled, twisted, or otherwise prevent free insertion of stop plank shall be removed and replaced.

### **PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

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**SECTION 06110  
STOP PLANKS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing all stop planks as scheduled and detailed on the Drawings.
- B. Stop plank grooves shall be provided under Section 05540, and as detailed on the Drawings.
- C. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. General arrangement and scaled dimensional drawings.

**1.03 PRODUCT HANDLING**

- A. Planks, when stored, shall be kept off wet or damp surfaces and covered with a weatherproof cover. Provide air circulation within, around, and under the cover of each stack of materials.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Stop planks shall be Southern Pine or Douglas Fir, pressure treated in accordance with ASTM D1760. Planks shall be of the width and thickness shown in the Stop Plank Schedule. Planks shall have a tapered tongue and groove.
- B. Each plank shall have two 1/2-inch stainless steel pins of the length shown on the Drawings.

**2.02 FABRICATION**

- A. Stop planks shall be as detailed on the Drawings.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. The Contractor shall ensure that all stop planks fit into the stop grooves without being in a special order.
- B. Planks shall be freely placed and not allowed to move or become wedged in place.
- C. Planks shall be inserted and removed with use of a lifting bail. Contractor shall provide a lifting bail.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 06220  
FRP HANDRAILING**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Section includes fiberglass reinforced plastic (FRP) railing.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Shop Drawings shall indicate:
      - 1) Layouts and typical sections.
      - 2) Materials of construction.
      - 3) Connection details.
      - 4) Accessory materials.
      - 5) Required field measurements.
    - b. Product literature.
  - 2. Information for the Record:
    - a. Sample of railing connection.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Fiber reinforced plastic rails and posts shall be 1-1/2-inch machine-made fiberglass reinforced thermosetting resin handrail. The rail and posts shall have a thermoplastic surfacing mat to prevent ultraviolet degradation. Railings, components, fastenings, and complete structure shall meet all requirements of OSHA.

**2.02 FABRICATION**

- A. All railings unless otherwise shown on the Drawings shall be as follows:
  - 1. All wall-mounted rails shall have a vertical height of not more than 2-feet-10-inch nor less than 2-feet-6-inch from the upper surface of the top rail to the surface of tread in line with face of riser at forward edge of thread. Wall support brackets shall be placed at a maximum of 6-feet or the manufacturer's recommendation, whichever is less.



2. All bottom-mounted rails shall be 3-feet-6-inch high, measured from the floor to the top of the rail, with two intermediate rails. Posts shall be placed at a maximum of 6-feet and at each change in direction. Posts shall be attached to the side of the walkway or grouted into the walkway. Posts grouted into the concrete shall be provided with a floor flange to improve the appearance of the Work.
3. Bends, where called for, shall be shop formed and present a pleasing appearance.
4. All protective handrails or guards shall be capable of withstanding a concentrated live load of 300 pounds applied perpendicular to any of its surfaces as well as complying with all other OSHA requirements.

### **2.03 OPENINGS**

- A. All openings in the railing shall be spanned with a 1/4-inch cadmium plated chain with corrosion-proof sturdy snap hook one end and fixed to post the other end. Hooks and eyes also shall be cadmium plated.

### **2.04 TOE BOARDS**

- A. Toe boards shall be channel shaped of the same materials used to form the handrail.
- B. Toe boards shall be at least 4-inch by 1-inch by 1/8-inch channels and mounted in such a manner as to provide vertical and horizontal stiffness to prevent sag and to run true with the handrail.

### **2.05 METAL ACCESSORIES**

- A. All metal fasteners and fabrications required for installation shall be Type 304 stainless steel.

## **PART 3 EXECUTION**

### **3.01 ERECTION**

- A. All FRP railings shall be erected in accordance with the manufacturer's recommendations.
- B. Support brackets shall be securely anchored into the wall by anchor bolts.
- C. Posts shall be set in approved sockets embedded in new concrete or holes bored into existing concrete and secured in the new sockets or holes. The boring of holes in existing concrete shall be included in this Section. Posts on roofs shall be set in pitch pockets specified in Section 07600.
- D. All ends that are field cut shall be recoated twice with resin so that premature fraying is avoided. Resin shall be compatible to original materials.

- E. All rails shall run square and true without warp, twist, sag, or buckle.

**PART 4 SPECIAL PROVISIONS**

**4.01 CONFIGURATION AND MANUFACTURER**

- A. Handrailing shall be square shaped and manufactured by Fibercast Co.; IMCO, Inc.; or equal.

END OF SECTION

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**SECTION 06630  
MANHOLE STEPS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes manhole steps for new cast-in-place and existing structures.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's installation procedures.
    - b. Product literature.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Steps to be embedded in new structure shall be delivered in sufficient time to permit proper placement.

**PART 2 PRODUCTS**

**4.01 MATERIALS**

- A. Manhole steps shall be polypropylene plastic reinforced with a 1/2-inch grade 60 reinforcing bar.
- B. Manhole steps for new structures shall be M.A. Industries Model PS-1, or equal. Manhole steps for existing structures shall be M.A. Industries Model PS1-PF or equal.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Contractor shall procure manhole steps in sufficient time for installation into precast and cast-in-place concrete structures.

**3.02 PREPARATION**

- A. Existing structures shall be prepared as required by manufacturer.

**3.03 INSTALLATION**

- A. Manhole steps shall be installed square, level, and plumb free of warp, twist, sag, and buckles.
- B. Manhole steps in new concrete structures, whether precast or cast-in-place, shall be installed at time of casting.
- C. Steps shall be installed in accordance with manufacturer's instructions.
- D. Contractor shall reinstall all steps that do not meet the approval of the Owner and Engineer.

**PART 4 SPECIAL PROVISIONS**

Not used.

END OF SECTION

**SECTION 08320  
FLOOR DOORS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing and installing floor doors in the locations shown on the Drawings.
- B. Floor doors shall be aluminum interior, exterior diamond plate or interior recessed to receive carpet, composition or resilient flooring specified under other Items.
- C. Door arrangement shall be either single leaf or double leaf hinged as shown on the Drawings.
- D. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
    - b. Manufacturer's literature.
    - c. Door Schedule.
    - d. Dimensional Drawing.
  - 2. Information for the Record:
    - a. Operation and maintenance manuals.

**1.03 GUARANTEE**

- A. The manufacturer shall guarantee proper operation and against defects in material and workmanship for a period of five years from date of shipment. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in General Conditions of these Specifications.

**PART 2 PRODUCTS**

**2.01 RESERVED**

**2.02 RESERVED**

**2.03 EXTERIOR DOORS**

- A. Doors shall have channel frames and shall be 1/4-inch aluminum with an anchor flange around the perimeter.
- B. Door leaf shall be 1/4-inch aluminum diamond pattern plate reinforced with aluminum stiffeners designed to withstand a live load of HS20 and as required to prevent distortion of the leaf when in any position. Doors shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators for easy operation, and automatic hold-open arm with release handle. A snap lock with removable handle shall be provided.
- C. A 1-1/2-inch drainage coupling shall be provided in the door frame. Drainage shall be piped by the Contractor to outlet with 1-1/2-inch PVC pipe to drain.
- D. Hardware shall be stainless steel throughout.
- E. Factory finish shall be mill finish with bituminous coating applied by the manufacturer to the exterior of the frame and all aluminum in contact with concrete.
- F. Doors shall be as manufactured by Bilco, or equal.

**2.04 ACCESS DOOR FALL PROTECTION**

- A. Each hatch shall be designed to combine covering of the opening, fall-through protection per OSHA standard 1910.23 and controlled confine space entry per OSHA standard 1910.146.
- B. The safety grate shall be made of 6061-T6 aluminum and designed per the "Specifications for Aluminum Structures", by the Aluminum Association, Inc. 5th Edition, December 1986 for "Bridge Type Structures."
- C. The grating shall be designed to withstand a live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.
- D. Grate openings shall allow for visual inspection, limited maintenance, and float adjustments while safety grate fall-through protection is left in place. The grating shall cover the full opening except for a maximum 6-inch width on each end of the opening.
- E. Design must assure that the fall-through protection is in place before the doors can be closed, thereby, protecting the next operator.
- F. Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90-degree position once opened.
- G. Each grate supplied with a locking device (for Owner's padlock) that will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and float adjustments without entering the confined space.

- H. Grate shall be coated with an OSHA-type safety orange or yellow color, promoting visual awareness of the hazard. The aluminum safety grates shall receive a two-coat, powder coating system, applied by the electrostatic spray process. The base coat is a thermosetting epoxy powder coat finish with a minimum thickness of 2 to 4 mils. The top coat is a mar-resistant, TGIC polyester powder coating with a minimum thickness of 2 to 4 mils. Each coat shall be baked at 450 to 375 degrees F until cured.
- I. Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. The Contractor shall install the floor doors in the locations shown on the Drawings. Installation shall be in accordance with the manufacturer's recommendations.
- B. Doors shall be modified by the manufacturer as required when necessary to suit the installation shown on the Drawings.
- C. Doors shall be installed to open in the direction shown on the Drawings or as ordered by the Engineer.
- D. The bituminous coating on door frames shall be touched up by the Contractor if the coating has been damaged.

**PART 4 SPECIAL PROVISIONS**

**4.01 FLOOR DOOR SCHEDULE**

- A. All access floor doors shown on the Drawings and scheduled below shall be provided:

Mark	Size	Type	Location
FD1	4'X4' Inside Dimension	Access Hatch	MH-SA-1.1
FD2	5'x6' Inside Dimension	Access Hatch	Meter Vault

- B. Schedules are not guaranteed to be complete. All floor doors shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

END OF SECTION



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**SECTION 11670  
FLUME LINER**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This specification includes all work necessary to furnish fiberglass flume liners, including all anchorage hardware required for proper installation of the system components.
- B. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop drawings complete with all dimensions, and size and location of any required openings.
  - 2. Specifications for all components.
  - 3. Details of the major fabricated components showing the arrangement of components, labeled with member sizes and materials of construction.
  - 4. Structural calculations for all components.
  - 5. Manufacturer's recommended procedures for jobsite storage of equipment, handling, and erection.
  - 6. Final approval for incorporation into the project will be made only after the review of shop drawings, specifications, and data.
- B. As part of the shop drawings for all components, the fabricator must supply any and all analyses pertinent to the composite design. A complete laminate analysis will be submitted for the calculated loads identifying the various factors of safety for each lamina used in the proposed laminate schedule. Factors of safety will be evaluated using criteria such as Tsai-Hill or equivalent theories.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer shall have a minimum of five years of history of successful installations of similar design. Past job list with customer contact information will be supplied if required.
- B. All fabrication shall be carefully inspected at the factory by inspectors who shall use whatever means necessary to assure the proper fit of all field connections and compliance with all material and fabrication requirements of the specifications.

- C. Manufacturer shall warrant the Parshall Flumes to be free of defects in materials and workmanship for a minimum of one year after installation with a maximum of 18 months from date of shipment.
- D. The contractor shall be responsible for verifying all field dimensions to develop and approve shop drawings.

#### **1.04 INSTALLATION, STORAGE, HANDLING, AND MAINTENANCE**

- A. The manufacturer shall provide detailed written instructions for the installation, long term storage, handling, and maintenance for the products provided.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL**

- A. The contractor shall furnish and install, as shown on the plans, a fiberglass reinforced plastic flume liner. The flume shall have a throat width and depth as specified on the plans. The flume shall be accurate in dimensions and shall include in one integrally molded piece, the approach, the throat and the downstream section. The inside of the flume shall be smooth and free of any irregularities. The outside surface of the flume shall include necessary flanges and/or other anchoring devices for firm, permanent anchorage to the concrete.
- B. The flume shall be shipped in one piece, ready for setting into the channel form work. The flume shall be furnished with suitable blocking and tie straps bolted to the flume to maintain the sides of the flume vertical during pouring of the concrete. Such blocking shall not be removed from the flume until the concrete backing is thoroughly cured.
- C. The flume liner shall be fabricated using general purpose resin with glass reinforcement as described in this specification. Wall thicknesses shall not be less than 3/16-inch for 3-inch through 9-inch flumes.

#### **2.02 MATERIALS**

- A. All materials shall be new and shall be specifically designed or selected for the function and service specified. No material may be used in the project that has not been approved by the Engineer.

#### **2.03 RESIN REQUIREMENTS**

- A. Resin shall be general purpose, corrosion resistant polyester unless otherwise specified, containing no bulk extenders or fillers except for viscosity control. Ultraviolet light inhibitors shall be added to the laminate.
- B. Manufacturer should select a resin capable to withstand a temperature of 200 degrees Fahrenheit.

**2.04 LAMINATE MINIMUM PHYSICAL PROPERTIES**

A. Minimum physical properties for the product shall conform to those presented below:

Property at 70 degree F	Value	Test Method
Tensile Strength (103 psi)	12.6	ASTM D638
Tensile Modulus (106 psi)	1.27	ASTM D638
Flexural Strength (103 psi)	21.3	ASTM D790
Flexural Modulus (166 psi)	0.9	ASTM D790
Barcol Hardness	35	ASTM D2583
Shear Strength (10 <sup>3</sup> psi)	13.0	ASTM D732
Glass Content	30 percent by weight	

- B. Exterior surface shall be a resin-rich coat with ultraviolet protection. A paraffinated wax additive shall be used in the top coat to eliminate the air inhibition (14-18 mils thick). Standard color will be blue-green.
- C. Cut edges or drilled holes must be deburred and resin sealed.

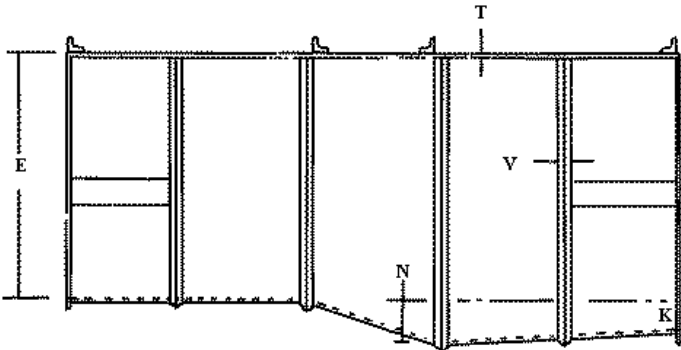
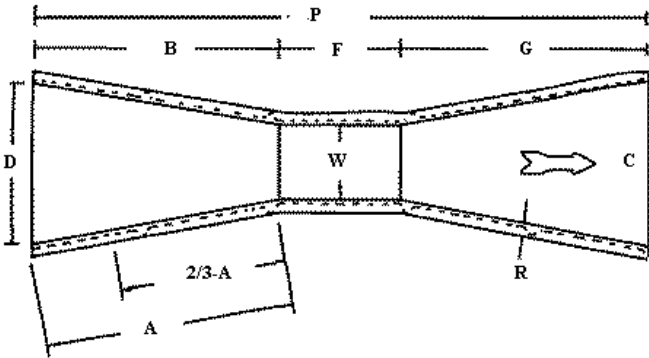
**PART 3 EXECUTION**

Not used.

**PART 4 SPECIAL PROVISIONS**

**4.01 FLUME LINER DIMENSIONS**

A. Flume shall have an 18-inch throat (W dimension) with the configuration shown below.



W	A	B	C	D	E	F	G	K	N	P	Flow range, gpm
18	57	55 7/8	30	40-3/8	36	24	36	3	9	66	78-11000

END OF SECTION

**SECTION 15260  
SLIDE GATES**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes wall thimbles, gate frames, slide gates, floor stands, extension stems, stem guides, operating devices, position indicators, wall brackets, floor boxes, anchors, and all appurtenances.
- B. Motors and electrical work incidental to installation and operation of the gates shall be included herewith unless specified otherwise.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Scaled dimensional drawings.
    - b. Wiring schematics with termination point identification.
    - c. Materials of construction.
    - d. Manufacturer's catalog data.
    - e. Motor information per Section 11050.
  - 2. Information for the Record:
    - a. Operation and maintenance manual.

**1.03 QUALITY ASSURANCE**

- A. Slide gates and their appurtenances shall conform to applicable portions of AWWA C501, C560, C561, C562 or C563, depending upon materials of construction.

**PART 2 PRODUCTS**

**2.01 SLIDE GATES**

- A. Slide Gates:
  - 1. All slide gates shown on the Drawings or listed in the specifications shall conform in all respects to the latest version of AWWA C561, with the noted changes and additions.
  - 2. Materials used in construction of slide gates and appurtenances shall conform to the following specifications:

Frame, Slide, Yoke, and Reinforcing	Stainless Steel, ASTM A240/A240M, Type 304L, or ASTM A240/A240M, Type 316L
Stainless Steel for stems	ASTM A276, Type 304
Stainless Steel for fasteners	F593/F594, Alloy Group 1, 2 (SS304, SS316)
Invert seals and compression load pad	Neoprene, ASTM D2000, 60 Durometer, with a stainless-steel ASTM A276, Type 304L, or Type 316L retainer bar
Side Seals	Ultra High Molecular Weight (UHMW) Polymer, ASTM D4040
Top Wedges	Type 316 stainless steel ASTM A351-CF8M

3. Slide gates shall be designed and constructed for the operating seating and unseating head shown in the Schedule. Allowable leakage shall not exceed 0.1 gallons per minute per foot of submerged perimeter.
4. The gate frame shall be an integral unit of structural shapes, rigidly assembled by welding or bolting to form the waterway opening. Side angles, cover bars and filler bars shall form guides for the slide and holes shall be provided for mounting on anchor bolts.
5. The head channels shall be welded or bolted to the gate frame. The channels shall be sufficiently spaced to allow removal of the gate slide. The primary slot of the frame shall contain polymer guide liner retained in grooves, to prevent metal-to-metal contact between slide and frame.
6. Gate slide shall be not less than 1/4-inch thickness and shall be reinforced such that deflection under full head shall be limited to 1/720 of the span. Gates over 24 inches wide shall have adjustable top wedges in order to prevent deflection in the slide resulting from over closure.
7. Slide gates where required shall incorporate a flush-bottom seal of neoprene that is mechanically fastened to the bottom frame invert member.
8. Side seals of UHMW polymer shall be provided. Seals shall be securely fastened to the frame with non-corrosive retainers and shall be replaceable and adjustable without removing the gate from the installed position. A compression device shall be set behind the UHMW seal to allow for a self-adjusting seal system.
9. The operating stem shall be of a size to safely withstand, without buckling or permanent distortion, the stresses resulting from at least two times the rated output of the floor stand or bench stand with a 40-pound effort on the crank or handwheel. The threaded portion of the stem shall have cold rolled threads. Stainless steel couplings, threaded and keyed to the stems, shall join stems of more than one section. Manually operated, rising stem type gates will be provided with an adjustable stop collar on the stem to prevent over-opening of the gate.

10. On slide gates with a width greater than twice the height and the width is greater than 48 inches, a tandem stem arrangement shall be used.
11. Gate lifts shall be handwheel or geared crank type as shown on the Drawings. Lifts shall operate the gate with a maximum pull of 40 pounds on the handwheel or crank, the center of which shall be located approximately 36 inches above the operating floor. All lifts shall have thrust bearings, bronze lift nuts, and an aluminum stop nut to limit the downward travel of the stem and slide. All geared lifts shall have cast or ductile iron housings and pedestals. All lifts shall be rising stem type. Stem covers made of clear polycarbonate with position indication shall be furnished for all lifts. Lifts shall be grease lubricated through grease Zerk fittings.
12. Where indicated on the Drawings or specified, motorized gate operators shall be furnished and installed.
13. Slide gates shall be Hydro Gate or equal.

## **2.02 RESERVED**

## **2.03 LIFT ASSEMBLIES**

- A. The guides on self-contained gates shall extend above the operating floor. They shall be sufficiently strong so that additional reinforcing is not necessary. The yoke to support the operating bench stand will be formed by two channels across the top of the guides. They shall be sufficiently spaced to allow removal of the gate slide. All lifts shall have thrust bearings, bronze lift nut and a stop nut.
- B. Where the head frame extends higher than 4-feet above the operating floor, the gate operator shall include a bevel gear assembly. The center of a crank or handwheel operator shall be centered approximately 36 inches above the operating floor and shall have a maximum pull of 40 pounds.

## **2.04 ELECTRIC VALVE OPERATOR**

- A. General:
  1. The operator shall be an all ferrous, spur gear type driven by an electric motor.
  2. The operator shall use grease to permanently lubricate the gears and will not use oil or an oil bath as the means of lubrication. Drive train parts shall be lubricated with a premium, heavy-duty lithium-based grease or heavy-duty synthetic grease.
  3. It shall be possible to carry out the setting of the torque, turns, and configurations of the indication contacts without the necessity to remove any electrical compartment covers.



4. Operator drive shall have integrated electronics and be able to operate in ambient temperatures of -40 degrees C to 60 degrees C.
  5. The valve actuator shall mount in any orientation.
  6. Operators shall be Beck Model 11 for one-quarter turn open/close and modulating service, and Beck Model 88 for multi-turn service or equal.
- B. Operator Sizing - The operator shall be sized to guarantee valve closure at the specified differential pressure. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. The operating speed shall be such as to give valve closing and opening at approximately 60 seconds unless otherwise stated in the specifications.
- C. One-Quarter Turn Open/Close and Modulation Actuators:
1. Motor:
    - a. The drive shall be furnished with a 120 volt AC, single phase, 60 Hz, synchronous inductor no-burnout motor. Motor shall be capable of withstanding 60 starts / stops per minute or a temporary stall condition without overheating. Design of the motor shall be such that electrical and thermal overloads are not required.
    - b. Electrical and mechanical disconnection of the motor should be possible without draining or loss of the lubricant from the actuator gearcase. Plugs and sockets are not acceptable as a means of electrical connection for the motor.
    - c. The drive motor shall be TENV with Class H insulation.
    - d. No protection to prevent motor overheating should be required.
  2. Modulation:
    - a. Actuators for open / close service may use a discrete contact closure signal to energize the motor directly without any electronics in the actuator required.
  3. Gearing:
    - a. Readily available gear modules shall provide for a range of torque and timing combinations within the drive's rated capacity, and shall be field interchangeable. Control drives shall be able to operate in any mounting orientation.
    - b. Motor bearings shall be maintenance-free.
  4. Braking:
    - a. Motor shall be non-coasting with instant magnetic braking, and shall be self-locking and self-releasing without the use of a separate brake

winding or mechanical brake. Actuator shall be designed to stay in place upon loss of power and shall be capable of holding a load equal to at least 200% of the rated output without AC power.

- b. Stall torque shall be self-limiting, not exceeding two and one half times the rated torque; torque switches shall not be required. Drive shall operate clockwise or counterclockwise on increasing signal and be field settable.
5. Hand Operation:
- a. Drive shall include a low-speed, disc-type motor hand wheel to permit manual operation of the drive without electrical power and without a declutching mechanism or engagement lever.
  - b. The Actuator will have an electrical handswitch to provide local override control with AUTO, CW, CCW and STOP functions. The handswitch shall be available with a locking feature and a dry contact for switch status.
6. Valve Position:
- a. Two SPDT over-travel limit switches shall be provided for over-travel protection. In addition, the drive shall have two auxiliary SPDT switches, adjustable over the full range of travel but set for remote indication of full open and full close status. Switches shall be rated for 6 amps at 120 volts AC. Drive shall have integral mechanical stops capable of limiting travel of the drive and load.
7. Display:
- a. Drive shall be provided with a dry contact for remote indication of actuator alarms. LED indicator lights on the actuator will indicate which condition has caused the alarm. Conditions include loss of power, loss of control signal, over travel, and/or over torque.
8. Modulation:
- a. Modulating actuator shall provide control through an integral, digital control module which positions the drive-in proportion to a 4-20 mA control input signal. The control module shall be capable of initiating shaft movement in steps down to 0.1 degrees. Upon loss of input signal, the drive shall be field configurable to move to any predetermined position or stay-in-place.
  - b. Modulating actuator shall also be equipped with a contactless position sensing device and be capable of providing an isolated 4–20 mA feedback signal in linear proportion to the 0-100% valve position. The sensing device shall have infinite resolution.
- D. Multi-Turn Actuators:
- 1. Motor:

- a. Actuator power shall be 480 Volt/3 phase /60 Hz.
  - b. The Actuator will have a Permanent magnet servo motor with solid-state thermal protection. Thermal protection shall be provided by an in-motor thermistor; thermal relays are unacceptable. The servo will provide programmable speed, acceleration, and torque. Motor shall start at full torque.
  - c. The Motor Control will be Soft Start to reduce wear and tear on the drive nut.
  - d. The Actuator will be capable of maintaining absolute position up to 4000 turns without batteries even with loss-of-power.
  - e. The operator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the 3-phase power supply connected to the actuator.
  - f. Protection shall be provided for the motor as follows:
    - 1) The motor shall be de-energized in the event of stall when attempting to unseat a jammed valve.
    - 2) Motor temperature shall be sensed by a thermistor to protect against overheating.
2. Braking:
- a. The Actuator will have a fail-safe brake to maintain position during power loss.
  - b. When powered, the Actuator will have redundant position sensing.
3. Hand Operation:
- a. Two-position and three-position, lockable, drive-mounted electric hand switches shall be provided to permit local electrical operation of the unit for control adjustment or operation on loss of control signal. The switches allow control in OPEN/CLOSE and LOCAL/STOP/REMOTE.
  - b. With the hand switch in REMOTE mode, the drive shall respond to remote control signals automatically. Configurable relays shall be provided for remote indication for when the switch is in REMOTE.
  - c. The hand wheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time.
  - d. Clockwise operation of the hand wheel shall give closing movement of the valve unless otherwise stated in the job specifications.

4. Display:
  - a. The Actuator will have a simple, easy to read LCD position readout with bright dedicated LED lights for indication of when the valve is in the open or the closed position. The Actuator will have an alpha-numeric display that allows local configuration through a menu display and handswitches. The Position Display is nonfunctional in the event of power outage.
  - b. The local display should be large enough to be viewed from a distance of six feet when the actuator is powered up.
5. Removal:
  - a. The Actuator stem nut shall be housed in an easily removable thrust module to simplify actuator installation and nut replacement, if necessary. The design should allow the actuator to be installed and removed from a valve stem independent of the thrust module and nut.
6. Integral Starter and Transformer (If Required):
  - a. The reversing starter, control transformer, and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation buildup.
  - b. For Open-Close service, this starter shall be electromechanical type, suitable for 60 starts per hour, and of rating appropriate to motor size.
  - c. For modulating duty, the starter shall be solid state and suitable for up to a maximum of 1,200 starts per hour or as required by the application. For modulating service the actuator shall also include dynamic braking.
  - d. The controls supply transformer shall be from two of the incoming three phases. It shall have the necessary tapings and be adequately rated to power for the following functions:
    - 1) 120-VAC energization of the contactor coils.
    - 2) 24-VDC output where required for remote controls.
    - 3) Supply for all the internal electrical circuits.
  - e. The primary and secondary windings shall be protected by easily replaceable fuses.
- E. Drive Nut - The operator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bush shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base, should be of the sealed-for-life type.
- F. Torque and Turns and Positional Accuracy:
  1. Torque and turns limitation to be adjustable as follows:

- a. Position setting range - 0.1 to 4,000 turns, with resolution to 1 degree of operator output.
  - b. Torque setting – 40% to 100% rated torque.
  2. “Latching” to be provided for the torque sensing system to inhibit torque off during unseating or during mid-travel against high inertia loads.
  3. The electric circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.
- G. Control Facilities:
1. The necessary wiring and terminals shall be provided in the operator for the following control functions:
    - a. Configurable external interlocks to inhibit valve opening and/or closing.
    - b. Connections for external remote controls fed from an external supply of (minimum 60-volt, maximum 120 volt) to be suitable for any one or more of the following methods of control:
      - 1) Open, Close, and Stop.
      - 2) Open and Close.
      - 3) Overriding Emergency, Shutdown to Close (or Open) Valve from a “Make” Contact.
    - c. Selection of maintained or push-to-run control for modes (1) and (2) above shall be provided and it shall be possible to reverse valve travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay on energization of approximately 300 ms.
    - d. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.
- H. Monitoring and Diagnostics Capabilities:
1. Facilities shall be provided for monitoring operation and availability as follows:
    - a. Availability relay, having one change-over contact, the relay being energized from the control transformer only when the Local/Off/Remote selector is in the “Remote” position, to indicate that the actuator is available for remote (control room) operation.
    - b. Where required, it shall be possible to provide indication of thermistor trip and “Remote” selected as discreet signals.
    - c. A non-intrusive hand-held computer or software on a Bluetooth capable device, capable of duplex communicator for uploading and downloading

all variables for the actuator as well as performing detailed diagnostics shall be provided.

2. Provision shall be made for the addition of diagnostic module which will store and enable download of historical actuator data to permit analysis of changes in operator or valve performance.
  3. Diagnostic status screens must be provided to show multiple functions simultaneously so troubleshooting can be affected rapidly and efficiently. All diagnostic information should be contained on no more than seven or eight screens so multiple functions can be checked simultaneously.
- I. Wiring and Terminals:
1. Internal wiring shall be of tropical grade PVC insulated stranded cable of appropriate size for the control and power. Each wire shall be clearly identified at each end.
  2. The terminals shall be embedded in a terminal block of high tracking resistance compound.
  3. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal.
  4. The terminal compartment of the operator shall be provided with a minimum of three threaded cable entries.
  5. All wiring supplied as part of the operator will be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.
  6. Control logic circuit boards and relay boards must be mounted on plastic mounts to comply with double insulated standards. No more than a single primary size fuse shall be provided to minimize the need to remove single covers for replacement.
  7. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of terminal box cover indicating:
    - a. Serial Number.
    - b. External Voltage Values.
    - c. Wiring Diagram Number.
    - d. Terminal Layout.This must be suitable for the Contractor to inscribe cable core identification beside terminal numbers.
- J. Enclosure:
1. Operator shall be O-ring sealed, watertight to IP68 minimum, and shall at the same time have an inner watertight and dustproof O-ring seal between the

terminal compartment and the internal electrical elements of the operator, fully protecting the motor and all other internal electrical elements of the operator from ingress of moisture and dust when the terminal cover is removed on site for cabling.

2. Enclosure must allow for temporary site storage without the need for electrical supply connection.
  3. All external fasteners should be of stainless steel.
  4. Operator for explosion/hazardous applications shall in addition be certified flameproof for Class 1 (Divisions 1 and 2) Group gases.
- K. Startup Kit:
1. Each operator shall be supplied with a startup kit comprising installation instruction, electrical wiring diagram, and sufficient spare cover screws and seals to make good any site losses during the commissioning period.
- L. Performance Test Certificate:
1. Each operator must be performance tested prior to shipment and individual test certificates shall be supplied free-of-charge. The test equipment should simulate a typical valve load and the following parameters should be recorded:
    - a. Current at maximum torque setting.
    - b. Torque at maximum torque setting.
    - c. Flash Test Voltage.
    - d. Actuator Output Speed or Operating Time.
  2. In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.
- M. Warranty:
1. Each operator shall be warranted for a minimum of 24 months of operation, up to a maximum of 36 months from shipment.

## 2.05 GATE OPERATION

- A. Opening Direction - Unless otherwise specified in Part 4, gates with screw stems shall open by turning counterclockwise, the direction being indicated by an arrow cast where easily visible to operator.

## 2.06 ACCESSORIES

- A. Operating stems and extensions shall be ASTM A276 stainless steel with high finish corrosion-resistant restraint threads and shall operate without binding or jamming in

the lift nut. Stems shall be of sufficient cross section to withstand the normal forces created during gate operation.

- B. Adjustable cast iron stem guides with bronze bushings shall be provided at the spacing recommended by the manufacturer.
- C. All gates which are to be operated by T-wrench shall have 2-inch square operating nut at the top of the extension stem. Where the operating nut extends through a concrete slab, a cast iron floor box with bronze bushing shall be cast in the concrete.
- D. All fasteners and hardware for mounting shall be 304 stainless steel.

**2.07 SHOP PAINTING**

- A. Shop painting shall be in accordance with the requirements of Section 01350.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Installation shall be as shown on the Drawings and in conformance with AWWA C560 for cast iron slide gates, AWWA C561 for fabricated stainless-steel slide gates, AWWA C562 for fabricated aluminum slide gates or AWWA C563 for fabricated composite slide gates.

**3.02 TESTING**

- A. After installation, the Contractor shall test each gate for satisfactory operation and water tightness against maximum operating pressure insofar as practicable.

**PART 4 SPECIAL PROVISIONS**

**4.01 SCHEDULE**

- A. A schedule of fabricated slide gates can be found on the Drawings.

Mark	Size	Model	Location
WG-1	3' Wide	Mueller HG561-120 SST Slide Gate with Weir Wall Mount	Industrial Diversion Chamber No. 1

- B. Schedules are not guaranteed to be complete. All gates shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the following schedule.

END OF SECTION



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**SECTION 16005  
ELECTRICAL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section includes furnishing, planning, and coordinating all labor, equipment, materials, tools, plant supplies, testing, adjusting, and all temporary Work necessary to install all required electrical components and function for a complete electrical system(s) installation.
- B. The Contractor shall provide all exposed, concealed, and underground electrical raceways, including conduits, wiring troughs, and auxiliary gutters, expansion and deflection fitting boxes, and all other fittings, supports, and other electrical raceway components required to complete the installation as shown and specified.
- C. The Contractor shall provide related excavation, backfilling, concrete work, cutting and patching, and the restoration of all surfaces to their original condition.
- D. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as herein specified and shown on the Drawings.
- E. This Section includes power wiring, power electrical conduit, power distribution panels, and circuit breakers, for HVAC equipment 115 volts and greater. Controls, control wiring, and control wiring conduit for HVAC equipment less than 115 volts is included in Section 15500.
- F. Additional product requirements are specified in Section 01350.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Where conduits are to be installed in a concrete slab, a conduit layout shall be submitted at least 14 days prior to the pour. All conduit layouts shall show conduits with anticipated number, size, and types of power, control or instrumentation, conductors/cables, spares, and grounds for each and every Section of Division 16 requiring separate conduits.
    - b. The Contractor shall submit detailed dimensional drawings covering all wiring systems and items of equipment. Drawings of co-jointly installed or operated equipment shall be submitted simultaneously for approval with Shop Drawings showing the assembly thereof. Drawings of

- equipment shall have the locations and service clearly noted. Shop Drawings, wiring and interconnection diagrams, where applicable, and manufacturer's test reports shall be submitted.
- c. Shop Drawings submitted for approval shall include complete wiring diagrams, showing control center wiring, including wiring between compartments, wiring to remotely located control stations, solenoids, limit switches, etc. Diagrams shall be supplemented by ladder-type schematic diagrams in accordance with NFPA 79, Annex D standards. Where ladder-type schematic information is not available from the manufacturer, the Contractor shall submit written evidence of same from the manufacturer.
2. Information for the Record:
    - a. Upon completion of the installation and acceptance by the Engineer, Record Documents of all electrical (schematic) diagrams, interconnection diagrams, panel layouts, instrument loop diagrams, and related support materials shall be corrected and amended, as required to reflect the installed system. This information shall be submitted in both of the following formats:
      - 1) Mylar plots of Drawings and photocopy of all other diagrams and literature.
      - 2) A computer file on CD of documents including but not limited to drawings in the latest version of AutoCAD format. Literature and other information shall be provided in either Microsoft Word or PDF format.
    - b. Certificate of final inspection and approval from the inspection authorities and the Fire Marshall.
    - c. Records of tests as required or as directed.
  3. Operation and maintenance manuals, with information for the specific model number(s) used underlined, or conspicuously marked, to segregate that information from other model(s) where the manual includes information for more than one model.

### 1.03 QUALITY ASSURANCE

- A. All Work shall be performed in accordance with the best modern practice and shall conform, as a minimum to the standards of the local authorities, the National Electrical Code, National Electric Safety Code, OSHA, and any other codes and standards specified or applicable. Where provisions of the cited codes or standards are modified or supplemented, the more stringent shall apply. The provisions or interpretation providing the highest standard work or quality of material shall prevail.

- B. The Contract Drawings are diagrammatic, but shall be followed as closely as conditions at the Site of the Work will permit. They shall be supplemented by the Contractor with complete working drawings, including wiring diagrams, connection diagrams, conduit and equipment layouts to scale, and details of the installation, including conduit and ductbank penetrations through structural slabs and walls and other required information.
- C. Wiring diagrams shown on the Contract Documents are suggestive only. Final control connections will depend upon the equipment selected. The Contractor may submit alternative diagrams for approval by the Engineer.
- D. Electrical materials and equipment shall be designed and manufactured in compliance with the latest applicable Standards of the UL; IEEE; NEMA; ANSI; ASTM; the Insulated Cable Engineers Association; and other applicable standards. Materials commonly bearing UL labels shall be so labeled.

#### **1.04 ELECTRICAL AND CONTROL COORDINATION**

- A. The locations of equipment, appliances, outlets, fixtures, and similar devices shown or specified shall be considered approximate. The exact locations shall be approved by the Engineer during construction, and as required to suit the ambient conditions at the time of installation. The Contractor shall obtain, in the field, all information of the actual Work and final locations under other sections required for the placing of his work, and shall consult the Engineer and ascertain the actual location required. The Contractor shall also consult with other trades and sections and examine their drawings so as to avoid conflicts with other Work and apparatus.

#### **1.05 GUARANTEE**

- A. Provide completed warranty information for each item. Include the following information:
  - 1. Date of beginning warranty period.
  - 2. Duration of warranty.
  - 3. Warranty options.
  - 4. Name, address, phone numbers, and procedures for filing warranty claims.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL**

- A. All equipment and materials shall be new and, if of the same kind or performing parts of the same system, shall be the products of the same manufacturer.
- B. All equipment and material shall be furnished by a manufacturer whose products have been in satisfactory use in similar service for not less than 5 years.

- C. Wherever materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type, or catalog number, such designation is to establish standards of desired quality, style, and dimensions and shall be the basis of the Bid.
- D. All control, instrument, monitoring, signal, or other such conductor installations, whether spare requirements are specifically mentioned or not, shall, as a minimum, include an additional unused 20% spare conductors over and above the number of conductors actually used or specified for this Contract, whichever is greater.
- E. Control wires and shielded cable wires regardless of the location on this project shall have identification wire markers on each end of each wire and the wire numbers shall be identified on the submittal drawings. Complete electrical wiring diagrams identifying all HVAC, machinery, and equipment wiring as well as all component wiring shall be submitted before the project is accepted.
- F. Electrical enclosure requirements shall conform with area classifications whether designated on the Drawings or not.
  - 1. Unless shown otherwise on the Drawings, or specified, enclosures shall conform to the following: Enclosures, pushbutton stations, and components for enclosures located outdoors shall be NEMA 4X, and light switches and duplex outlets shall be weatherproof.
  - 2. Areas with process equipment shall have minimum NEMA 4X enclosures and the installation shall conform to NEC Electrical Standards.
  - 3. Office areas shall be NEMA 12 areas, but all HVAC wiring shall as a minimum conform to process area requirements described above.
  - 4. "Hazardous" areas with process equipment shall be a Class I, Division 1, Group D type classification for enclosures and the installation per (NEC) Electrical Standards unless marked differently on the drawings.

## 2.02 RESERVED

## 2.03 CONDUIT

- A. Conduit shall be galvanized rigid steel, manufactured in accordance with UL 1242, and meeting the requirements of FS WWC-581, unless specified otherwise in the Project Specifications, or indicated on the Contract Drawings.
- B. Conduit shall be hot-dip galvanized, including threads and couplings. Each length of conduit shall bear the UL label and the manufacturer's name and trademark.
- C. No conduit smaller than 3/4-inch shall be incorporated in the Work, unless otherwise designated in the Project Specifications. Conduit installed underground or in poured concrete shall be 1-inch minimum size.
- D. Thin wall (EMT) steel conduit, where explicitly permitted, shall be of standard and uniform circular cross section and weight, and shall be hot-dipped galvanized. Each

length of conduit shall bear the Underwriter's Laboratory label and manufacturer's name or trademark. Couplings and fittings shall all be in compliance with the NEC.

- E. Plastic conduit (PVC) shall be heavy wall, Schedule 40 or Schedule 80, depending on installation, manufactured in compliance with NEMA TC-2 specifications and UL-651 Standards.
- F. Underground plastic duct (PVC) shall be for concrete encasement or direct burial as specified and indicated. It shall conform to NEMA TC-6 and ASTM F512 Standards for underground installation. Concrete encasement shall be as recommended by the manufacturer. Plastic spacers, end bells, and fittings shall be furnished and installed, as required.
- G. All flexible metallic conduit shall be liquidtight unless otherwise indicated on the Contract Drawings or in the Project Specifications. Fittings shall be liquidtight and as recommended by the conduit manufacturer. Conduit shall be "Sealtite", or equal.
- H. PVC Coated Conduit (where specified): A plastic coating shall completely encapsulate metallic conduit to provide total protection against corrosion. The zinc surfaces of the conduit shall remain intact on both the inside and outside of the conduit throughout the preparation and application processing.
  - 1. The conduit shall be "Hot Dipped" galvanized inside and outside including the threads. "Hot galvanizing" is not acceptable.
  - 2. The threads shall be coated with urethane over the "Hot Dipped" galvanized threads.
  - 3. A minimum thickness of 40 mils PVC exterior coating shall be permanently fused to a hot dipped galvanized rigid steel conduit.
  - 4. A urethane or polyurethane interior coating shall be applied at a nominal 2 mil thickness to the interior of the conduit and over the hot dipped galvanized threads.
  - 5. The PVC coating on all Form 8 fittings shall form a gasket-like flange of at least 5/16-inch wide and 0.040-inch thick covering the top of the fitting around the opening. All fittings should have a minimum of 40 mils PVC coating even around the edge of covers. Also, all fittings to have urethane coating inside and outside prior to PVC coating.
  - 6. GUA type boxes shall be supplied with WOD type covers (Feraloy iron instead of aluminum) to prevent corrosive reaction between dissimilar metals. Conduit fittings (couplings, elbows, etc.) shall be of the same material.
  - 7. PVC coated conduit shall be UL listed and conform to the same standards as a metallic conduit. PVC coated conduit shall be "OCAL BLUE" as manufactured by OCAL, Inc., "Permacote", "Korcap" or "Plasti-Bond" as manufactured by Robroy Industries, or equal.
  - 8. Conduit shall be supported by corrosion resistant straps and clamps.

9. Contractor shall follow manufacturer's recommendations regarding the handling, bending, coupling, tools, and installation of the conduit specified herein.

#### **2.04 CONDUIT FITTINGS**

- A. Conduit fittings shall be standard threaded type of cast ferrous alloy, to suit the location and purpose. Fittings shall be Crouse-Hinds, Appleton Electric, or equal.
- B. Fittings for use with plastic conduit/duct, or PVC coated conduit, shall be compatible with the type of plastic conduit/duct, or PVC coated conduit used, and shall be of the same manufacturer.
- C. Fittings shall be vapor proof, weatherproof, or explosion proof where required.
- D. Unless specified otherwise, all exposed fittings, junction boxes, outlet boxes, terminal boxes, etc., shall be cast threaded hub type as specified. Also, all shall be hot-dip galvanized or cadmium plated.
- E. Conduit expansion/deflection fittings shall be complete with bonding jumpers and shall be watertight.
- F. Conduit insulating bushings with ground lug shall be the armored type.
- G. Fire stops shall have a 3-hour fire resistance rating and shall be made by the 3M Company or equal.

#### **2.05 BOXES**

- A. The volume of each outlet box shall be in compliance with the requirements of Article 314 of the NEC, minimum.
- B. Outlet boxes, except where otherwise indicated or specified, shall be standard code gauge galvanized steel boxes of patterns adapted to the specific requirements of the outlet.
- C. Outlet boxes located outside of buildings or in wet or damp locations shall be galvanized malleable or cast iron, or corrosion resistant stainless steel.
- D. Pullbox size and gauge, unless otherwise indicated or specified, shall comply with Article 314 of the NEC, and be complete with covers. Pullboxes having any dimension greater than 8-inches shall be fabricated of not less than No. 12 gauge sheet steel, complete with cover and silicon-bronze screws, or equal. Boxes shall be constructed with all seams continuously welded, not spot welded. After fabrication, boxes shall be hot-dipped galvanized. Where additional pullboxes are required by code or to facilitate installation, they shall be furnished and installed at locations approved by the Engineer, at no additional cost to the Owner.

## 2.06 WIRE AND CABLE

- A. All wires and cables shall be delivered in full coils or reels and shall be properly tagged and well protected against damage by layers of paper and burlap wound around coils. UL "Approved Tags" giving grade of insulation, sizes and length of wire in each coil or reel, and the manufacturer's name must be securely attached.
- B. Unless specified otherwise, all conductors shall be soft drawn annealed copper wire of 98% conductivity, with THHN/THWN insulation for 600-volt service. All service, feeder, and motor circuit conductors larger than No. 4 AWG shall have 90 degrees C Type XHHW-2, crosslinked polyethylene insulation.
- C. All fixture wire, including circuit extensions in fluorescent fixture channels, shall comply with NEC requirements.
- D. All power wires shall be No. 12 AWG or larger. Control wires shall be No. 14 AWG or larger, unless specified otherwise. Signal wires shall be No. 16 AWG or larger, unless specified otherwise. All conductors shall be stranded copper.
- E. Cable terminators shall be as required for the type of cable involved, O-Z/Gedney Electrical Manufacturing Co., Thomas and Betts Co., or equal, unless specified otherwise.

## 2.07 GROUNDING MATERIALS

- A. Grounding materials shall be corrosion-resistant and chemically compatible with the materials with which they come in contact.
- B. Ground rods shall be copper clad and not less than 3/4-inch in diameter and 10 feet long.
- C. Connections in readily accessible locations shall be compression or bolted connectors of Burndy Engineering Company or equal.
- D. Connections in locations not readily accessible after installation including splices and connections of grounding cable shall be made by exothermic welding by Cadweld or equal.

## 2.08 SPLICING MATERIALS

- A. Dry Locations
  - 1. No. 6 AWG and smaller wires
    - a. Insulated spring connectors (wire nuts)
    - b. Indentor butt connectors.
  - 2. No. 4 AWG and larger wires
    - a. Splices to uncut main runs shall be made with "Crimpits", or equal for No. 4 AWG thru No. 4/0 AWG.



- b. Splices to uncut main runs shall be made with “Hytaps”, or equal for wires larger than No. 4/0 AWG.
- B. Wet and Damp Locations
  - 1. Indentor or compression connectors equal to “Sta-kon”, “Thomas and Betts”, or equal.
    - a. Splices to uncut main runs shall be made with “Crimpits”, or equal for No. 14 AWG thru No. 4/0 AWG.
    - b. Splices to uncut main runs shall be made with “Hytaps”, or equal for wires larger than No. 4/0 AWG.

## 2.09 CONCRETE

- A. Concrete slabs for electrical equipment mounted on outdoor slabs shall be provided as shown. Unless otherwise indicated, slabs shall be 6 inches thick, project 2 inches above the highest-grade point, have No. 5 reinforcing bars 12 inches on center each way top and bottom, and set on 6 inches of No. 67 selected stone fill on top of compacted soil.

## 2.10 RESERVED

## 2.11 IDENTIFICATION

- A. Nameplates and Legends:
  - 1. All new equipment shall be identified by means of a laminated phenolic nameplate.
  - 2. Nameplate shall have white background with black engraved lettering or black background with engraved white lettering identifying function or equipment designation.
  - 3. Main nameplate on MCC switchgear, control panel, etc. shall be 2 inches high by 6 inches wide with 1-inch high letters. Individual nameplates shall be 1-inch high by 3 inches wide with 1/4-inch high letters.
  - 4. Legends shall be completely worded without abbreviations except as approved by the Engineer.
  - 5. Nameplates shall be fastened by means of 3/16-inch diameter roundhead, stainless steel, self-tapping screws. All UL 508 4X enclosure nameplates shall be secured with silicon adhesive.
  - 6. Blank nameplates shall be included on all unused components. Modified equipment shall be identified in the same manner as was the original equipment. Equipment whose designation has been changed shall be relabeled accordingly.

7. All nameplates on electrical panels which are fed from a remote source shall include, in addition to their function, where the power originates from (e.g. Scum Pump Panel - fed from MCC-1, MCC-1 fed from Main SWG).
- B. All wires and cables, except at lighting and 120 volts convenience outlets, shall be identified by means of tags describing circuit. Tags shall be on all connections, splices, and terminations, and shall also be applied where entering common wireway and at a minimum of 30 foot centers within the wireway. Wire tags shall be equal to Thomas & Betts Model WPR-125A white, self-adhesive wrap type labels. Tags shall be vinyl or polyester, resistant to heat, water, cold, dirt, and grease. The tag type-on area shall be sufficient size to contain five numerals on each line. Wire numbers shall be typed on with Thomas & Betts E-Z Coder Printer, WD-26P, or equal.
- C. Pull, terminal, and junction boxes shall be identified by stenciling the names of the feeders and system wires and cables passing through them.
- D. Direct current conductors shall be identified by the following methods:
  1. Provide self-sticking markers on each direct current conductor.
  2. Marker colors shall be black letters on "alert orange" background.
  3. Each marker shall designate circuit conductor polarity and voltage (e.g. +28 VDC).

### **PART 3 EXECUTION**

#### **3.01 COORDINATION**

- A. Coordinate electrical systems, equipment, and materials installations with other building components and building trades.
- B. If the current requirement of any motor or piece of equipment is increased to such an extent that the wiring, conduit, or starter for that motor or equipment must be increased from that shown on the Electrical Drawings, the Contractor shall furnish and install the larger items at no additional cost to the Owner.
- C. Certain equipment furnished under the equipment Sections shall be connected to the plant control system as shown on the P&ID drawings. Mechanical and electrical components for these connections shall be furnished, under the equipment sections, as required to provide control functions compatible with the plant control system. These connections and any remote-control connections shall be furnished and wired to clearly labeled terminal strips within the equipment control panel.
- D. If the electrical control requirements change from that specified or shown on the Electrical or P&ID drawings due to the requirements of the actual equipment furnished, the Contractor shall perform all necessary modifications under the equipment section and no additional compensation will be allowed. The final installation shall meet the operational intent of that specified and shown on the Drawings.

### 3.02 INSTALLATION

- A. Contractor shall furnish and install all wires, cables, conduits, conduit fittings, and other accessories. Contractor shall drill all holes required for the installation. Parts shall be insulated effectively from the ductwork and building structure, and objectionable noise or vibration. The electrical materials, equipment, and apparatus shall be installed in such a manner that parts requiring inspection, adjustment, and maintenance shall be readily accessible.
- B. Wiring shall be contained in metal, PVC, or fiberglass raceway, and at the completion of the job all boxes shall have closed covers and where brought into panels all shall be identified and bundled in a neat fashion.

### 3.03 OPENINGS AND SLEEVES

- A. All electrical conduit penetrations through an exterior surface above grade level shall be sealed and made water tight. For metal panels, use a sealant around the conduit penetration on both sides of the wall.
- B. All electrical conduit penetrations through the fire resistance rated walls or floors shall be fire stopped as required by the NEC using the approved method as recommended by the manufacturer.

### 3.04 CONCRETE

- A. Contractor shall furnish and install all concrete and reinforcing steel necessary to complete the electrical work, including foundations and all materials for concrete and reinforcing steel work wherever required. All concrete shall conform to the requirements specified in Section 03300.

### 3.05 MOUNTING AND ATTACHMENT

- A. Equipment Mounting Pads - All indoor freestanding electrical equipment including motor control centers, switchgear, switchboards, and panels, excepting units with leg supports or rollout equipment, shall have concrete equipment mounting pads provided. Equipment mounting pads shall be 4-inches high with 1-1/2-inch chamfer on all exposed edges.
- B. Cut ends of galvanized manufactured channels shall be painted with brush-on, 85% zinc-enriched paint.

### 3.06 CONDUIT AND FITTINGS

- A. Minimum size of conduit shall be 3/4-inch, except that concealed homeruns, underground, and embedded conduits shall be not less than 1-inch. Conduit shall be located for protection from mechanical damage. All conduit shall be sized in accordance with NEC.

- B. Conduit in concrete slabs and underground shall be PVC conduit unless otherwise noted. Exposed conduit shall be galvanized rigid steel unless otherwise specifically called for. Conduit stub-ups between underground or slab construction and exposed or concealed wall construction shall be bends of rigid galvanized steel conduit, made in accordance with Section 344-10 of the NEC, and shall have an ample coating of asphaltic paint prior to the placement of concrete. Nonmetallic runs shall change to encased galvanized conduit approximately six diameters before becoming exposed.
- C. Exposed rigid metallic conduit shall be installed parallel with or at right angles to the lines of the structure, except as otherwise shown, and supported in an approved manner. Conduit fastened directly to structures shall be held with one-hole, malleable iron clamps and clamp backs, or otherwise suitably spaced from concrete or masonry surfaces. Concealed rigid metallic conduit shall be installed in as direct a line as possible, and shall be rigidly supported by approved methods and materials.
- D. PVC conduit shall be installed in true alignment and sloped 1/16-inches per foot minimum for drainage wherever possible. PVC conduits which terminate in the concrete walls of manholes, handholes, or other concrete walls shall be provided with manufactured end bells. The installation of non-metallic conduit shall conform to the requirements for metallic conduit.
- E. Flexible connections to all equipment subject to movement or vibration shall be made by means of liquid tight flexible conduit equal in length to approximately ten times the diameter of the conduit but not exceeding 3 feet in length.
- F. Bushing caps shall remain in place until immediately before the conductors are installed.
- G. In areas designated as hazardous, all fittings, material, and equipment shall be of the type approved for such installation. Seal-off fittings shall be used as required by the NEC and local codes, and the complete installation shall be in accordance with the requirements of such codes. All components and Work shall conform to Class I, Division 1, Group D requirements.
- H. All conduits to pumps or other equipment shall, unless otherwise shown on the Drawings, be routed through or below concrete floor slabs. Runs on floor slabs are not permitted unless specifically shown as such on the Contract Drawings. Conduit shall be concealed in all locations where walls are faced with glazed tile, or ceilings are suspended. In other areas, except in slabs, conduit shall be run exposed and as approved by the Engineer. Wherever conduit is concealed in masonry of any type, it shall be the responsibility of the Contractor to maintain a clear passageway throughout the entire conduit system, and to clean the conduit system before installing the conductors.
- I. Where conduit bushings are constructed wholly of insulating material, a locknut shall be installed both inside and outside the enclosure to which the conduit is attached. Ungrounded conductors No. 4 AWG or larger shall be protected with insulated throat bushings where entering or leaving enclosure in conduit systems.

- J. Pulling distances shall be limited to 125 feet, and suitable pull boxes, etc., shall be provided whether shown on the Drawings or not. All "tee" type and in-line conduit pulling fittings shall be with the tee-hub plugged, or pull boxes per Specifications. Conduit bends between pull points shall be a maximum of 3. Bends in conduit bearing cables for voltages greater than 600 VAC shall have a minimum radius of 36-inch.

### 3.07 RESERVED

### 3.08 BOXES

- A. Outlet, fixture, and device boxes in unfinished areas shall be surface mounted unless otherwise specified. Outlet, fixture, and device boxes shall conform to the requirements specified in the paragraphs herein.
- B. Concealed - Concealed galvanized steel outlet and switch boxes and plaster rings for electric lights, wall switches, and receptacles, shall be installed where required. In every instance, boxes shall be of such form and dimension as to be adapted to the number, size, and arrangement of conduits connected thereto. Outlet boxes shall be firmly anchored in place and shall be provided with approved 3/8-inch fixture studs where required. Junction boxes shall be provided with blank covers to match other covers in the same area.
- C. Sizes - Ceiling outlet boxes shall be 4-inches octagonal or 4-11/16-inches square when required, and not less than 1-1/2-inches deep. Switch and receptacle outlet boxes shall be 4-inch, with provisions for standard switch covers.
- D. Exterior and Exposed - Outlets in exterior locations and in exposed conduit shall be "FS" or "FD", and PVC where used with PVC conduit.
- E. Concrete and Masonry - Outlet boxes installed in unfinished concrete walls or columns shall be provided with 1-inch deep plaster ring. Box and ring shall be set in position before concrete is poured. Cover plate may be installed flush with unfinished surface. In case of brick walls, the same procedure shall be followed, and mason shall fill in around the plaster ring with mortar. Boxes shall be flush where outlets, switches, are so indicated on the Drawings. Protection from entrance of foreign materials shall be provided during construction.
- F. Wall mounted convenience receptacles shall be mounted 18-inches above the finished floor unless shown otherwise on the Drawings, required by the NEC, or where required to clear radiators, grilles, louvers, or other equipment and piping.
- G. Wall mounted switches shall be mounted 50-inches above finished floor to the center of the box unless directed otherwise. Space between door openings and switches shall be as uniform as possible throughout the buildings.
- H. Special purpose outlets shall be located as shown on the Drawings, or in accordance with project or manufacturer's requirements.

- I. Splices made with wire nuts, crimp connectors, terminal blocks, split-bolts, or similar connectors shall be in boxes which are readily accessible. Terminal boxes shall be located a maximum of 8-feet above the floor and shall have a vertical-facing orientation.

### 3.09 WIRE AND CABLE

- A. 120 and higher voltage wiring shall be in conduit. When installing wire or cable, extreme care shall be used to prevent any injury or damage to the materials. The Contractor shall observe the installation instructions and precautions issued by the manufacturer of the wire and cable. The Contractor shall avoid dragging cables across abrasive surfaces or obstructions in a manner which could damage the cable covering. Before pulling wires and cables, the Contractor shall file the record of conduit tests with the Engineer. No wires and cables shall be pulled until all operations which are likely to damage the conductors have been completed. Pulling compounds shall be submitted for approval prior to use, and shall be of such composition as not to damage the conductor covering. The Contractor shall provide adequate equipment for installation of cables which are satisfactory to the Engineer. Cables shall be pulled through conduits in such a manner as not to over stress, stretch, score, cut, twist, or damage the protective covering or insulation of the material. If mechanical means are employed for pulling the cables, a dynamometer shall be used.
- B. Damp or Wet Locations - The ends of low-voltage cables installed in damp or wet locations shall be carefully sealed, as specified for deadends, until permanently connected or spliced. The Contractor shall be responsible for maintaining a dry condition while the cables are being pulled.
- C. Support in Boxes and Enclosures - Wiring shall be done in a workmanlike manner and shall be furnished to give a neat and orderly appearance. Cables in boxes and equipment enclosures shall be neatly arranged, supported, and laced with approved materials. Cables shall be supported on cable racks in concrete pullboxes and manholes.
- D. Pull Wires - Conduits left empty under this Contract shall be equipped with a polypropylene pull rope. Where conduits have less than 25% fill of required conductors/spares, they shall also have a suitable polypropylene line pulled-inch. The pulling line shall be cut and tied off to an anchored steel eyebolt at each box, cabinet, or other destination. Pulling lines may be omitted on lighting conduits less than 60 feet in length.
- E. 120 volt "home runs" in excess of 100 feet shall be No. 10 AWG minimum. Branch circuits supplying 1500 watts or more at 115 volts shall be No. 10 AWG minimum.
- F. Conductors in vertical runs shall be adequately supported with approved conductor supports, as outlined in the NEC.
- G. Conductor Combination and Separation - The combining of conductors of various systems within one conduit system shall not be permitted. Conduit layouts shall provide for the cable separation requirements between various systems and between various

signals within given systems throughout this Division as required by this Section. Each of the following shall be maintained in a separate conduit system apart from the others:

1. Lighting and 120-volt utility.
  2. Power Distribution - Conductors for voltages over 600 VAC shall be in conduit separate from conduit containing power conductors for 600 VAC or less.
  3. Motor Branch Circuit. Exception: Where conductors are less than No. 4 AWG, they may be combined with 7 below.
  4. Communication Systems.
  5. Alarm Systems.
  6. Shielded Pair Instrumentation and Control.
  7. 120-volt motor and equipment controls.
  8. UL approved intrinsically safe instrumentation.
- H. Separation distance requirements between each of the Items 1 through 8 above shall be as shown on the Drawings, or as otherwise required by the specifications. Shielded cables shall be placed in rigid galvanized conduit, and shall be spaced 12 inches minimum away from power and control conduits. Shielded cable conduits require no spacing between each other when being installed.

### **3.10 SPLICES AND TERMINATIONS: 600 VOLT AND BELOW**

- A. Splices and terminations in wires and cables rated 600 volts or less shall be made as described below. Indentor and compression type connectors shall be applied to conductors by means of a tool providing controlled indentation or compression. Splices and connections shall have a conductivity and insulation resistance at least equal to that of the cable and shall be in strict accordance with the conductor manufacturer's recommendations.
1. Wherever conductors are terminated they shall be bundled and identified in a manner matching approved Contractor submitted drawings. Conductors shall be terminated wherever shown or implied on the Contract Drawings.
- B. Splices - Wire and cable lengths shall be continuous and without splices between the points of connection, except as otherwise specified, indicated on the Drawings, or approved by the Engineer.
- C. The Owner reserves the right to inspect any and all joints made in 600 volt wiring before they are taped, or if they are taped without being inspected, to order the tape removed from any joint(s), and the Contractor shall correct any defect found. After inspection and correction of any fault found, the Contractor shall properly re-tape the joints.
1. Dry Locations - No. 6 AWG and Smaller - Single-conductor, rubber or plastic-insulated conductors with nonmetallic coverings shall be spliced using the materials listed in Part 2 of this specification, followed by wrapping with two

half-lapped layers of approved plastic tape extending a distance of not less than 1-inch from the connector.

- a. Insulated spring connectors.
  - b. Indentor butt connectors.
2. Dry Locations - Conductors No. 4 AWG and Larger - Conductors shall be spliced using the materials listed in Part 2 of this specification, except as otherwise specified, by wrapping with two half-lapped layers of approved plastic tape extending a distance from the connector of twice the outside diameter of the larger conductor or 1 inch, whichever is greater.
  3. The insulation of Conductors No. 2 AWG and larger shall be penciled to the diameter of the connector.
  4. Where necessary to provide a smooth taping surface, approved electrical insulating putty shall be used as a filler before applying the tape.
  5. Wet Locations or Locations Subject to Flooding or Hosing - Single-conductor, rubber or plastic-insulated conductors of all sizes with nonmetallic covering shall be spliced by the use of the connectors listed below, except as otherwise specified, by wrapping with four half-lapped layers of approved plastic tape, extending a distance from the connector of twice the outside diameter of the larger conductor, or 1 inch, whichever is greater. Splices in manholes shall only be permitted where specifically shown on Drawings. In manholes, splices No. 4 AWG and smaller shall be in submersible NEMA terminal boxes within easy reach of ground level.

### 3.11 GROUNDING

#### A. General:

1. System neutrals; secondaries of control power, instrument, metering and relaying transformers; noncurrent-carrying metallic equipment enclosures; exposed metal structures; and supports shall be effectively grounded to ground grids and busses provided under this Contract.
2. Noncurrent-carrying metallic parts, electrical equipment and systems including, but not limited to, transformers, motors, lighting, equipment, raceways, control panels and consoles, panelboards, and cable shields, as well as metallic structures, shall be grounded.
  - a. Care shall be taken to ensure ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires, sized per NEC Table 250-95, shall be installed.
  - b. Conduits stubbed-up below a motor control center shall be fitted with insulated grounding bushings, and connected to the motor control center ground bus or structure. Boxes mounted below motor control



centers shall be bonded to the motor control center ground bus. The grounding wire shall be sized in accordance with Table 250-95 of the National Electrical Code, except that a minimum No. 12 AWG copper shall be used.

- c. Liquid tight flexible metal conduit, UL approved for grounding, shall be permitted as equipment grounding means in the 1-1/4-inch and smaller trade sizes, if the total length in any ground return path is 6 feet or less, and the conduit is terminated in fittings approved for grounding.
  - 1) Flexible metal conduit, where permitted by NEC Article 348, is permitted as equipment grounding means if the above restrictions for the liquid tight flexible type are met, and if the circuits are limited to 20 amperes.
  - 2) Flexible metal and liquid tight metal conduit shall be bonded around externally on sizes 1-1/2-inch trade size and larger. Grounding liquid tight connectors or bronze grounding bushings shall be used for the installation of equipment grounding conductor around the flexible metal conduit.
- d. Insulated grounding bushings shall be used on the grounding of conduits 480 volts and higher, with the appropriate size copper equipment grounding conductor.

B. Conductors - Ground conductors shall be run with feeders in polyvinyl chloride conduits, whether shown or not, sized no less than required by NEC or larger if required by the Drawings.

C. Connections:

- 1. Exposed connections shall be made by means of approved grounding clamps. In readily accessible locations, compression or bolted connectors shall be used. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal. Buried connections shall be made by welding process.
- 2. Where grounding conductors are carried external to flexible conduit, they shall originate in bronze grounding clamps and terminate in a terminal bolted to the main frame of the motor (not to sheet metal terminal boxes).

### 3.12 IDENTIFICATION

- A. The Contractor shall furnish and install equipment nameplates, typed panel rosters, wire and cable tags, stenciling, and other identification with text, lettering type, etc., as specified or as directed.

### 3.13 FIELD TESTING

- A. General - Wherever testing is required, test shall be completed and accepted before the Contractor proceeds with subsequent Work. When adjustments are required following test procedure, test shall be repeated as many times as required to obtain test results acceptable to the Engineer or Permitting Authority. Written reports shall be required on tests.
- B. The Contractor shall be responsible for the procurement and installation of compatible components and equipment, and shall perform Work necessary for the proper operation and guarantee of the equipment. The Contractor shall provide all labor, instruments, and apparatus required, and shall make such tests as may be necessary to demonstrate that the Work and equipment, as installed, complies with the Contract Documents.
- C. Field testing shall be performed by the Contractor, as outlined herein, and as required to demonstrate that the installation meets the requirements of the Contract Documents. When required, such tests shall be performed in the Engineer's presence. Before conducting field tests, the Contractor shall submit to the Engineer, a written outline of the methods and equipment used. The Engineer reserves the right to require the Contractor's instruments be checked by an independent instrument tester. Test equipment shall be provided by the Contractor. Records shall be kept of each test, and copies shall be submitted to the Engineer.
- D. Conduit - Cleaning and Clearance - After conduit and accessories have been installed, and all concreting operations completed, conduit runs shall be satisfactorily cleared of obstructions and foreign matter. Any defects which might damage cable upon installation shall be corrected.
  - 1. Conduits shall be tested, in the presence of the Engineer, by pulling through each conduit a flexible cylindrical mandrel having an outside diameter 1/4-inch less than the inside diameter of the conduit, followed by a stiff wire brush of the same diameter as the conduit. Where conduits installed under this Contract are connected to conduits installed by others, the entire runs between boxes, manholes, or other termination points shall be tested.
  - 2. Record of Conduit Tests - The Contractor shall keep a record, by number, of conduits tested clear, and shall submit such record to the Engineer.
  - 3. Any defects or stoppages in conduit runs installed by the Contractor shall be corrected at the Contractor's expense. Any defects or stoppages in conduit runs installed by others shall be reported to the Engineer, who shall determine the corrective measure to be taken.
- E. Made Grounds - The Contractor shall test the ground resistance of the systems. Test equipment shall be provided under this Section and be approved by the Engineer. Dry season resistance of each system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, provide additional grounding as directed by the Engineer. Made grounds shall be tested by the Contractor, in the presence of the

Engineer, for continuity and resistance; readings shall be recorded and submitted to the Engineer. Ground resistance of more than 5 ohms shall be reduced to 5 ohms or less by the use of additional ground rods or ground connections.

F. Low Voltage Systems:

1. Tests Before Equipment Connection - Upon the completion of each electrical system rated 600 volts or less, but before wiring connections are made to equipment, the Contractor shall test each circuit and each piece of equipment for:
  - a. Continuity.
  - b. Grounds.
  - c. Insulation resistance, phase-to-phase and phase-to-ground, of 480 volt conductors and equipment with a 500-volt megohmmeter. (See 3.13.F.2, below.)
2. Correction - If discontinuities or grounds are discovered in low voltage systems, they shall be corrected before the insulation resistance is measured. If any insulation resistance readings are lower than required, the Contractor shall repair or replace the equipment or wiring involved.
3. The Contractor shall perform insulation resistance testing of 480-volt power feeder circuits with a 500-volt megger, and prepare a written test report of the results. Equipment which may be damaged during this test, such as solid-state motor starters, variable-speed drives, etc., shall be disconnected. Tests shall be performed with all other equipment connected to the circuit. Resistance values from line to ground of less than 3 megohms are not acceptable.
4. After control cable installation and conductor termination for instrumentation and control, the Contractor shall perform tests witnessed by the Engineer to ensure that control cable shields are isolated from ground except at the grounding point. The Contractor shall remove all improper grounds at no additional cost to the Owner.
5. Following the satisfactory completion of the circuit and equipment insulation resistance tests and the connection of wiring to equipment, but before it is energized, the tests specified above shall again be carried out. The same care shall be taken to protect equipment as in 3.13. F. 3. above.
6. Motors shall be checked for proper rotation along with controls for proper function and corrected by contractor.

- G. Acceptance Tests - Upon completion, and before the final estimate is submitted for payment, the entire installation shall be tested in the presence of the Engineer to see that the conditions of the specifications have been met. The entire system shall test free from shorts and unintentional grounds, and each part shall function properly, as

intended. The entire system shall show an insulation resistance between conductors, and between conductors and ground not less than 3 megohm.

- H. The Contractor shall measure and tabulate the line voltage of each phase at the load terminals of the main switch or circuit breaker in the building.

#### **PART 4 SPECIAL PROVISIONS**

##### **4.01 SUPPORT MATERIAL SCHEDULE**

- A. Exterior – All exterior supports shall be 304 stainless steel.
- B. In Chamber or Exposed to Wastewater – All supports shall be 304 stainless steel.
- C. Headworks Screen Room, Grit Areas, Container Area, Primary Sludge Pump Station – All supports shall be 304 stainless steel.
- D. Headworks Electrical/Blower Room and Boiler Room, Secondary Effluent Pump Station (not included in one of the description above) – Carbon Steel.
- E. Disinfection Building and Iron Salts Building – FRP or 304 stainless steel.

##### **4.02 SPARE PARTS**

- A. Spare fuses shall be provided and delivered to the Owner as follows:
  - 1. Secondary (600 VAC or less) fuses shall be provided in the amount of 10% of each size and type installed, but in no case shall less than three spares of a specified size and type be supplied. Special control fuses, capacitor fuses, and electronic fuses shall be furnished exactly as provided by the equipment manufacturer with no substitutions permitted.
- B. Primary (over 600 VAC) fuses shall be provided with one set of spare fuses for each set of primary fuse holders.

END OF SECTION

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**SECTION 16902**  
**METERING AND CONTROL EQUIPMENT**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Work under this Section includes furnishing and installing all metering and control equipment which is part of the Plant Control System except the programmable controller system and the graphic user interface system.
- B. All Work performed shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

**1.02 SUBMITTALS**

- A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's literature including model number, type, size, materials, quantity, connections, equipment number, mounting hardware, and installation information.
  - 2. Information for the Record:
    - a. Equipment suppliers report that equipment is properly installed and satisfactory operation is obtained.
    - b. Software, cables, etc. for configuration, programming or operation of meters or equipment, minimum of two each is required.
    - c. Operation and maintenance manuals.
    - d. Schedule of Owner's training for all new equipment.

**PART 2 PRODUCTS**

**2.01 PRODUCT REQUIREMENTS**

- A. All metering and control equipment shall be as indicated on the Drawings and as specified, and shall include, but not be limited to those devices hereinafter defined. Should additional devices be required, but not specifically indicated elsewhere, in order to affect the intent of the Contract Documents, such devices shall be furnished.
- B. All metering and control equipment used for similar applications shall be the product of a single manufacturer.

- C. All features and requirements listed in the individual instrument specifications are required.
- D. All field instrument enclosures shall be NEMA 4X construction except in hazardous locations where the enclosures shall be NEMA 7 for Class I, Division 1, Group D service, unless otherwise noted. Equipment in hazardous locations shall indicate temperature rating as specified in the NEC.
- E. All faces of panel mounted instruments shall be NEMA 4X construction except where the panel is located in a protected Control Room environment.
- F. Whenever an "or equal" equipment item is proposed in lieu of that specified it will not be considered equal if it is of non-potted construction and the specified item is potted construction.

**2.02 PERFORMANCE REQUIREMENTS**

- A. Intrinsically safe equipment shall be Factory Mutual approved for Class I, Division 1, Group D service.
- B. Analog signals for input to a programmable controller system shall be isolated 4-20 mA DC and where required, current to current transducers or other device shall be furnished to produce an isolated signal to the programmable controller analog input modules.
- C. Digital input signal sources shall provide an isolated contact rated at 5-amp minimum, 115 VAC, to the programmable controller system.
- D. Power supplies shall be furnished for two-wire transmitters and other devices requiring DC power. No more than four loops shall be powered from one power supply. Separate power supplies shall be provided for duplicate instruments to ensure failure of one power supply will not inhibit operation of secondary equipment.
- E. The Site is in an area subject to radio frequency activity. Any equipment sensitive to radio frequency interference (RFI) shall be provided with the proper RFI filters, be properly shielded and grounded, or otherwise protected to allow proper operation of the equipment.

**2.03 POWER AND POWER CONDITIONING**

- A. Constant Voltage Regulation

Function:	Provide regulated and filtered power supply for electronic devices and remote I/O panels
Input Voltages:	As shown on Drawings
Output Voltages:	120 volt, 60 Hz
Filtering:	Harmonic
Overload:	Automatic protection
Isolation:	Galvanic
Approval:	UL Laboratories

Temperature:	-20 to +50 degrees C
Features:	Voltage regulation of +/- 1%, 10-year warranty
Loading:	Design loading with 80% of nominal input voltage
Manufacturer:	Sola/HEVI-DUTY, or equal
Model:	Type CVS

B. Instrument Power Supply

Function:	Power for up to six 4-20 mADC signal loops. If more than six loops, use additional units of the same size.
Type:	Electronic Solid State
Input:	120 VAC, 60 Hz
Output:	As required, +/- 1 VDC adjustable
Load:	Load +/-0.05%, Line +/- 0.05%
Ripple and Noise:	0.5 mv RMS
Mounting:	Plug-in with octal base and screw terminals.
Features:	Overvoltage protection
Manufacturer:	Acopian, or equal
Model:	V"x"J Series ("x" is required output voltage)

**2.04 RESERVED**

**2.05 SIGNAL CONTROL**

A. Pushbutton ((HN))

Function:	Manual Operator Control
Type:	Momentary contact pushbutton unit, NEMA rating as required
Contacts:	1 NO and 1 NC minimum
	Provide contact arrangement as required to perform necessary functions
Contact Rating:	10 amps at 120 VAC, 60 Hz
Operator Type:	Momentary, color and designation per function
	Black - (Start, Run, or Open)
	Red - (Stop or Close)
	Green - (Silence)
Mounting:	Panel face, with legend plate
Manufacturer:	Allen-Bradley, or equal
Model:	800H



2.06 RESERVED

2.07 RESERVED

2.08 FLOW

A. Flow Element and Transmitter ((FE)/(FIT))

Function:	Measure, indicate and transmit the process flow in a full pipe. Meter must be a full bore meter with the magnetic field traversing the entire cross section of the flow tube. Insert magmeters or multiple single point probes inserted into a spool piece are not acceptable. Magnetic flow meter, operating based with high impedance electrodes. Flow tube with two coils mounted outside a 304 stainless steel tube, transmitter, interconnection cables and mounting hardware.
Type:	Pulsed DC magnetic induction with absolute zero stability
Size:	As specified on Drawings and in Schedule
Input Signal:	Analog Process Flow
Conductivity:	Minimum 5 Micromho/cm
Process Temperature:	0 to +140 degrees F
Outputs:	Isolated 4-20 mA DC into 1,000 ohms. Scaled pulse outputs as standard.
Power Requirements:	110/120 VAC 50/60 Hz.
Modular Construction:	The measurement system consists of a flow sensor and a signal converter. It is available as remote version.
Remote Version:	TIDALFLUX 2300F
Signal Converter:	Field housing- IFC 300F (DieOcast aluminum powder coated (Epoxy primer and Polyester topcoat)
Measurement Range:	-40 to 40 ft/sec)
Electrodes:	Hastelloy C, bullet nosed electrodes on wastewater and flush electrodes on clean fluid. Titanium or others for chemical feed applications. It is the manufacturer's responsibility to provide materials comparable with the process medium.
Liner:	Polyurethane, hard rubber, neoprene for sewage meters. Ebonite, Teflon or Tefzel for all sludge meters (RAS, WAS, thickened). Meters 14 inches and larger shall have a polyurethane or hard rubber liner. All meters specified in potable water lines shall have an NSF 61 or FDA approved liner.
Flow Tube:	
0-12 inches:	304 or 316 stainless steel, meters 0-12 inches shall be capable of accidental submergence with 30 feet of cable to remote converter. Meters located below grade or in a meter vault shall be NEMA 6P rated with 100 foot cable. Cable shall be factory installed and potted. Compound mixtures installed in

	the field are not acceptable. All meter housings shall be of a welded design.
12-72 inches:	304 or 316 stainless steel shall be capable of continuous submergence in 30 feet of water with cable to remote converter.
End Connections:	
0-4 inches	150 lb. ANSI carbon steel or wafer design
6-24 inches	150 lb. ANSI carbon steel flanges
30-78 inches	Class D AWWA flanges
Lay length	All meters should comply with ISO 13359 lay lengths
Grounding:	All meters must be supplied with orifice type 316 stainless steel grounding rings. Grounding electrodes are not acceptable. Meters shall have 316 grounding straps.
Modular Construction:	The measurement system consists of a flow sensor and a signal converter. It is available as remote version.
Remote Version:	TIDALFLUX 2300F
Signal Converter:	Field housing- IFC 300F (DieOcast aluminum powder coated (Epoxy primer and Polyester topcoat)
Power Requirements:	12-24VDC (55%/+30%) 12VDC-10%
HART:	
Description:	HART protocol via active & passive current output HART version: 5 Universal HART parameter: completely integrated
Load:	>=230 ohm at HART test point
Multi-Drop operation:	Current output= 4 mA Multi-Drop address adjustable in operation menu 1 to 15
Device drivers:	FC 375/475
Registration (HART Communication Foundation)	Yes
Transmitter Enclosure:	NEMA 4X die cast aluminum rectangular housing immune to RFI inference, with flow rate and totalization indication.
Electrical Rating	All meters installed in a wastewater treatment plant shall be FM approved Class 1 Division 2 Grounds A, B, C and D. Meter shown on drawings in Class 1 Div 1 area shall be rated for that area.
Ambient Temperature:	-40 to 149 degrees F
Manufacturer:	Krohne
Model:	TIDAFLUX 2300 F.

**2.09 RESERVED**

**2.10 RESERVED**

**2.11 RESERVED**

**2.12 RESERVED**

**2.13 ACCESSORIES**

- A. All piping and tubing for connections to instruments shall be stainless steel. Threaded pipe shall be ASTM A312, Grade TP304, Schedule 40S, and fittings shall be AISI Type 304. Tubing shall be ASTM Grade TP304, 0.028-inch minimum wall thickness for flareless "bite" type with threaded nut and ferrule fittings.
- B. Valves shall be stainless steel eccentric plug valves with a bolted-on non-removable lever actuator. Valves shall be equal to DeZuric Figure 130 with synthetic rubber faced plugs. Valves shall have screwed or flanged ends as required. Valves for gas service shall be designed for gas service and shall provide leak-proof shutoff.
- C. Diaphragm seals shall provide continuous isolation between pressure gauges, switches, and transmitters from process fluid. Upon instrument removal or failure, there shall be no leakage. Seals shall be of the type to allow instrument and diaphragm top housing to be removed from the process piping with no leakage of process fluid. Seal fill fluid shall be incompressible, non-corrosive, and suitable for materials of construction and temperature encountered, and shall be selected to minimize temperature effect. Sludge piping process connections shall be 1-1/2-inch, 150 pound flanged. Gas and water piping process connections shall be 3/4-inch NPT. All instrument piping connections shall be 1/2-inch or 1/4-inch NPT, as required. All process connections shall have a 1/4-inch NPT flushing connection with a 316 SS plug.
- D. All mechanical fasteners such as bolts, nuts, screws, cinch anchors, clamps, etc., shall be stainless steel.
- E. All special mounting brackets shall be stainless steel, galvanized, or nonferrous non-corrosive metal.
- F. All equipment mounted outdoors that includes any type of visual indicator, LCD, etc., shall be furnished with a sun visor.
- G. All equipment located outdoors shall include a thermostatically controlled space heater.
- H. All field instruments and devices shall be equipped with a 1-inch x 3-inch stainless steel identification tag firmly affixed to the instrument or device with stainless steel fasteners. Each tag shall show the manufacturer's name, serial number, part number, tag number (to be approved by the Engineer), calibrated ranges, or calibration constants.

- I. For each type of device installed, the Contractor shall supply two complete sets of software, hardware, calibration devices, and cabling, used to configure, calibrate, or make adjustments.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. The features and installation of the instrumentation shall be coordinated for optimal performance with the characteristics of the process material to be metered.
- B. Care must be exercised to identify locations that meet the requirements of the manufacturer including upstream and downstream distances, pressures, temperatures, and accessibility for maintenance.
- C. Verify equipment requirements and dimensions with provisions specified under this Section. Check actual field conditions, report necessary changes, and submit equipment reflecting changes.
- D. Coordinate Work with other trades to avoid conflict and to provide correct rough-in and electrical connection requirements. Inform Contractors of other trades of the required access to and clearances around equipment to maintain serviceability and code compliance.
- E. Where the installation of any device is dependent on, or affected by, Work performed under other sections of these specifications, the Contractor shall coordinate the Work. Installation coordination includes the correct location and placement of devices, piping to the equipment, pipe taps, control power circuits, connections to the control system, etc.
- F. Installation of instrumentation in an existing system being modified, replaced, or abandoned, shall be coordinated with the Owner and shall be performed to minimize operational disruptions and minimize time that equipment may be out of service.

#### **3.02 INSTALLATION**

- A. Installation shall include the provision of materials, and the coordination of all details, necessary to properly install the instruments including location, arrangement in piping, power source, signal wiring and conduit, special brackets, and all mounting hardware.
- B. All instrumentation devices shall be installed in accordance with the manufacturer's installation requirements.
- C. Wiring practices for intrinsically safe systems shall be in accordance with ISA RP12.06.01.
- D. Instruments shall be installed so that the various components are accessible for maintenance. Care shall be taken in the installation to ensure sufficient space is provided between instruments and other equipment, including piping, for ease of

removal and servicing. All instruments shall be readily accessible from grade, permanent platforms, or fixed ladders.

**3.03 STARTUP AND TRAINING**

- A. The Contractor shall provide the services of component manufacturer’s factory trained personnel for the supervision of installation, initialization, and calibration of equipment.
  - 1. These services shall also include a minimum of one eight-hour day to instruct the Owner’s personnel in the operation and maintenance of the equipment.

**PART 4 SPECIAL PROVISIONS**

**4.01 GENERAL**

- A. Schedules included herein are intended to supplement the Drawings and are not guaranteed to be complete. All instrumentation devices shown in the Contract Documents or otherwise required to complete the Work shall be furnished and installed.

**4.02 RESERVED**

**4.03 FLOW INSTRUMENT SCHEDULE**

- A. The following schedule is a listing of new flow devices to be installed.
- B. The following letter designations are used in the schedule:

Item Designation:

FT-1	First Letter	F	=	Indicates Flow Device
	Second Letter	T	=	Function, Transmitter
	Number	1	=	Item Number

Function:

S	Switch
I	Indicator
T	Transmitter

- C. Flow devices are numbered on the Drawings and scheduled as follows:

Item Designation	Function	Pipe Size	Range gpm	Process psig/in. H2O	Process Conditions	Power Supply	NEMA Rating	Dwg No.	Spec No.
FIT/FE-101	Flow Measurement	24-inch	0-5300 gpm		Sewer pipeline	120VAC	NEMA 6P	SA-1.1 and SA1.2	16902-2.08

017.7892.001  
05/2023

Issue for Bid  
Kalamazoo, MI  
Kalamazoo/GPI Effluent Sewer Realignment

4.04 RESERVED

4.05 RESERVED

4.06 RESERVED

4.07 SPARE PARTS

- A. The Contractor shall furnish spare parts as recommended by the manufacturer. The spare parts shall be individually packaged for protection against dirt and moisture. Each package shall be labeled as to its contents with a description and part number.
- B. All spare parts shall become the property of the Owner. The Contractor shall maintain the spare parts inventory level as shown in the Spare Parts Schedule, and replace at no cost to the Owner all spare parts consumed during the one-year warranty period.

4.08 RESERVED

END OF SECTION

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**CITY OF KALAMAZOO  
DEPARTMENT OF  
PUBLIC SERVICES**

**WATER RESOURCES DIVISION**



**PUBLIC SERVICES DEPARTMENT**

WATER RESOURCES DIVISION  
415 STOCKBRIDGE AVE.  
KALAMAZOO, MICHIGAN 49001-2898  
PHONE 269-337-8601  
FAX 269-337-8533

**Standard Specifications for  
Water Main and Service Installation  
2021**





## WATER MAIN AND WATER SERVICES

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This Section includes furnishing and installing water main systems.
- B. Reconnection of proposed water main and/or water service connections to existing water main and/or water service constructions shall be in conformance with requirements of this Section.
- C. This Section shall include furnishing, excavating, installing, testing, disinfecting, and backfilling all required water main pipe, water service pipes, water main appurtenances, water service, and other work incidental to the water main and/or water service installation unless specifically included under other Items.
- D. This work shall also consist of providing as-constructed plans of the completed work.

#### 1.02 SUBMITTALS

- A. Submittals shall be the responsibility of the Contractor:
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project.
  - 2. Information for the Record:
    - a. Manufacturer's certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.
    - b. Manufacturer's installation instructions.
    - c. The laboratory shall submit test certifications of pipe ordered tested under "Field Quality Control," of this Section.
  - 3. Engineer may request additional Shop Drawings or Information for the Record as required.
  - 4. **Requests for approved equals must be submitted to the Engineer for review a minimum of two (2) weeks prior to bid.**

#### 1.03 AS CONSTRUCTED RECORD

- A. During construction the contractor shall be required to keep current a set of "as constructed" drawings. Before final payment shall be made, the contractor shall submit for approval to the City of Kalamazoo the complete set of as constructed drawings. Each set of "as constructed" drawings shall be labeled "As Constructed", dated, and contain at a minimum the following information (additional information may be required by the City of Kalamazoo):
  - 1. Note distance between all fittings (Center to Center of Fittings).
  - 2. Note Hydrant to valve, valve to main distances (Center to Center of Fittings).
  - 3. Note the type of bend used, (# of degrees), and the Direction of Bend: (Up or down), (N-S-E-W).

4. Note lengths and locations of restrained joints.
5. Details and profiles of special field situations that relate to the water distribution system shall be included.
6. Dimensional information locating each water distribution system component to real world features, such as property lines, right-of-way lines, and centerlines of roads.
7. On all cul-de-sacs with no center island, measure bends and hydrants to center of cul-de-sac. On all cul-de-sacs with a center island, measure bends and hydrants to center of the roadway.
8. When fittings/hydrants are installed as proposed, please circle the proposed listing.
9. All hydrants shall be noted as to whether or not drip valve plugs were installed.
10. When installing 12 inch or larger valves, (Butterfly Valves), indicate which side of the main the operating nut was placed, as well as gear box style with number of turns to close.
11. The contractor shall complete the service card information including a sketch of the water service installation with dimensions and location of the curb box.
12. Contractor shall GPS all valves, hydrants, fittings, as well a minimum every 3 lengths of pipe for straight runs. DWG files shall be provided to the Engineer upon completion of the project. GPS accuracy shall be subfoot.
13. **All as-built record drawings shall be completed and turned in to the Engineer within 2 weeks from completion of the installation.**

#### 1.04 CONTRACT WORK

- A. Prior to the start of construction, the City of Kalamazoo shall be given the opportunity to provide construction services for any and all portions of the water main construction. The City of Kalamazoo shall submit an estimated cost to perform the work or will issue a bill based on time and material costs. A separate contract with the City of Kalamazoo will be needed for work to be performed by the City of Kalamazoo.
  1. City of Kalamazoo shall perform all water main taps in the water system, unless otherwise directed by the Engineer.
- B. The City of Kalamazoo Department of Public Services must approve the Contractor who will perform water main installation. A reference list of at least five (5) Type 1 supply water main projects completed by the Contractor shall be submitted in support of the Contractor's qualifications. The Department of Public Services maintains a list of Contractors approved for water main installation and can be contacted to receive a current copy of that list.
- C. The Contractor (when hired by the City) or Developer (when the Contractor is hired to perform work by the Developer), shall provide a written statement of warranty (Warranty Bond) for a period of 2 years from the date of **final acceptance** for water main work or **after meter is installed** for water service work. Warranty work shall cover any necessary cost to repair water main or appurtenance leaks and water main or appurtenance leak damage at no cost to the City of Kalamazoo. Final acceptance on all water main and appurtenance work shall not occur until all items have been inspected by the Engineer, passed all required testing, as well as receipt and approval of all as built documents. Additionally, final acceptance on a water service will only be given **once the water meter is installed**.
  1. Water service or water main warranty work shall be completed either a prequalified contractor under the inspection of the City of Kalamazoo, or by City of Kalamazoo field service crews. All warranty work shall be paid for by the Developer or the Contractor.
- D. The Contractor is responsible for field locating all work which has not yet received final acceptance by the City of Kalamazoo. All damage to work that has not received final acceptance is the responsibility of the Contractor.

## PART 2 PRODUCTS

All Products shall be supplied new from the manufacturer and certified new from the supplier. No second hand or salvaged material shall be allowed. All products shall be **“Buy American”** unless otherwise specified in this section.

### 2.01 DUCTILE IRON

#### A. Ductile Iron (DI) Pipe Specifications:

1. Ductile Iron Pipe shall be manufactured in accordance with American National Standards Institute (ANSI) and American Water Works Association (AWWA) ANSI/AWWA C150/A21.50 and C151/A21.51. Pipe shall be minimum thickness Class 52 pipe. Flanged pipe shall be manufactured in accordance with ANSI/AWWA C 115/A21.15. Pipe through concrete floors or foundations shall be minimum thickness Class 53 pipe.
  - a. Water pipe must be lined with a standard thickness cement mortar lining sealed with a bituminous seal coat in accordance with ANSI/AWWA C104/A21.4, unless otherwise required. The outside of the pipe must be coated with the standard bituminous seal and each length of pipe must be marked with the following information
    - 1) Metal thickness class.
    - 2) Net weight of the pipe without lining.
    - 3) The nominal size.
    - 4) The manufacturer's identifying symbol.
  - b. Underground pipe shall be push on or mechanical joints and above ground pipe shall be flanged joints with gaskets meeting the requirements of ANSI/AWWA C111/A21.11. Nitrile or fluoroelastomer gaskets shall must be used as indicated on the plans and in locations of known or suspected soil or groundwater contamination as necessary. Gaskets provided will be specified based on the type of contamination that is encountered. Each joint shall contain serrated silicon bronze electrical continuity wedges as directed by the Engineer or authorized representative. 4 to 6 inch pipe shall use 2 wedges, 8 to 12 inch pipe shall use 3 wedges, and 16 inch and above shall use 4 wedges.
  - c. Pipe used in conjunction with Horizontal Directional Drilling operations shall be Flex-Ring or TR FLEX joints.

#### B. Restrained Joints

1. Restrained joints shall meet the requirements of ANSI/AWWA C111/A21.11, and AWWA/ANSI C110/A21.10 or ANSI/AWWA C153/A21.53.
2. Mechanical restrained joints shall be EBAA Iron Megalug series 1100, Romac Romagrip, Ford Series 1400, or approved equal.
  - a. Restraint devices for nominal pipe sizes 4 inch through 54 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.
  - b. The devices shall have a working pressure rating of 350 psi for 4 to 16 inch, 250 psi for 18 to 48 inch and 200 psi for the 54 inch size. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.

- c. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
  - d. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.
  - e. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
  - f. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.
  - g. All components shall be manufacture and assembled in the United States.
  - h. Coating for restraint devices shall consist of the following:
    - 1) All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.
    - 2) All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.
    - 3) The coating system shall be MEGA-BOND by EBAA Iron, Inc. or approved equal.
3. Push on restrained joint shall be field locking gasket or Flex Ring style as manufactured by US Pipe, McWane, American USA, or approved equal. Field locking or Flex Ring gasket shall match appropriately to the manufacturer of the pipe used.
  4. Use of threaded rods or thrust blocks as a restrained joint shall not be permitted, unless approved by the Engineer.
  5. Restrained flange adapters shall be EBAA Iron Megaflange series 2100 or approved equal.
    - a. Restrained flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10 (125#/Class 150 Bolt Pattern).
    - b. Restraint for flange adapter shall consist of plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.
    - c. The flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum of 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
    - d. All internal surfaces of the gasket ring (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. The coating shall meet ANSI/NSF-61. Exterior surfaces of the gasket ring shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.
    - e. Restraint Ring coated with MEGA-Bond Restraint Coating System.

C. Ductile Iron Pipe Fittings

1. Fittings, plugs, and gaskets must meet the requirements of ANSI/AWWA C111/A21.11, and AWWA/ANSI C110/A21.10 or ANSI/AWWA C153/A21.53. Cement mortar linings for fittings must meet the requirements of ANSI/AWWA C104/A21.4.
2. Mechanical joints shall be EBAA Iron Megalug series 1100, Romac Romagrip, or approved equal.
3. Restrained flange adapters shall be EBAA Iron Megaflange series 2100 or approved equal.

2.02 Ductile Iron Valves

- A. All underground valves in sizes from 4 inches to 10 inches shall be reduced wall, resilient-seated gate valves for water supply service meeting the requirements of AWWA C 515. Valves shall be American Flow Control Series 2500, Clow model 2638, or EJ Flowmaster Series resilient seated gate valve, Mechanical joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, stainless steel stem, mechanical joint restraint, and  $\frac{3}{4}$  inch tee head bolts. Valves shall open right (clockwise) and be equipped with standard AWWA operating nut. Nut shall be color coded red. Valves shall have a working pressure rating of 250 psi or greater.
  1. In lieu of a mechanical joint restraint, American Flow Control Series 2500 valves may be equipped with ALPHA joints.
- B. All underground valves 12 inches and larger shall be rubber-seated butterfly valves meeting the requirements of AWWA C 504. Valves shall be Pratt Groundhog Butterfly Valves, by Henry Pratt Company, Clow, M&H, or Kennedy model 4500, mechanical joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, mechanical joint restraint, and  $\frac{3}{4}$  inch tee head bolts. Valves shall open right (clockwise) and be equipped with standard AWWA operating nut. Nut shall be color coded red. Valves shall have a working pressure rating of 250 psi or greater.
- C. All above ground or in pits/vaults valves between 3 inches and 10 inches shall be rubber seated gate valves meeting the requirements of AWWA C515. Valves shall be American Flow Control Series 2500 Resilient Wedge Gate Valve, Clow model 2638, EJ Flowmaster Series, or approved equal with flanged joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, stainless steel bolts, nuts and washers, stainless steel stem, and be equipped with a hand wheel to operate. Valves shall have a working pressure rating of 150 psi or greater.
- D. All above ground or in pits/vaults valves 12 inches and larger shall be rubber seated butterfly valves meeting the requirements of AWWA C504. Valves shall be by Henry Pratt Company, Clow, M&H, or Kennedy, flanged joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, and  $\frac{3}{4}$  inch stainless steel bolts, washers and nuts. Valves shall open right (clockwise) and be equipped with standard wheel to operate. Valves shall have a working pressure rating of 150 psi or greater.
- E. All underground valves in sizes from 4 inches to 16 inches used in combination with a tapping saddle shall be reduced wall, resilient-seated gate valves for water supply service meeting the requirements of AWWA C 515. Valves shall be American Flow Control Series 2500, Clow model 2638, EJ Flowmaster Series with one flanged and one mechanical joint ends with rubber gaskets (per AWWA/ANSI C 111/A21.11), ductile iron body, stainless steel stem, mechanical joint restraint, and  $\frac{3}{4}$  inch tee head bolts or approved equal. Valves shall open right (clockwise) and be equipped with standard AWWA operating nut. Nut shall be color coded red. Valves shall have a working pressure rating of 250 psi or greater.

- F. All valves used in conjunction with a fire service line shall be Mueller R-2361-6 Outside Screw and Yoke (O.S.&Y.) with sample tap or approved equal. The stem shall be type 304 stainless steel. Sample tap shall have a 4 ½ inch brass nipple, brass ball valve, and brass plug meeting NSF/ANSI Standard 61 requirements. Sample tap shall be ½ inch for 4 inch and smaller valves and ¾ inch for valves larger than 4 inch.
- G. All valves installed using the insertion style method shall be an all stainless steel body Resilient Wedge Gate Valve designed for permanent use in potable water systems. The design will allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service without system shutdown. No restraining devices, restraining fasteners, or transition gaskets shall be required for the installation or operation of the valve. Valves in sizes 4 inches to 12 inches shall be Hydra-Stop Insta-Valve 250 or approved equal. 16 inch valves shall be Hydra-stop Insta-Valve Plus 250 or approved equal.

## 2.03 HYDRANTS

- A. All fire hydrants shall be American Flow Control or EJ and shall meet the requirements of AWWA C502. Hydrants shall be provided as complete units including hydrant, hydrant marker, pipe, pipe fittings and valve meeting section 2.01, 2.03 and 2.04 requirements. Hydrants shall be supplied for a bury depth of 5.5 feet. The hydrant barrel shall be painted safety yellow by the manufacturer. Hydrant caps and operating nut shall be painted John Deere green by the manufacturer.
  - 1. American Flow Control hydrants shall be 5 ¼ inch Waterous Pacer Traffic Model WB67-250. Hydrants shall be supplied with a 16 inch upper standpipe length. The Hydrant will come equipped with a bronze upper valve washer. In lieu of a mechanical joint restraint, hydrants may be equipped with ALPHA joints.
  - 2. EJ hydrants shall be WaterMaster Model 5BR250 with snow barrel.
- B. Hydrants shall come equipped with a Carrol Drain. Drain piping shall be made of type 304 stainless steel. External port shall have removable cap for flushing hydrant. Carrol Drain assembly shall be constructed so that it is removable when replacement of assembly is necessary.
- C. Hydrants shall have two 2 ½ inch national standard hose connections, 7.5 threads per inch, OD of threads 3 1/16 inch and one 5 inch integral "STORZ" type nozzle connection. Hose nozzle cap nut, weather shield hydrant operating nut, Storz nozzle cap nut, and Carrol Drain cap nut shall be square 15/16 inch at bottom of nut tapered to 13/16 inch at top (Waterous reference #19). The hydrant mechanism shall be on a non-rising stem opening clockwise. Chains shall not be supplied with the hydrant caps.
- D. Hydrants shall be equipped drip valve, tapped for plug. The drip valve system shall be bronze. Draining system shall be positively activated by the main operating rod, meaning the drip valve will open when the hydrant is closed. Hydrant shall be provided with plug removed.
- E. Hydrants shall have a 6 inch shoe with mechanical joint connections in conformance to ANSI/AWWA C115/21.11.

## 2.04 FIRE HYDRANT MARKER

- A. The fire hydrant sign shall be installed on a galvanized 2 pound sign post.
- B. The fire hydrant sign shall be aluminum 8 inch x 18 inch (MDOT type III-A) with hydrant symbol and down arrow of a reflective material.
- C. Fire hydrant mounted marker whips shall be 4 feet x 3/8 inch solid pultrusion fiberglass shaft, with seven (7) 6 inch bands of E.G. reflective sheeting of alternating lime green and red color.

Marker shall have a single solid stainless steel spring with aluminum threaded insert, and use Zinc coated bolt & mounting hardware.

## 2.05 TAPPING SLEEVES

- A. Tapping sleeves for size on size taps or 12 inch and larger sleeves:
  - 1. Model shall be American Flow Control series 2800-C, Tyler Union, Smith-Blair series 665, Romac style SST III, Ford style FTSS, Ford MJTS, or approved equal.
  - 2. Ductile Iron Tapping Sleeves.
    - a. Sleeves shall be of construction meeting ASTM A536. Side flange seals shall be O-ring type of round cross-sectional shape.
    - b. All sleeves to include the end joint accessories and split glands necessary to assemble sleeve to pipe.
    - c. Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.
  - 3. Stainless Steel Tapping Sleeves.
    - a. Sleeves shall be 18-8 type 304 Stainless Steel in accordance with AWWA C223.
    - b. Bolts, nuts, and washers shall be 18-8 Type 304 Stainless Steel. Nuts shall be heavy hex, and coated to prevent galling.
- B. Tapping sleeves smaller than 12 inch which are not size on size:
  - 1. Model shall be Smith-Blair series 665, Romac style SST III, Ford style FTSS, or approved equal.
  - 2. Sleeves shall be 18-8 type 304 Stainless Steel in accordance with AWWA C223.
  - 3. Bolts, nuts, and washers shall be 18-8 Type 304 Stainless Steel. Nuts shall be heavy hex, and coated to prevent galling.
- C. Line Stop Tapping Sleeves and appurtenances:
  - 1. Model shall be Hydra-Stop HSF 250 Patriot or approved equal
  - 2. Body shall be type 304 Stainless Steel in accordance with AWWA C223.
  - 3. Blind Flange shall be Epoxy Coated Carbon Steel or type 304 Stainless Steel.
  - 4. Bolts, Nuts and Washers shall be type 304 Stainless Steel.
  - 5. Completion Plug shall be HSF 250 Push and Pin Style, made of reinforced composite polymer.
  - 6. Completion Plug O-ring shall be BUNA-N Rubber
  - 7. Completion Plug Pins shall be SAE Grade 8, Zinc coated to prevent corrosion
  - 8. Completion Pin Plug shall be type 304 Stainless Steel, coated to prevent galling.
  - 9. Flange O-Ring shall be BUNA-N Rubber.
- D. All gaskets shall be Nitrile in compliance with NSF-61.
- E. No special tools shall be required other than standard socket wrench.
- F. Flange end pilot dimensions to be in compliance with MSS-Sp-60.

## 2.06 AIR RELEASE VALVES

- A. Air Release Valves – All air release valves shall be manufactured per ANSI/AWWA C512-04. Cla-Val Series 36 Combination Air Valves, or approved equal. The valves shall be of the size listed in the plans.
1. The combination air valve shall combine the operating features of both an air and vacuum valve and an air release valve in one housing. The air and vacuum valve portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allow air to reenter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, or other emergency. The air release valve portion shall automatically release small amounts of air from the pipeline while it is under pressure.
  2. The inlet and outlet of the valve shall have the same cross section area. The float shall be guided by a stainless steel guide shaft and seat drip tight against a synthetic rubber seal. 4 inch and larger valves shall have dual guided shafts of hexagonal cross section and a protective discharge hood.
  3. The float shall be of all stainless steel construction and capable of withstanding maximum system surge pressure without failure. The body and cover shall be concentrically located and of ductile iron and the valve internal parts shall be stainless steel or Buna-N rubber.
  4. All 1 inch and 2 inch valves shall be NPT. All valves 4 inch and larger shall be flanged.
- B. Vent piping shall be 2 inch diameter, with copper piping below grade and galvanized piping above grade.
- C. Air vent screens shall be black PVC, with NPT threaded to match the size of the connection pipe. Screen shall be one-piece 304 Stainless, mesh size 100. Silver reflective tape shall be placed on the vent pipe.
- D. An air release valve sign shall be installed on a galvanized 2 pound sign post.
- E. The valve sign shall be aluminum 8 inch x 18 inch (MDOT type III-A) with valve symbol and down arrow of a reflective material.

## 2.07 REPAIR SLEEVES

- A. All repair sleeves shall be certified NSF/ANSI 61-G and 372, and be in accordance with AWWA C230. Sleeves without service tap shall be Smith – Blair model 226, PowerSeal model 3121, or approved equal. Sleeves with service tap shall be Smith – Blair model 238, PowerSeal model 3131, or approved equal.
- B. Sleeves shall use Type 304 Stainless Steel hardware in accordance with ASTM A193/A194. Sleeves shall have conductivity feature.
- C. The repair sleeves shall be of the full circle type designed to repair a fully broken (completely separated) pipe and shall be rated for a working pressure of not less than 150 psi. Repair sleeves 12 inches or under in size will have a single joint.
- D. The length of the sleeves shall not be less than 7 ½ inches. Sleeves shall have no less than three (3) guide bolts of the minimum specified length. Sleeves of longer length shall have an additional guide bolt for every two (2) inches of additional band length.
- E. Each sleeve shall consist of a sealing gasket, a non-magnetic stainless steel band with contact buttons protruding through specially prepared gaskets, clamp lugs, bolts and nuts.
- F. No welding will be permitted in the manufacture of stainless steel repair sleeves except for the addition of the tap to repair sleeve.



- G. The lugs shall not be deformed in the process of attachments to the band during assembly or during removal in the field.
- H. The gasket shall be natural rubber, nitrile or approved equal and shall be of the tapered overlap design to give a pressure tight fit on the pipe surface to form a leak tight, permanent seal when the repair sleeve is installed. The gasket shall have a grid pattern to conform pipe surface irregularities.
- I. The gasket shall have a stainless steel bridge plate flush mounted and securely bonded into the gasket during the molding of the gasket.

#### 2.08 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement must be manufactured using 8 mil thick virgin polyethylene in accordance with ANSI/AWWA C105/A21.10. Provide the tube size recommended by the manufacturer to protect the pipe and fitting sizes. Provide adhesive tape for the polyethylene tube as recommended by the manufacturer. Tape for repairing damage to the polyethylene must have a life expectancy equal to or greater than the life expectancy of the polyethylene.

#### 2.09 STEEL BLOW-OFF PIPE

- A. Steel pipe shall be hot dipped galvanized meeting the requirements of ASTM A53.

#### 2.10 WATER SERVICES AND APPURTENANCES

##### A. Copper Service Lines

- 1. Copper pipe shall be used for service lines which are ¾ inch, 1 ¼ inch and 2-inch. All copper services shall conform to AWWA C800. Water service pipe shall be copper meeting the requirements of ASTM B88, type K.
- 2. All appurtenances on copper service lines shall be flare copper connections. Other connections may be used in lieu of flare copper connections if approved by the Engineer prior to installation.

- B. All water service appurtenances shall meet the requirements of AWWA C800 and be from The Ford Meter Box Company, Inc., A.Y. McDonald Mfg. Co., or as approved by the Engineer. All water service appurtenances for 2 inch and smaller are as follows:

##### 1. ¾ inch services:

- a. Corporation Stop ¾ inch – FB600-3-NL or AY McDonald 74701B NL (3/4 inch)
- b. Service Saddle – Smith-Blair 311(4 to 12 inch water main), Smith-Blair 313 (16 to 24 inch water main), Romac 101U(4 to 12 inch water main), Romac 202SSU (16 to 24 inch water main), Ford F101(4 to 12 inch water main), or Ford F202(16 to 24 inch water main).
- c. Curb Stop (for use when reducing a 1 ¼ inch street service to ¾ inch yard service) – Ford B21-555-NL, C18-35-NL, and C28-33-NL
- d. Curb Stop (when using ¾ inch street service) – Ford B22-333-NL or AY McDonald 76100 NL (¾ inch)
- e. Brass Fittings – All brass fittings such as tees, elbows, caps, nipples and similar items shall be manufactured in the U.S.A.
- f. Couplings – Ford C22-33-NL or AY McDonald 74758 NL (¾ inch)

##### 2. 1 ¼ inch services:

- a. Corporation Stop – Ford FB600-45-NL or AY McDonald 74701B NL (1 x 1 ¼ inch)

- b. Service Saddle – Smith-Blair 311(4 to 12 inch water main), Smith-Blair 313 (16 to 24 inch water main), Romac 101U(4 to 12 inch water main), Romac 202SSU (16 to 24 inch water main), Ford F101(4 to 12 inch water main), or Ford F202(16 to 24 inch water main).
  - c. Curb Stop – Ford B22-555-NL or AY McDonald 76100 NL (1 ¼ inch)
  - d. Brass Fittings – All brass fittings such as tees, elbows, caps, nipples and similar items shall be manufactured in the U.S.A.
  - e. Couplings – Ford C22-55-NL or AY McDonald 74758 NL (1 ¼ inch)
3. 2 inch services:
- a. Tapping Valve – Ford B11-777-NL
  - b. Service Saddle – Smith-Blair 313, Romac 202S, or Ford F202
  - c. Brass Fittings – All brass fittings such as tees, elbows, caps, nipples and similar items shall be manufactured in the U.S.A.
  - d. Couplings – Ford C44-77-NL
4. Water meters – All water meters shall be Neptune Water Meters. They shall be supplied and installed by the City of Kalamazoo.
- C. All water service appurtenances larger than 2 inch shall be in accordance with section 2.01.
- D. All multiple meter settings with more than two meters excluding the fire meter shall use a fabricated meter manifold. Fabricated manifold shall be manufactured as follows:
- 1. Water manifold shall be made using 304 Schedule 40 Stainless Steel pipe.
  - 2. Inlet and outlets shall be threaded or welded flange. End cap shall be welded flange with a blind flange for future additions.
- E. Conduit used as sleeves shall be schedule 40 PVC or approved by Engineer.

## 2.11 METER SETTINGS

- A. Interior meter settings shall use components from the following manufactures.
- 1. 1 inch meter – Ford KV23-454W-NL Angle Valve, Ford C38-44-2-625-NL, Brass Nipple, Apollo 94ALF-105-01A Ball Valve or approved equal
  - 2. 1½ inch and 2 inch meter – Ford FV13-777W-NL Angle Valve, Ford CF35-66NL (1 ½ inch), Ford CF 35-77-NL (2 inch), Brass Nipple, Watts LFFBV-3C Ball valve or approved equal.
  - 3. 3 inch and larger- rubber seated gate valves meeting the requirements of AWWA C515. Valves shall be American Series 2500 Resilient Wedge Gate Valve with hand wheel by American or equal flanged joint with rubber gaskets (per AWWA/ANSI C 111/A21.11), and be equipped with a hand wheel to operate, Hymax 874-56-03008812 (3 inch), 874-56-04010812 (4 inch), 874-56-06016312 (6 inch), or 874-56-08021712 (8 inch) Flange Adaptor, and flange to plain end ductile or type 304 stainless steel spool piece.
- B. Exterior meter settings shall use components from the following manufactures.
- 1. 5/8 inch meter – Ford V81-22-33-NL
  - 2. ¾ inch meter – Ford V83-22-33-NL
  - 3. 1 inch meter – Ford V84-22-55-NL Copper setter

4. 1 ½ inch and 2 inch meter – Watts LFFBV-3C Ball Valve or approved equal. Ford CF-77-1-937-NL Meter Flange, Ford C28-77-NL Coupler, and Brass Nipple.
5. 3 inch and larger – All above ground or in pits/vaults valves 3 inches and larger shall be rubber seated gate valves meeting the requirements of AWWA C515. Valves shall be American Series 2500 Resilient Wedge Gate Valve with hand wheel by American or equal flanged joint with rubber gaskets (per AWWA/ANSI C111/A21.11), and be equipped with a hand wheel to operate, Hymax 874-56-03008812 (3 inch), 874-56-04010812 (4 inch), 874-56-06016312 (6 inch), or 874-56-08021712 (8 inch) Flange Adaptor, and flange to plain end ductile or type 304 stainless steel spool piece.

#### 2.12 FIRE SERVICE APPURTENANCES

- A. All fire service appurtenances shall meet the requirements of AWWA/ANSI C110/A21.10, AWWA C115, and be from the following manufacturers.
  1. Double Check Valve Detector Assembly – Zurn Wilkins Model 350DA or 350ADA with meter setting, AMES Colt LFC300 with meter setting, or approved equal. The City of Kalamazoo will supply the 5/8 inch water meter.
  2. Reduced Pressure Zone Assembly – When using a RPZ in lieu of double check valve for a backflow device, a Zurn Wilkins Model 375DA or 375ADA with meter setting, AMES Colt LFC500 with meter setting, or approved equal shall be required. The City of Kalamazoo will supply the 5/8 inch water meter.

#### 2.13 METER BOXES AND VAULTS

- A. All Meter Boxes, Meter Vaults and components shall be from the following manufactures.
  1. Box – Hancor MP NL1 24 0008 - 24 inch x 48 inch or ADS24X48MP 24 inchx48 inch white corrugated meter pit or Engineer approved equal.
  2. Vault – Precast concrete meter vault shall have a 3 inch minimum wall thickness and size shall be depended on number of meters and meter size. The wall shall have steps that are equally spaced 12 inches apart. Meter vault shop drawings shall be submitted to the Engineer and approved for each installation.
  3. Meter Pit Cover – Vestal 32-497, 32-055, 32-104, and 32-046 or approved equal.
  4. Meter Vault Cover – Ford MC-24HH-MB-T

#### 2.14 VALVE BOXES AND VAULTS

- A. Curb Stop Boxes for 1 ¼ inch Service – Bingham & Taylor Fig. No. 4901-B, 94-F with 2 ½” New Style Flush Fit Cover or approved equal. Cover shall be inscribed with the word “water”.
  1. Curb Stop Box extensions shall be cast iron and manufactured by Bingham & Taylor, capable of being mounted directly to the curb stop box.
- B. Gate Valve Box or 2 inch Service Box – the valve box shall be of adjustable length screw type. The valve box shall be a malleable iron casting conforming to subsection 908.03 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction*. This valve box shall either be a two or three piece screw type and the cover shall be inscribed with the word “water.” Valve box 8550 Series (two piece) or 8560 Series (three piece) manufactured by EJ, 4905 size no. 22 manufactured by Bingham & Taylor, or approved equal.
  1. Gate Valve Box extensions shall be cast iron and manufactured by EJ or Bingham & Taylor, capable of being mounted directly to the gate valve box.
- C. Valve Vaults for Insta-Valves – Valve vaults used in conjunction with Insta-Valves shall be constructed with materials as detailed in WA-8-A of the City of Kalamazoo Standard Plans.

They shall be of the diameter specified and in accordance with subsection 823.02 of the Michigan Department of Transportation *Standard Specifications for Construction* for Gate Wells.

- D. Valve Vaults for Air Release Valves – Valve vaults used in conjunction with Air Release Valves shall be constructed with materials as detailed in the latest WA-4-Series or WA-5-Series of the City of Kalamazoo Standard Plans. They shall be of the diameter specified and in accordance with subsection 823.02 of the Michigan Department of Transportation *Standard Specifications for Construction* for Gate Wells.

#### 2.15 BACKFILL MATERIALS

- A. Use materials meeting the requirements of section 902 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction*.

#### 2.16 BELL JOINT LEAK CLAMP

- A. Bell Joint Leak Clamps shall be Smith-Blair Model 274, Ford Meter Box FBC or MJSC style, or approved equal.
  - 1. The bell spigot ring, section connector, and range spacer shall be ductile iron 80-55-06 in accordance with ASTM 536. Fusion bonded epoxy finish shall meet application methods per AWWA C213. Spigot ring design shall be interlocking to allow ease of installation without interrupting the flow of the pipe. The bolt head pocket shall be integral for one wrench installation.
  - 2. Gasket shall be Nitrile Buna-N per ASTM D2000, and certified to NSF/ANSI 61-G & 372.
  - 3. Restraint Rods and Nuts shall be Type 304 Stainless Steel. Restraint Rod shall have rolled threads, and Nut shall be fluoropolymer coated to prevent galling.
- B. Bell encapsulating couplings shall be Ford Meter Box MJBE style.
  - 1. The coupling shall be designed to fully encapsulate the pipe bell. The coupling shall be of split mechanical joint design with independent end seal and side seal gaskets.
  - 2. All welded components shall be constructed with ASTM A 36 carbon steel.
  - 3. The end seal and side seal gaskets shall be virgin NBR formulated for water service. The gaskets shall not require field trimming, cutting or modification.
  - 4. The end seal compression ring shall be manufactured with ductile iron per ASTM A 526 Grade 65-45-12 or ASTM A 36 carbon steel.
  - 5. The coupling shall be coated to an average of 12 mills thickness with a fusion-bonded epoxy that is NSF 61 listed and meeting application methods of AWWA C213.

#### 2.17 COUPLINGS

- A. Wide range couplings shall be Romac Alpha or approved equal.
  - 1. All cast components shall be ductile iron, meeting or exceeding ASTM A 536, grade 65-45-12
  - 2. Grippers shall be ductile iron, meeting or exceeding ASTM A 536, grade 65-45-12.
  - 3. Gaskets shall be SBR compounded for water service per ASTM D2000 and meet NSF61 classification.
  - 4. Bolts and nuts shall be 304 stainless steel.
  - 5. Body shall be epoxy coated, and NSF61 Certified.

2.18 STRUCTURE CASTINGS

- A. All 24 inch structure covers shall be a malleable iron casting conforming to subsection 908.03 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction*. The structure cover shall be series 1040 manufactured by EJ, inscribed with the word "Water".

2.19 STEEL CASING PIPE AND APPURTENANCES

- A. Steel casing pipe shall meet the requirements in accordance with subsection 909.05.D of the 2012 Michigan Department of Transportation *Standard Specifications for Construction* with the exceptions listed below:

- 1. For steel casing pipe jacked under a railroad, replace in its entirety the entry for 30 inch nominal size listed in Table 909-18 with the following:

**Nominal OD and Wall Thickness in Inches Jacked in Place Steel Pipe**

Nominal Size	Nominal Outside Diameter	Wall Thickness
30	30.000	0.406(a)
<ul style="list-style-type: none"> <li>a. Coated or cathodically protected (0.469 inch minimum if uncoated and unprotected)</li> </ul>		

- 2. Steel casing must have a minimum yield strength of 35,000 pounds per square inch (psi) and be in accordance with ASTM A53, Type E or S, Grade A or B and be designed for Cooper E80 loading requirements. In all cases, the allowable jacking strength capacity of the casing pipe shall be capable of withstanding the maximum jacking forces imposed by the operation.

- B. Stainless steel band spacer shall be Advance Products & Systems model SSIM or approved equal. The bands shall be constructed of circular stainless steel bands, which bolt together forming a shell around the carrier pipe. The spacers shall be designed with runners to support the carrier within the casing and maintain a minimum clearance of 1.00 inches between the casing inside diameter (ID) and the spacer outside diameter (OD). The spacers shall contain four modular runners – two on each half. Stainless steel bolts, nuts and washers shall be supplied with the casing spacers.

The band shall be manufacture of 8 inch wide 14-guage T-304 stainless steel. Abrasion resistant runners, having a minimum length of 7 inches and a minimum width of 1 inch, shall be attached to each band to minimize friction between the casing pipe and the carrier pipe as it is installed. Runner material shall be of glass filled polymer with compression strength of 33,000 psi, flexural strength of 40,000 psi, and tensile strength of 27,000 psi. The ends of thall runners shall be beveled to facilitate installation over rough weld beads or the welded ends of misaligned or deformed casing pipe.

Interior surfaces of the circular stainless steel band shall be lined with PVC, or EPDM alternate, having a minimum thickness of .090 inches with a harness of Durometer "A" 85-90.

Recommended position of the spacers is one placed not more than one foot from each end of the casing and pipe joint. Subsequent spacers shall be placed every 6-8 feet apart thereafter.

- C. Casing end seal shall be Advance Products & Systems model AC or approved equal. Pull-on casing end seals shall be manufactured of 1/8 inch thick neoprene rubber assuring excellent chemical resistance and resiliency. End seals must be effectively used in the temperature range of -20 degrees to 190 degrees Fahrenheit. End seals shall include ½ inch wide T304 stainless steel bandings with 100% nonmagnetic worm gear mechanism. End seals shall be seamless, have vulcanized edges, and can be pulled on at the time of construction.

## PART 3 EXECUTION

### 3.01 CONSTRUCTION

- A. The plans show the locations of existing utilities in accordance with available data. If the work requires precise information on the location of existing utilities, the Contractor will expose utilities shown on the plans to determine the actual locations.

Do not disturb or cut into existing in-service water mains. If the operation of valves in existing water mains is required, notify the City of Kalamazoo a minimum of 3 working days in advance. Coordinate scheduling of water main connections with the City of Kalamazoo. Secure the Engineer's or authorized representative's approval of the schedule before beginning the work.

The City of Kalamazoo will open or close in service valves and provide on-site inspections for all water main and water service installations. The City of Kalamazoo will perform this work for an estimated time and material charge. The cost of opening and closing valves and on-site inspection will need a separate contract with the City of Kalamazoo prior to start of work. This does not apply to work being contracted by the City of Kalamazoo.

Minimize the out of service time for existing water mains. Make connections at night, on Sundays, or on holidays, as conditions require or as approved by the City of Kalamazoo. Minimize interference with the water supply if abandoning existing water mains and incorporating new water mains into the water system.

No trees or permanent structures shall be placed within 10 feet of the centerline of the water main or service line.

### 3.02 TRENCH EXCAVATION

- A. Excavate water main trenches to the lines and grades shown on the plans in accordance with modifications approved by the Engineer, or authorized representative, or to meet or bypass existing utility structures. Excavate trenches to the depths shown on the plans to provide 5 feet of cover from top of water main to the final grade. Excavate trenches to the widths shown on Michigan Department of Transportation Standard Plan R-83 Series.
- B. Excavate the bottom of the trench to the required grade to allow 6 inches of bedding for the pipe. Do not block under the pipe.
- C. Maintain trenches for water mains free of ground or surface water by pumping or as otherwise approved by the Engineer or authorized representative
- D. Install, and later remove, temporary timber bracing, as required to prevent movement or damage to new or existing water mains or adjacent utilities.
- E. During backfilling, carefully remove supports for sheeted and braced excavations to prevent earth banks or adjacent streets from collapsing.
- F. The Contractor may leave sheeting and bracing in place during backfilling and remove after completing backfilling operations. The Contractor may leave sheeting and bracing in place, if approved by the Engineer and the Contractor cuts it off 5 feet below the ground surface.

### 3.03 DISPOSAL

- A. Dispose of waste material as specified in section 205 of the 2012 Michigan Department of Transportation *Standard Specifications for Construction*.

### 3.04 LAYING OF THE PIPE

- A. Install the pipe joint restraint system in accordance with the manufacturer's recommendations, or as directed by the Engineer. Assemble the pipe in the trench. If deflections at joints are required by changes in grade, alignment, or to plumb valve stems, ensure deflections of bell and spigot joints and mechanical fitting joints do not exceed three-quarters of the maximum deflection recommended by the joint manufacturer or that allowed by AWWA C600, whichever is less. Do not store or leave tools or other objects in the pipe.
- B. Provide restrained joints as indicated on the plans. No tie rods or thrust blocks shall be allowed unless approved by the Engineer or authorized representative.
- C. Proper actuation of the gripping wedges of the mechanical joint restraint shall be ensured with torque limiting twist off nuts.
- D. The Contractor shall provide a written statement of warranty (Warranty Bond) for a period of 2 years from the date of **final acceptance (after meter is installed)**. Warranty work shall cover any necessary cost to repair water main or appurtenance leaks and water main or appurtenance leak damage at no cost to the City of Kalamazoo. Final acceptance will only be given **once the water service meter is installed**.
- E. Pipe shall be laid with bell ends facing the direction of laying, unless otherwise directed by the Engineer or authorized representative. When pipe is laid on a grade of 10 percent or greater, the laying shall start at the bottom and proceed upward with the bell ends of the pipe upgrade.
- F. Install silicon bronze wedges between all push-on joint pipes to allow for underground location and thawing of pipeline. 4 to 6 inch pipe shall use 2 wedges, 8 to 12 inch pipe shall use 3 wedges, and 16 inch and above shall use 4 wedges at each pipe joint.
- G. Pipe shall be restrained in accordance with Table 3.1.

**Table 3.1 Pipe Thrust Restraint Table**

NON-POLYWRAPPED PIPE								
Pipe Size (Inches)	90° Bend	45° Bend	22.5° Bend	11.25° Bend	Tee*	Reducer (One Size)	Reducer (Two Sizes)	Dead End
4	44	18	9	5	42	-	-	42
6	62	26	13	7	59	31	-	59
8	82	34	17	9	78	33	56	78
10	100	42	20	10	94	32	58	94
12	119	50	24	12	110	33	59	110
16	157	65	32	16	143	61	85	143
20	195	81	39	20	173	61	109	173
24	233	97	47	23	204	61	111	204
30	288	120	58	29	246	86	134	246
POLYWRAPPED PIPE								
Pipe Size (Inches)	90° Bend	45° Bend	22.5° Bend	11.25° Bend	Tee*	Reducer (One Size)	Reducer (Two Sizes)	Dead End
4	62	26	13	7	60	-	-	60
6	88	37	18	9	84	44	-	84
8	117	49	24	12	111	47	80	111
10	142	59	29	14	133	45	82	133
12	170	71	34	17	158	47	84	158
16	224	93	45	23	203	87	121	203
20	278	116	56	28	247	87	155	247
24	332	138	66	33	291	87	159	291
30	411	171	82	41	351	123	191	351
* Length of restraint for branch; use the size of the branch Consult Engineer for scenarios not included in table.								

**3.05 INSTALLATION OF PIPE INVOLVING HORIZONTAL DIRECTIONAL DRILLING**

- A. Horizontal direction drilling (HDD) is a method of trenchless construction using a surface launched steerable drill tool controlled from a mobile drilling frame, and includes a field power unit, drilling fluid mixing system, and mobile spoils extraction system. The work generally consists of three phases:
1. Drilling a pilot hole from the surface or pit at a starting point to an exit pit at the surface beyond the obstacle or area that is to be avoided.
  2. Reaming the pilot hole to make it large enough for the pipeline to be installed.
  3. Pipeline is pulled into place. During the pipe pulling operation, drilling fluid (a bentonite, water, and polymer solution) is injected to stabilize the hole, remove cuttings, and lubricate the pipe.
- B. Coordination



1. Drilling operations shall not interfere with, interrupt or endanger surface features or surface activities.
2. When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of drilling operation are encountered, the Contractor and Engineer shall review the situation and jointly determine the feasibility of continuing drilling operations, making adjustments or switching to an alternative construction method.
3. The contractor shall familiarize themselves with the geologic characterization of the soil stratum at the proposed drilling path. The Contractor shall be responsible for informing the Engineer of any changes that are required in the directional drilling procedure due to geologic conditions.
4. Launching and recovery pits shall be as small as practical. Dewatering of pits and excavations shall be done in accordance with the City of Kalamazoo Standard Specifications. When groundwater is encountered, the Contractor shall provide a dewatering system of sufficient capacity to keep any excavation free from water until the backfill operation is in progress. Dewatering shall be performed in a manner that removal of soil particles is held to a minimum. Water from the dewatering system shall be desilted before discharge. Methods of dewatering and desilting, including all costs shall be the Contractor's responsibility and are included in the Horizontal Directional Drilling Water Main pay item.
5. Utilities shown on the plans are approximate. In areas where there is a potential conflict, the Contractor shall dig up and verify the locations and elevations of the utilities at no additional expense to the City. The Contractor shall assume full responsibility for the protection fall utilities, structures and their foundations which may be affected by the work.
6. Before beginning the drilling process, the Engineer shall stake the proposed drill path.

C. Drill Path Survey

1. The Drill path shall be walked in the presence of the Engineer and the Contractor with the guidance system that shall be used for each segment of drill path. The contractor shall locate and record any surface and subsurface magnetic variations or abnormalities and all points of interference, as well as verifying all utility locations and corresponding utility maps. Should any discrepancies arise between utility maps, field locations and guidance system findings, the Contractor shall clarify all discrepancies prior to beginning drilling operations. The drill path survey shall be performed no earlier than two days prior to commencing drilling operations. Provide the Engineer 48-hour notice of drill path survey.

D. Equipment

1. The drilling equipment shall be capable of placing the pipe within the planned line and grade without inverted slopes.
2. The drilling equipment shall be capable of pulling product pipe from either the downstream or upstream pit locations. The equipment must be adequately sized for the application.
3. The guide system shall have the capability of measuring inclination, roll and azimuth. The guidance system shall have an independent means to ensure the accuracy of the installation. The Contractor shall demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance

system shall be capable of generating a plot of borehole survey for the purpose of a record drawing. The guidance system shall meet the following specifications:

Inclination:	Accuracy	+0.05
	Range	+90
	Repeatability	+0.02
Roll:	Accuracy	+0.05
	Range	+90
Azimuth	Accuracy	+0.05
	Range	+90

4. Equipment setup requirements at the launch and recover locations shall be determined by the Contractor in accordance with the Plans and shall be submitted to the Engineer prior to commencement of drilling operations.

E. Pilot Hole Drilling

1. The entry angle of the pilot hole and the drilling process shall maintain a curvature that does not exceed the allowable bending radii of the carrier pipe per the manufacturer's recommendations.

F. The contractor shall follow the pipeline alignment as shown on the Plans, within the specification requirements. The location and depth of the drill head in relation to the profile and centerline of the alignment shall be determined at a maximum of ten-foot intervals. Acceptable tolerance shall be 0.5 feet variation from the centerline of the pipe in both vertical and horizontal directions (1-foot tolerance window).

G. In the event of difficulties at any time during drilling operation requiring the complete withdrawal from the tunnel, the Contractor shall either be allowed to withdraw and abandon the tunnel and begin a second attempt at a different location. The alternate locations shall be approved by the Engineer before the Contractor withdraws.

H. Access pits shall be at the beginning and end segments shown on the Plans. Intermittent pits shall be approved by the Engineer prior to proceeding with drilling operations. No intermittent access pits shall be allowed in Railroad Right of Ways.

I. Installing the Carrier Pipe:

1. After the pilot hole is completed, the Contractor shall install a swivel to the reamer and commence pullback operations.
2. Reaming diameter shall not exceed 1.5 times the diameter of the carrier pipe being installed.
3. The carrier pipe being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.
4. Pullback forces shall not exceed the allowable forces for the carrier pipe.

J. The Contractor shall allow sufficient lengths of carrier pipe to extend past the termination point to allow connections to adjacent pipe sections, tees, or fittings. Pulled pipe shall be allowed 24 hours of stabilization prior to making tie-ins. The length of extra carrier pipe shall be at the Contractor's discretion.

K. Field Inspection

1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Engineer at the Contractor's expense.
2. Defective material shall be marked with an "X" in pink paint and shall be removed from the job site.

L. Drilling Fluid Containment and Disposal Requirements

1. The contractor shall contain, handle, and dispose of drilling fluids in accordance with the following requirements:
  1. All drilling fluid and fluid additives shall be disclosed, and Material Safety Data Sheets (MSDS) shall be provided to the permit agency and the Engineer upon request.
  2. Excess drilling fluid shall be confined in a containment pit at the entry and exit location until recycled or removed from the site.
  3. Precautions shall be taken to ensure that drilling fluid does not enter the roadways, streams, municipal storm or sanitary sewer lines, and/or any other drainage system or body of water.
  4. When installing below railroads, vents shall be installed on either side of the railroad tracks to direct any excess drilling fluid to a containment area and to prevent unintended surfacing of drilling fluid within the Railroad Right of Way.
  5. Unintended surfacing of drilling fluid shall be contained at the point of discharge and recycled or removed from the site.
  6. Drilling fluids that are not recycled and reused shall be removed from the site and disposed at an approved disposal site.
  7. Drilling fluids shall be completely removed from the construction site prior to backfilling or restoring the site.

3.06 ABANDONING WATER MAINS

- A. Remove and dispose of abandoned pipe, gate boxes, or other appurtenances, as necessary for placement of a new water main at no additional cost to the City of Kalamazoo. Remove portions of gate boxes to at least 3 feet below the pavement surface under the road, and to at least 12 inches below the planned grade outside the road. If the Engineer determines abandoned mains may remain in place, cap the end of pipe with cap and megalug or as directed by the Engineer or authorized representative. If shown on the plans or directed by the Engineer or authorized representative, fill abandoned water mains with non-structural flowable fill.

3.07 VALVES

- A. Prior to installation, all valves shall be fully operated open and close to verify its functionality and number of turns. Set and join valves to the water mains as required for cleaning, laying, and jointing the required type of pipe, as shown on the plans. Install valves as required by the contract, or as approved by the Engineer. Place the valve stems plumb. Install valves to not bear on the pipe. Install anchor coupling with valves installed on tees or crosses, with swivel gland located on the valve side of the anchor coupling.
- B. When installing 12 inch and larger valves (Butterfly Valves), the operating nut shall be located on the side of the valve furthest from the centerline of the roadway, unless otherwise directed by the Engineer.

### 3.08 LIVE TAPS TO IN SERVICE WATER MAINS

- A. Prior to tapping of the main contractor shall disinfect all pipe, appurtenances, tapping machine with chlorinated water.
- B. Contractor shall install all necessary tapping appurtenances according to manufacturer's recommendation.
- C. Contractor shall use equipment which allows the tapping machine to rinse out metal shavings and tap water main per manufacturer's recommendations. No tap 4 inches or larger shall be allowed within 4 feet from any joint, fitting, or exiting tap regardless of location of tap. 1 ¼ inch taps located within 10 feet of previous tap shall be offset 15 degrees.
- D. Once tapping is complete Contractor shall disinfect all exposed water main and appurtenances with chlorinated water.

### 3.09 VALVE BOXES.

- A. Provide valve boxes that do not transmit shock or stress to the valve. Place valve boxes plumb over the operating nut of the valve, with the box cover flush with the pavement, or as approved by the Engineer or authorized representative. Provide firm support for valve boxes.
- B. Valve boxes shall be installed, centered and plumbed over the operating nut of the gate valve. The area around the valve box shall be back-filled with Granular Material Class II placed in layers not to exceed 12 inches, and thoroughly compacted to the required density. The Contractor shall take due care to prevent the box from shifting during backfilling operations. The tops of the valve boxes shall be flush with the established pavement or ground surface.

### 3.10 ADJUSTING OR RECONSTRUCTING WATER SHUT OFFS OR VALVE BOXES

- A. Adjust and reconstruct water shutoffs or valve boxes to the final grade or as approved by the Engineer or authorized representative. Replace shutoff or gate box materials damaged during adjustment or reconstruction, as determined by the Engineer, or authorized representative, at no additional cost to the City of Kalamazoo.

### 3.11 WATER SERVICES

- A. Water Services shall not be connected to the water main until approved by the Engineer or authorized representative.
  - 1. The standard size for all new services shall be 1 ¼ inch. The property owner/developer may request a larger size if needed.
  - 2. ¾ inch service materials may only be used when performing repairs or partial replacements of an existing ¾ inch service, or when replacing the yard service of a ¾ inch service. When replacing a complete street side service of a ¾ inch service, a new 1 ¼ inch tap will be completed, new 1 ¼ inch street service line installed, and reduced down at the curb shut off per section 2.10.
- B. Tap water main per section 3.08.
- C. When more than two meters excluding the fire meter are required to be set on a single service line, a fabricated meter manifold shall be installed.
- D. Water Services 2 inch and Smaller
  - 1. Construct services from the distribution main to the water meter. Lay services in a straight line perpendicular to the water main unless approved by the Engineer or authorized representative. Construct service with a continuous piece of copper from the corporation stop to the curb stop and curb stop to the water meter unless

approved by the Engineer or authorized representative. Services over 300 feet will require an exterior meter setting (meter pit).

2. All couplings shall be located as close to the water main as possible, but outside roadway unless approved by the Engineer.
3. The use of thread sealant shall be not be allowed on flare fittings.
4. No splices shall be allowed for 1 ¼ inch or smaller yard services 90 feet and shorter in length.
5. Tap and curb shut off locations shall be no closer than 5 feet to edge of driveways. If a service is required to be abandoned due to improper location, service shall be fully abandoned at the water main tap location and new service installed the developer's expense. Corporation stop shall be shut off, copper piping removed, and copper disc installed on the corporation stop.
6. If finish grade changes from plan grade after installation of service, curb shutoff shall be adjusted to 5 foot bury depth at the developer's expense.
7. When the street service is installed separately from the yard service a copper disk shall be installed on the yard side of the curb valve per the manufactures recommendations as approved by the Engineer or authorized representative.

E. Water Services Greater than 2 inch

1. For services entering a building with no basement, install the stand pipe flange 12 inch from the finished floor elevation and 6 to 12 inches away from any walls. Install the flange pipe so two bolt holes are parallel from each wall (two hole). For services entering a building with a basement or into a concrete vault, install the stand pipe flange 6 to 12 inches off the wall. Install the flange pipe so that two bolt holes are parallel to the floor, normal to the wall. For all services entering a building, the service line shall be located in room located on an outside wall of the building, with enough room to maintain the service.
2. Contractor shall complete installation of service prior to pressure testing and disinfection. The Contractor shall hydrostatic test the complete fire service from the nearest outside valve to first valve (OS&Y) before installing the fire check valve per section 3.22. Service shall be cleaned, flushed and tested per section 3.23. No connection shall be made to these services until after pressure test is complete and consecutive negative bacterial test results have been received in accordance with sections 3.22 and 3.23 of this specification, and the water main approved by the Engineer or authorized representative.
3. No adapter flange or grooved pipe joint shall be used on any portion of the service to be maintained by the City of Kalamazoo, with the exception of the meter side of an OS&Y fire service valve.
4. For service lines with multiple meter settings, a valve the same size as the incoming service line shall be installed prior to the tee or manifold. If one of the meter settings is for a fire service, the valve shall be an OS&Y valve in accordance with section 2.02.F.

F. Construct the service pipe with at least 5 feet of cover, unless Engineer or authorized representative requires additional depth.

G. Make all service connections, and transfers. Maintain and protect, at no additional cost, existing service connections requiring transfer, but not shown on the plans, until reconnection or disposal.

- H. If relocating a portion of water service, shut down the water service by method approved by the Engineer or authorized representative.
- I. Service lines entry points into the structure shall be sealed with hydraulic cement or mastic putty and oakum to prevent groundwater infiltration. For ductile iron pipe services, link seals should be used as the preferred method.
- J. FIRE SERVICES
  - 1. The Contractor shall notify the Engineer or authorized representative a minimum of 3 working days prior to flushing the fire service or testing the fire system capacity.
  - 2. All fire services shall have an OS&Y valve meeting the requirements of 2.02.F installed. The sample tap on the OS&Y Valve shall be installed on the downstream side of the valve.
- K. INTERIOR METER SETTINGS (PREFERED)
  - 1. Interior valve and meter inlet connection shall be installed by the Contractor in accordance with the Engineer, or authorized representative's recommendations and final approval.
  - 2. The meter setting shall be located in a heated portion of the building. The meter setting shall not be located in a crawl space, above electrical appliance, or near an electrical panel. A clear and unobstructed access to the meter of not less than 24 inches by 24 inches shall be provided.
    - a. 1 ¼ meter settings must be placed in basements. Meter setting shall be placed in the front of the building facing the street or within three feet of the front on the side unless otherwise approved by the Engineer or authorized representative. Water Services shall not be placed under footings. If service enters house under the porch and the porch footing extends below water service, a 2 inch PVC sleeve will be required.
    - b. A ½ inch schedule 40 PVC conduit, or larger, shall be installed from the meter setting to the remote reading point. There shall be no more than 75 feet of conduit between pull boxes. There shall be no more than four (4) 90-degree bends between pull boxes. All pull boxes must be installed no more than 96 inches above the floor. Pull boxes shall not be installed in attics or crawl spaces.
  - 3. The City of Kalamazoo will install the meter, readout, readout wire, copper ground wire, outlet meter connection and valve.
- L. EXTERIOR METER SETTINGS
  - 1. Exterior meter settings shall be installed by the Contractor according to the Engineer's or authorized representative's recommendations, and in accordance with City of Kalamazoo Standard Plans. Meter settings will be required for services greater than 300 feet, slab on grade, crawl spaces, where minimum 5 foot bury depth cannot be maintained, and other reasons. Contractor shall verify proper meter location with the Engineer prior to construction.
  - 2. Meter boxes or vaults shall not be installed in any street, alley, parking area, driveway, or sidewalk. Major landscaping (shrubs, boulders, etc.) and structures (retaining walls, fences, buildings, etc.) shall not be placed within seven and a half (7.5) feet or trees shall not be planted within ten (10) feet of any meter box or vault, unless otherwise directed by the Engineer.

3. The ground surrounding meter boxes, pits and vaults shall slope away from the lid at a minimum grade of 2%
4. No plumbing or electrical connections will be allowed inside the meter box or vault, unless otherwise directed by the Engineer.
5. All tees, connections, and couplings shall be a minimum of five (5) feet downstream from the meter box or vault wall on the outlet side. Tees and connections shall not be installed between the curb stop and the meter setter or copper horn.
6. Meters shall be installed by the City of Kalamazoo upon inspection and acceptance of the meter setting.
7. Meter boxes shall be used for all 1 inch exterior meter settings. The Contractor shall install meter boxes to horizontal location and to final grade as determined by grade stakes. Meter boxes shall be installed 5 feet outside the right of way in private property. All work shall be in accordance with the current WS-8 of the City of Kalamazoo Standard Plans.
8. For services 1 ¼ inch and smaller, curb shutoffs shall be located in the right of way, centered in the curb lawn area, or as directed by the Engineer.
9. The Contractor shall install meter vaults for 1 ½ inch and larger meter settings.
10. Meters shall be installed by the City of Kalamazoo upon inspection and acceptance of the meter setting.

### 3.12 WATER MAINS, CUT AND PLUG

- A. All work related to water main, cut and plug shall be in accordance with section 3.06.A. If the plans show cutting and plugging water mains, arrange for the City of Kalamazoo to shut down the main. Remove the section of pipe and plug the water main as shown on the plans or as approved by the Engineer or authorized representative. Construct the required restraint as directed by the Engineer or authorized representative.

### 3.13 FIRE HYDRANTS

- A. Set fire hydrants at the locations shown on the plans and in accordance with City of Kalamazoo standard plans and manufacturer's recommendations or as coordinated with the City of Kalamazoo. When installed, the hydrant shall be located on the side of the water main furthest from the centerline of the roadway, unless otherwise directed by the Engineer. Equip the hydrant with auxiliary valves, as shown on the plans. Stand hydrants plumb, with side nozzles parallel to the curb, and with the pumper nozzle normal to the curb, unless otherwise directed by the Engineer. Place the nozzles at the height specified by the City of Kalamazoo.
- B. For all gate valves connected adjacent to a tee or hydrant, the anchor between the fitting or hydrant and the valve shall be a 6 inch by 13 inch swivel by solid adapter with swivel gland. The swivel gland shall be located on the hydrant side of the solid adapter.
- C. Install a valve box over hydrant valve in accordance with section 3.09.
- D. Hydrants shall have a protective cover placed over hydrants prior to backfilling to ensure the hydrant is not damaged. If hydrant is damaged, the contractor shall repair or replace the hydrant at no cost to the City.
- E. If site conditions are such that it is not desirable for hydrant drain into the surrounding soil (i.e. when hydrant has less than 10 feet of separation from a sewer, high ground water, impervious or contaminated soils, etc.), hydrant drip valve plug(s) shall be installed by the Contractor onsite. Final determination on drip valve plug installation shall be made by the

Engineer or his representative. As constructed records shall be noted whether or not the drip valve plug was installed.

### 3.14 FIRE HYDRANT MARKER

- A. The sign shall be located between the hydrant and curb and offset from the pumper nozzle, or as directed by the Engineer. The sign shall be placed 3 feet away from the hydrant. The sign shall be single sided or double sided as directed by the Engineer or authorized representative. The sign shall have an installed height to the bottom of the sign of 7 feet above the final grade in areas with sidewalk and 5 feet above the final grade in areas without sidewalk.
- B. A fire hydrant mounted whip may be installed in addition to fire hydrant sign if approved by the Engineer. Fire hydrant whip shall be mounted to the fire hydrant opposite the pumper nozzle in accordance with the manufacturer's specifications.

### 3.15 FIRE HYDRANT REMOVAL

- A. If the plans show removal of a fire hydrant, remove the entire hydrant assembly, including the following:
  - 1. Auxiliary gate valve and box, unless otherwise approved by the Engineer or authorized representative.
  - 2. Internal valve assembly;
  - 3. Top bonnet;
  - 4. Standpipe; and
  - 5. Hydrant inlet body, unless otherwise approved by the Engineer.
- B. If the City of Kalamazoo approves leaving the auxiliary gate valve and box in place, remove to at least 3 feet below the pavement surface under the road, or at least 12 inches below planned grade outside the road.
- C. Stockpile the removed material at a location accessible to the City of Kalamazoo. The City of Kalamazoo will maintain ownership of the hydrant, and will remove the assembly from the project site

### 3.16 RELOCATING FIRE HYDRANTS

- A. If the plans show relocating a hydrant, arrange for the City of Kalamazoo to shut down the hydrant auxiliary valve. Remove the hydrant and reinstall at the required location. Reconnect the hydrant to the water main by shutting down the main, tapping a new hydrant outlet, or using the existing outlet. Install piping as required. If the relocated hydrant does not pass testing the hydrant shall be replaced with new at no cost to the City of Kalamazoo.

### 3.17 MISCELLANEOUS FITTINGS

- A. Install the following at the locations shown on the plans and in accordance with good construction practices and manufactures recommendations:
  - 1. Elbows,
  - 2. Tees,
  - 3. Corporation stops,
  - 4. Blow offs,
  - 5. Pipe adapters,
  - 6. Pipe couplings,



7. Retaining glands, and
8. Other miscellaneous fittings.

### 3.18 AIR RELEASE VALVES AND VAULTS

- A. Construct air release valves and vaults in accordance with the current WA-4-Series and WA-5-Series of the City of Kalamazoo Standard Plans.
- B. When installing the air release valves in conjunction with new water main construction, the contractor shall use ductile iron fittings.
- C. When installing the air release vaults as a retrofit to existing water main, live taps may be performed as directed by the engineer.

### 3.19 BACKFILLING AND COMPACTING

- A. Backfill and compaction shall be in accordance with Michigan Department of Transportation Standard plan for utility trenches R-83-Series.
- B. Backfilling Under Existing Conduits – Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the spring line of the conduit a distance of 2-feet on either side and thence downward at its natural slope.
- C. Backfilling with Excavated Material – Unless otherwise specified or directed, material excavated in connection with the work shall be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification.
- D. Backfill Immediately Following Inspection – All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer or authorized representative. Under no circumstances shall water be permitted to rise in un-backfilled trenches after pipe has been placed.
- E. Service leads shall not be backfilled until the pipe ends are referenced and the Engineer or authorized representative has measured the pipe for payment.
- F. Backfilling around and over structures and pipes shall be carefully done by hand and tamped with suitable tools of approved weight to a point 1-foot above the top of pipe. Selected material or, where specified or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6-inch in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.
- G. Backfilling by Machinery – After the backfill has been placed and compacted around the boxes and pipe to a height of 1-foot above the top. The remainder of the trench may be backfilled by machine. The backfill material shall be deposited in horizontal layers and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

### 3.20 COMPACTION REQUIREMENTS

- A. Compact each layer to 95% (90% if outside the influence of the roadway) maximum density as tested by the Michigan Department of Transportation Density Testing and Inspection Manual.

### 3.21 COMPACTION TEST

- A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Compaction tests shall be performed on each layer immediately after compaction.
- B. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.
- C. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.

3.22 HYDROSTATIC TESTING

- A. Perform hydrostatic testing of water mains in accordance with AWWA C600.
- B. Ensure City of Kalamazoo personnel witness pressure testing. Give the City of Kalamazoo personnel at least 1 full working day notice before testing.
- C. Provide the personnel, temporary timber bracing, plugs, test pumps, temporary connections to the Municipal water system, and any other required apparatus. Provide the water for hydrostatic testing if not available from the City of Kalamazoo. Water must be pumped from a measurable source in order to determine testing allowance water.
- D. Before applying test pressure, expel air from the pipe in increments of no greater than 1,000 feet. Pressure test each section of water main. If the Contractor chooses not to pressure test against an existing valve, a new valve may be installed at the expense of the Contractor.
- E. Pipe shall be pumped with water to a minimum test pressure of 150 pounds per square inch (psi) at the highest point of elevation to begin test. Test shall last for at least 2 hours, with a maximum drop of pressure of 5 psi. If the pressure drop is greater than 5 psi but less than 20 psi, a testing allowance water test shall be performed. Testing allowance water, as measured by the quantity of water pumped into the pipe to attain the pressure at which the test began must not exceed the testing allowance.
- F. Testing allowance water is determined using the following formula

$$L = \frac{SD\sqrt{P}}{148,000}$$

Where

- L= testing allowance water in gallons per hour
- S= length of pipe in feet
- D= actual pipe diameter in inches, and
- P= 150 psi

- G. If testing allowance water is above the allowable limit occurs during hydrostatic testing, remove backfill to expose pipe and repair the joints. Repeat testing after repairs are complete. If multiple leaks occur the contractor may be required to reinstall main at Contractors expense.
- H. Correct visible leaks regardless of the amount of leakage. Replace faulty pipes, fittings, gate valves, or other accessories disclosed by testing. Repeat the test until the pipes, fittings, gate valves, and other accessories meet the requirements.

### 3.23 DISINFECTION, FLUSHING, AND BACTERIOLOGICAL TESTING

- A. Disinfect the water main in accordance with AWWA C651 and applicable Michigan Department of Environment, Great Lakes, and Energy (EGLE) regulations after successful hydrostatic testing.
- B. Disinfect and flush new, and portions of existing, water mains as required by the EGLE.
- C. Use blow offs, fire hydrants, or other means as shown on the plans or approved by the Engineer, or authorized representative, to flush water mains in accordance with AWWA C651, with a velocity of at least 3 feet per second. Provide hoses and other equipment and arrange a means of disposing of the water without damaging the work or adjacent property.
- D. Use the continuous feed method with chorine added simultaneously with the water. Add chlorine or liquid hypochlorite to meet the requirement of at least 25 milligrams per liter of chlorine. Slowly add the water to the main and allow it to stand for at least 24 hours. At the end of the 24-hour period, ensure the chlorine residual is a minimum of 10 milligrams per liter. If not met, re-chlorinate and flush the water main until a minimum 10 milligrams per liter residual remains after 24 hours.
- E. After completing disinfection, initially flush the water mains with water at a velocity of at least 3 feet per second to replace the entire volume of chlorinated water in the pipeline. After initial flushing, perform final flushing until the residual chlorine content meets the standard level for the water distribution system. The City of Kalamazoo may require a waiting period after flushing and before bacteriological sampling.
- F. Dispose of chlorinated water in accordance with applicable state and local requirements. If necessary, apply a reducing agent to the water to neutralize the chlorine and create a chlorine residual of no greater than 1 ppm. Dechlorination shall be in accordance with AWWA C655.
- G. After flushing, perform bacteriological testing in accordance with AWWA C651 and EGLE requirements. Test chlorine residuals before taking each bacteriological sample. Ensure the chlorine residual is less than 1.5 milligrams per liter before taking a bacteriological sample. The City of Kalamazoo will collect samples from each branch of pipe in the presence of the Engineer, or authorized representative, and contractor personnel. The City of Kalamazoo will be responsible for the transportation of the samples to a State of Michigan approved lab for testing. Two consecutive bacteriologically safe tests at 24-hour intervals for each section of pipe are required. Acceptable tests are negative for bacteria and as otherwise defined by AWWA C651 and EGLE regulations.
- H. If a bacteriological test fails, repeat disinfection, flushing, and testing.
- I. Pressure and chlorination taps shall be removed within one business day of passing tests, so main can be activated.

### 3.24 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement will be required for all ductile iron installations when the soil test evaluation is greater than or equal to 10 points based as indicated in AWWA/ANSI C105/A21.5 or as directed by the Engineer. Sampling of the soils is to be completed by the developer or municipality responsible for the installation.
- B. Install polyethylene encasement on water mains and fittings installed through concrete floor and foundations and as indicated on the plans in accordance with the manufacturer's installation instructions and AWWA/ANSI C105/A21.10. Appropriately sized polyethylene encasement shall be used so that there are no longitudinal splices. This may require using one or more size larger diameter encasement than the pipe installed.

- C. Polyethylene encasement shall be required for all installations when groundwater is detected in the utility trench.
- D. Polyethylene encasement shall be required for all directional drilling installations involving ductile iron pipe.

3.25 WATER INFRASTRUCTURE IN STEEL CASING

- A. Work shall be performed in accordance with section 401 of the Michigan Department of Transportation *Standard Specifications for Construction* and as detailed herein. In all cases, the Contractor shall submit a work plan detailing the following:
  - 1. Means and methods for bracing and shoring;
  - 2. Methods of maintaining and adjusting line and grade;
  - 3. Drilled/bored diameter;
  - 4. Drill hole stabilization procedures;
  - 5. Size and location of the auger head relative to the casing;
  - 6. Methods of dealing with cobbles/boulders and obstructions;
  - 7. Estimated jacking thrust required;
  - 8. Method of monitoring casing elevation;
  - 9. Thrust block design calculations;
  - 10. Record keeping system to document casing advance and jacking pressures;
  - 11. Grouting procedures;
  - 12. Temporary dewatering measures and;
  - 13. Mitigation procedures if sinkholes or settlement above the pipe occurs or excessive movement of the settlement monitors is observed.
- B. Minimum Allowable Depths.
  - 1. The minimum allowable depth of the Horizontal Auger Bore (HAB) installed casing pipe shall be in accordance with Table 3.2

<b>Table 3.2 Minimum Allowable Depths Table</b>	
<b>Location</b>	<b>Minimum Depth</b>
Base of Rail	6 Feet
Existing Ground	5 Feet
Roadway	5 Feet
Ditch Flowline	5 Feet

- C. Access Pits.
  - 1. Excavate jacking and receiving pits as necessary. Provide and install all sheeting, shoring, bracing and any other earth retention measures in accordance with section 704 of the Michigan Department of Transportation *Standard Specifications for Construction*. Provide site drainage and subsurface dewatering and other items associated with the operation as necessary to facilitate the proposed work.
- D. Lead Auger/Overcut Allowance.

1. A full-size auger section shall be used as the lead section of the casing. The auger shall not protrude from the leading edge of the casing. However, if soil conditions halt the movement of the casing, the auger shall be allowed to protrude not more than 1 inch in front of the casing during the boring operation. Overcut is the annular space between the excavated hole and the outside diameter of the casing pipe. The allowable overcut diameter is one inch greater than the casing pipe radius.
- E. Watertight joints.
1. Watertight joints are required to ensure the integrity of the road and railroad bed. Casing pipe shall be constructed to prevent water leakage or earth infiltration and must be certified free from any breaks or leaks throughout its entire length.
- F. Lubrication Fluids.
1. Lubrication fluids are specifically required for this method regardless of the soil conditions. Any deviations from the use of lubrication shall require prior approval for the Engineer. The Contractor shall install vents on either side of the casing pipe to prevent fracking during installation. These vents shall also be used as relief in case of a water main break. Lubrication fluids, consisting of a mixture of water and bentonite or bentonite/polymer, shall be used in the annular space between the casing being installed and the native soil to stabilize and lubricate the drill hole. Grease will not be allowed for use as lubrication for this purpose.
- G. Pipe Locating and Tracking.
1. One of the following tracking, locating, and guidance systems shall be used:
    - a. Waterline system.
    - b. Mechanical control head.
    - c. Electronic (inertial) control head.
    - d. Walkover system.
    - e. Laser guided tunnel attachment.
    - f. Laser guided pilot rod.
  2. The Contractor will be responsible for submitting their proposed pipe locating tracking method at the preconstruction meeting for approval.
- H. Settlement/Heaving Monitoring.
1. Settlement/Heaving monitoring shall be performed in a manner that will minimize the movement of the ground in front of, above, and surrounding the horizontal auger bore operation; and will minimize subsidence of the surface above and in the vicinity of the boring. The ground shall be supported in a manner to prevent loss of ground and keep the perimeter and face of the boring stable at all times, including during shutdown periods. A survey shall be performed one day prior to initiating this operation at each required monitoring location. A similar survey shall then be performed at each location, on a daily basis, until the permitted activity has been completed. All survey readings shall be recorded to the nearest one-hundredth (0.01) of a foot. Digital photographs of the pavement and rail conditions shall also be taken prior and after the pipe installation. Specific monitoring locations and requirements may also be provided for railway crossings.
- I. Ground Water Control.

1. Dewatering shall be conducted whenever there is a high ground water table level to prevent flooding and facilitate the operation. The water table elevation shall be maintained at least 1 foot below the bottom of the casing at all times. When needed, dewatering may be initiated prior to any excavation.
2. Minor water seepage or pockets of saturated soil may be effectively controlled through bailing or pumping. This control shall be accomplished without removing any adjacent soil that could weaken or undermine any access pit, its supports, or other nearby structures.
3. Larger volumes of ground water shall be controlled with one or more well points or with staged deep wells. Well points and staged deep well pumping systems shall be installed and operated without damage to property or structures, and without interference with the right of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors. Any pumping methods used for dewatering and control of ground water and seepage shall have properly designated filters to ensure that the adjacent soil is not pumped along the water. Well diameter, well spacing and the pump's pumping rate shall provide adequate draw down of the water level. Wells shall be located to intercept ground water that otherwise would enter the access pit excavation and interfere with the work. Upon removal of a well, the hole shall be filled and grouted.
4. Existing storm sewers shall only be used to discharge water from the dewatering operation in accordance with a permit obtained from the appropriate storm sewer owner. Filters or sediment control devices shall be required to ensure that the existing system is not adversely affected by construction debris or sediment.

J. Casing End Seals/Bulkheads

1. Casing ends shall be enclosed using 1/8 inch thick synthetic rubber casing ends seals in accordance with section 2.19.C of this document. Ensure end seals are water tight and attach securely to the casing pipe and the carrier pipe (water main). Ensure end seals are acceptable to the Engineer.

K. Backfill Requirements.

1. Remove the pits and backfill the excavations as necessary with material meeting the standard specifications as approved by the Engineer.

L. Railroad Specific Requirements.

1. For Steel casing pipe jacked in place under a railroad, the following will apply in accordance with the current AREMA Manual;
  - a. When steel casing pipe is used, the joints must be fully closed by welding or mechanical means as approved by the Engineer.
  - b. Minimum cover over the casing must be at least 6.0 feet from the bottom of the railroad tie to the top of the casing pipe at its closest point.
  - c. Casing pipe must extend beyond the limits of the entire railroad right-of-way.
  - d. Jacking construction requirements must be in accordance with the current AREMA Manual, Chapter 1, Part 4.

3.26 INSTALLATION OF LINE STOPS AND INSERTION VALVES

- A. Line Stops and Insertion Valves shall be performed in the locations as detailed on the plans or as directed by the Engineer. Prior to installation of the line stop or insertion valve, coordinate the deactivation of the water main so that all customers have been given proper notification

of the shutdown. No work shall be performed without the Engineer or authorized representative present.

B. Excavate and expose the water main. Remove scale from the water main and make sure there are no flaws which would affect the seal with the saddle.

C. Line Stops

1. Install permanent line stop body on the pipeline and perform line stop according to manufacturer's instructions. Upon completion of the work associated with the line stop, reactivate the water main and install permanent blind flange on the line stop body. Ensure that all as built information is recorded and submitted as detailed in section 1.03.

D. Insertion Valves

1. Install Insertion Valve body on the pipeline and perform valve insertion according to manufacturer's instructions. Operate the valve to ensure that it is fully functional.

2. Construct valve vault as detailed in WA-8-A of the City of Kalamazoo Standard Plans. Ensure that all as built information is recorded and submitted as detailed in section 1.03.

### 3.27 FINAL RESTORATION

A. Contractor shall restore site to preconstruction condition or better, or as detailed on the plans.

B. Final grade shall be 5 feet above completed water main or water service line, unless otherwise approved by the Engineer. If final grade is changed greater than 6 inches from the approved plans, the Developer or Contractor shall raise or lower water main and water services so that they are maintained at 5 feet below final grade. All costs associated with this work shall be paid for by the Developer or Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.01 PAY ITEMS

Measurement a payment may not apply if construction is not being funded with City of Kalamazoo funds. Please review signed construction contract for actual measurement and payment specifications.

<b>Pay Item</b>	<b>Pay Unit</b>
Water Main, DI __ inch, Tr Det __ .....	Foot
Water Main, DI __ inch, in Casing.....	Foot
Water Main, DI __ inch, HDD.....	Foot
Gate Valve and Box, __ inch,.....	Each
Butterfly Valve and Box, __ inch.....	Each
Polyethylene Encasement.....	Foot
Water Main, __ inch, Cut and Plug .....	Each
Fire Hydrant .....	Each
Hydrant, Rem .....	Each
Hydrant Relocate, Case __ .....	Each
Water Serv .....	Each
Water Serv, Long.....	Each
Water Serv, Conflict .....	Each
Water Serv, Yard .....	Each
Copper Tubing, Additional Length .....	Foot
Water Serv, 2 inch.....	Each
Water Serv, Conflict, 2 inch .....	Each
Copper Tubing, Additional Length, 2 inch .....	Foot



Steel Casing Pipe, \_\_ inch, Jacked in Place.....Foot

4.02 MEASUREMENT OF PAY ITEMS

- A. Payment for Water Mains shall be measured based on the sizes and trench details required, along the centerline of the pipe, with no deductions for fittings. The unit price of Water Main, DI, includes the cost of the following:
  - 1. Excavation and backfill;
  - 2. Dewatering operations (trench and/or pipe);
  - 3. Provide temporary water system to maintain service during construction;
  - 4. Hydrostatic testing;
  - 5. Disinfecting and flushing the water main and bacteriological testing;
  - 6. All material, labor and equipment necessary to remedy an unsatisfactory hydrostatic test, including removing and replacing any backfill;
  - 7. Providing and installing fittings, gaskets, bracing or sheeting, blocking and miscellaneous items for installing pipe and reconnecting to the Municipal Water System;
  - 8. Preparing and providing as-constructed plans.
  
- D. The City of Kalamazoo may withhold payment and/or final acceptance until the City of Kalamazoo accepts the as-built plans.
  
- E. The cost of dewatering of trenches, pipe, or both associated with alterations to the Municipal Water System, is included in the unit price for relevant items of work.
  
- F. The cost of excavating, disposing of excess material, and providing, placing, and compacting the backfill, is included in the unit price for related items of work.
  
- G. The cost of removing or abandoning existing water mains, gate valve boxes, and other appurtenances to provide clearance for the proposed water main or roadway, is included in the unit price for relevant items of work.
  
- H. Payment for Gate Valves, Butterfly Valves, and Valve Boxes, shall be as follows:
  - 1. The unit prices of **Gate Valve and Box** and **Butterfly Valve and Box**, of the types and sizes required, include the cost of providing and installing the valve and valve box, complete and ready for use.
  
- I. Payment for water services 1 ¼ and smaller shall be as follows:
  - 1. **Water Serv** refers to services between the water main and the curb shut off no greater than 33 feet long. **Water Serv, Long** refers to services between the water main and the curb shut off greater than 33 feet long and up to 66 feet in length. **Water Serv, Yard** refers to the services between the curb shut off and the water meter setting, up to 25 feet in length. **Copper Tubing, Additional Length** refers to the additional copper tubing and work needed when services between the curb shut off and the water meter setting are over 25 feet in length, and when the length of the service between the center of the road and the curb shut off exceeds 66 feet. **Water Serv, Conflict** refers to relocating only a portion of a water service.
  
- J. Payment for water services 2 inches in size shall be as follows:
  - 1. **Water Serv, 2 inch** refers to the services between the water main and the water meter setting no greater than 58 feet in length. **Water Serv Conflict, 2 inch** refers to relocating only a portion of a 2 inch water service. **Copper Tubing, Additional length, 2 inch** refers to the additional copper tubing and work needed when services exceed 58

feet in length.

- K. Services with a diameter larger than 2 inches will be measured and paid for as water mains.
- L. The unit prices for **Water Serv, Water Serv, Long, Water Serv, Yard, Copper Tubing, Additional Length, Water Serv Conflict, Water Serv, 2 inch, Water Serv Conflict, 2 inch,** and **Copper Tubing, Additional Length, 2 inch**, include the cost of the following, unless otherwise accounted for in other pay items:
  - 1. Earth excavation;
  - 2. Removing pavement;
  - 3. Replacing pavement;
  - 4. Jacking and boring;
  - 5. Providing and installing type K copper tubing, service saddle, corporation stops, service stops, and service boxes;
  - 6. Disinfecting;
  - 7. Providing, placing, and compacting backfill;
  - 8. Slope Restoration to equal or better conditions; and
  - 9. Miscellaneous material, equipment, or operations.
- M. Payment for additional service connections, not shown on the plans, but maintained, protected, and reconnected or disposed of by the Contractor will be paid for as **Water Serv**, or **Water Serv, Long**.
- N. The pay item **Water Serv, Conflict** will apply only to portions of water services requiring relocation due to direct conflict with utilities, other items of work, or as otherwise approved by the City of Kalamazoo. Payment for all other relocations requiring replacement of corporation or service stops will be paid for as Water Serv or Water Serv, Long.
- O. Payment for **Water Main, \_\_inch, Cut and Plug** includes the cost of cutting the existing water main, providing and placing the required plug, and thrust blocks.
- P. Payment for **Fire Hydrant** includes the cost of providing and installing the hydrant, hydrant valve, valve box, and all pieces between the valve and hydrant, including the coarse gravel and concrete base, fire hydrant marker at the locations shown on the plans in a ready-for-use condition unless noted otherwise.
- Q. Payment for **Hydrant, Rem** includes the cost of breaking down the auxiliary gate valve, gate box, the hydrant assembly, backfilling, and plugging the opening in the existing main.
- R. Payment for **Hydrant, Relocate, Case \_\_** (of the case required), includes the cost of vertically adjusting the relocated hydrant to final grade and the following:
  - 1. Case 1 includes the cost of removing the hydrant, extending the existing hydrant lead from the gate valve, reinstalling the hydrant in a ready-for-use condition, adjusting the existing gate box and hydrant to final grade, and providing and installing sleeves, fittings, and joint restraints.
  - 2. Case 2 includes the cost of removing the existing hydrant, gate valve and box, and reinstalling the hydrant and gate valve in a ready-for-use condition, adjusting the existing gate box and hydrant to final grade, and providing and installing the cutting-in-sleeve, pipe coupling, tee, elbow, and joint restraints.
- S. Payment for **Steel Casing Pipe, \_\_inch, Jacked in Place** of the size required will be paid for by the length installed. The unit price for **Steel Casing Pipe, Jacked in Place** includes the cost of excavating the pits, providing and installing sheeting, bracing, and any other safety devices, providing jacking equipment: drainage and dewatering; bulkheading and sealing the casing, providing and installing vents, grouting the annular space between the casing and native soil and any other items associated with the operation.

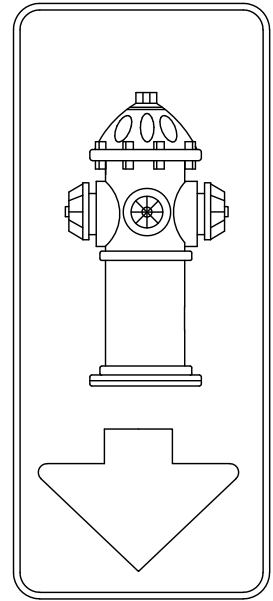
- T. Payment for **Water Main, DI, \_\_inch, in Casing**, of the size required will be paid for by the length installed. The unit price for **Water Main, DI \_\_inch, in Casing** shall include the cost for furnishing and installing the water main and casing spacers inside the casing.
- U. Payment for **Water Main, DI, \_\_inch, HDD**, of the size required will be paid for by the length installed. The unit price shall include the cost of all equipment and materials, excavation and backfill, dewatering operations (trench, pit or pipe), temporary water system to maintain service during construction, hydrostatic testing, disinfecting and flushing the water mains, and bacteriological testing, all materials, labor and equipment necessary to remedy and unsatisfactory hydrostatic test, including removing and replacing any backfill, providing and install all, gaskets, bracing or sheeting, blocking and miscellaneous items for installing pipe of the required size and material and reconnecting to the water system as shown on the plans.

END OF SECTION

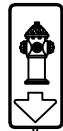
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WA-1-D

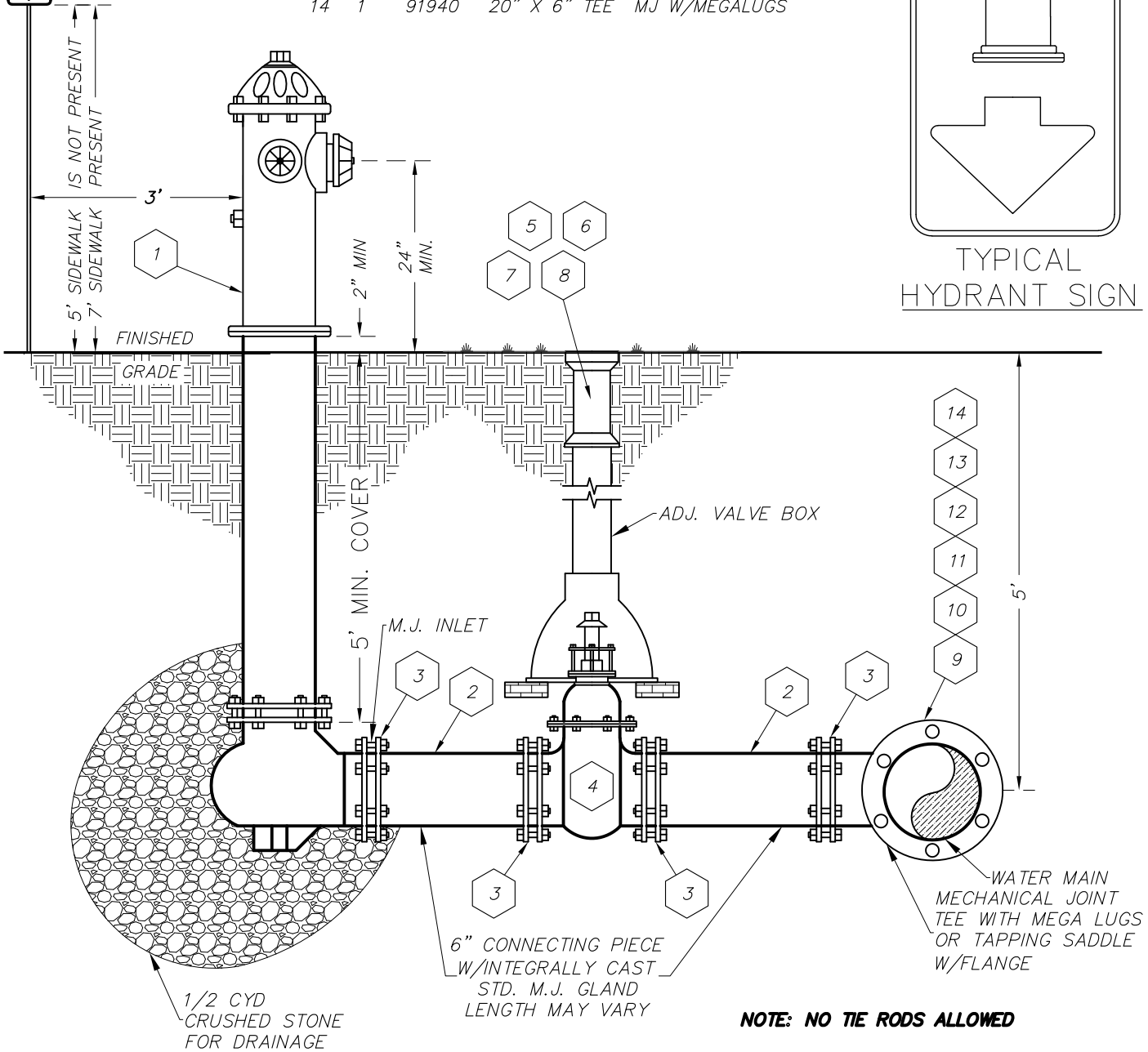
ITEM	QTY.	#	DESCRIPTION
1	1	39887	6" HYDRANT W/CARROLL DRAIN
2	2	70000	CONNECTING PIECE (13")
3	4	33801	6" GASKET (MJ)
4	1	96696	6" GATE VALVE (MJ)
5	1	08550	VALVE BOX BOTTOM
6	1	08520	VALVE BOX TOP SECTION
7	1	08500	VALVE BOX RING CASTING
8	1	08490	VALVE BOX COVER
9	1	91440	6" TEE MJ
10	1	91525	8" X 6" TEE MJ W/MEGALUGS
11	1	91750	10" X 6" TEE MJ W/MEGALUGS
12	1	91825	12" X 6" TEE MJ W/MEGALUGS
13	1	91909	16" X 6" TEE MJ W/MEGALUGS
14	1	91940	20" X 6" TEE MJ W/MEGALUGS



TYPICAL HYDRANT SIGN



DOUBLE SIDED HYDRANT SIGN



CITY OF KALAMAZOO  
 Department Of Public Services

## TYPICAL FIRE HYDRANT & GATE VALVE DETAIL

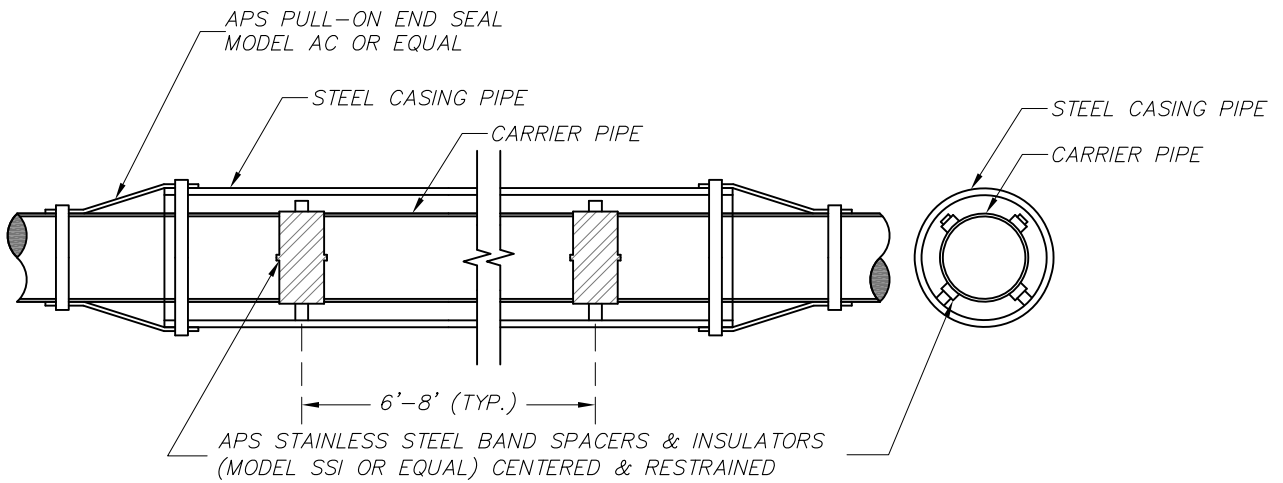
RECOMMENDED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

ACCEPTED BY \_\_\_\_\_

DATE \_\_\_\_\_



**CASING CARRIER PIPE DETAIL**

SIZE CASING AND CARRIER PIPES PER PLAN AND SPECIFICATIONS

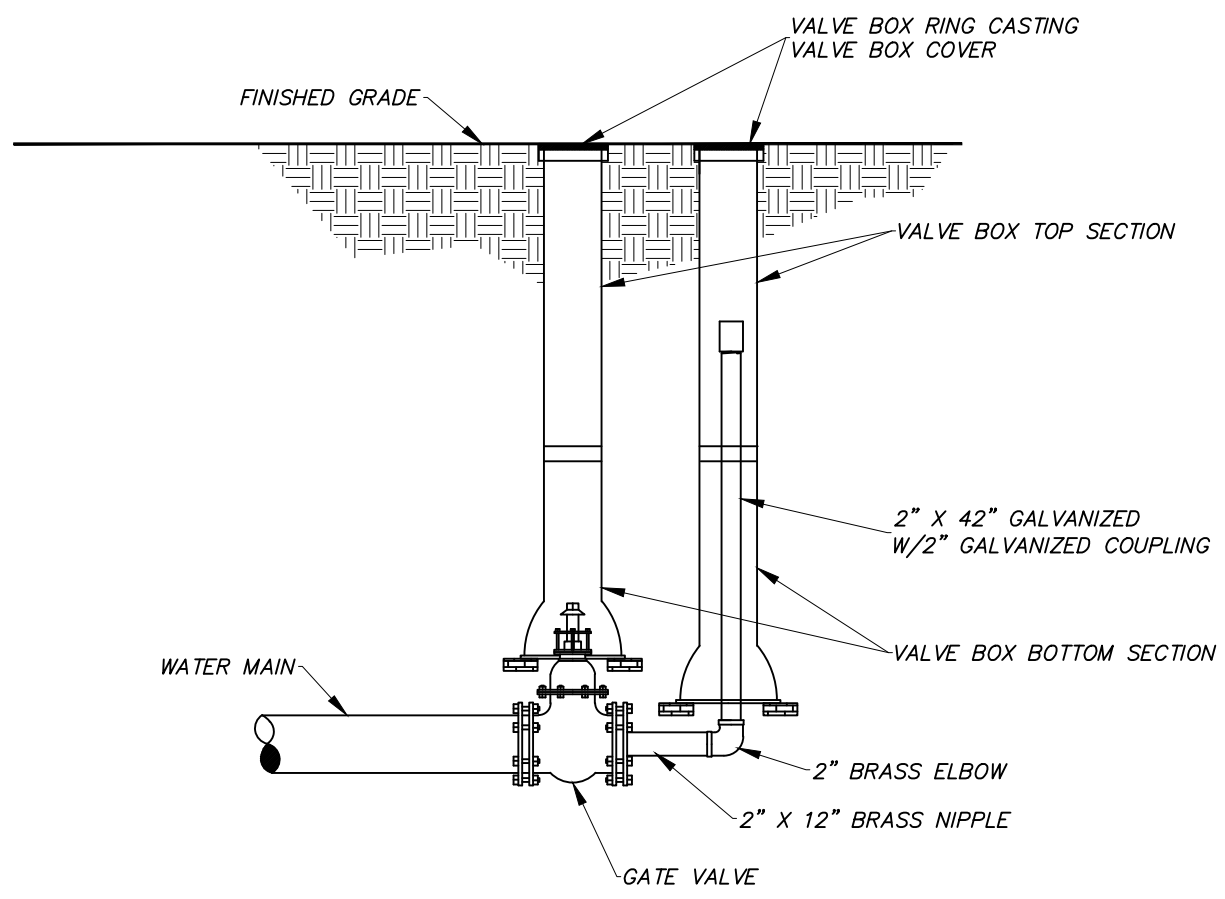
TYPICAL BAND SPACER POSITIONING:  
 ONE PLACED NOT MORE THAN 1 FOOT FROM EACH END OF THE CASING AND  
 PIPE JOINTS WITH SUBSEQUENT SPACERS PLACED EVERY 6-8 FEET THEREAFTER.  
 FOR 18 FOOT PIPE THERE SHALL BE THREE BAND SPACERS.  
 FOR 20 FOOT PIPE THERE SHALL BE FOUR BAND SPACERS.



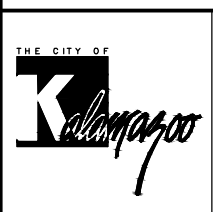
CITY OF KALAMAZOO  
 Department Of Public Services

**CASING CARRIER PIPE**

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	



NOT TO SCALE

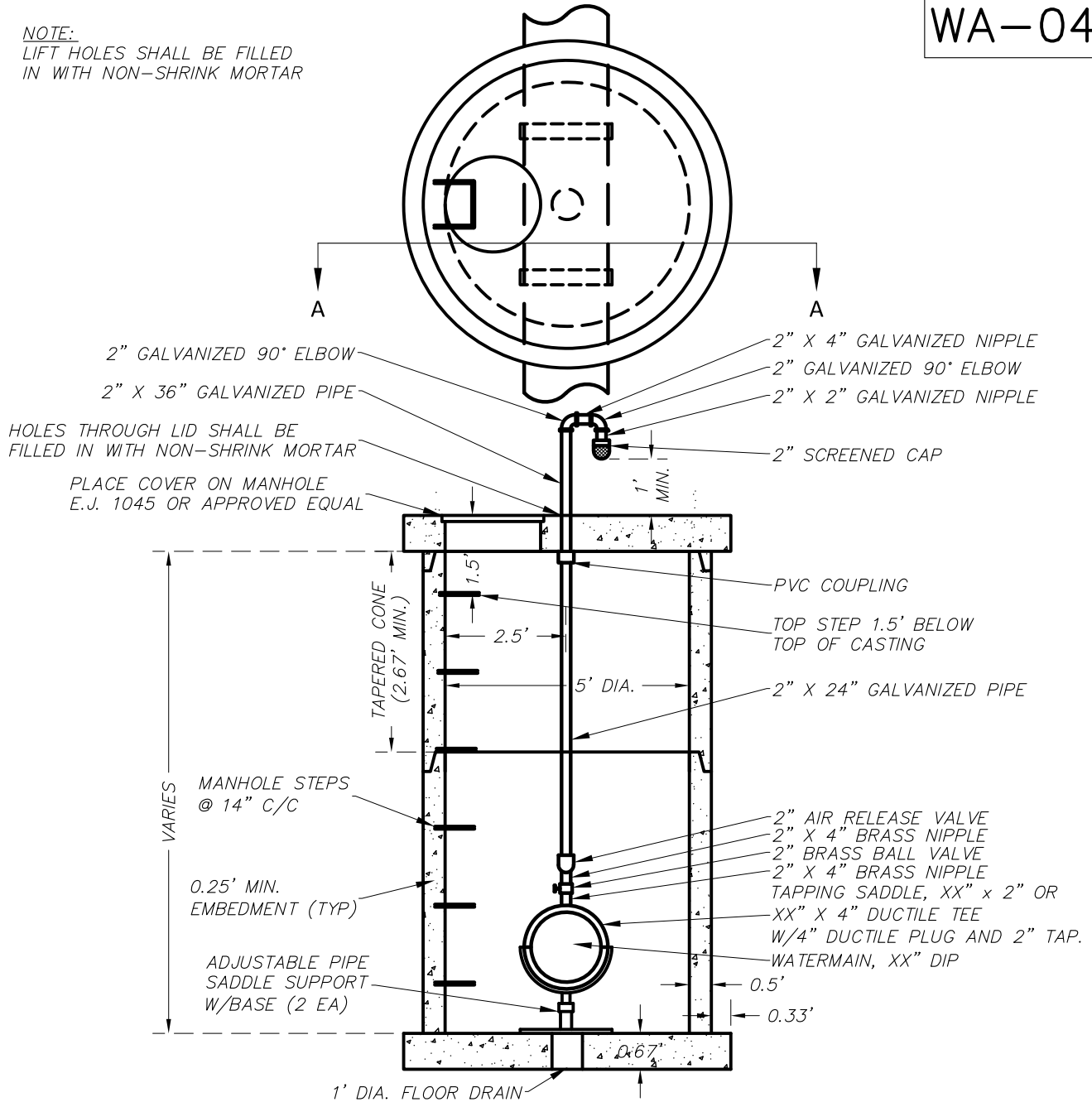


CITY OF KALAMAZOO  
Department Of Public Services

**2" BLOW OFF  
CONNECTION**

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	

**NOTE:**  
LIFT HOLES SHALL BE FILLED  
IN WITH NON-SHRINK MORTAR



**TYPICAL 2" AIR RELEASE MANHOLE**

PRECAST REINFORCED CONCRETE SHOWN (OTHER OPTIONS INCLUDE  
CONCRETE BLOCK, BRICK OR CAST IN PLACE WALL SECTIONS)

**SCHEDULE OF FITTINGS**

ITEM DESCRIPTION	QUANTITY
AIR RELEASE VALVE, 2"	1
GALVANIZED PIPE, 2" X 60"	1
GALVANIZED NIPPLE, 2" X 4"	1
GALVANIZED NIPPLE, 2" X 2"	1
GALVANIZED 90° ELBOW, 2"	2
PIPE SUPPORT BASE	2

ITEM DESCRIPTION	QUANTITY
TAPPING SADDLE, XX X 2"	1
BRASS BALL VALVE, 2"	1
BRASS NIPPLE, 2" X 4"	2



CITY OF KALAMAZOO  
Department Of Public Services

**AIR RELEASE MANHOLE**

RECOMMENDED BY \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED BY \_\_\_\_\_

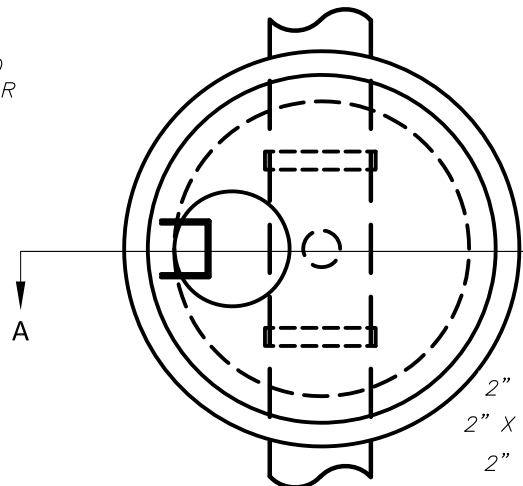
APPROVED BY \_\_\_\_\_

ACCEPTED BY \_\_\_\_\_



WA-05-C

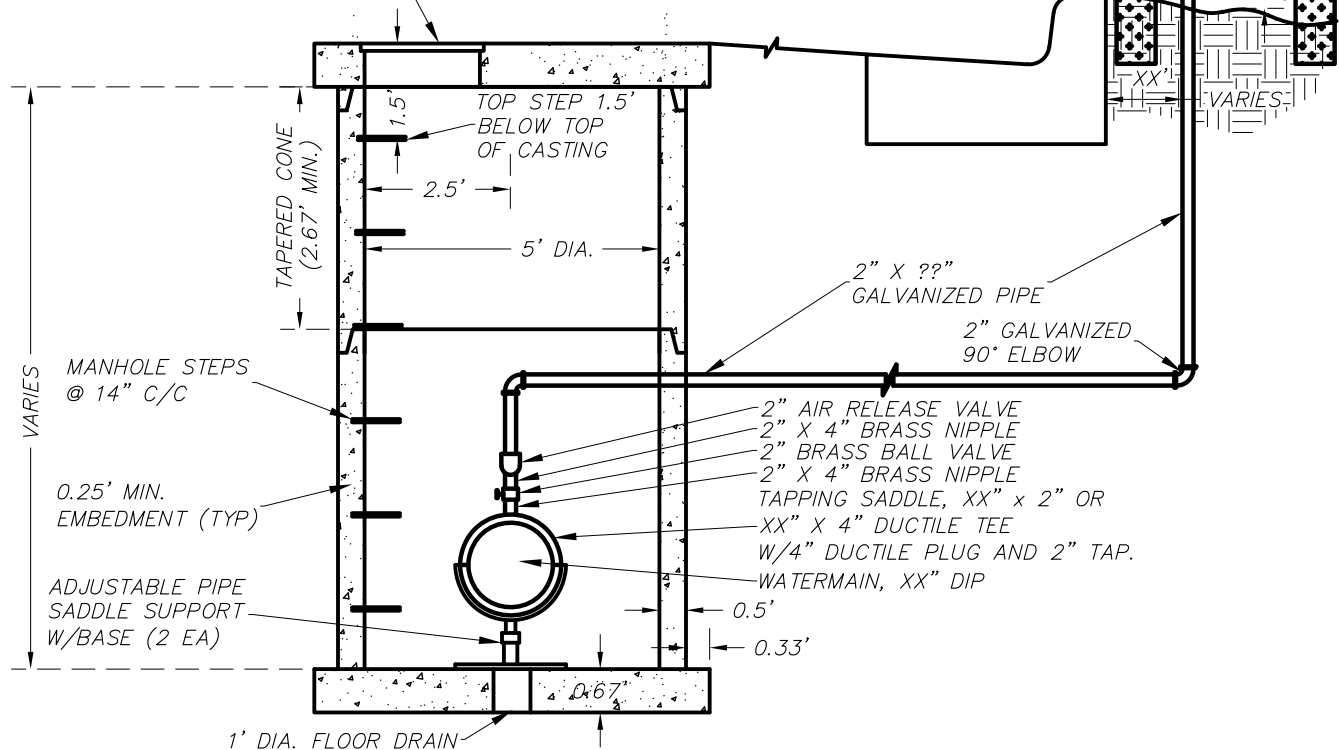
**NOTE:**  
LIFT HOLES SHALL BE FILLED  
IN WITH NON-SHRINK MORTAR



- 2" GALVANIZED 90° ELBOW
- 2" X 4" GALVANIZED NIPPLE
- 2" GALVANIZED 90° ELBOW
- 2" X 2" GALVANIZED NIPPLE
- 2" SCREENED CAP

BOLLARD POSTS  
AS SPECIFIED  
BY ENGINEER

PLACE COVER ON MANHOLE  
E.J. 1045 OR APPROVED EQUAL



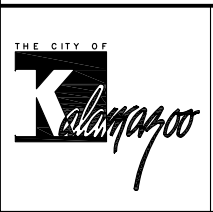
### TYPICAL 2" AIR RELEASE MANHOLE

PRECAST REINFORCED CONCRETE SHOWN (OTHER OPTIONS INCLUDE  
CONCRETE BLOCK, BRICK OR CAST IN PLACE WALL SECTIONS)

#### SCHEDULE OF FITTINGS

ITEM DESCRIPTION	QUANTITY
AIR RELEASE VALVE, 2"	1
GALVANIZED PIPE, 2" X 60"	1
GALVANIZED NIPPLE, 2" X 4"	1
GALVANIZED NIPPLE, 2" X 2"	1
GALVANIZED 90° ELBOW, 2"	2
PIPE SUPPORT BASE	2

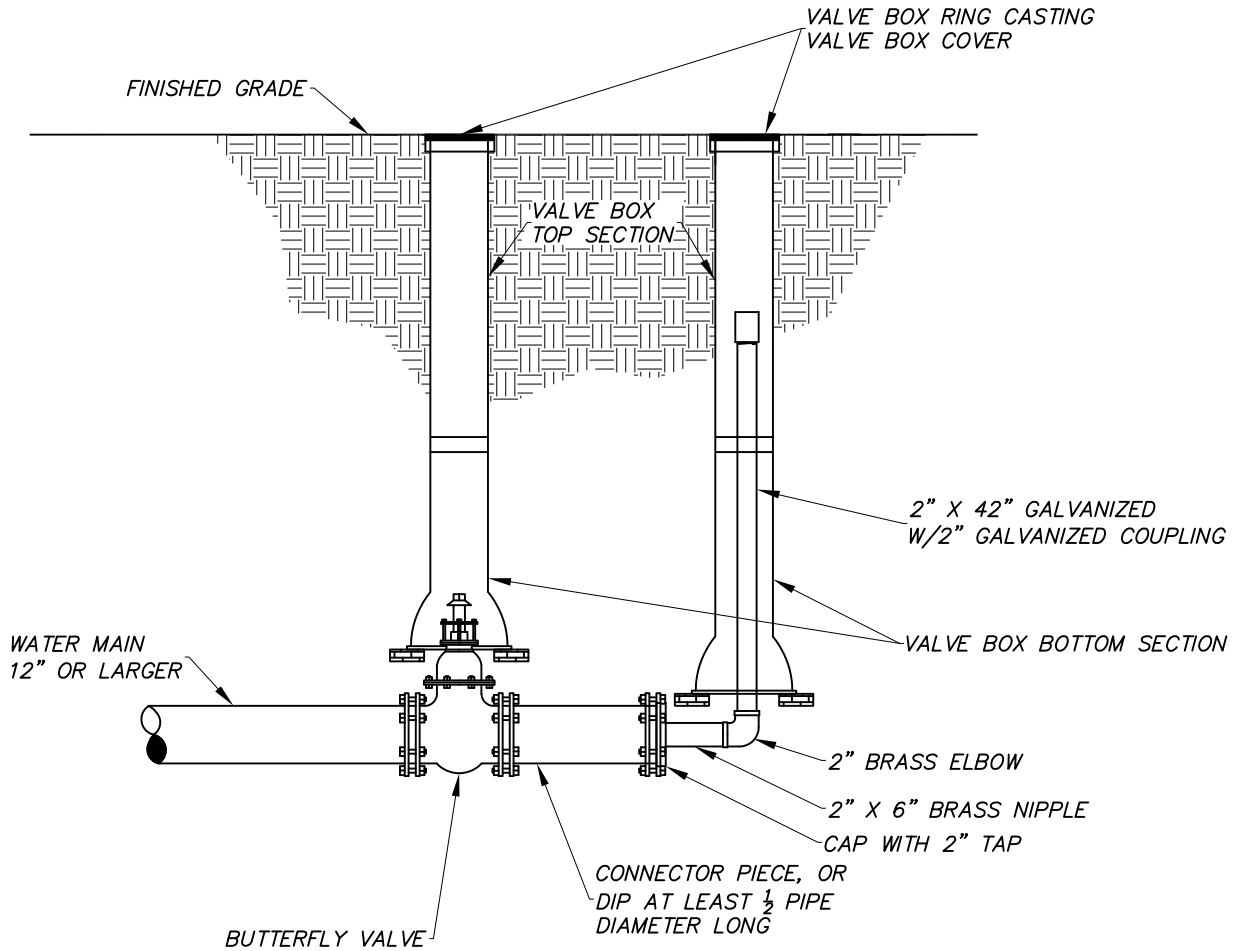
ITEM DESCRIPTION	QUANTITY
TAPPING SADDLE, XX X 2"	1
BRASS BALL VALVE, 2"	1
BRASS NIPPLE, 2" X 4"	2



CITY OF KALAMAZOO  
Department Of Public Services

## AIR RELEASE MANHOLE IN ROADWAY

RECOMMENDED BY	DATE
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	



NOT TO SCALE

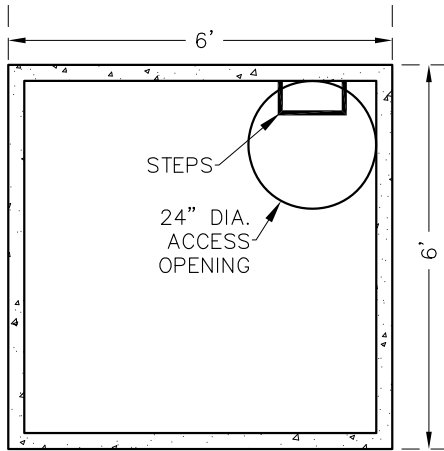


CITY OF KALAMAZOO  
Department Of Public Services

**2" BLOW OFF  
CONNECTION  
12" OR LARGER MAIN**

RECOMMENDED BY \_\_\_\_\_  
APPROVED BY \_\_\_\_\_  
APPROVED BY \_\_\_\_\_  
ACCEPTED BY \_\_\_\_\_

DATE

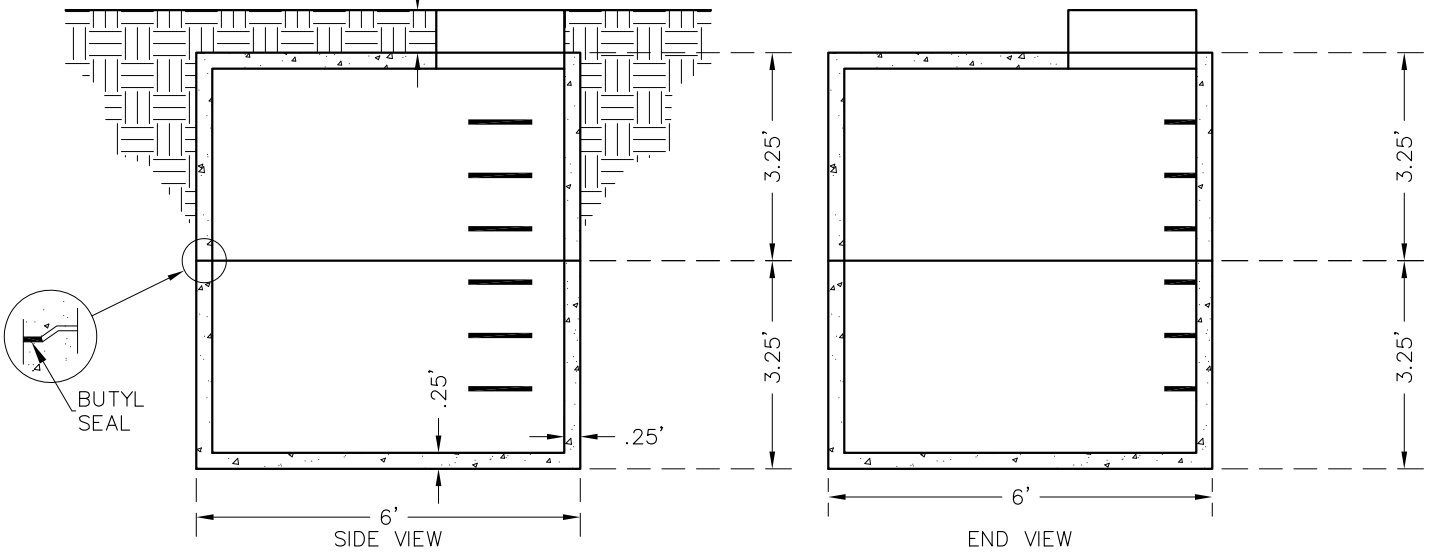


TOP VIEW

NOTES:

1. METER VAULT DESIGN TO BE SUBMITTED AND APPROVED FOR EACH INDIVIDUAL INSTALLATION. DESIGN SHALL CONFORM TO KALAMAZOO WATER ENGINEERING STANDARDS LATEST REVISION.
2. THE DISTANCE BETWEEN RUNGS, CLEATS AND STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
3. PLACEMENT OF CURB BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF THE CURB BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.
4. ACCESS COVER - FORD MC-24-MB-T WITH AN INNER LID, VESTAL 32-055, 32-104, AND 32-046 OR APPROVED EQUAL.

TOP OF PIT TO FINAL GRADE SHALL NOT EXCEED 8"



SIDE VIEW

END VIEW



CITY OF KALAMAZOO  
Department Of Public Services

STANDARD METER PIT

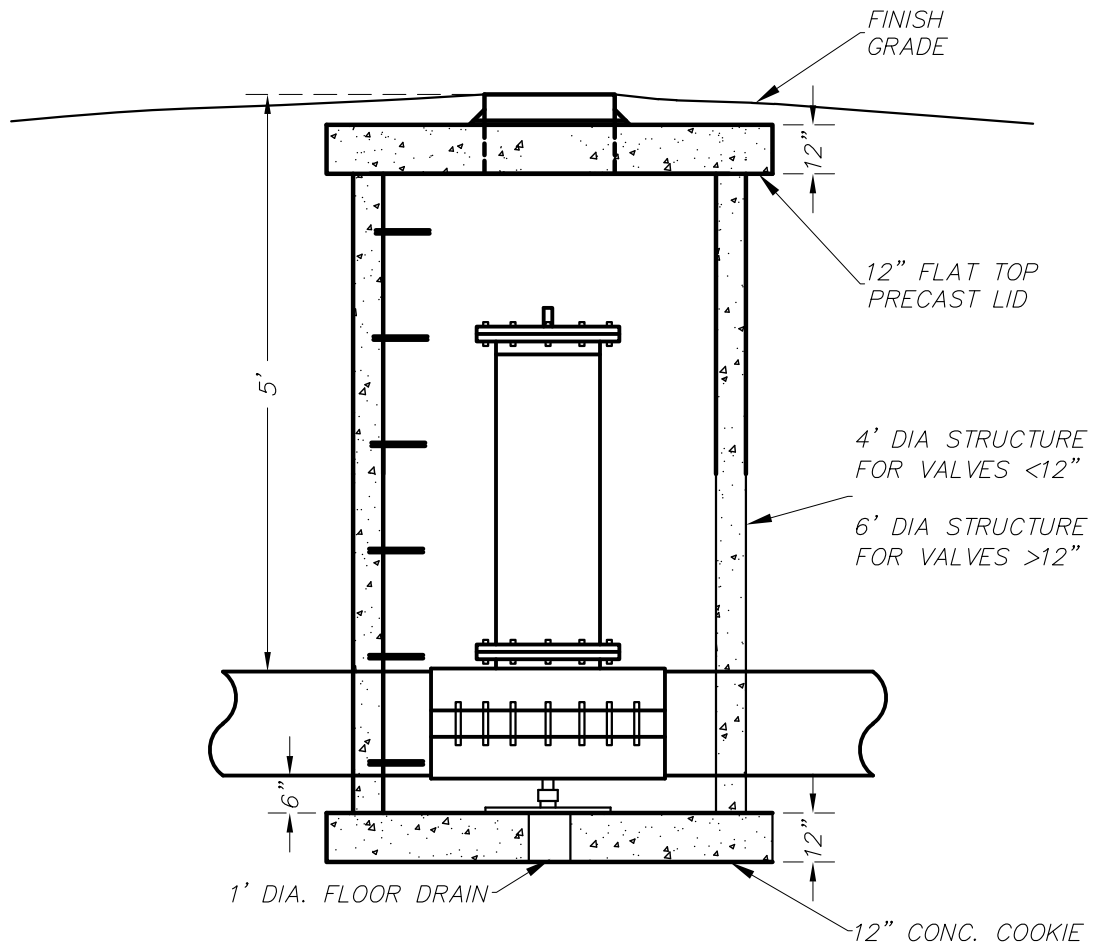
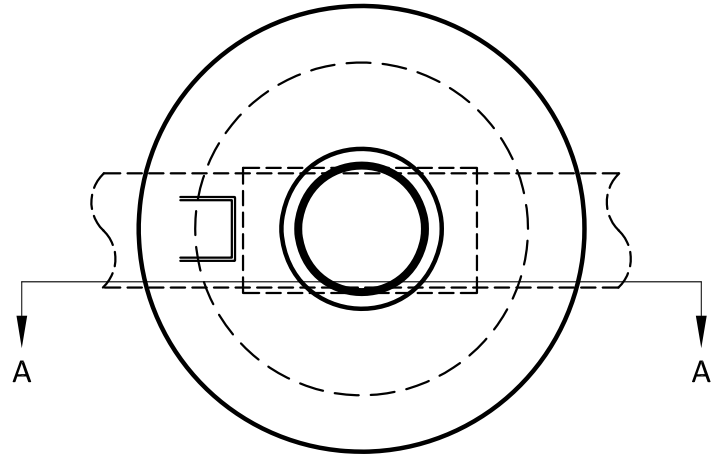
RECOMMENDED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

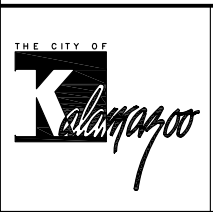
APPROVED BY \_\_\_\_\_

ACCEPTED BY \_\_\_\_\_

DATE



**TYPICAL INSERTA – VALVE**  
*PRECAST REINFORCED CONCRETE SHOWN*



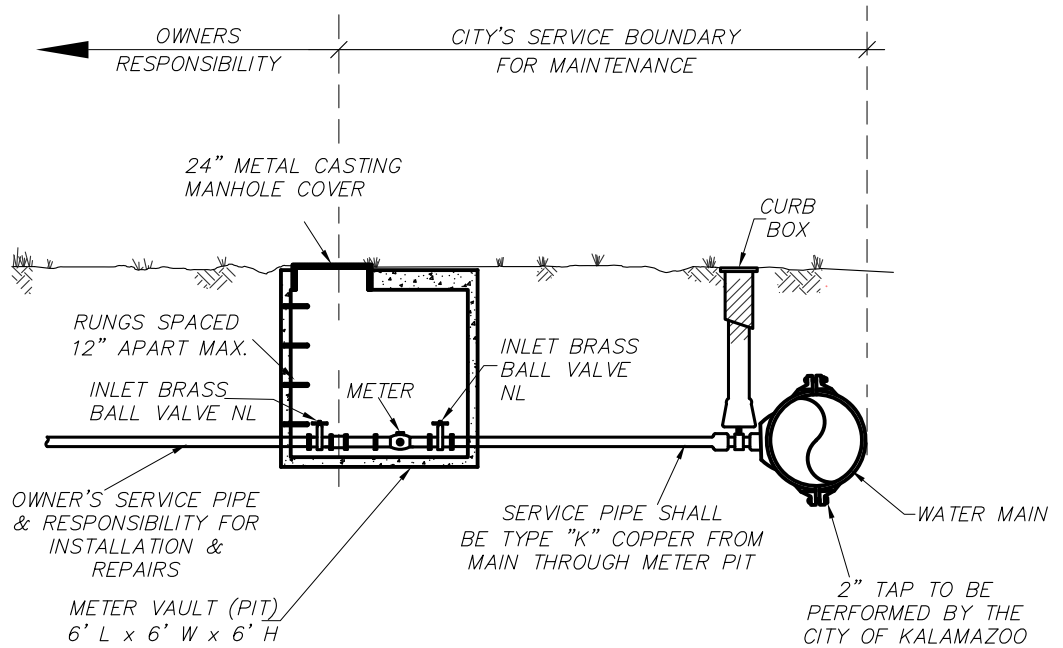
CITY OF KALAMAZOO  
 Department Of Public Services

**INSERTA-VALVE  
 STRUCTURE**

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	

NOTES:

1. METER VAULT (PIT) DESIGN MUST BE SUBMITTED AND APPROVED FOR EACH INDIVIDUAL INSTALLATION. DESIGN SHALL CONFORM TO THE CITY OF KALAMAZOO STANDARD SPECIFICATIONS FOR WATER MAIN AND SERVICE INSTALLATION LATEST REVISION.
2. THE DISTANCE BETWEEN RUNGS, CLEATS & STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
3. CURB BOX WILL BE INSTALLED AT THE WATER MAIN.
4. COVER FOR METER PIT & CURB BOX SHALL BE INSTALLED & MAINTAINED LEVEL WITH THE ADJACENT GROUND.



CITY OF KALAMAZOO  
Department Of Public Services

**2" SERVICE LINE  
METER VAULT**

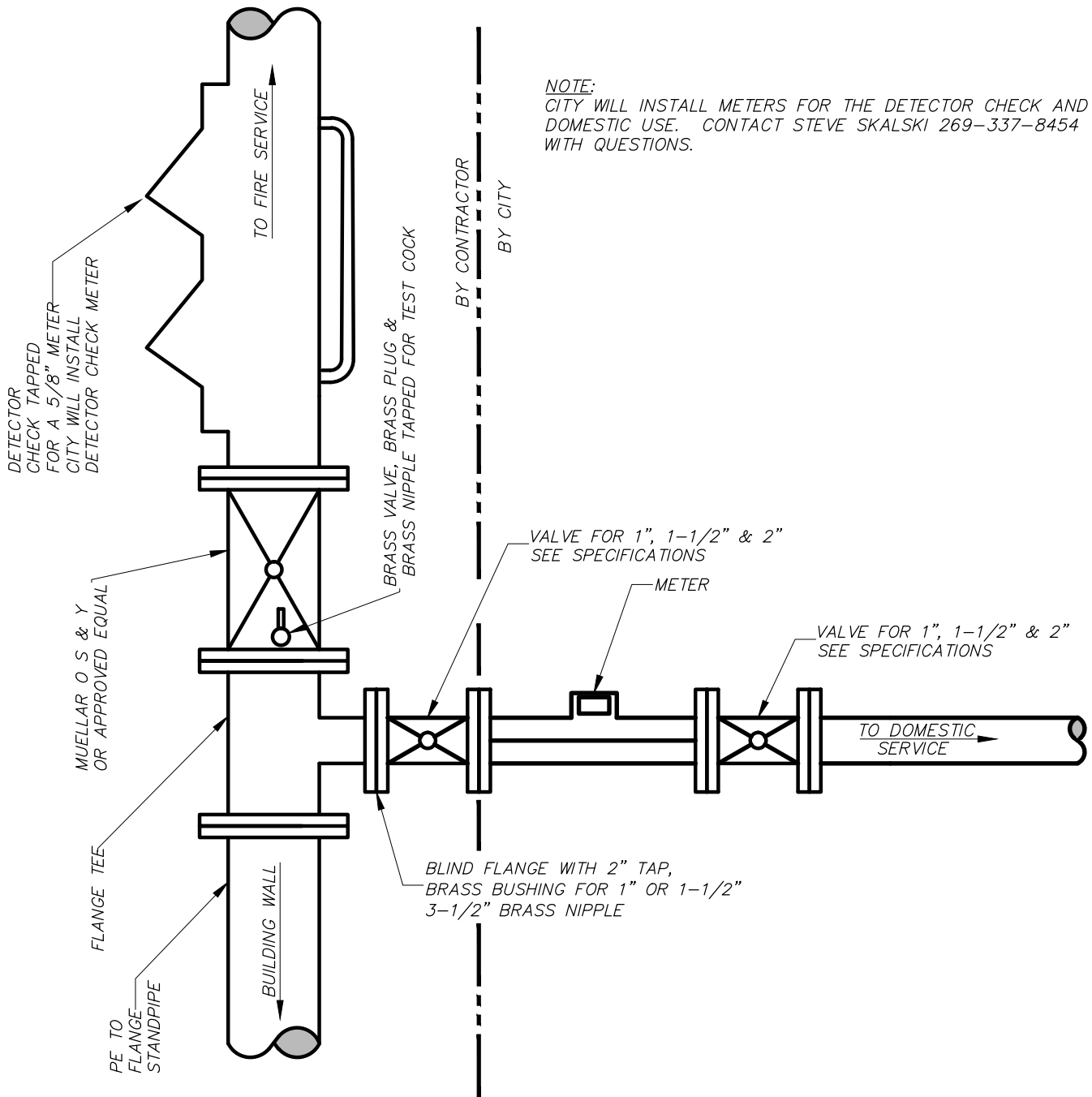
RECOMMENDED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

ACCEPTED BY \_\_\_\_\_

DATE



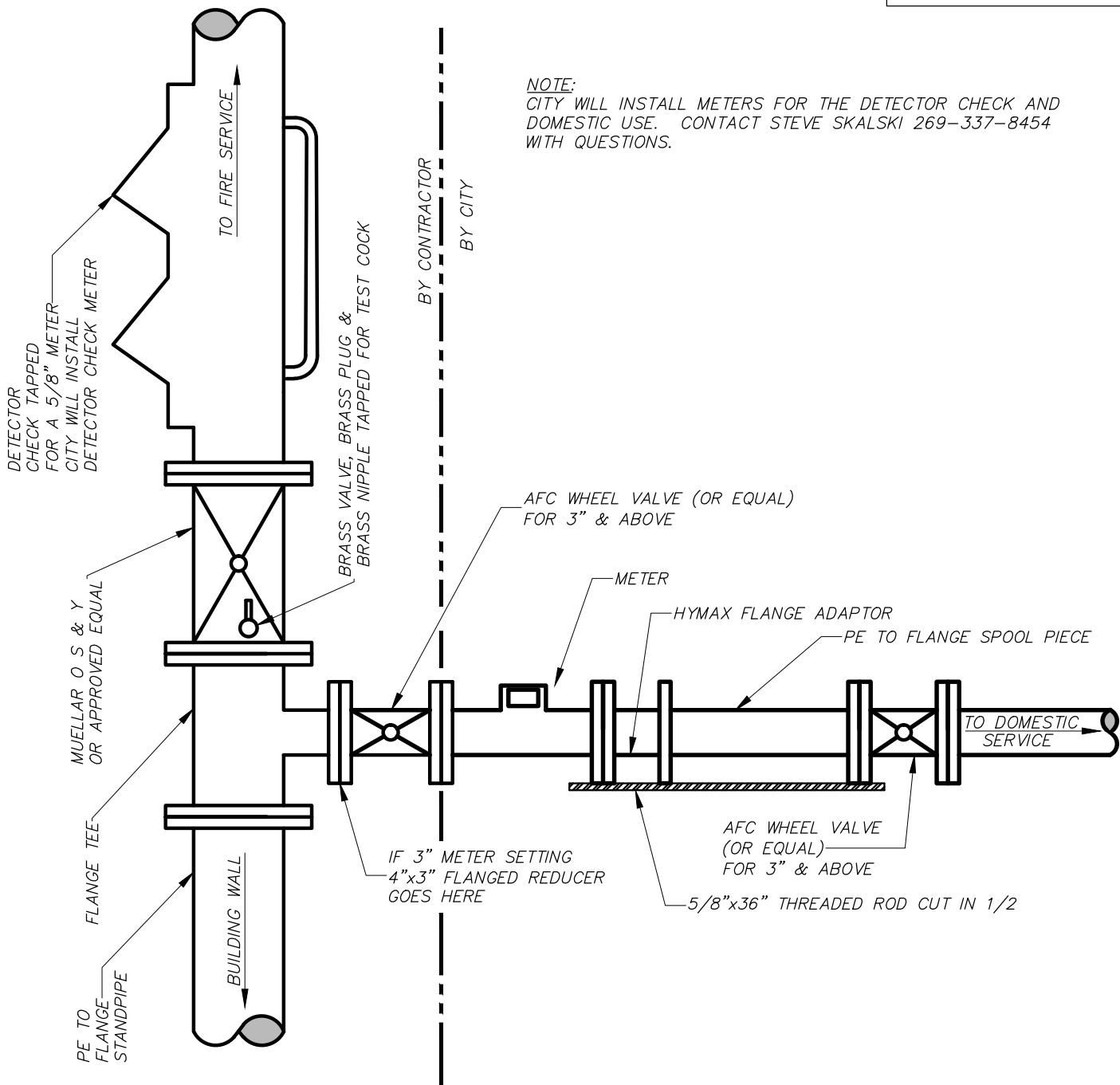
**NOTE:**  
 CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269-337-8454 WITH QUESTIONS.

BY CONTRACTOR  
 BY CITY



CITY OF KALAMAZOO  
 Department Of Public Services  
**TYPICAL FIRE SERVICE**  
**DETAIL**  
 1" 1-1/2" 2"

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	



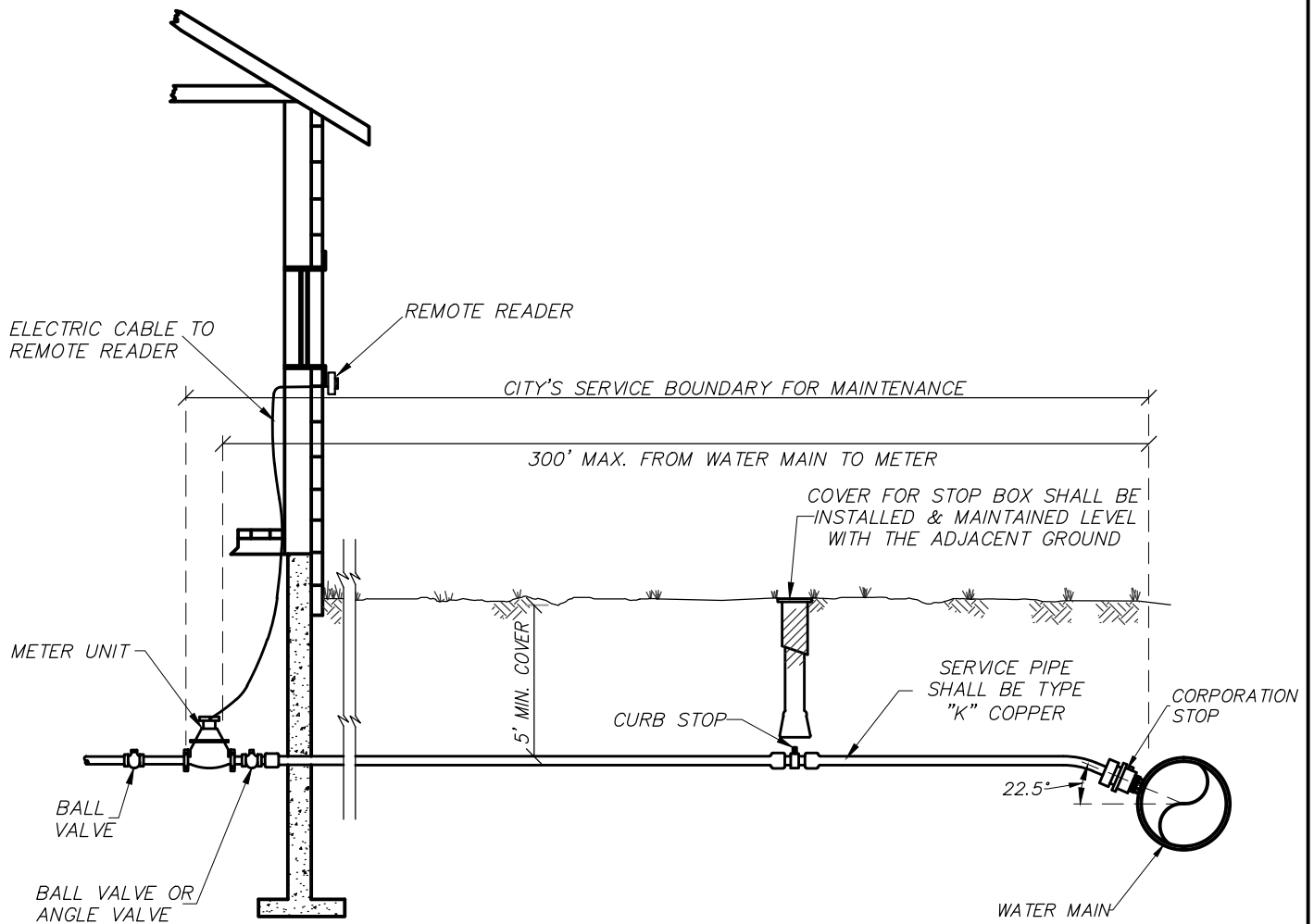
CITY OF KALAMAZOO  
Department Of Public Services  
**TYPICAL FIRE SERVICE  
DETAIL**  
3" 4" 6"

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	

NOTES:

1. PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 5 FEET INSIDE THE PROPERTY LINE. PLACEMENT OF THE STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.

2. CITY WATER WILL REPAIR LEAKS ON SERVICE LINES WHEN NOTIFIED, FROM THE CORPORATION STOP TO METER.



9/15/2015 1:27:03 PM



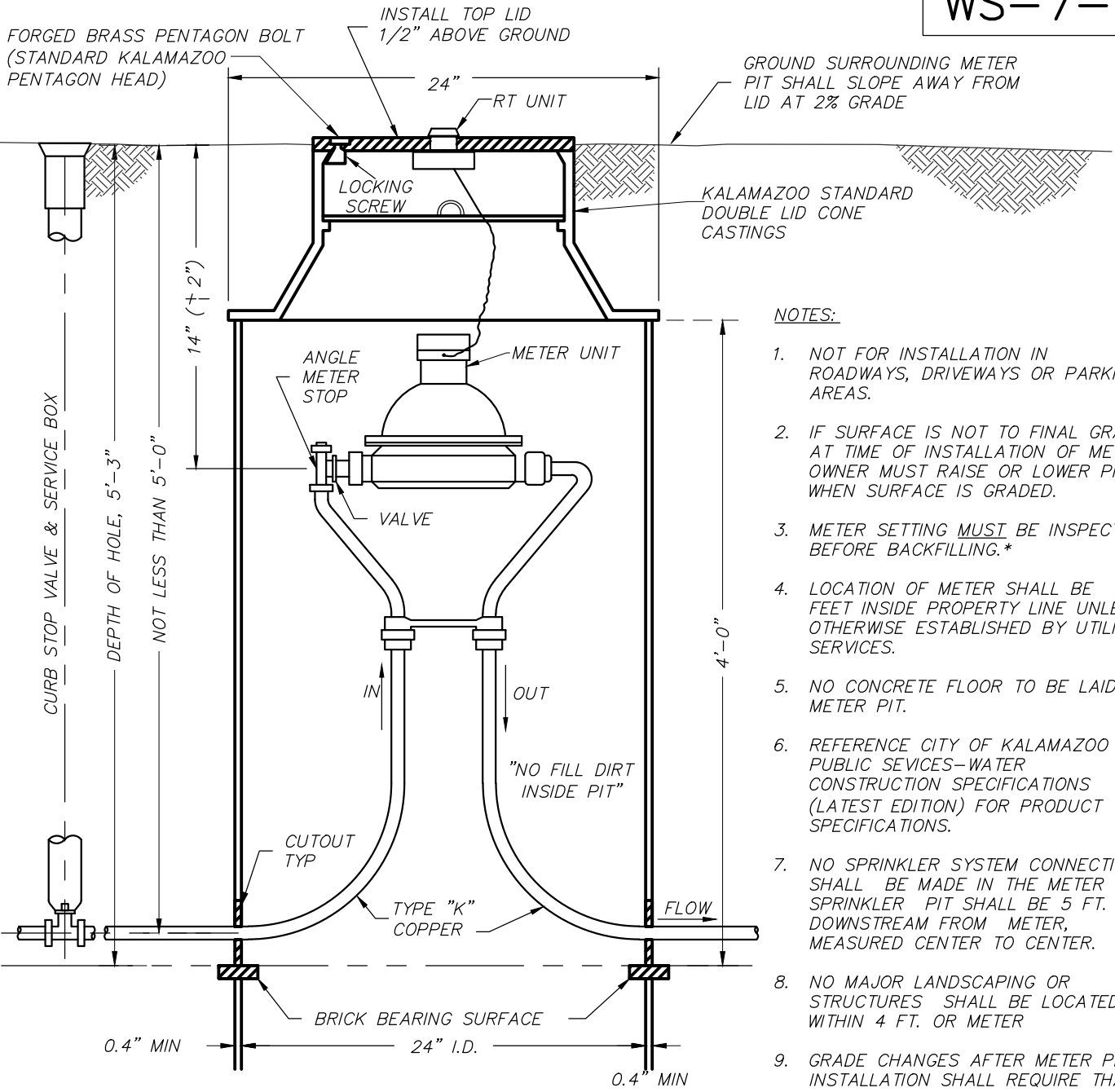
CITY OF KALAMAZOO  
Department Of Public Services

**SERVICE LINE, STOP BOX AND  
INSIDE METER INSTALLATION  
1-1/4" SERVICE & 1" METER**

	DATE
RECOMMENDED BY _____	
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	



WS-7-A



NOTES:

1. NOT FOR INSTALLATION IN ROADWAYS, DRIVEWAYS OR PARKING AREAS.
2. IF SURFACE IS NOT TO FINAL GRADE AT TIME OF INSTALLATION OF METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.
3. METER SETTING MUST BE INSPECTED BEFORE BACKFILLING.\*
4. LOCATION OF METER SHALL BE 5 FEET INSIDE PROPERTY LINE UNLESS OTHERWISE ESTABLISHED BY UTILITY SERVICES.
5. NO CONCRETE FLOOR TO BE LAID IN METER PIT.
6. REFERENCE CITY OF KALAMAZOO PUBLIC SERVICES-WATER CONSTRUCTION SPECIFICATIONS (LATEST EDITION) FOR PRODUCT SPECIFICATIONS.
7. NO SPRINKLER SYSTEM CONNECTIONS SHALL BE MADE IN THE METER PIT. SPRINKLER PIT SHALL BE 5 FT. DOWNSTREAM FROM METER, MEASURED CENTER TO CENTER.
8. NO MAJOR LANDSCAPING OR STRUCTURES SHALL BE LOCATED WITHIN 4 FT. OF METER
9. GRADE CHANGES AFTER METER PIT INSTALLATION SHALL REQUIRE THAT THE OWNER ADJUST METER PIT COVER TO 1/2" ABOVE FINAL GRADE.
10. IF PRESSURE REDUCING VALVE IS REQUIRED BY PLUMBING CODE, IT SHALL BE INSTALLED INSIDE THE BUILDING, IMMEDIATELY FOLLOWING THE MAIN SHUT OFF VALVE.
11. COPPER PIPE SHALL SHOW NO VISIBLE CRIMPING.

\* FOR INSPECTION CALL (269) 998-6433 INSPECTOR  
 \* FOR INSPECTION CALL (269) 337-8769 ENGINEER

J:\COK CAD STANDARDS\STANDARD DETAILS\WATER\UPDATED DRAWINGS\WS-7-A OUTSIDE METER 1 INCH.dwg, 4/1/2014 8:18:07 AM

	CITY OF KALAMAZOO Department Of Public Services	RECOMMENDED BY _____	DATE _____
	<b>OUTSIDE SETTING FOR                  1" METER</b>	APPROVED BY _____	
		APPROVED BY _____	
		ACCEPTED BY _____	

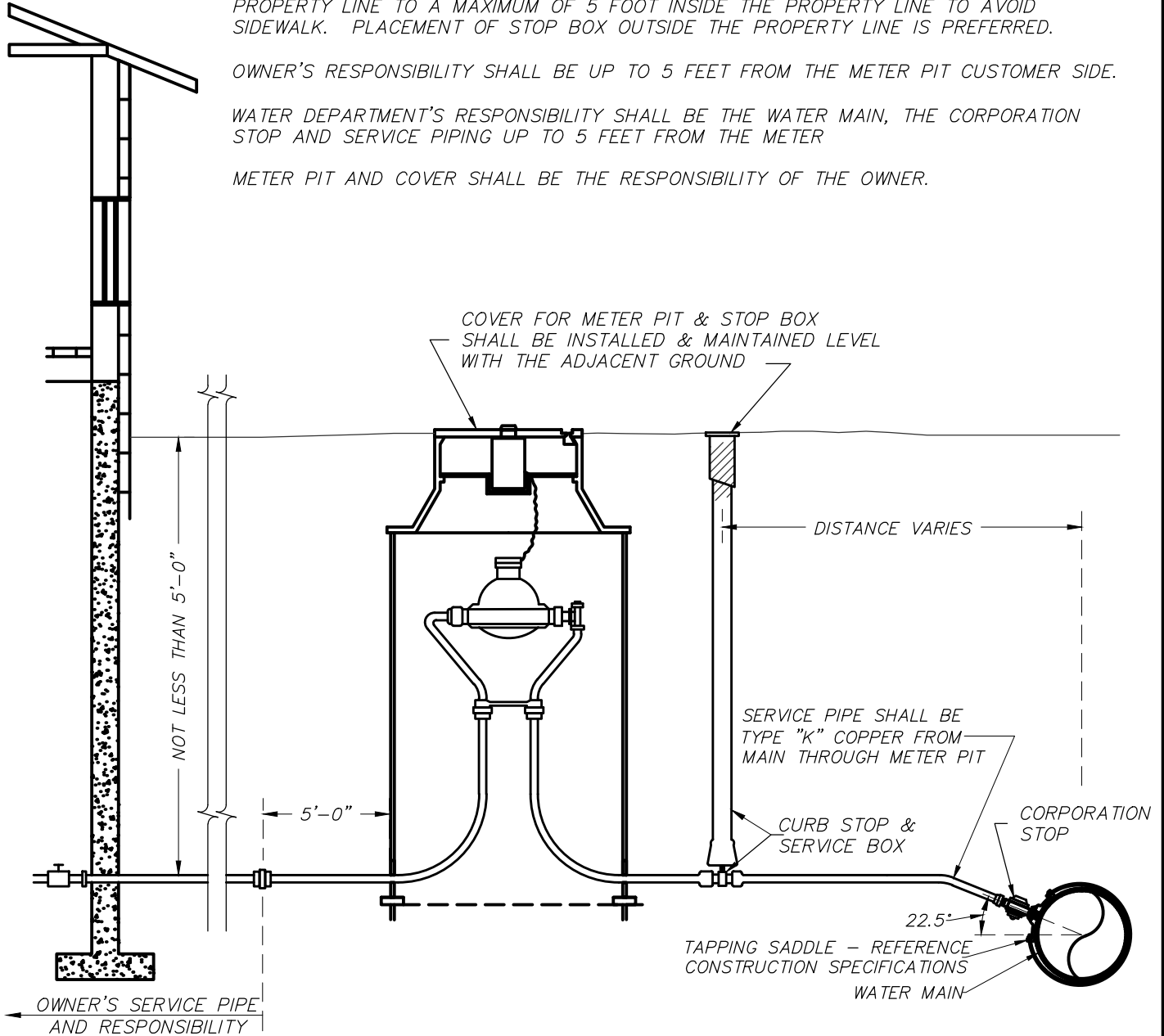
NOTES:

PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FOOT OUTSIDE THE PROPERTY LINE TO A MAXIMUM OF 5 FOOT INSIDE THE PROPERTY LINE TO AVOID SIDEWALK. PLACEMENT OF STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.

OWNER'S RESPONSIBILITY SHALL BE UP TO 5 FEET FROM THE METER PIT CUSTOMER SIDE.

WATER DEPARTMENT'S RESPONSIBILITY SHALL BE THE WATER MAIN, THE CORPORATION STOP AND SERVICE PIPING UP TO 5 FEET FROM THE METER

METER PIT AND COVER SHALL BE THE RESPONSIBILITY OF THE OWNER.



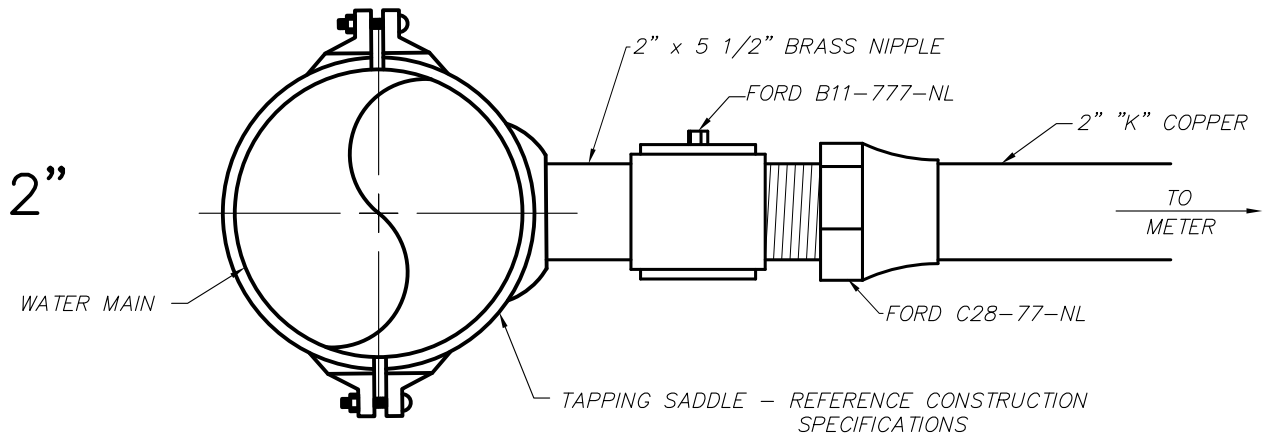
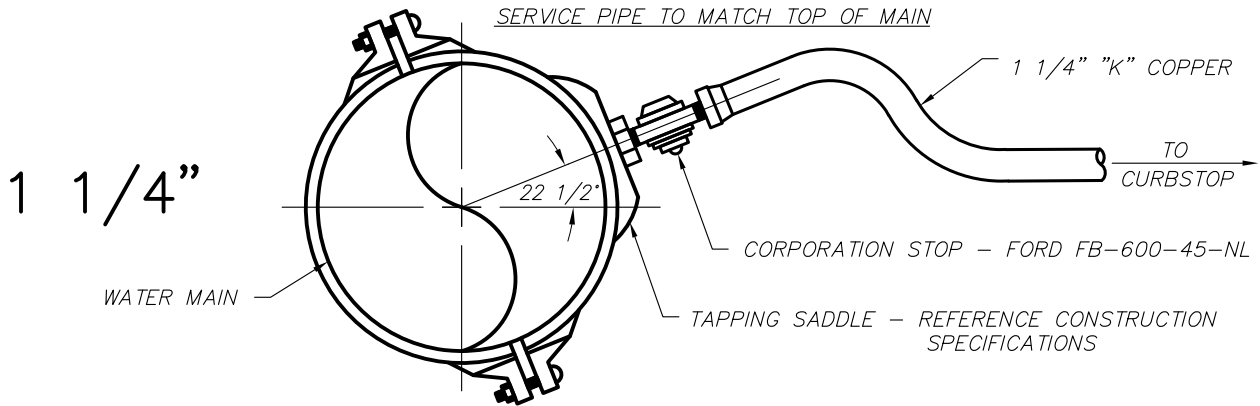
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CITY OF KALAMAZOO  
Department Of Public Services

**1-1/4" SERVICE LINE,  
STOP BOX AND OUTSIDE  
METER INSTALLATION**

RECOMMENDED BY _____	DATE
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	



CITY OF KALAMAZOO  
Department Of Public Services

**WATER SERVICE  
TAPPING SLEEVE**

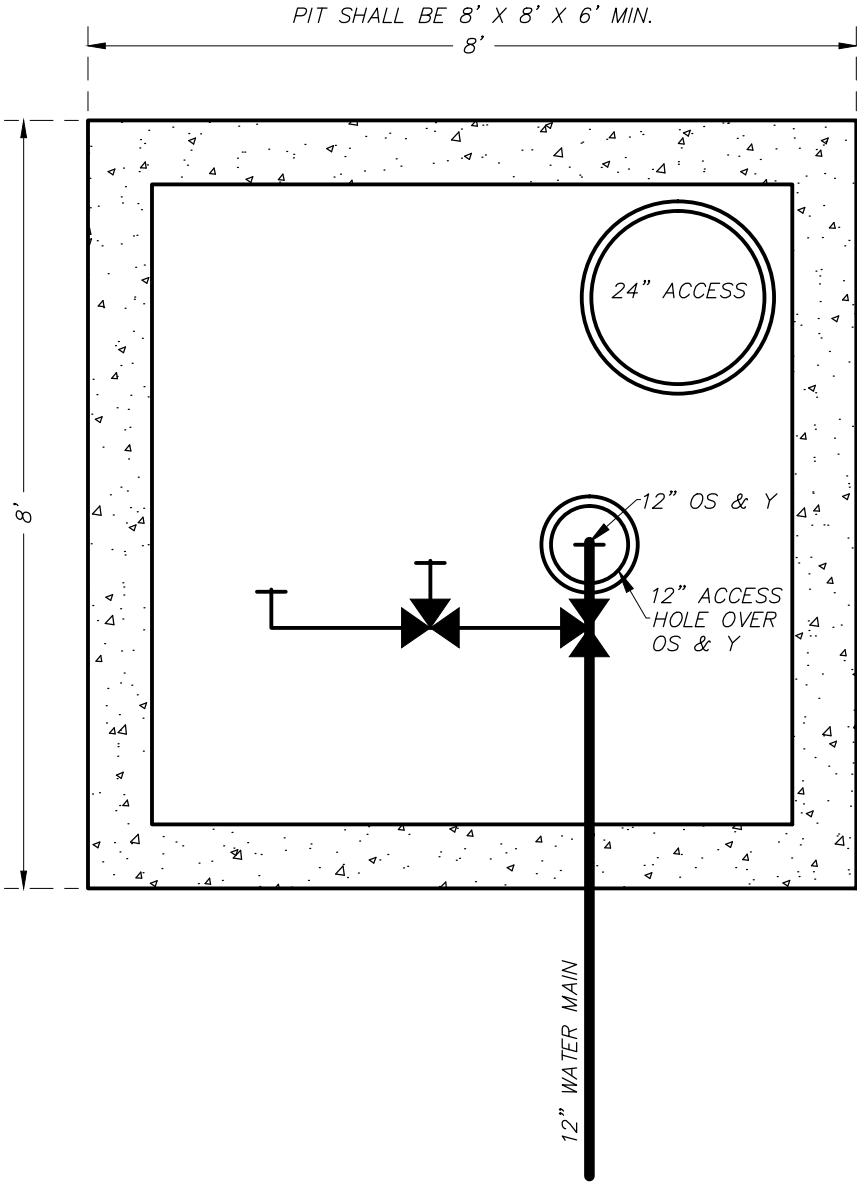
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APPROVED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

ACCEPTED BY \_\_\_\_\_

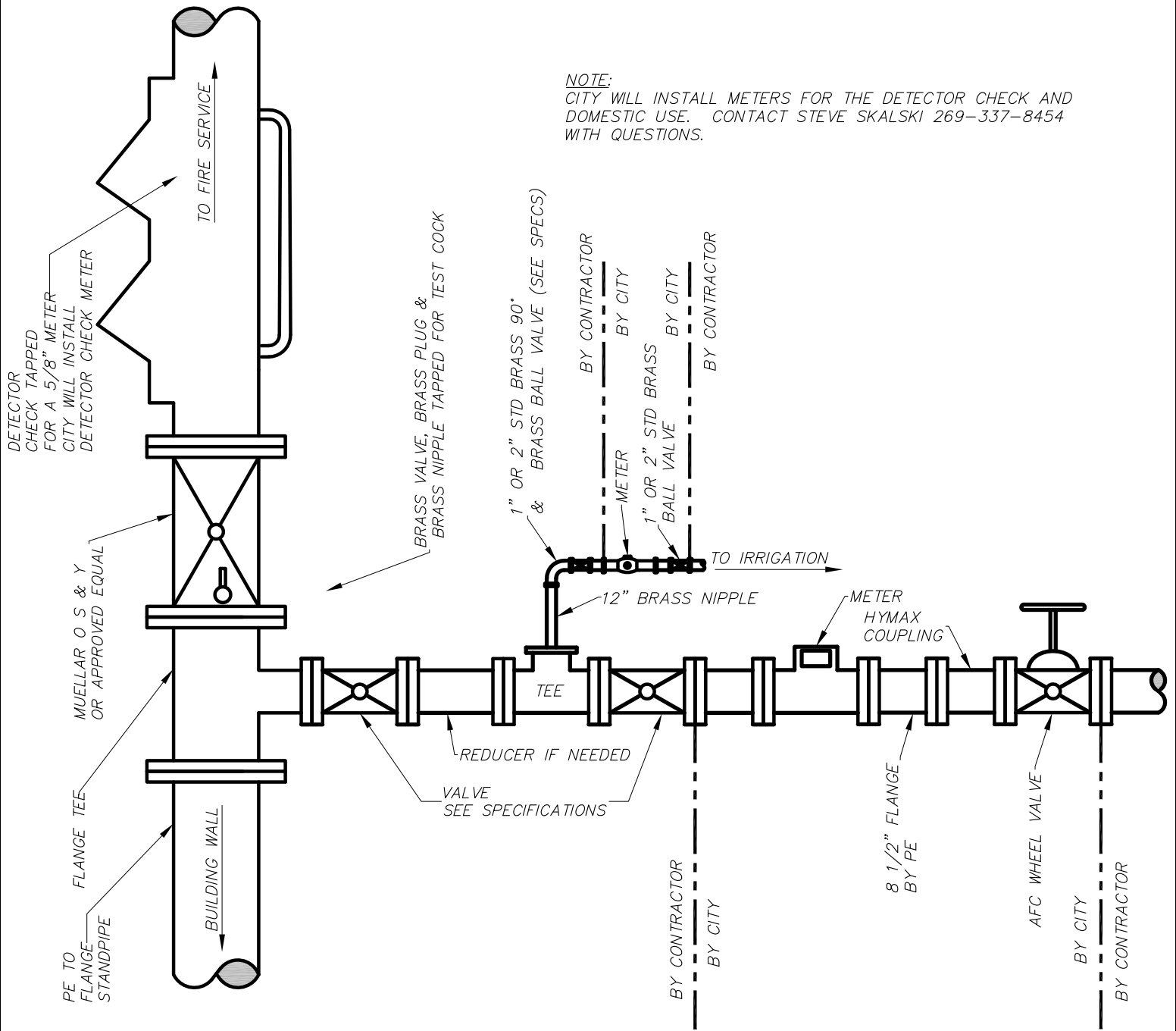
DATE



CITY OF KALAMAZOO  
Department Of Public Services

### 12 INCH METER PIT

	DATE
RECOMMENDED BY _____	
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	



TYPICAL FIRE SERVICE  
DETAIL, DOMESTIC 3", 4",  
& 6" & IRRIGATION 1" OR  
2" VERTICAL SETTING

RECOMMENDED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

ACCEPTED BY \_\_\_\_\_

DATE

**NOTE:**  
 CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269-337-8454 WITH QUESTIONS.

1" OR 2" STD. 90°  
 W/1" OR 2" BRASS BALL VALVE  
 OR FORD ANGLE VALVE  
 (FV13-777W-NL) 2"  
 (KV13-444W-NL) 1"

1" OR 2" X 12" BRASS NIPPLE

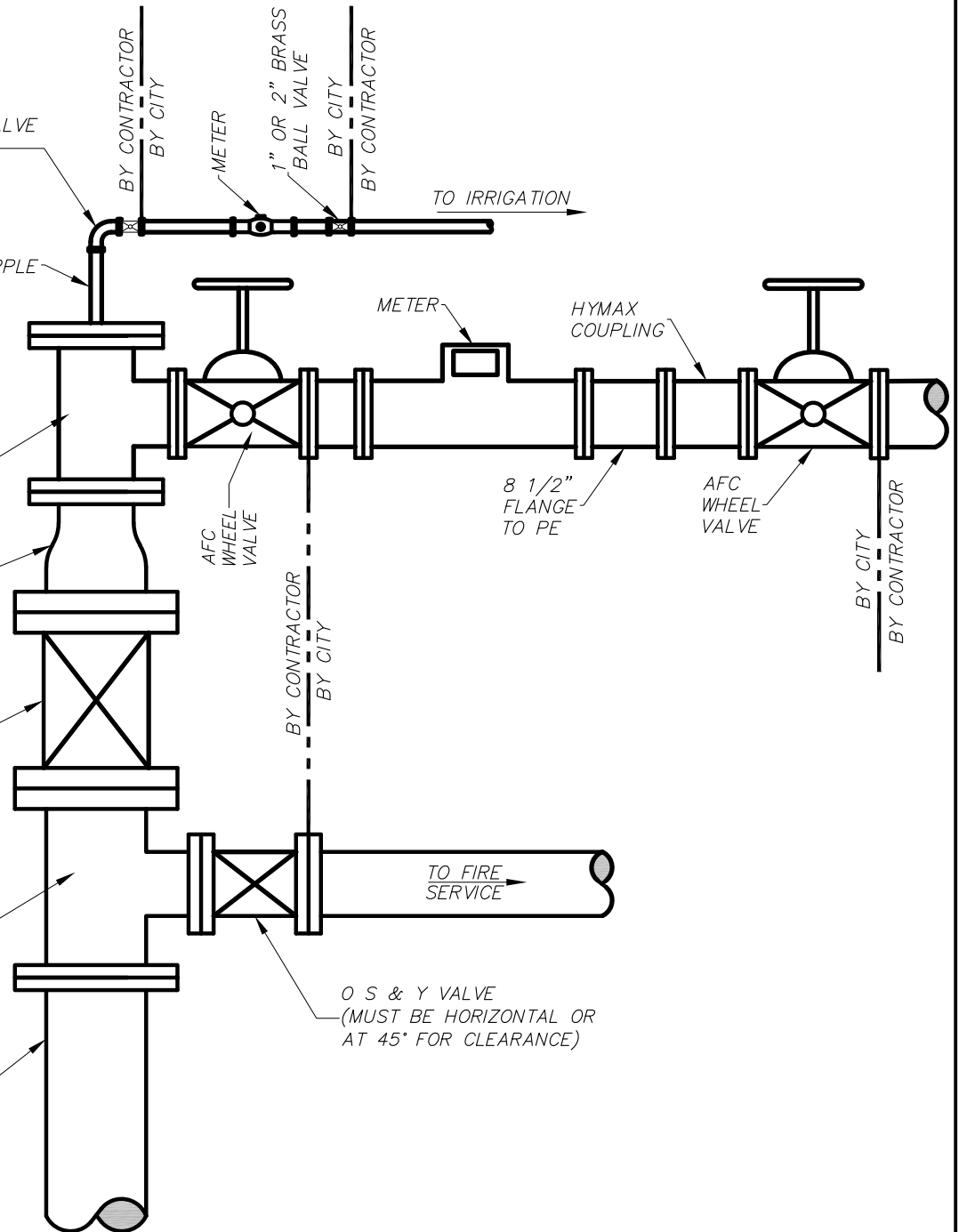
VALVE  
 SEE SPECIFICATIONS

REDUCER  
 (IF NEEDED)

TEE

TEE

PE TO  
 FLANGE  
 STANDPIPE



O S & Y VALVE  
 (MUST BE HORIZONTAL OR  
 AT 45° FOR CLEARANCE)

TO IRRIGATION

TO FIRE  
 SERVICE

BY CONTRACTOR  
 BY CITY

BY CONTRACTOR  
 BY CITY

BY CONTRACTOR  
 BY CITY

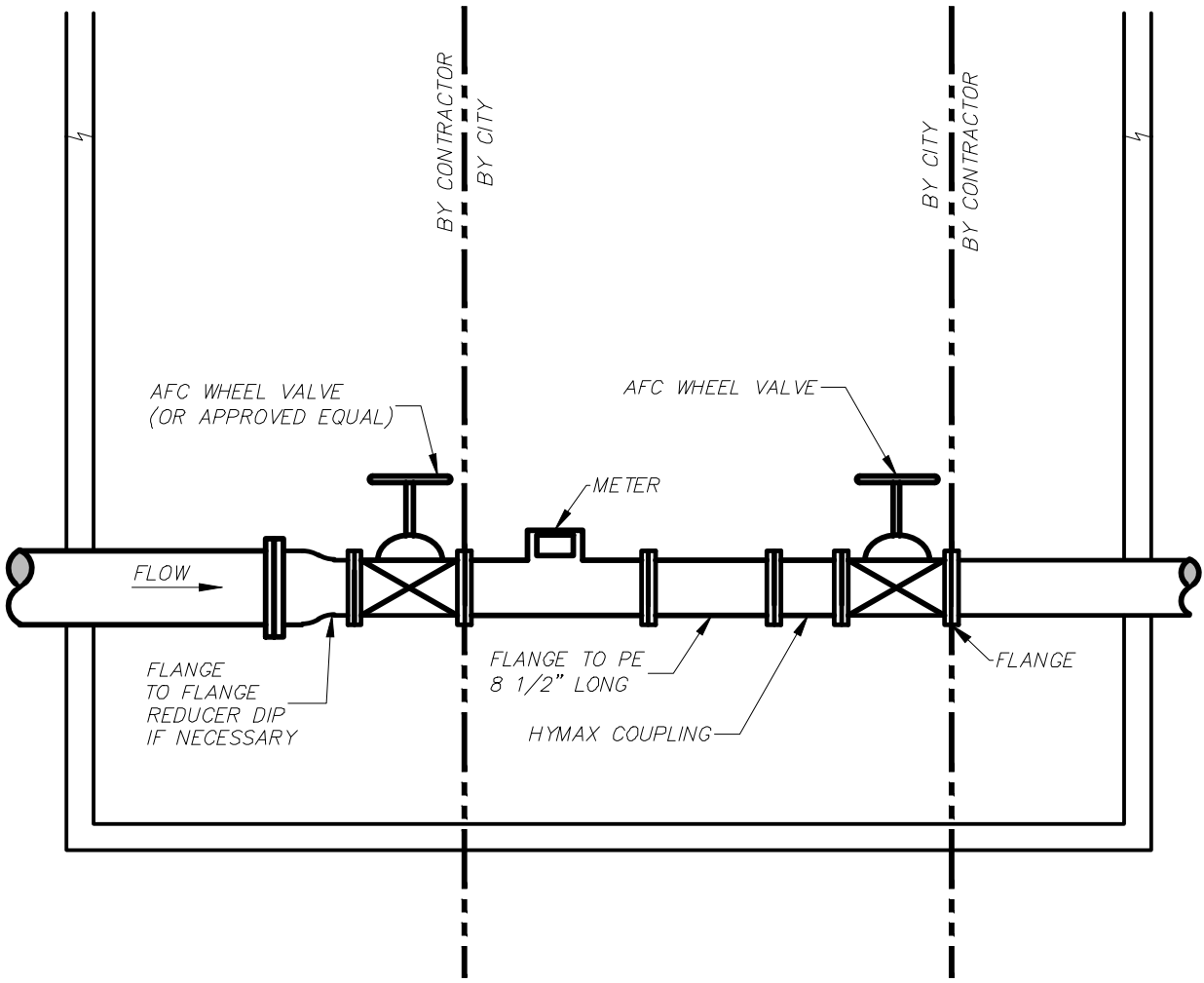
BY CONTRACTOR  
 BY CITY



CITY OF KALAMAZOO  
 Department Of Public Services  
**TYPICAL FIRE SERVICE DETAIL**  
**HORIZONTAL SETTING**  
**W/3", 4", OR 6" DOMESTIC**  
**& 1" OR 2" IRRIGATION**

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	

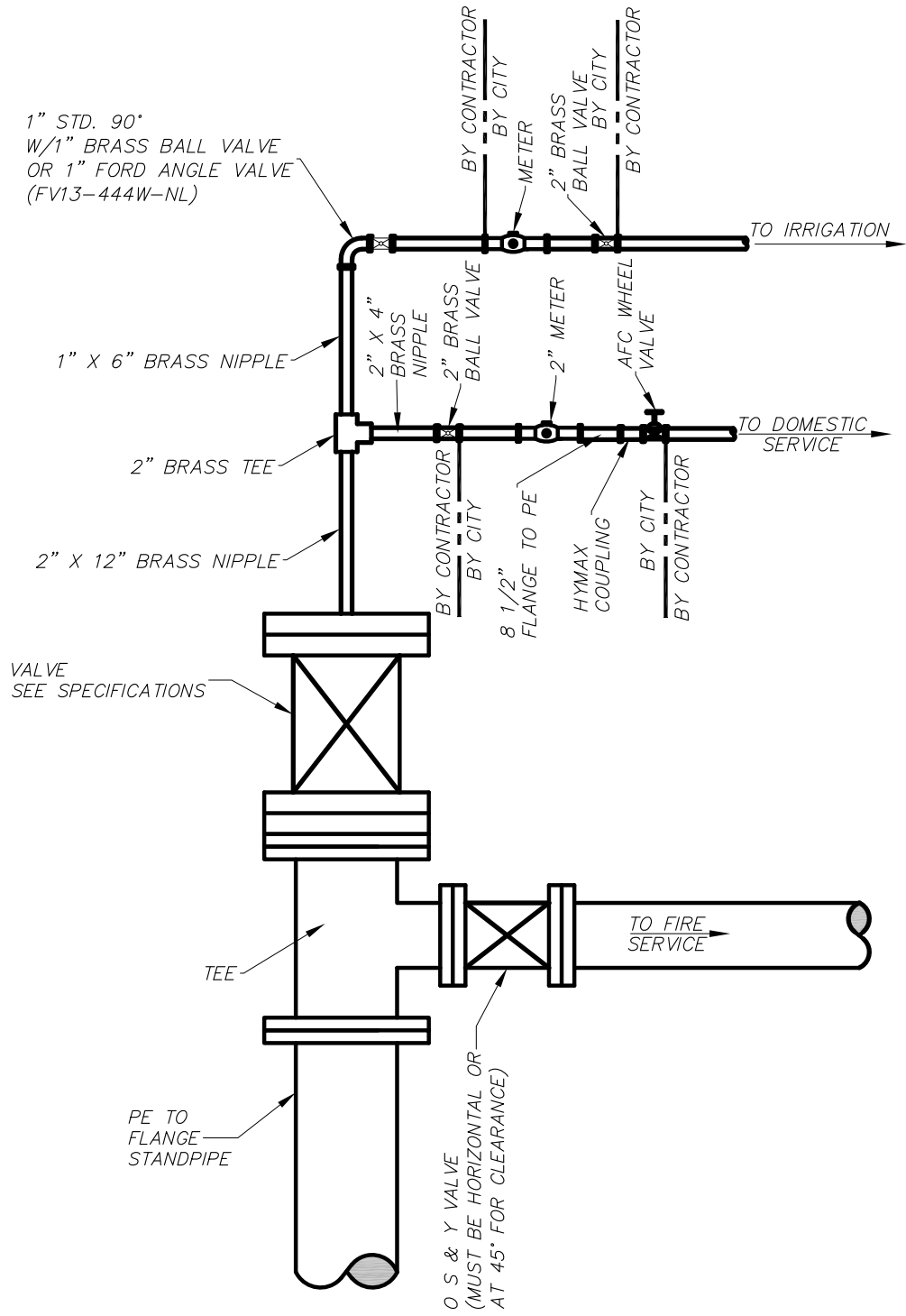
NOTE:  
 CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND  
 DOMESTIC USE. CONTACT STEVE SKALSKI 269-337-8454  
 WITH QUESTIONS.




CITY OF KALAMAZOO  
 Department Of Public Services  
**PIT METER SETTING  
 DETAIL FOR  
 3", 4", 6" & 8"**

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	

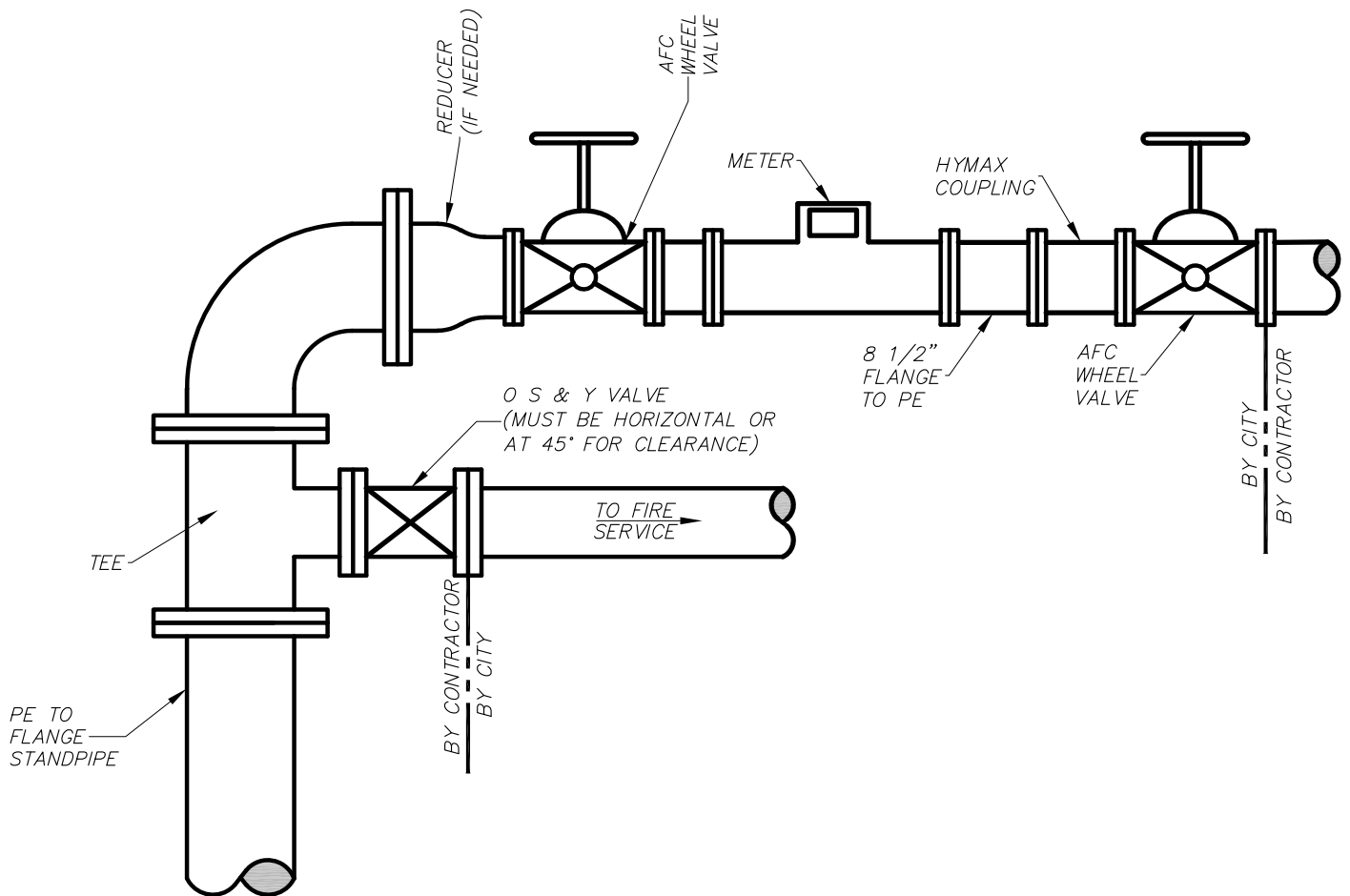
**NOTE:**  
CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND DOMESTIC USE. CONTACT STEVE SKALSKI 269-337-8454 WITH QUESTIONS.



	CITY OF KALAMAZOO Department Of Public Services	RECOMMENDED BY _____	DATE
	<b>TYPICAL FIRE SERVICE DETAIL                  HORIZONTAL SETTING                  2" DOMESTIC                  1" IRRIGATION</b>	APPROVED BY _____	
		APPROVED BY _____	
		ACCEPTED BY _____	



NOTE:  
 CITY WILL INSTALL METERS FOR THE DETECTOR CHECK AND  
 DOMESTIC USE. CONTACT STEVE SKALSKI 269-337-8454  
 WITH QUESTIONS.

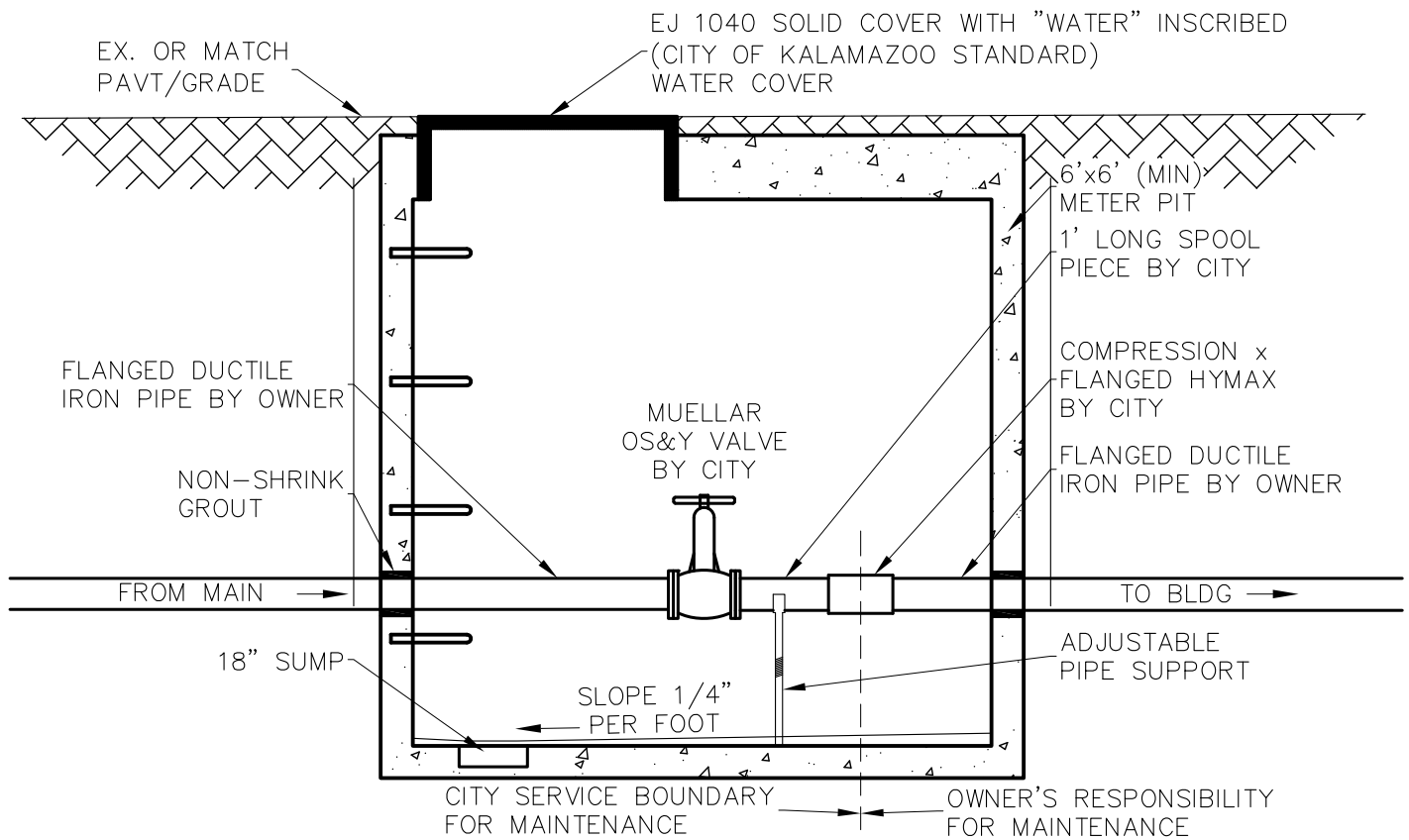
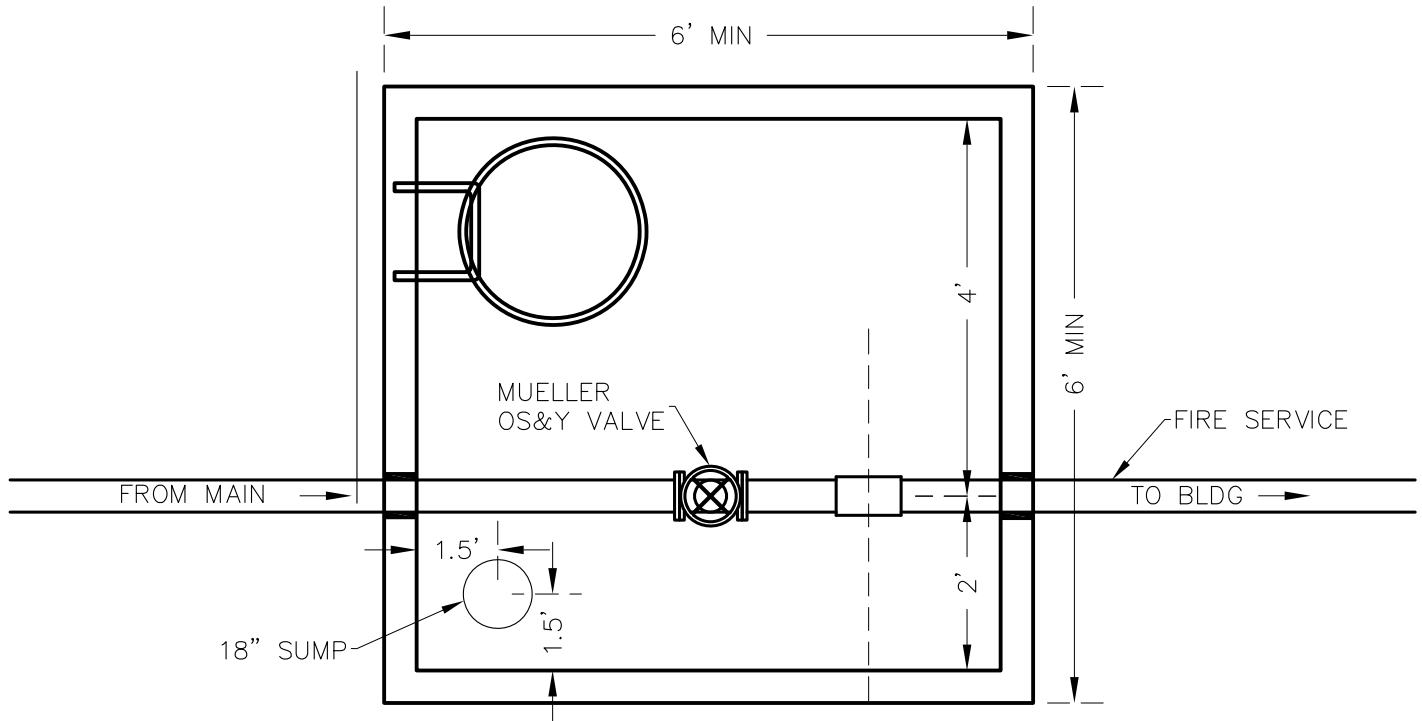


CITY OF KALAMAZOO  
 Department Of Public Services

**TYPICAL FIRE SERVICE DETAIL  
 HORIZONTAL SETTING  
 W/3", 4", OR 6" DOMESTIC**

RECOMMENDED BY _____	DATE _____
APPROVED BY _____	
APPROVED BY _____	
ACCEPTED BY _____	

WS-16-A



	CITY OF KALAMAZOO Department Of Public Services	RECOMMENDED BY _____	DATE _____
	<b>FIRE SERVICE IN PIT DETAIL</b>	APPROVED BY _____	
		APPROVED BY _____	
		ACCEPTED BY _____	

**CITY OF KALAMAZOO  
DEPARTMENT OF  
PUBLIC SERVICES**

**ENGINEERING DIVISION**



**PUBLIC SERVICES DEPARTMENT**

ENGINEERING DIVISION  
415 STOCKBRIDGE AVE.  
KALAMAZOO, MICHIGAN 49001-2898  
PHONE 269-353-8769  
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**Standard Specifications for  
Wastewater Sewer Installation  
2012**

## SANITARY SEWERS

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This Section includes furnishing and installing sanitary sewer systems.
- B. Reconstruction of existing sewers and house connections shall be in conformance with requirements of this Section.
- C. This Section shall include furnishing and installing all required pipe, bends or beveled pipe, tees, wyes, tee manhole base pipes, bulkheads and stoppers, jointing material, granular material for pipe bedding, concrete used for encasement or bedding, making watertight connections to existing and new sewers and existing manholes, cleaning, testing, and videotaping sewers, removing temporary bulkheads, and other work incidental to the sewer installation unless specifically included under other Items.

#### 1.02 SUBMITTALS

- A. Submittals shall be the responsibility of the Contractor :
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project.
  - 2. Information for the Record:
    - a. Manufacturer's certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.
    - b. Manufacturer's installation instructions.
    - c. The laboratory shall submit test certifications of pipe ordered tested under "Field Quality Control," of this Section.
  - 3. Engineer may request additional Shop Drawings or Information for the Record as required.

#### 1.03 AS CONSTRUCTED RECORD

- A. During construction the contractor shall be required to keep current a set of "as constructed" drawings. Before final payment shall be made, the contractor shall submit for approval to the City of Kalamazoo the complete set of as constructed drawings. Each set of "as constructed" drawings shall be labeled "As Constructed", dated, and contain at a minimum the following information (additional information may be required by the City of Kalamazoo):

Structures:	Pipes:	Laterals:
1. Rim Elevations	1. Diameter	1. Address
2. Diameter	2. Length	2. Wye Station
3. Adjustment Ring Height	3. Material	3. Property Line Station
4. Cone/Top Material	4. Slope	4. Wye Elevation
5. Cone/Top Shape		5. Property Line Elevation
6. # of IN pipes		6. Wye Depth
7. # of Out pipes		7. Cleanout Depth
8. # of IN drops		8. Diameter

- 9. # of Out drops
- 10. Invert Elevations
- 11. Depth of Structure

- 9. Material
- 10. Lead Length
- 11. Riser Height
- 12. Distance from DS MH
- 13. Tie downs of CO and horizontal bends
- 14. Distance and direction from edge of house

**PART 2 PRODUCTS**

**2.01 PIPES**

**A. Polyvinyl Chloride (PVC) Sewer Pipe Specifications:**

- 1. ~~For pipe 15 inch diameter and smaller: Pipe, fittings, and jointing systems shall conform to ASTM D-3034, except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall be 35.~~
- 2. ~~For pipe 18 inch thru 24 inch diameter: Pipe, fittings, and jointing systems shall conform to ASTM D-3034 except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall be 26.~~
- 3. ~~For pipe 27 inch thru 54 inch. Pipe, fittings, and jointing systems shall conform to ASTM F-1803 and UNIB-9 (Vylon Pipe) and shall comply with the requirements for a minimum cell classification of 12364 as defined by ASTM D-1784. Impact resistance shall be 220 ft lbs for 27 inch and 440 ft lbs for 30 inch and larger. Test shall be per ASTM D-2444 and ASTM F-1803.~~
- 4. ~~Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F-477 requirements. Joint materials and testing shall conform to ASTM D-3212 requirements.~~
- 5. ~~All service connections shall be made using a wye and a bend. Tees shall be used only as directed by the Engineer. Tees and wyes shall be die cast or factory fabricated. All service pipes shall be SDR 35.~~

**2.02 ACCESSORIES**

**A. Flexible Pipe Repair Couplings:**

- 1. Flexible repair couplings shall be made of elastomeric polyvinyl chloride boot with series 300 stainless steel shield and clamps. Couplings shall be Strong Back RC series as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Logan Clay Pipe Co., Logan, Ohio; Mission Clay Products Corp., or equal.

**B. Flexible Watertight Joints:**

- 1. Flexible watertight joints used in connecting to existing sewers shall be a "boot" type sealed to the pipe wall with an internal expanding band and around the connecting pipe with an external adjustable band. Other types of applicable flexible joints may be submitted for approval.

**C. Granular Pipe Bedding Material:**

- 1. Granular pipe bedding material shall be Class IIIa as specified in table 902-3 of the 2012 Michigan Department of Transportation Standard Specifications for Construction. .

## 2.03 REPLACEMENT DRAINS, SEWERS, AND APPURTENANCES

- A. All existing sanitary sewer pipe removed shall be replaced using pipe and joints as specified in this section. Connections to existing sewers shall be as specified in this section.

## 2.04 SOURCE QUALITY CONTROL

### A. Pipe Manufacturer's Certification:

1. The pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.
2. A test results report shall accompany that manufacturer's certificate. The report shall compare test results to Specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

### B. ~~Profile Wall Basis of Design:~~

1. ~~In addition to the above certifications, and if required by the Engineer, for pipe 18-inch and larger or greater than 20 feet in depth, the manufacturers of plastic profile wall pipes shall provide a certification that shows the basis of design for each pipe class furnished and that they are satisfactory for use as shown on the Drawings. Basis of design limits provided shall include but are not limited to; crushing resistance of pipe wall, pipe deflection, and constrained buckling resistance.~~
2. ~~The following constraints shall be used as minimum conditions for the basis of design:~~
  - ~~Safety Factor = 2~~
  - ~~Bedding Class = ASTM D 2321 Class 1A~~
  - ~~Loads = Soil weight (120 lb/ft) + H<sub>2</sub>O~~
  - ~~Depth of burial as shown of Drawings~~
  - ~~Depth of submergence as indicated on soil borings or 4 feet minimum.~~

## PART 3 EXECUTION

### 3.01 PREPARATION OF TRENCH

- A. The trench shall be excavated so the pipe can be laid to the alignment and grade required. Removed material (regardless of nature encountered) shall be stockpiled if approved to be reused or removed from site and disposed of according to all applicable laws and regulations.
- B. For pipes the width of trench at the top of pipe 18-inch in diameter or less shall be 36 inches. For pipe having a diameter greater than 18-inch, the width of trenches at the top of the pipe shall be two (2) times the inside diameter of the pipe. .
- C. Trenches shall be of such extra width as to permit the placing of sheeting and bracing where required. The contractor shall furnish and put in place all bracing, shoring or sheeting as may be required for the protection of the work and public or adjacent property. The bracing, shoring or sheeting shall be removed as the work progresses in such a manner as to prevent the caving in of the excavations or any damage to the sewer or structure. Any voids left by removal of said materials must be filled in with granular material as specified and compacted. This work shall be included in the pay item and will not be paid for separately.

- D. Unless otherwise indicated all sewer trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as shown on Michigan Department of Transportation (MDOT) R-83 Series Standard Plans
- E. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein are completed. In waterbearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.
- F. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

### 3.02 PIPE INSTALLATION

- A. All loose dirt shall be removed from the bottom of the trench and the trench backfilled with specified bedding material to pipe laying grade, as detailed on the Drawings. Pipe trenches shall be excavated to the depth indicated on MDOT R-83-Series Standard Plans to provide adequate depth of pipe bedding and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Hand tampers shall be used for installing bedding material around pipes smaller than 36-inch diameter and mechanical hand tampers shall be used around pipes 36-inch diameter and larger unless otherwise directed by the Engineer. The remainder of the trench shall be backfilled as specified in the R-83-series standard with a maximum size of 1.5 inches within two feet of the pipe.
- B. Concrete bedding and encasement in lieu of bedding material shall be installed as shown on the Drawings or specified.
- C. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.
- D. All pipe shall be laid to lines and grades by use of a laser beam and checked for conformance. Pipes installed more than 0.04 feet above or below specified elevation shall be removed and reinstalled to grade.

### 3.03 PIPE JOINTS

- A. Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.
- B. Flexible Plastic Gasket Joints - Materials used for gaskets shall be as specified in this Section. Cross section size of gaskets and method of installation shall conform to the manufacturer's recommendations.

### 3.04 CONNECTIONS TO EXISTING SEWERS

- A. Unless indicated otherwise connections to existing sewers shall be connected in conformance with the manufacturer's recommendations as approved by the Engineer.

### 3.05 BACKFILLING AND COMPACTING

- A. Backfilling Under Existing Conduits - Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the spring line of the conduit a distance of 2-feet on either side and thence downward at its natural slope.
- B. Backfilling With Excavated Material - Unless otherwise specified or directed, material excavated in connection with the work shall be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12-inch, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry greater than 1.5 inches shall be deposited closer than 24-inch from the completed outside surface of any structure or pipe.
- C. Backfill Immediately - All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in unbackfilled trenches after pipe has been placed.
- D. ~~House Leads shall not be backfilled until the pipe ends are referenced and the Engineer has measured the pipe for payment.~~
- E. Backfilling around and over structures and pipes shall be carefully done by hand and tamped with suitable tools of approved weight to a point 1-foot above the top of pipe. Selected material or, where specified or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6-inch in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.
- F. Backfilling by Machinery - After the backfill has been placed and compacted around the structures and conduits to a height of 1-foot above the top. The remainder of the trench may be backfilled by machine. The backfill material shall be deposited in horizontal layers and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

### 3.06 COMPACTION REQUIREMENTS

- A. Compact each layer to 95% maximum density as tested by the Michigan Department of Transportation Density Testing and Inspection Manual.

### 3.07 COMPACTION TESTS

- A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Compaction tests shall be performed on each layer immediately after compaction.
- B. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.
- C. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.



- D. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

### 3.08 FIELD QUALITY CONTROL

- A. The Engineer may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the Contractor's laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. The Contractor shall pay for tests on the first sample. Should the sample fail to meet specifications, retests shall be conducted by the Contractor's laboratory in conformance with the specifications and shall be at no additional expense to Owner.

- B. ~~Deflection of PVC Pipe:~~

- ~~1. Vertical Ring Deflection—Before final acceptance of sewer lines, all sections of sewer pipe 8 inch and larger specified diameter shall be measured for vertical ring deflection by the Contractor and witnessed by the Engineer. Maximum deflection under full load shall not exceed 5 percent of the ASTM designated average inside diameter as determined by the laboratory for the specified piping.~~
- ~~2. Failures—Should a pipe exceed the allowable deflection, the Contractor shall replace those pipes and retest the section.~~
- ~~3. Equipment used in testing shall be go-no-go pull through gauges of a type approved by the Engineer. A metal or plastic gauging ring of diameter equal to 95 percent of the specified average inside pipe diameter shall be furnished with each gauge.~~
- ~~4. The Contractor shall furnish testing equipment and personnel and perform the required tests. Tests shall be witnessed by the Engineer.~~
- ~~5. Use of mechanical pulling devices is not permitted.~~
- ~~6. Deflection testing shall not be performed until the completed and accepted trench backfill has been in place for at least 30 days.~~

- C. Field Inspection:

- 1. Individual sections of pipe may be rejected at any time because of defective joints, dimension variations, fractures, cracks, chips, or blisters exceeding the permissible tolerances.
- 2. Rejected pipe shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.

### 3.09 LOW PRESSURE AIR ACCEPTANCE TESTS

- A. The Contractor will perform low pressure air acceptance tests in lieu of infiltration or exfiltration tests. Test shall be made in accordance with ASTM F-1417-Plastic Gravity Sewer Lines.

- 1. If the air pressure required for the test is greater than 5.0 psig, the low pressure air acceptance test shall not be used.

- B. The Contractor shall furnish all equipment, materials, and labor, and conduct the tests under observation of the Engineer.

- C. Safety:

- 1. The air test may be dangerous if the line is improperly prepared. All plugs shall be installed and braced in such a manner to prevent blowouts. No one shall be allowed in manholes during testing.

2. Pressurizing equipment shall include a regulator set at the maximum pressure.

D. Line Preparation:

1. Sewers to be air tested shall be prepared and inspected as specified herein for infiltration and exfiltration tests.
2. Where porous pipe materials are used, the pipe walls may be wetted to temporarily reduce the porosity of the material.
3. All pipe outlets shall be plugged, braced, and the joints restrained adequately to prevent blowouts.

E. Test Procedure:

1. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water above the invert of the pipe.
2. When a constant pressure of 4.0 psig greater than the average back pressure of any ground water above the pipe is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes to permit temperature equalization.
3. When temperatures have been equalized and the pressure stabilized at 4.0 psig greater than the average back pressure of any ground water above the pipe, the air supply shall be shut off or disconnected.
4. Decrease the pressure in the sealed line until the continuous monitoring pressure gauge reads 3.5 psig greater than the average back pressure of any ground water above the pipe. When this pressure is reached, timing shall commence with a stop watch.
5. Determine the time, as shown on the stop watch, required for the pressure in the sealed line to drop 1.0 psig.

F. Test Method ASTM F-1417-Plastic Gravity Sewer Line:

1. Low pressure air test method shall be the Time-Pressure Drop Method.
2. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.
3. The time required for the pressure in the test section to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM F-1417, the section fails. The table below has been reprinted from ASTM F-1417 for Contractor's information.

Pipe Diameter, Inches	Minimum Time, Min.: Sec.	Length for Minimum Time, Feet	Time for Longer Length, Sec. (L=Ft)
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470L
24	22:40	99	13.674L

Note: Minimum time applied to all lengths less than or equal to the length shown. For more information, see ASTM F-1417, Table 1.

G. Air Pressure Adjustment For Groundwater:

1. In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately, 10-inch long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube.
2. The air pressure correction, for the average back pressure of the groundwater above the pipe, shall be calculated by subtracting the average invert elevation from the measured groundwater elevation and dividing the difference by 2.31 psi/ft.. This correction must be added to the test pressures stated in the test procedure.

3.10 CLOSED CIRCUIT TELEVISION INSPECTIONS (CCTV)

- A. Perform CCTV television inspections on sanitary mains and laterals per the City of Kalamazoo Standard Specifications for Closed Circuit Television Inspections of Sewer Mains, Manholes, and Laterals

PART 4 MEASUREMENT AND PAYMENT

Pay Item	Pay Unit
Sanitary Sewer, PVC, _ inch, TR Det .....	Foot
Sanitary Service, PVC, _ inch, TR Det .....	Foot
Sanitary Cleanout, PVC, _ inch, TR Det .....	Each

Sanitary sewer shall be measured in place per foot as measured from center of manhole to center of manhole.

~~Sanitary service shall be measured in place per foot as measured from the wye connection to the center of each bend, tees, wyes, or plugs until the pipe terminates or is connected to the existing service. Connection to the existing service shall be considered incidental to construction and will not be paid for separately~~

~~Sanitary cleanouts shall be measured per unit installed and include the riser pipe, plug/cap, and any additional items as detailed on the drawings.~~

Payment for each item includes all excavation, trenching, backfilling, compacting, shoring/bracing cleaning and CCTV inspection, labor and equipment to complete pay item.

END OF SECTION

## PRECAST SEWER MANHOLES

### PART 1 GENERAL

#### 1.04 SCOPE

- A. This Section includes furnishing and installing precast sewer manholes, including drops and manhole stacks of types and at locations shown on the Drawings and scheduled.
- B. This Section includes removing existing structures, additional excavation to widen and deepen trenches for manhole construction, furnishing and installing concrete of classes called for, Portland cement mortar, reinforcing steel, precast concrete pipe integral base sections, bottom riser sections, transition sections, and riser sections, eccentric cones, flat slab tops and grade rings, flexible manhole connections, pipe for drop connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, forming channels through manhole bottoms, making watertight connections to new and existing sewers, and other work incidental to manhole construction and testing.

#### 1.05 SUBMITTALS

- A. Submittals shall be the responsibility of the Contractor :
  - 1. Shop Drawings for Review:
    - a. Manufacturer's Shop Drawings indicating physical dimensions, joint details, and reinforcing steel layout for each size and type of manhole components furnished for the project.
    - b. Manufacturer's certification indicating that the manhole components and joints meet specifications for each production run for each size and type furnished.
  - 2. Information for the Record:
    - a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.
  - 3. Engineer may request additional Shop Drawings or Information for the Record as required.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Type of Manhole Sections:
  - 1. Manhole Stacks - Manhole stacks shall mean 4-foot diameter manholes used for access to reinforced concrete manhole chambers and precast manhole riser tee sections.
  - 2. Type I Manholes - Type I manholes shall mean 4-foot diameter manholes with precast integral base sections for sanitary sewers. All connections to manholes shall be made with flexible water tight joints. Type I manholes are intended for installation on sewers 18-inch diameter and smaller.
  - 3. Type II Manholes - Type II manholes shall mean manholes with 5-foot diameter precast integral base sections. All connections to manholes shall be made with flexible water tight joints. Type II manholes are intended for installation on 21-inch through 30-inch diameter sewers.

4. Type III Manholes – Type III manholes shall mean manholes with precast integral base sections or precast bottoms that are larger than 5-foot diameter. The diameter of the bottom riser sections shall be as shown on the Drawings. All connections to manholes shall be made with flexible water tight joints. Type III manholes are intended for installation on pipes where the additional wall area is needed for installation of flexible joints and on 36-inch through 48-inch diameter sewers.
  5. Type IV Manholes - Type IV manholes shall mean manholes with cut-outs in the bottom riser sections installed on cast-in-place concrete bases. The diameter of the bottom riser sections shall be as shown on the Drawings. All connections to manholes shall be made with flexible water tight joints. Type IV manholes are intended for installation on sewers 48-inch diameter and larger and on existing sewers where identified on Drawings.
  6. Type S Manholes - S following manhole type shall mean the designated type manhole constructed with a precast flat slab top in lieu of a precast cone.
- B. Precast manhole sections, integral base sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM C-478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.
  - C. Joints shall be manhole gaskets conforming to ASTM C-923.
  - D. The standard length of riser sections shall be 48-inch. Lengths of 32-inch or 16-inch shall be used to meet required dimensions and as specified.
  - E. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer, except “cut-out” openings may be made in bottom riser sections for Type IV manholes. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
  - F. Precast integral base sections shall be of monolithic construction. Base flat slab floors or integral floors shall have a minimum thickness of 6-inch for risers up to and including 48-inch in diameter and 8-inch for larger diameters. A layer of reinforcement shall be placed above the midpoint, and shall have a minimum area of 0.12 square inch/linear feet in both directions.

## 2.02 ACCESSORIES

- A. Manhole Steps - Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod. Steps shall be M. A. Industries Model PS-1, or equal.
  1. Specified manhole steps shall be factory installed to provide a continuous ladder of 14-inch Center-to-Center rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with nonshrink mortar to insure a watertight joint. Manhole step installation shall be in compliance with OSHA regulations. If the outer surface of the pipe wall is pierced the patch shall be completely covered with a bituminous sealer.
- B. Manhole frames and covers shall be as shown on the Drawings.
  1. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

- C. Mortar:
  - 1. Mortar used for the structures herein specified shall conform to ASTM C-270 Type S, containing no masonry cement. The mortar shall be composed of one part portland cement to two parts sand by volume.
  - 2. Non-shrinking Mortar - Materials for nonshrinking mortar shall be Sauereisen F-100, Five-Star, or equal.
- D. Cast-in-Place Concrete:
  - 1. All cast-in-place concrete used for concrete bases and for forming channels in manhole bottoms shall be Class A as shown in table 1
  - 2. All concrete used for supporting precast concrete manhole bases shall be Class B as shown in table 1

**Table 1: Concrete Requirements**

Concrete Class	Min 28-Day Compressive Strength (psi)	Maximum Water - Cement Ratio	Minimum Cement Content Sacks/CY	Slump Min.	Inches Max
A	4000	.45 (5.1*)	6.5	1	4
AA	3000	.53 (6*)	6	2	4
B	1750	.71 (8*)	4	1	6

\* - Water in U.S. gallons per 94 -lb. sack of cement

- E. Reinforcing Steel - Reinforcing steel used in cast-in-place concrete shall meet the requirements of the City of Kalamazoo pre-cast concrete manhole drawings.
- F. Pipe for Manhole Drops - Pipe for manhole drops shall conform to specifications of Sanitary Sewer for the required size and type shown on the Drawings.

**PART 3 EXECUTION**

**3.01 COORDINATION**

- A. Location and type of manholes installed shall be as shown on the Drawings or directed.
- B. Construction shall be in conformance with details shown on the Drawings and as specified.
- C. Excavation for manhole construction shall be prepared as directed in applicable paragraphs of the Sanitary Sewer Specification.

**3.02 INSTALLATION OF INTEGRAL BASE SECTIONS**

- A. Class B concrete shall be poured as to provide a minimum 4-inch thick pad under the entire area of the manhole base. Place the manhole base on the pad before the concrete is completely set so that final leveling adjustment can be made. Alternatively, the manhole base may be placed on 4-inch compacted granular bedding material. Bottom sections placed on bedding shall be a minimum of 6-inch thick.

**3.03 INSTALLATION OF BOTTOM RISER SECTIONS (WITHOUT INTEGRAL BASE)**

- A. Unless otherwise called for on the Drawings or directed, precast bottom riser sections shall be placed with cast-in-place reinforced concrete bases.
- B. The base shall be of Class A concrete 12-inch thick minimum placed on undisturbed earth. Reinforcing shall be as shown on the Drawings.

- C. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section. The sewer pipe shall be bedded in concrete monolithic with the base to the first joint each way from the manholes.

#### 3.04 CHANNELING MANHOLE BOTTOMS

- A. ~~The bottoms of all manholes shall be channeled to conduct flow in the planned direction. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer in such a manner to not obstruct maintenance of flow in the sewers and shall match inverts of connection pipe at the manhole wall.~~
- B. ~~In integral base sections (only) channels may be constructed using brick and Portland cement mortar. Mortar shall be 3/4 inch thick minimum between bricks and between bricks and concrete and 1 inch thick minimum on all exposed surfaces.~~

#### 3.05 PRECAST CONCRETE RISER SECTIONS

- A. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the eccentric cone section or the flat slab top.
- B. Pipe section joints shall be pointed and lifting holes filled with nonshrinking mortar.

#### 3.06 INSTALLATION OF MANHOLE FRAMES

- A. Manhole frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of manhole castings shall be made using specified precast grade rings and Portland cement mortar joints or preferred bitumen seals.
- C. Each pressure tight manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.
- D. The maximum depth of adjustment below any manhole casting shall be 12-inch and the minimum depth of adjustment shall be 4-inch
- E. In concrete pavement, separate frame from pavement with 1/2-inch thick premolded mastic joint material extending from the base of the frame to the top of the frame.

#### 3.07 MANHOLE TESTING

- A. Each manhole shall be tested after assembly and after all lift holes have been plugged with an approved non-shrink grout, after backfilling is complete and prior to installation of any specified chimney seals.
- B. Testing shall be by drawing a vacuum on the manhole using equipment specifically designed for such testing. All pipes entering the manhole shall be plugged and braced to prevent being drawing into the manhole. A test head with necessary gauges and connections shall be placed at the inside of the top of the cone section and sealed in accordance with the manufacturer's instructions. A vacuum of 10 inches of mercury shall then be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to 9 inches. The test shall be successful if the time measured is greater than 60 seconds. If the test is unsuccessful, necessary repairs shall be made and retesting shall proceed until a satisfactory test is obtained.

PART 4 MEASUREMENT AND PAYMENT

<b>Pay Item</b>	<b>Pay Unit</b>
Sanitary Manhole, _ inch .....	Each
Sanitary Manhole, _ inch, Add Depth, 8 foot to 15 foot .....	Foot
Sanitary Manhole, _ inch, Add Depth, more than 15 foot .....	Foot
Sanitary Manhole, Tap, _ inch .....	Each
Sanitary Manhole Cover .....	Each

Payment for each item includes all excavation, trenching, backfilling, compacting, shoring/bracing cleaning and videotaping, labor and equipment to complete pay item.

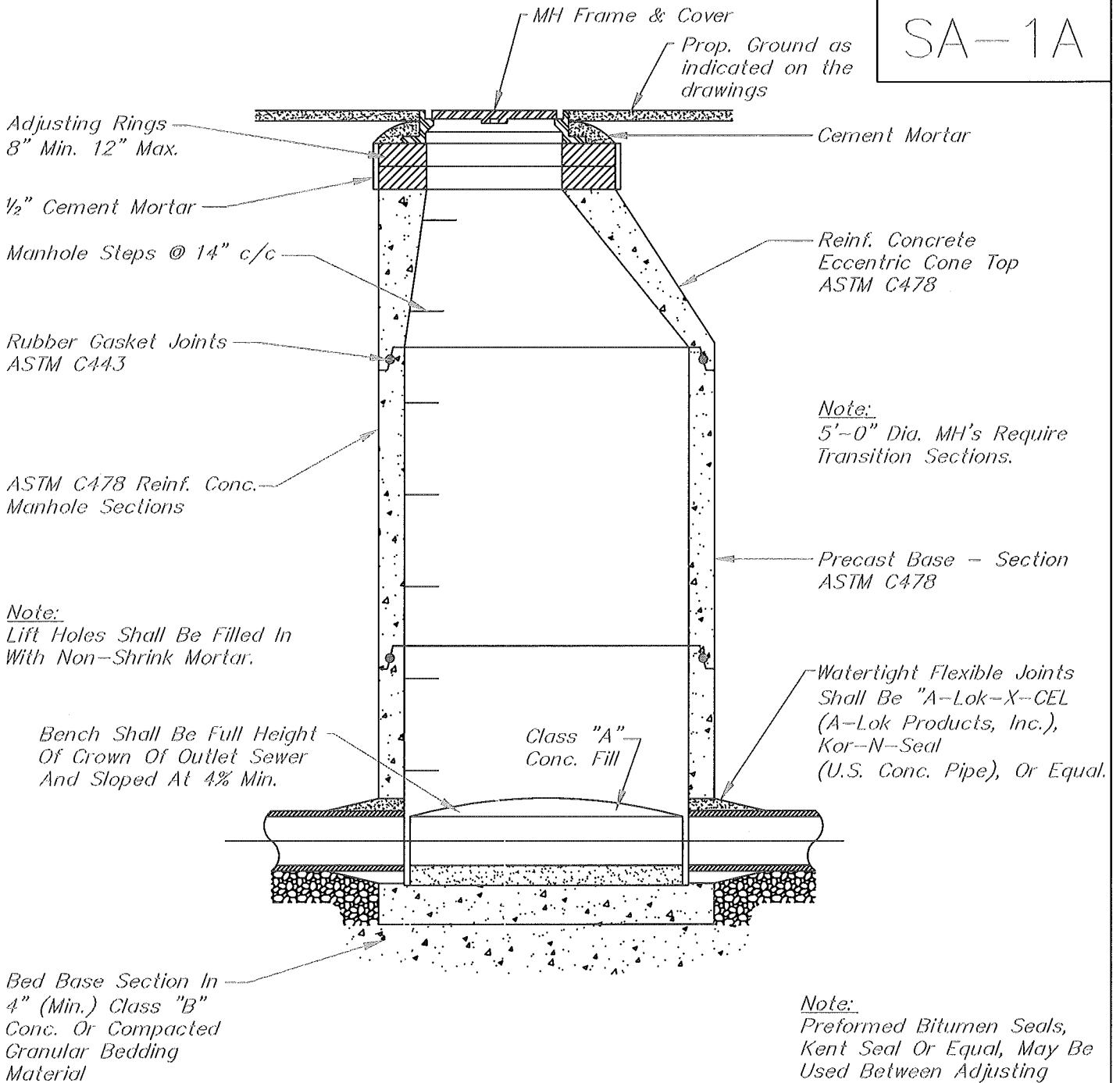
Payment for Sanitary Manhole, \_inch shall include the concrete footing and no greater than 8 feet of concrete structure depth measured from the flow line to the bottom of the chimney or adjustment rings. The price also includes the cost of temporary and/or final adjustments of structure.

Payment for Sanitary Sewer, \_ inch, Add Depth, \_\_\_\_\_ shall be the cost of the structure portions which are greater than 8 feet but less than 15 feet and more than 15 feet.

END OF SECTION



SA-1A



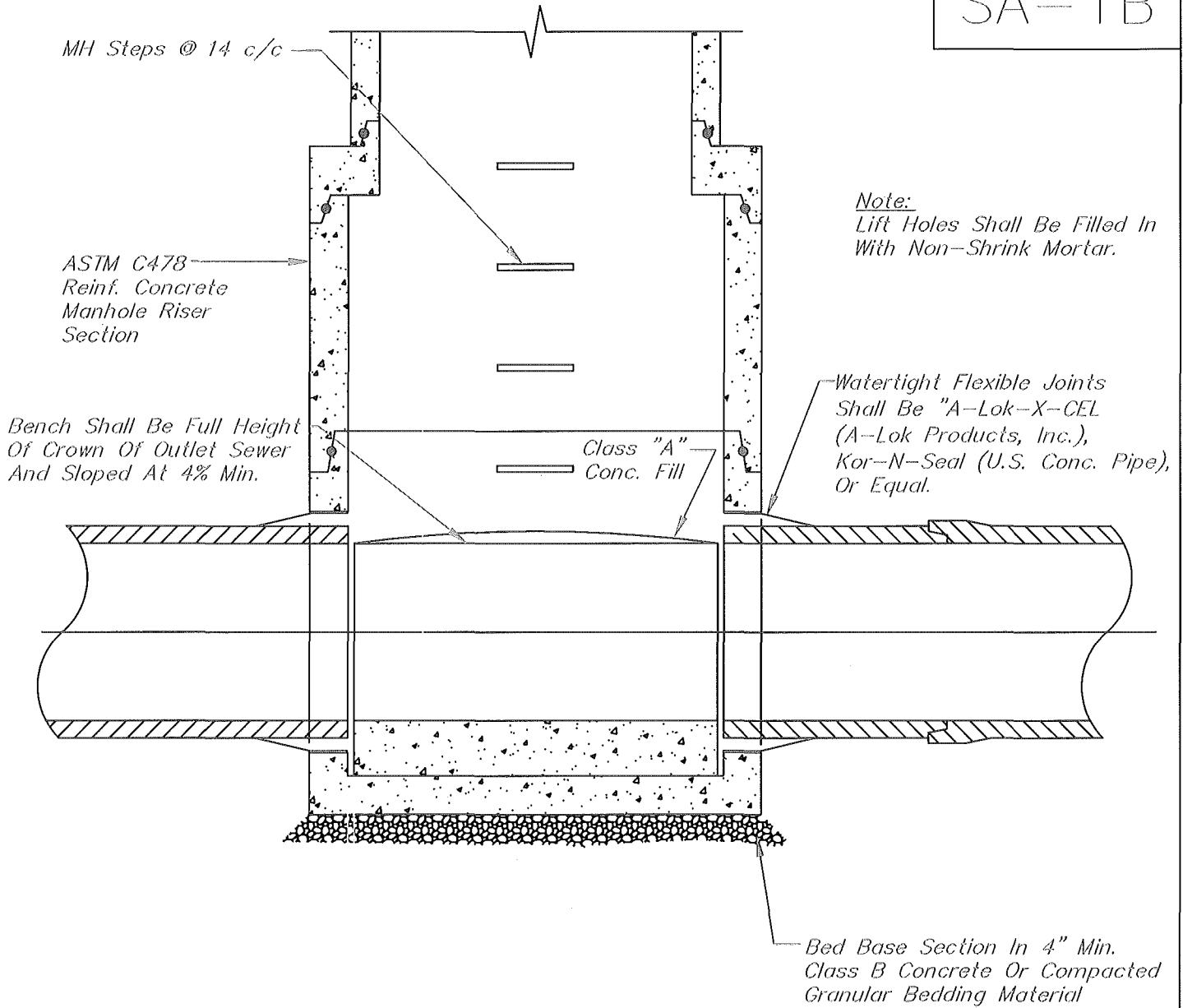
TYPE I & II MANHOLES

1/4" = 1'-0"



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-I & II  
MARCH 2012

SA-1B



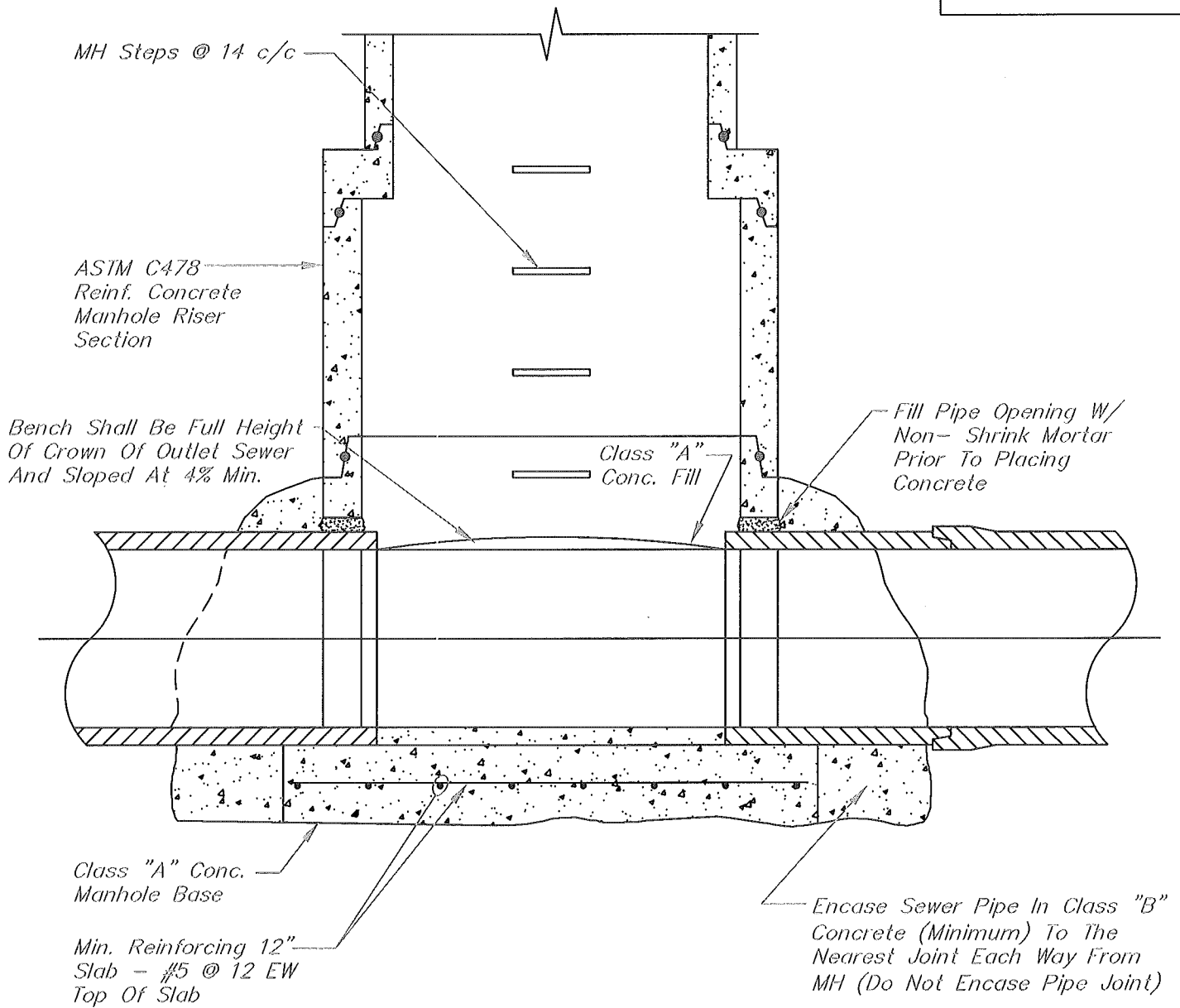
TYPE III MANHOLE

$\frac{1}{4}'' = 1'-0''$



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-III  
MARCH 2012

SA-1C



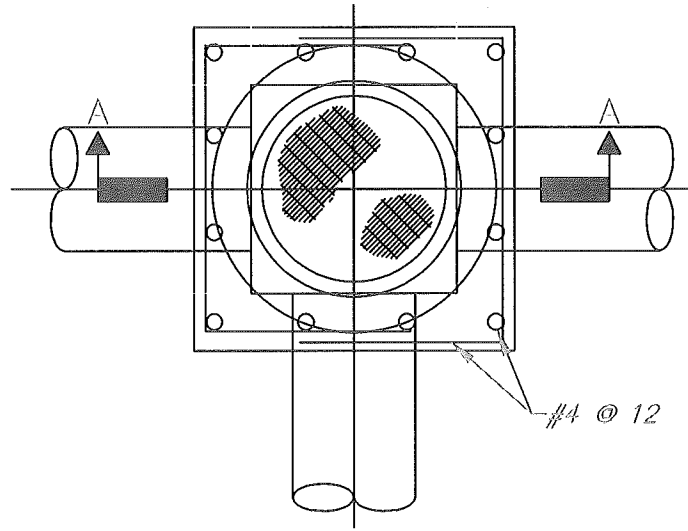
TYPE IV MANHOLE

$\frac{1}{2}'' = 1'-0''$

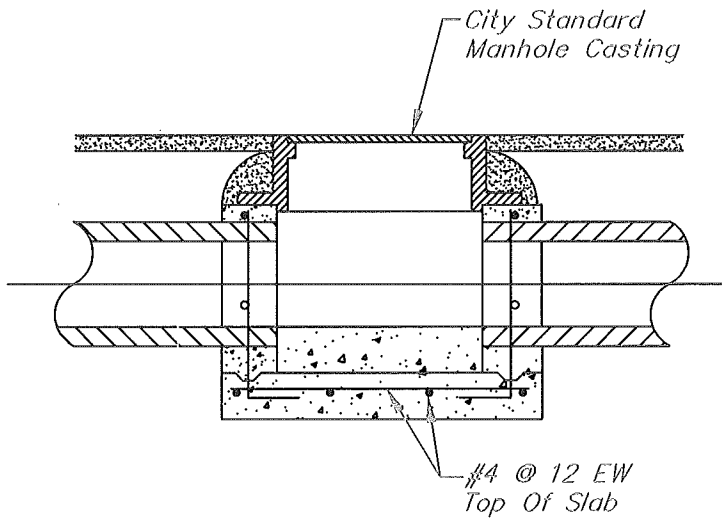


CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-IV  
MARCH 2012

SA-1D



PLAN



SECTION A-A

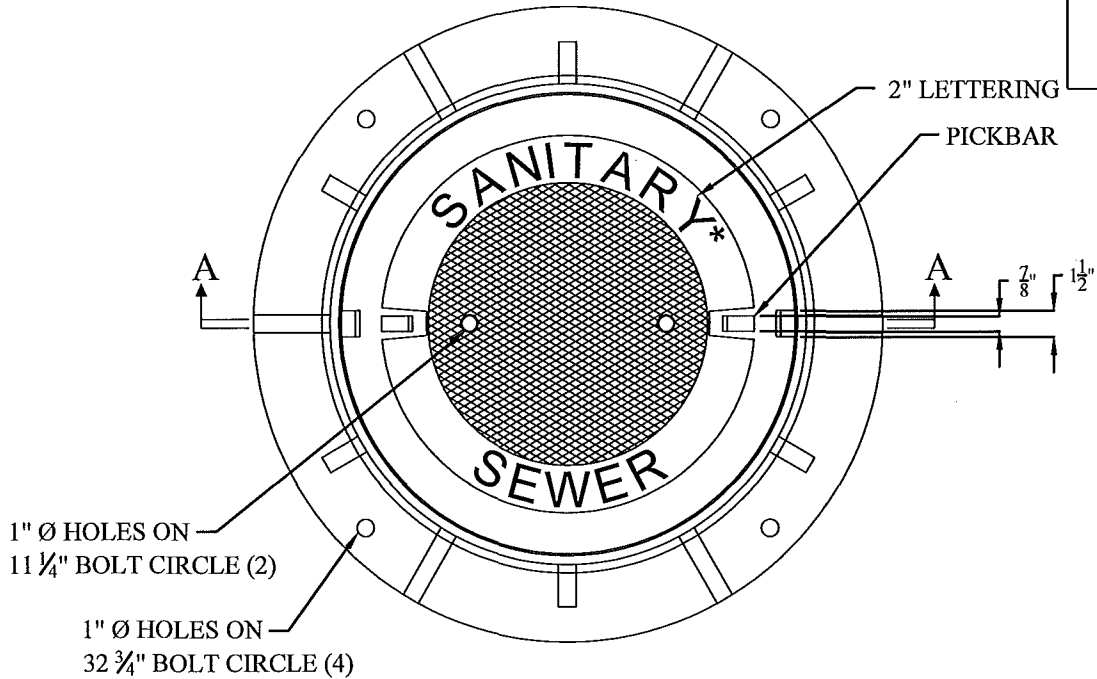
TYPE V MANHOLE

$\frac{1}{4}'' = 1'-0''$



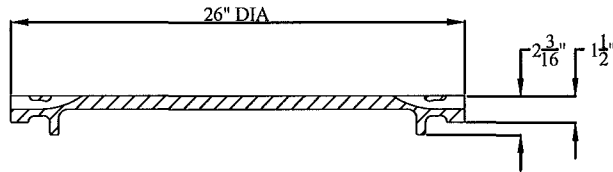
CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
STD. MANHOLES  
TYPE-V  
MARCH 2012

SA-2A

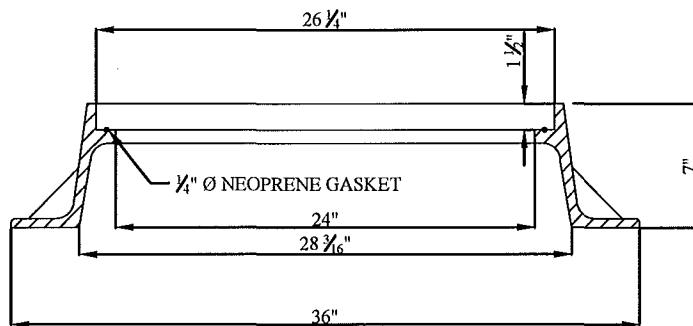


### FRAME AND COVER

\*WHEN USED ON STORM SEWER, THE COVER SHALL READ 'STORM SEWER'



### COVER SECTION



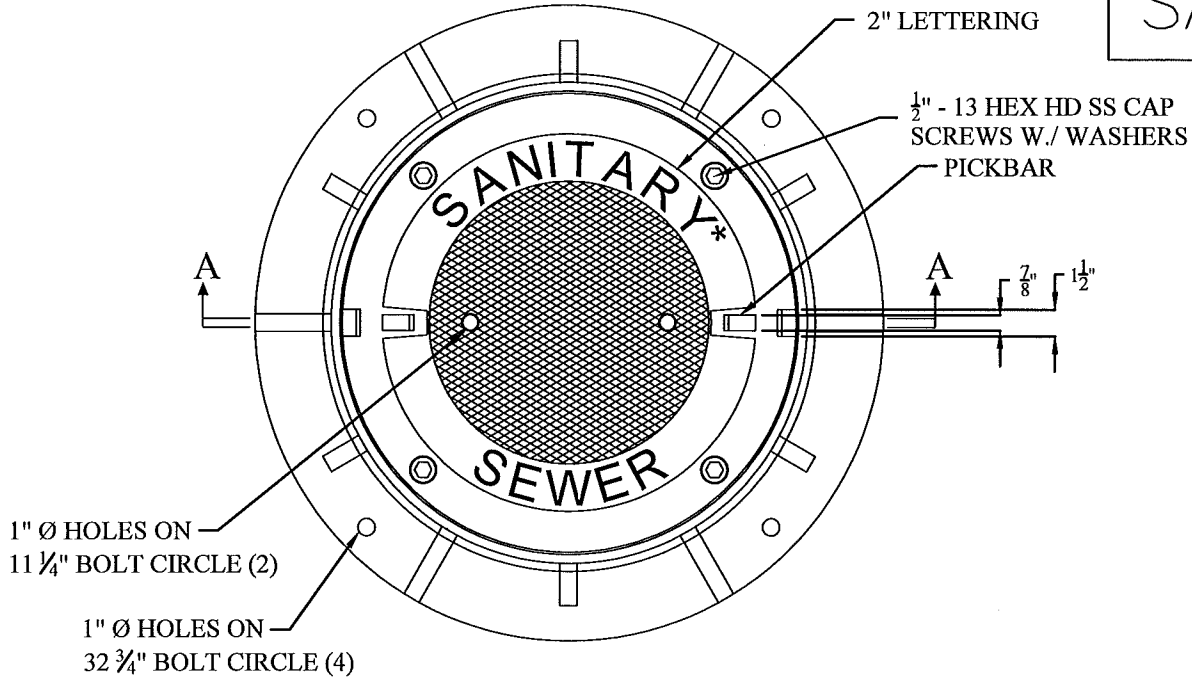
### SECTION A-A

NOMINAL WEIGHT - 320 LBS



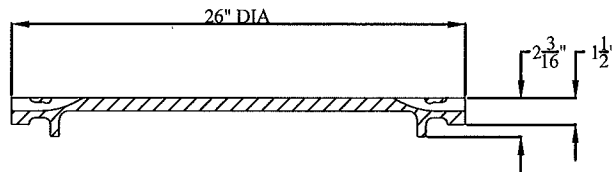
CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SEWER  
CASTING  
NOVEMBER 2012

SA-2B

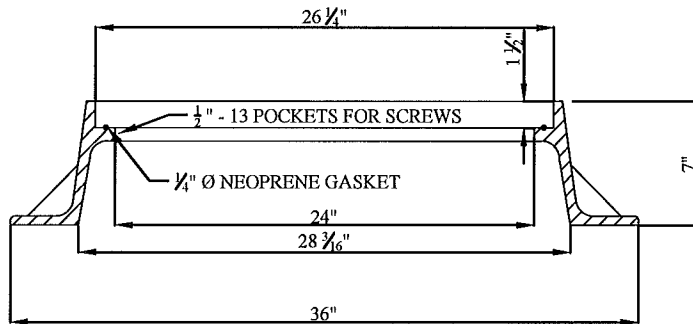


### FRAME AND COVER

\*WHEN USED ON STORM SEWER, THE COVER SHALL READ 'STORM SEWER'



### COVER SECTION



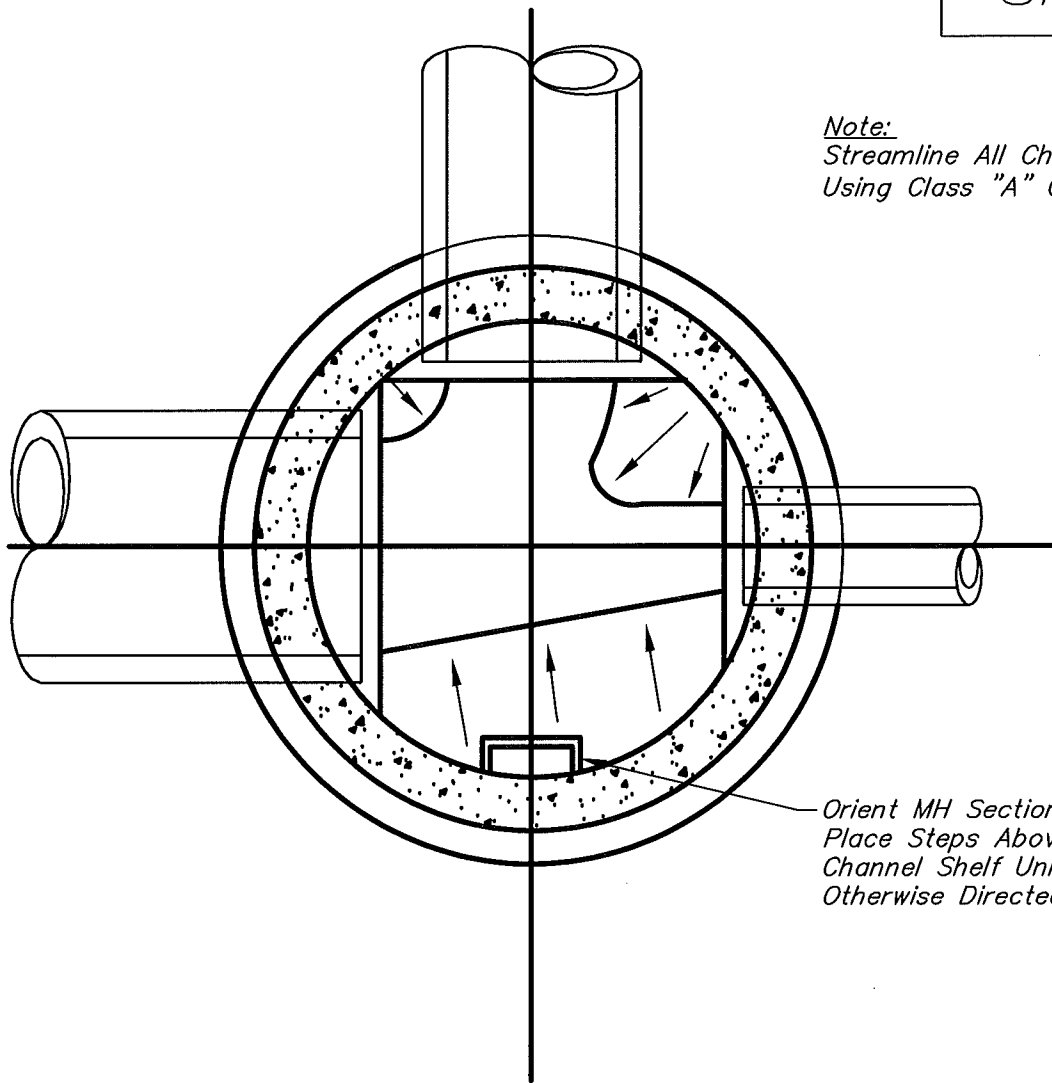
### SECTION A-A

NOMINAL WEIGHT - 200 LBS



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SEWER  
CASTING (LOCKING)  
NOVEMBER 2012

SA-3



*Note:*  
Streamline All Channels  
Using Class "A" Conc.

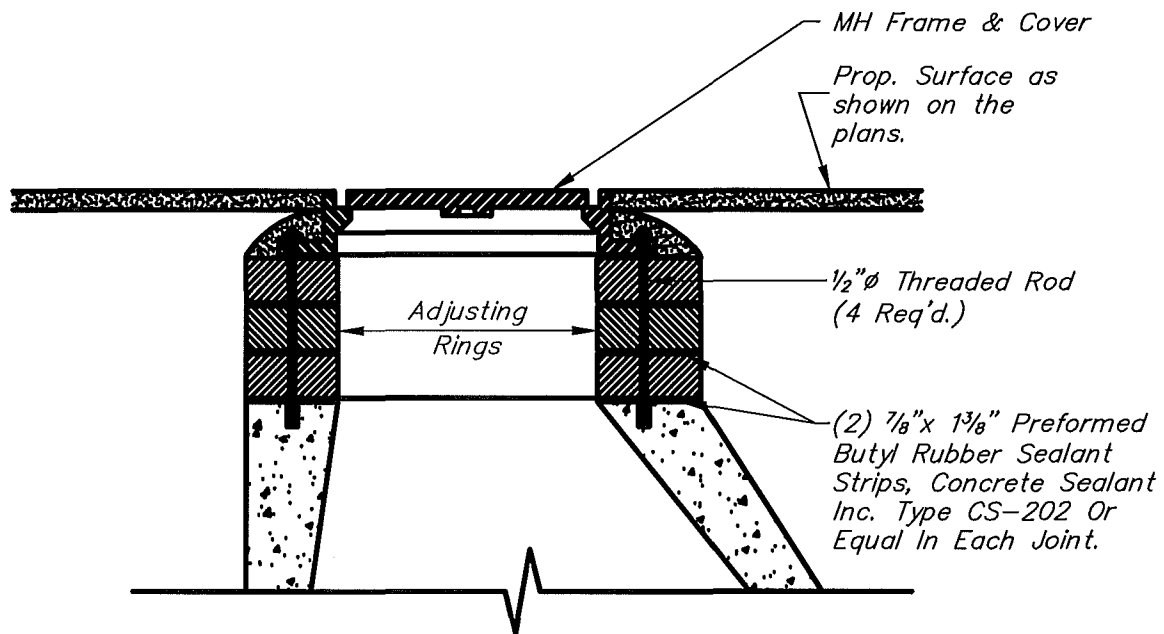
*Orient MH Sections To  
Place Steps Above  
Channel Shelf Unless  
Otherwise Directed*

SECTIONAL PLAN  
 $\frac{1}{2}'' = 1' - 0''$



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
FLOW CHANNEL  
SECTIONAL PLAN  
MARCH 2012

SA-4

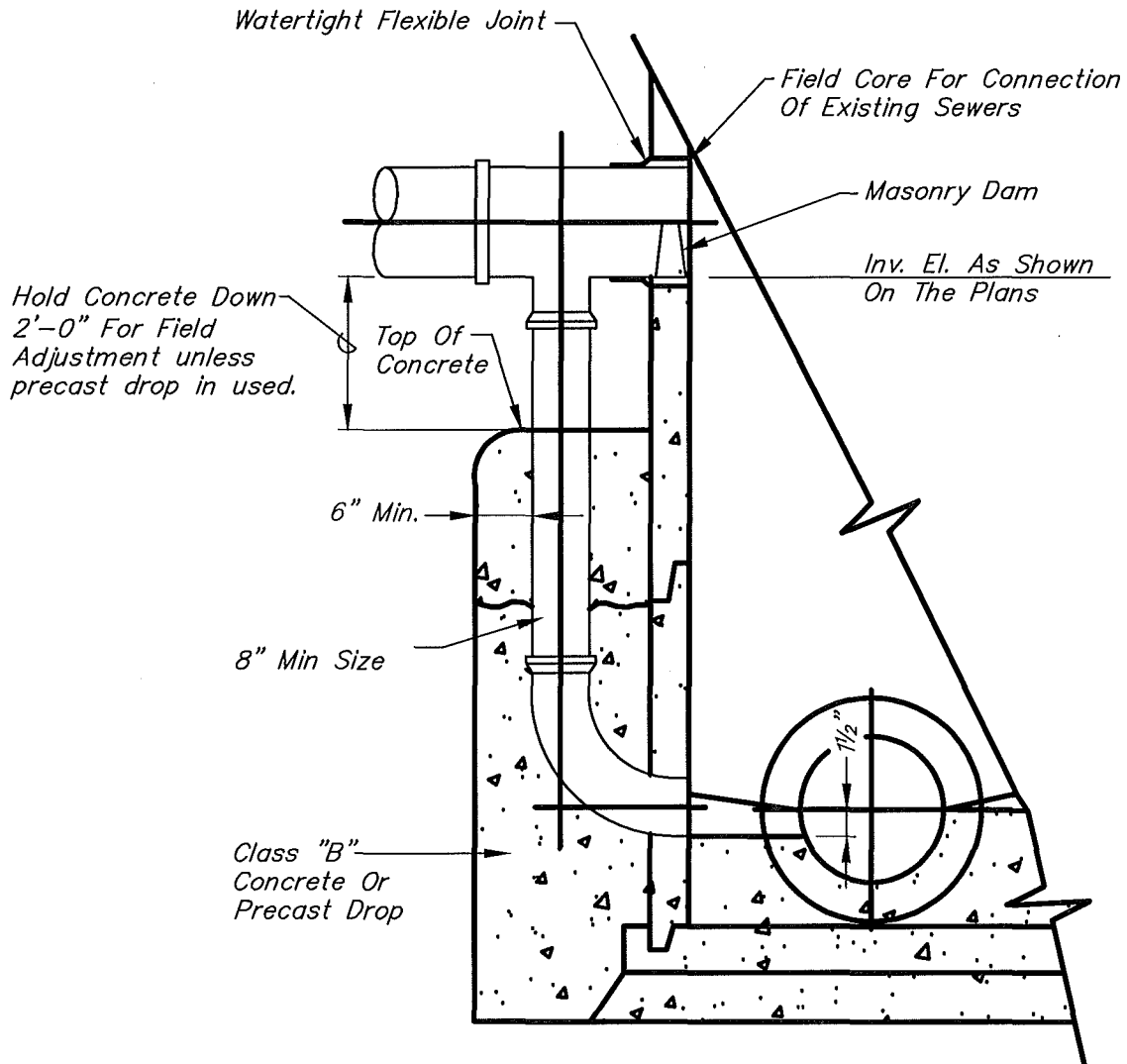


BUTYL RUBBER SEALANT DETAIL  
NTS



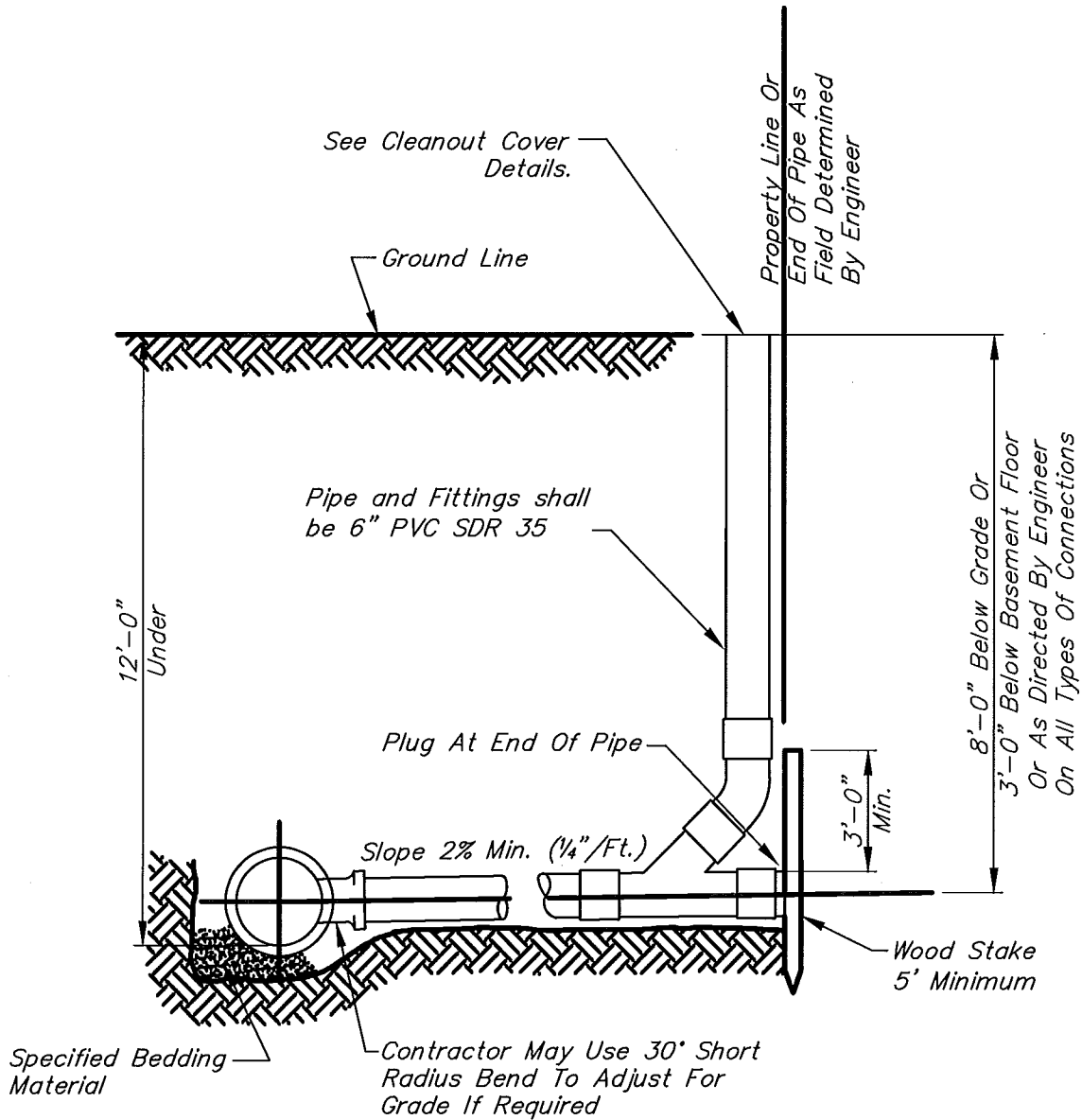
CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
BUTYL RUBBER  
SEALANT DETAIL  
MARCH 2012





MANHOLE WITH DROP  
NTS

SA-6A



SECTION

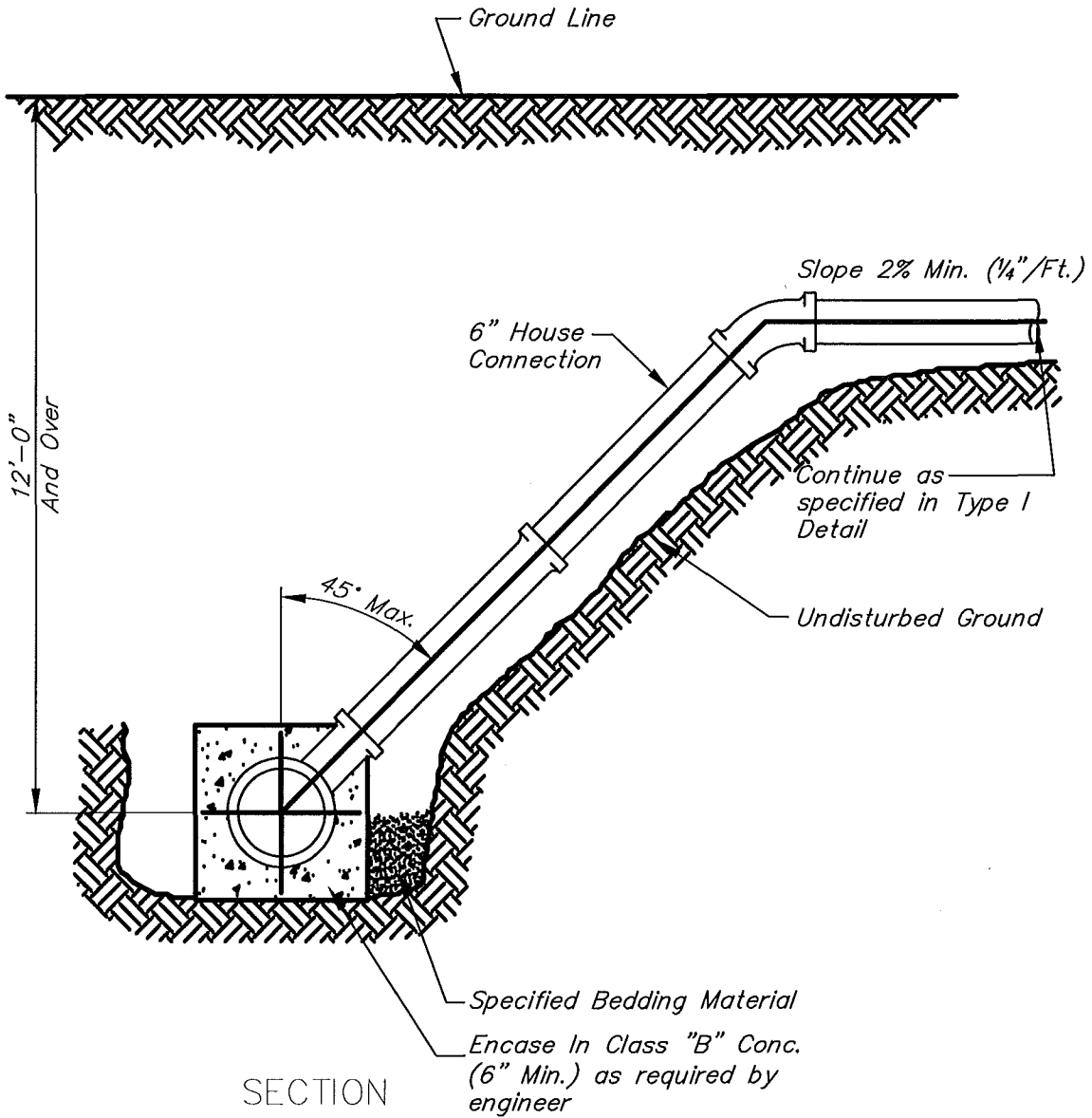
TYPE - 1

(To Be Used Where Main Sewer Is Less Than 12' In Depth)



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
TYPE - 1  
MARCH 2012

SA-6B



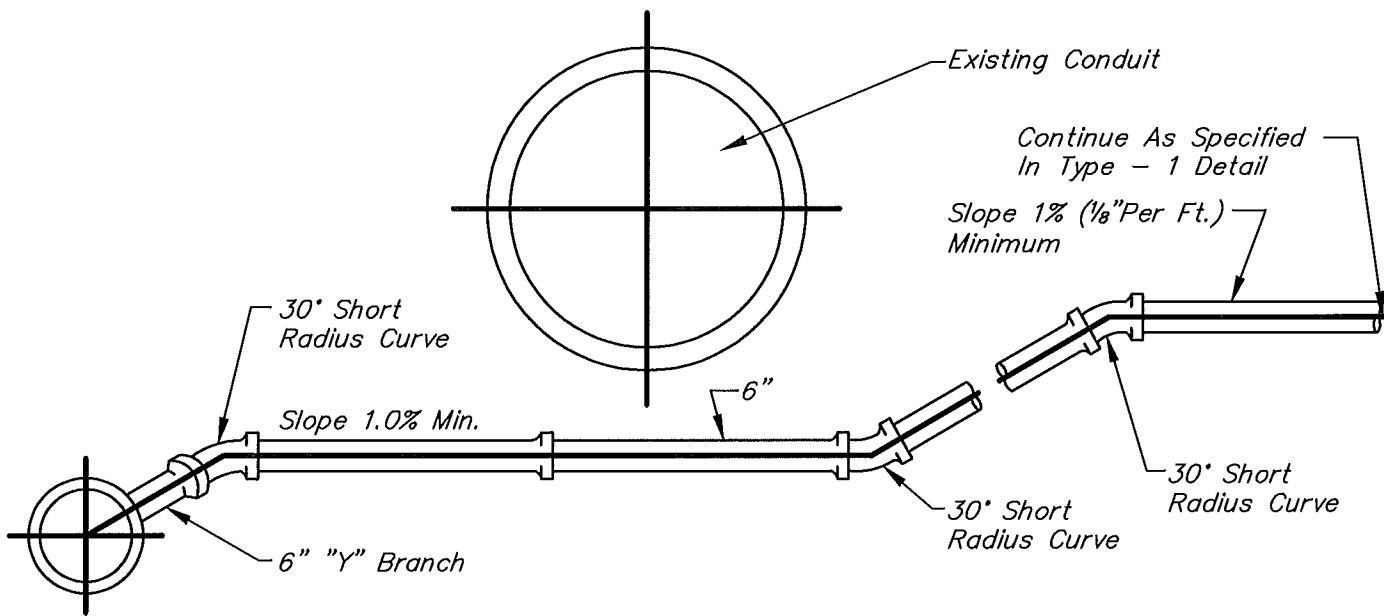
TYPE - 2

(To Be Used Where Main Sewer Is More Than 12' In Depth)



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
TYPE - 2  
MARCH 2012

SA-6C



UNDER EXISTING CONDUITS

SERVICE CONNECTION DETAILS

NTS

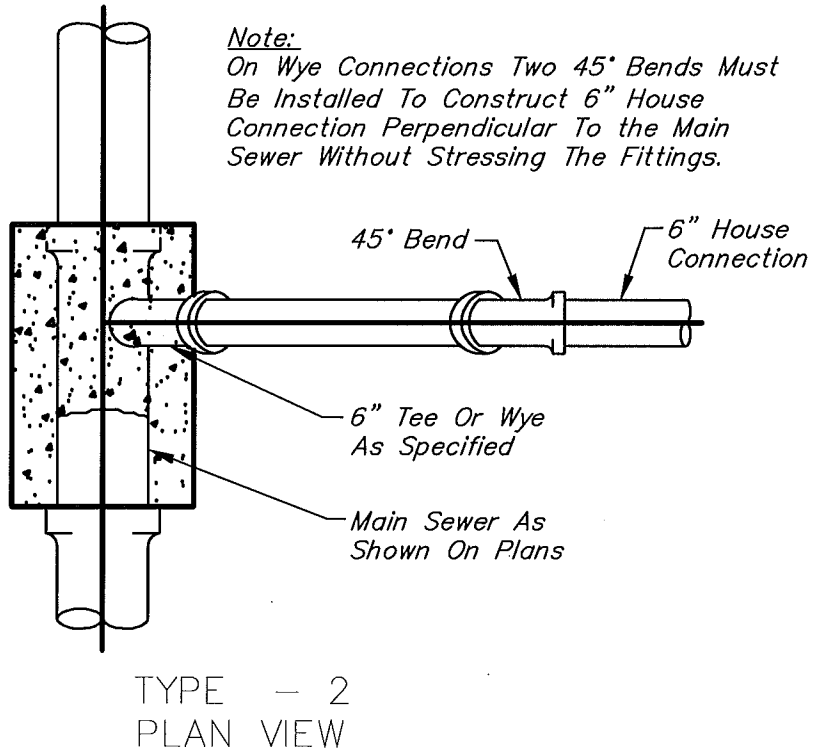
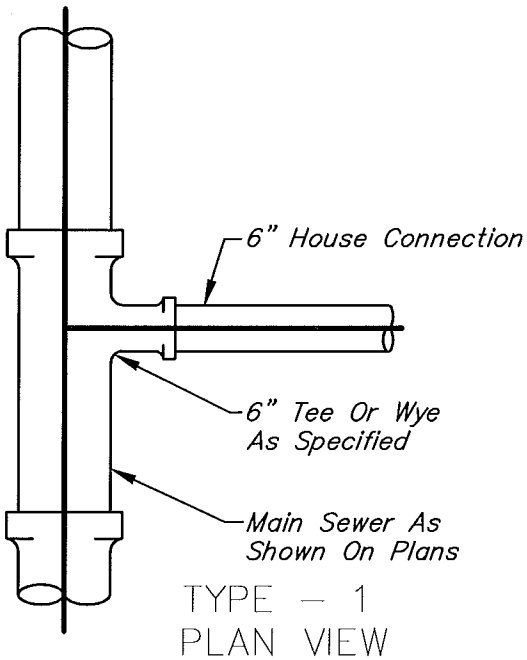


CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
UNDER EXISTING  
CONDUIT  
MARCH 2012

SA-6D

Service Connection Notes

- A. Contractor Shall Not Backfill Service Connection Until The Engineer Has Inspected And Taken Measurements, Elevations & Other Information Required For Purpose Of Record.
- B. All Tee And Wye Branches In The Main Sewer Line, Rotated More Than, 30° From Horiz. Shall Be Encased In 6" Min. Of Class "B" Concrete.
- C. Wye Branches Shall Be Used In all Connections For Sewers 18" and Smaller. Tee Branches May Be Used In Lieu Of Wye Branches For Connections To Main Sewers 18" And Larger.

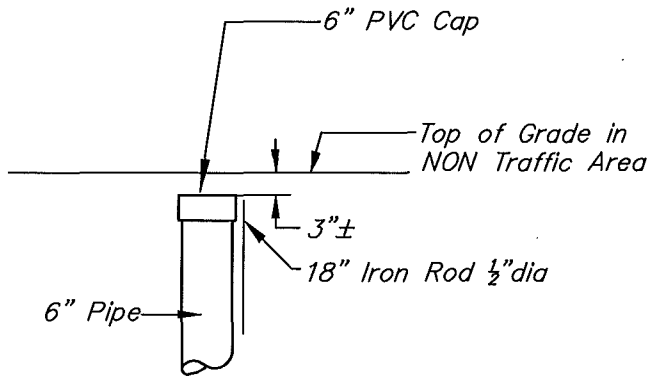
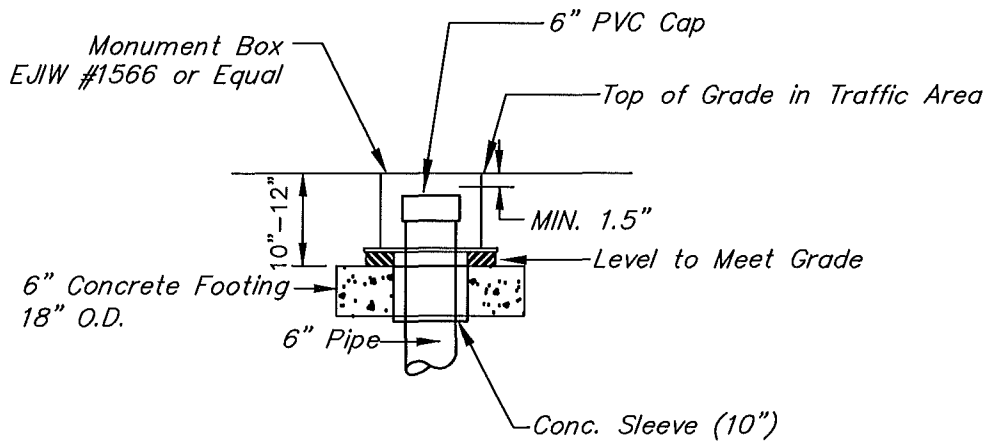


Note:  
On Wye Connections Two 45° Bends Must Be Installed To Construct 6" House Connection Perpendicular To the Main Sewer Without Stressing The Fittings.



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY SERVICE  
PLAN VIEW & NOTES  
MARCH 2012

SA-6E



CITY OF KALAMAZOO  
DEPT. OF PUBLIC SERVICES  
SANITARY CLEANOUT  
COVER DETAILS  
MARCH 2012

**APPENDIX D  
PLANS**



**THE CITY OF KALAMAZOO  
DEPARTMENT OF PUBLIC SERVICES  
WASTEWATER DIVISION**

**PLANS**

**GPI EFFLUENT SEWER  
REALIGNMENT**

**Bid Reference #: 91345-004.0**

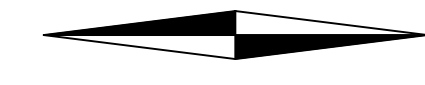


# CITY OF KALAMAZOO, MICHIGAN KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

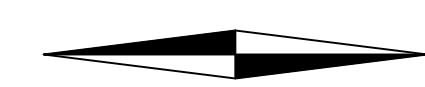


**LOCATION MAP**

INITIAL AND ULTIMATE SERVICE AREA = 77.89 ACRES

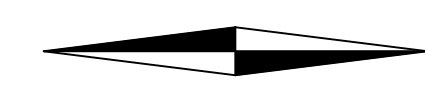


2023



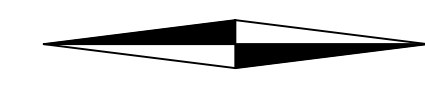
## ADMINISTRATION

- JAMES RITSEMA - CITY MANAGER
- JAMES J. BAKER, PE - PUBLIC SERVICES DIRECTOR & CITY ENGINEER
- JIM CORNELL - WASTEWATER DIVISION MANAGER
- STEVE HELMER - TREATMENT OPERATIONS SUPERINTENDENT
- CHRIS NELSON - COLLECTIONS AND PLANT MAINTENANCE MANAGER
- RYAN STOUGHTON, PE - ASSISTANT CITY ENGINEER - WASTEWATER

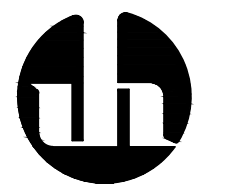


## MEMBERS OF COMMISSION

- DAVID ANDERSON - MAYOR
- DON COONEY - VICE MAYOR
- JEANNE HESS
- CHRIS PRAEDEL
- QIANNA DECKER
- STEPHANIE HOFFMAN
- ESTEVEN JUAREZ



Jones & Henry  
Engineers, Ltd.



Fluid thinking.<sup>®</sup>  
www.jheng.com

STATUS: ISSUE FOR BID  
DATE: MAY 2023



**TYPICAL EXISTING SYMBOLS AND ABBREVIATIONS**

	AERIAL CONTROL POINT		PETROLEUM PUMP
	AERIAL WING POINT		POST
	AIR CONDITIONING UNIT		POWER LINE MARKER
	AXLE		POWER POLE
	BARBEQUE GRILL		POWER POLE AND TELEPHONE POLE
	BENCHMARK		RAIL ROAD CROSSING SIGNAL
	BOLLARD		RAIL ROAD GATE
	BOLT		RAIL ROAD FROG
	CABLE TV		RAIL ROAD MILE POST
	CATCH BASIN		RAIL ROAD SPIKE
	CLEAN OUT		RAIL ROAD SPIKE SET
	CONCRETE MONUMENT		SANITARY MAN-HOLE
	CONIFEROUS TREE		SANITARY VALVE
	CONTROL POINT		SANITARY VENT
	CONTROLLER POLE MOUNTED		SANITARY MARKER
	CURB INLET		SATELLITE DISH
	DECIDUOUS TREE		SEPTIC TANK
	DECORATIVE ROCK		SHRUB
	DRAIN TILE		SIGN
	DRILL HOLE		SIGNAL
	DRY WELL		SOIL BORING
	EDGE OF PAVEMENT		SPIGOT
	ELECTRIC MAN-HOLE		SPRINKLER HEAD
	ELECTRIC METER		SPOT ELEVATION *POINT OF ELEVATION IS DECIMAL
	ELECTRIC PULLBOX		STORM LINE MARKER
	ELECTRIC TRANSFORMER		STORM MAN-HOLE
	ELECTRIC VAULT		STUMP
	EXISTING BUILDING		SUPPORT POLE
	FIRE HYDRANT OR YARD HYDRANT		T-BAR
	FLAG POLE		TACKED HUB
	FORCE MAIN FLUSHING CONNECTION		TANK FILLER CAP
	FOUND MONUMENT BOX		TC - TOP OF CURB ELEVATION
	GAS LINE MARKER		G - GUTTER ELEVATION
	GAS LINE VENT		TELEPHONE BOOTH
	GAS MAN-HOLE		TELEPHONE LINE MARKER
	GAS METER		TELEPHONE MAN-HOLE
	GAS TEST STATION		TELEPHONE PEDESTAL
	GAS VALVE		TELEPHONE POLE
	GAS WELL		TELEPHONE POLE AND LIGHT POLE
	GOLF BALL WASHER		TOP OF WALK
	GUY WIRE		TOPO GRADE SHOT (THE . OF THE NUMBER SIGNIFIES THE LOCATION OF THE SHOT)
	HEAD STONE		TOWER
	INLET PROTECTION		TPB
	INVERT ELEVATION		TRAFFIC MAN-HOLE
	IRON PIN (OR LABELED POST, MARKER ETC.)		TRAFFIC PULL BOX
	LIGHT, POWER POLE AND TELEPHONE POLE		UNKNOWN BOX
	LIGHT POLE		UNKNOWN MAN-HOLE
	LIGHT POLE BOX		UNKNOWN PEDESTAL
	MAILBOX		UNKNOWN POLE
	METER PIT		UNKNOWN VALVE
	MINE SPIKE		UNKNOWN WELL
	MONITORING WELL		VAULT
	NEWS PAPER BOX		VENT PIPE
	OIL TANK		WATER LINE MARKER
	PARKING METER		WATER MAN-HOLE
	PAVEMENT BORING		WATER MAIN PLUG
	PAY PHONE		WATER METER
			WATER METER PIT
			WATER WELL
			WATER VALVE
			WATER VENT
			YARD LIGHT

**SERVICE**

AA	AERATION AIR
AL	ALUM
C	CABLE (UNDERGROUND)*
CA	COMPRESSED AIR
CL	CHLORINE SOLUTION
CO	COMBINED SEWER
CLG	CHLORINE GAS
DG	DIGESTER GAS
DS	DIGESTED SLUDGE
DW	DILUTION WATER
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
EW	EFFLUENT WATER
E	ELECTRICAL (UNDERGROUND)*
FC	FERRIC/FERROUS CHLORIDE
FD	FOUNDATION DRAIN
FE	FINAL EFFLUENT
FO	FIBER OPTIC
FU	FUEL OIL
G	NATURAL GAS (OFF SITE)
GR	GREASE
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
IC	IRON CHLORIDE
ML	MIXED LIQUOR
NG	NATURAL GAS (ON SITE)
NPW	NON POTABLE WATER
P	POLYMER
PE	PRIMARY EFFLUENT
PS	PRIMARY SLUDGE
RAS	RETURN ACTIVATED SLUDGE
RD	ROOF DRAIN
RS	RAW SEWAGE
RW	RAW WATER
SA	SANITARY SEWER
SB	SECONDARY BYPASS
SC	SCUM
SE	SECONDARY EFFLUENT
S	SIGNAL (UNDERGROUND)*
SPA	SPARE
ST	STORM SEWER
SM	STEAM
SP	DIGESTER SUPERNATANT
TD	TANK DRAIN
T	TELEPHONE (UNDERGROUND)*
TE	THICKENER EFFLUENT
TS	THICKENED SLUDGE
TWAS	THICKENED WASTE ACTIVATED SLUDGE
WAS	WASTE ACTIVATED SLUDGE

	CENTER LINE
	FENCE LINE
	PROPERTY LINE
	RIGHT OF WAY
	PERMANENT EASEMENT
	CONSTRUCTION EASEMENT
	SILT FENCE
	CABLE (UNDERGROUND)*
	COMBINED SEWER
	ELECTRICAL (UNDERGROUND)*
	GAS LINE
	OVER-HEAD WIRES
	PETROLEUM, OIL, LUBRICANTS
	SANITARY SEWER
	SIGNAL (UNDERGROUND)*
	STORM SEWER
	TELEPHONE (UNDERGROUND)*
	WATER LINE
	LARGE DIAMETER LINES (ANY TYPE)
	UTILITY LINE TO BE REMOVED ***
	UTILITY LINE TO BE ABANDONED
	PROPOSED UTILITY
	PROPOSED LARGE DIAMETER UTILITY
	PROPOSED TRENCHLESS UTILITY

ALPHA DESIGNATION REFERS TO UTILITY TYPE OR SERVICE TYPES, NUMERICAL DESIGNATION REFERS TO PIPE NOMINAL DIAMETER. LINES WITH NO NUMERICAL DESIGNATION ARE OF UNKNOWN SIZE.

\* AERIAL LINES, IF SHOWN, ARE DESIGNATED WITH LOWER CASE LETTERS  
 \*\* FOR ELLIPTICAL SEWERS, THE VERTICAL DIMENSION (RISE) IS CALLED OUT FIRST FOLLOWED BY THE HORIZONTAL DIMENSION (SPAN). EXAMPLE: 45X35 (RISE X SPAN) THE VERTICAL DIMENSION IS 45", THE HORIZONTAL DIMENSION IS 35".  
 \*\*\* INDICATES THE REMOVAL OF ALL SPECIFIED STRUCTURES AND APPURTENANCES.

VERTICAL DATUM:  
 VERTICAL DATUM IS BASED ON '88 NAVD.

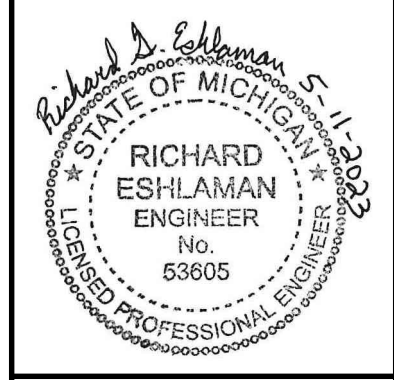
**NOTE: ACCURACY OF EXISTING ELEVATIONS AND DIMENSIONS IS NOT GUARANTEED. FIELD VERIFY BEFORE CONSTRUCTION.**

**PROPOSED SYMBOLS**

	ABANDON VALVE BOX		PLUG VALVE AND BOX
	ABANDON VALVE MAN-HOLE		PLUG VALVE AND MAN-HOLE
	AIR RELEASE VALVE AND MAN-HOLE		POLE TO BE TEMPORARILY SUPPORTED AND PROTECTED BY CONTRACTOR
	BUTTERFLY VALVE AND BOX		REDUCER
	BUTTERFLY VALVE AND MAN-HOLE		SANITARY MAN-HOLE
	CATCH BASIN		STORM MAN-HOLE
	CLEAN OUT		STUMP TO BE REMOVED
	CURB INLET		TAPPING SLEEVE VALVE AND BOX
	FIRE HYDRANT ASSEMBLY, TYPE A		TAPPING SLEEVE VALVE AND MAN-HOLE
	FIRE HYDRANT ASSEMBLY, TYPE B		TREE TO BE REMOVED
	FIRE HYDRANT TO BE REMOVED		
	FORCE MAIN FLUSHING CONNECTION		
	GATE VALVE AND BOX		
	GATE VALVE AND MAN-HOLE		
	INSERTING VALVE AND MAN-HOLE		
	METER PIT		

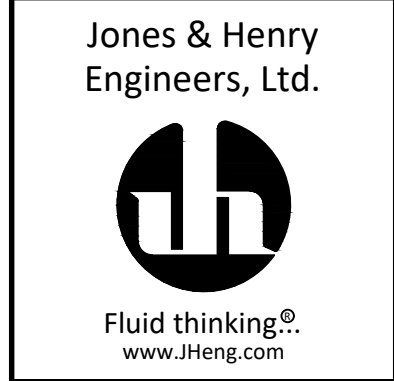
**DRAWING INDEX**

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3	G-0.3	GENERAL SUMMARY
REMOVALS		
4	R-1.1	INDUSTRIAL DIVERSION CHAMBER 1 - REMOVALS
5	R-1.2	PARSHALL FLUME - REMOVALS
6	R-1.3	JUNCTION CHAMBER - ABANDONMENT DETAILS
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13	ST-1.1	STORM - PLAN & PROFILE STA 10+00 TO 13+00
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15	S-1.1	INDUSTRIAL DIVERSION CHAMBER 1 - PLANS
16	S-1.2	PARSHALL FLUME - PLANS
ELECTRICAL		
17	E-0.1	ELECTRICAL LEGEND
18	E-1.1	ELECTRICAL SINGLE LINE DIAGRAM AND DETAILS
19	E-1.2	INDUSTRIAL DIVERSION CHAMBER 1 - ELECTRICAL PLAN



**LEGENDS, INDEX AND GENERAL NOTES**  
 CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

DESIGNED: RGE  
 DRAWN: CJAF  
 CHECKED: RGE  
 STATUS: ISSUE FOR BID  
 DATE: MAY 2023  
 SHEET NO. G-0.1  
 1 OF 19



JOB NO. 017-7982.001  
 SCALE NONE  
 THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE  
 DESIGNED: RGE DRAWN: CJAF CHECKED: RGE  
 STATUS: ISSUE FOR BID  
 DATE: MAY 2023  
 SHEET NO. G-0.1  
 1 OF 19

Alignment Name: PROPOSED SANITARY  
 Description:  
 Station Range: Start: 0+00.00, End: 6+84.00

PI Station	Northing	Easting	Distance	Direction
0+00.00	296,180.59'	12,797,035.30'		
			13.42'	S87°E
0+13.42	296,179.87'	12,797,048.70'		
			44.46'	S86°E
0+57.88	296,176.94'	12,797,093.06'		
			112.56'	S34°E
1+70.44	296,083.86'	12,797,156.35'		
			286.45'	S22°E
4+56.89	295,817.91'	12,797,262.78'		
			194.86'	S1°W
6+51.75	295,623.09'	12,797,259.11'		
			6.65'	S1°W
6+58.40	295,616.43'	12,797,258.99'		
			25.59'	S66°E
6+84.00	295,605.95'	12,797,282.33'		

Alignment Name: PROPOSED STORM  
 Description:  
 Station Range: Start: 10+00.00, End: 13+00.00

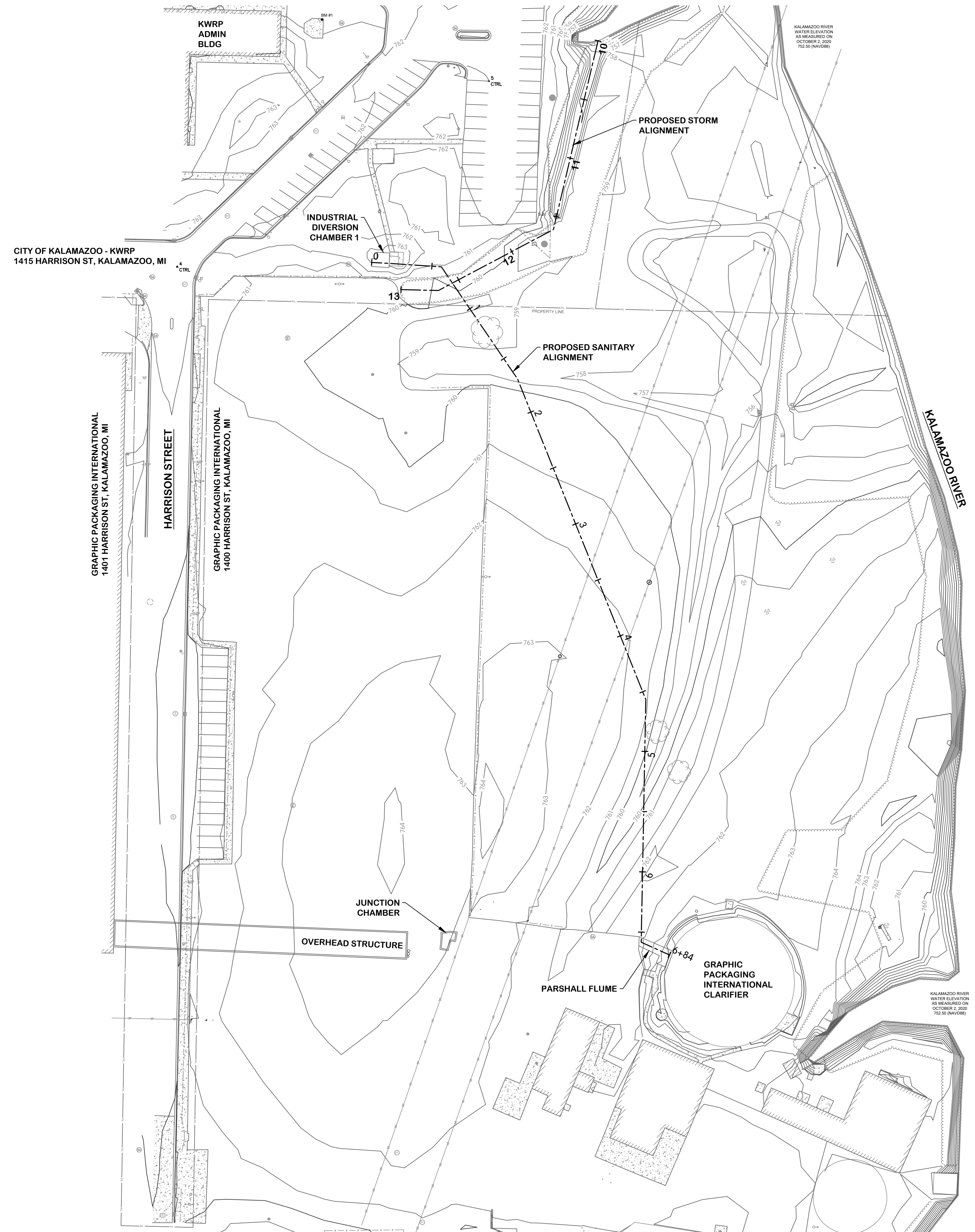
PI Station	Northing	Easting	Distance	Direction
10+00.00	296,364.48'	12,797,223.13'		
			160.87'	S13°W
11+60.87	296,207.93'	12,797,186.12'		
			108.09'	S62°W
12+68.96	296,157.29'	12,797,090.63'		
			31.04'	N89°W
13+00.00	296,158.03'	12,797,059.60'		

SURVEYOR NOTES:

- Utilities shown are approximate locations derived from actual measurements. They should not be interpreted to be exact locations nor should it be assumed that they are the only utilities in this area.
- Benchmark #1: Plastic tag stamped "763.76" near the NE corner of overflow chamber East of the Administration Building. ELEVATION:763.30 (NAVD88).
- Basis of Coordinates: Michigan State Plane South, International feet.
- Control Point Information:

NO.	NORTHING	EASTING	ELEV	
1	296855.290	12797095.924	760.27	MAG NAIL
2	296626.441	12797089.940	761.54	MAG NAIL
3	296403.981	12797084.294	761.92	MAG NAIL
4	296177.009	12796873.824	761.58	MAG NAIL
5	296331.126	12797132.506	762.99	MAG NAIL

NOTE IN PLAN VIEW



EXISTING PROJECT AREA  
 AND SURVEY CONTROL

CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

DESIGNED	RGE	DRAWN	CJAF	CHECKED	RGE
STATUS: ISSUE FOR BID					
DATE: MAY 2023					
SHEET NO. G-0.2					
2 OF 19					

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JOB NO. 017-7982.001

SCALE 1:50

THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE

DESIGNED RGE DRAWN CJAF CHECKED RGE

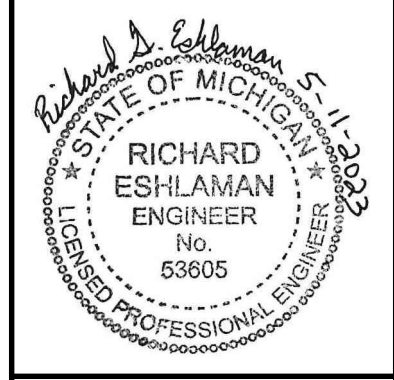
STATUS: ISSUE FOR BID

DATE: MAY 2023

SHEET NO. G-0.2

2 OF 19

KAL-7982001-G02-EXISTING SITE PLAN AND SURVEY CONTROL  
 5/10/2023 2:52 PM - CFERRELL  
 5/11/2023 2:29 PM



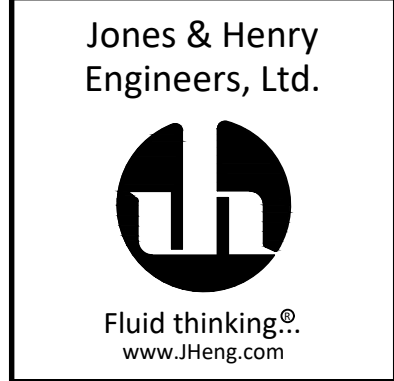
**GENERAL SUMMARY**

CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

GENERAL SUMMARY																							
Item No.	Plan Quantity	Unit	Description	G-0.1	G-0.2	G-0.3	R-1.1	R-1.2	R-1.3	C-0.1	C-0.2	C-0.3	C-1.1	C-1.2	SA-1.1	SA-1.2	ST-1.1	S-0.1	S-1.1	S-1.2	E-0.1	E-1.1	E-1.2
1	1	LS	General Conditions/ Mobilization	1																			
2	1	LS	Audio/Video Recording	1																			
3	3	EA	Tree and Stump Removal 6 inches to 18 inches										3										
4	0.25	AC	Clearing and Grubbing											0.25									
5	1	LS	Reconstruct Industrial Diversion Chamber No. 1				0.45												0.45			0.05	0.05
6	1	LS	Remove, Fill, and Abandon Existing Junction Chamber						1														
7	1	LS	Reconstruct Parshall Flume Structure					0.50												0.50			
8	1	LS	Meter Vault												1								
9	2	EA	5' Diameter Storm Manhole															2					
10	258	LF	30" Diameter HDPE Storm Sewer															258					
11	1	EA	30-inch Concrete Storm Sewer Outlet Headwall															1					
12	15	SY	6"-12" Rip Rap															15					
13	14	LF	12-inch Diameter Class 52 DI Sanitary Sewer (Labor Only)												14								
14	641	LF	24-inch Diameter Class 52 DI Sanitary Sewer (Labor Only)												443	198							
15	3	EA	24-inch Class 52 DI Flanged Tee (Labor Only)								3												
16	1	EA	24-inch x12-inch Class 52 DIMJ Tee (Labor Only)												1								
17	3	EA	24-inch Blind Flange (Labor Only)								3												
18	3	EA	24-inch Flanged 45 Degree Bend (Labor Only)								3												
19	2	EA	24-inch Flanged 11.25 Degree Bend (Labor Only)								2												
20	1	EA	24-inch Flanged 22.5 Degree Bend (Labor Only)								1												
21	9	EA	24-inch Mega-Flange Adapter (Labor Only)								9												
22	9	EA	24-inch Nut & Bolt Gasket Set (NLA 24 304 SS 150# RR FF 1/8 FLG P) (Labor Only)								9												
23	1	EA	24-inch MJ 90 Degree Bend (Labor Only)								1												
24	6	EA	24-inch Megalug F/DI (Labor Only)								6												
25	6	EA	24-inch MJ Bolt & Gasket Package Less Gland (Labor Only)								6												
26	5	EA	12-inch Megalug F/DI								5												
27	5	EA	12-inch MJ Bolt & Gasket Package Less Gland (Labor Only)								5												
28	1	EA	12-inch MJ 90 Degree Bend (Labor Only)												1								
29	3	EA	Type III Sanitary Sewer Manhole (8' Diameter)												3								
30	641	EA	CIPP 24-inch sanitary Sewer												443	198							
31	1	EA	Post-CCTV Inspection of Sewers	1																			
32	206	LF	Remove Chain Link Fence											206									
33	156	LF	6-foot High Chain Link Fence											156									
34	1	EA	Restoration	1																			
35	1	EA	Materials Testing	1																			
36	1	EA	Construction Staking	1																			

KAL-798200100-GENERAL SUMMARY  
5/11/2023 2:28 PM - CERRELL  
5/11/2023 2:29 PM

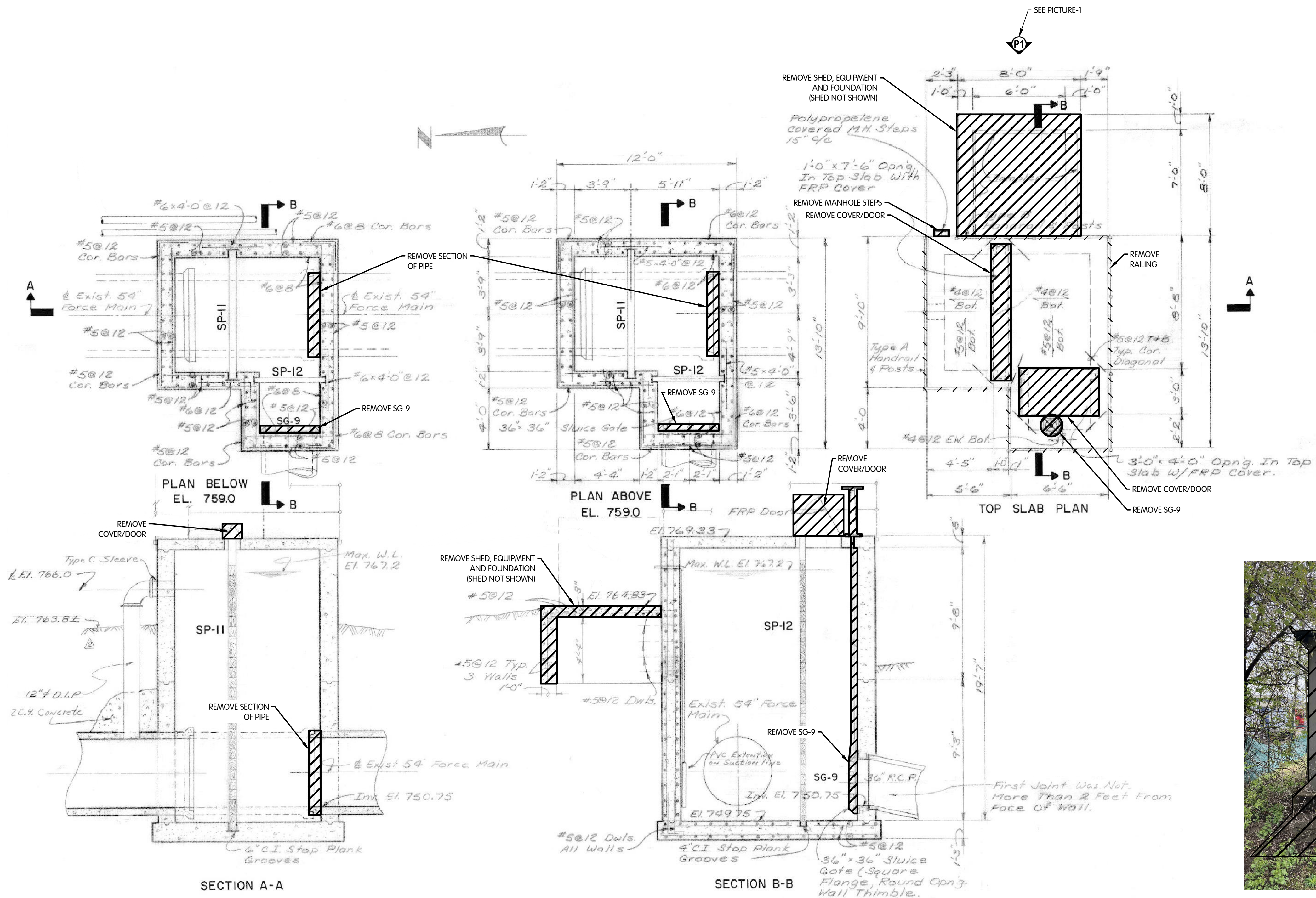
REVISIONS AFTER ISSUED FOR BID  
NO. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50



JOB NO. 017-7982.001  
SCALE NONE  
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE  
DESIGNED RGE DRAWN CJAF CHECKED RGE  
STATUS: ISSUE FOR BID  
DATE: MAY 2023  
SHEET NO. G-0.3  
3 OF 19

INDUSTRIAL DIVERSION CHAMBER I  
 REMOVALS

CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT



PICTURE-1

- NOTES:  
 1. ALL ELEVATIONS SHOWN ARE NGVD 29.  
 2. VERIFY ALL EXISTING DIMENSIONS, ELEVATIONS AND CONDITIONS AT THE INTERFACE BETWEEN EXISTING AND NEW CONSTRUCTION PRIOR TO CONSTRUCTION. NOTIFY THE ENGINEER OF ANY DISCREPANCIES FOR RESOLUTION.  
 3. ESTIMATED SCALE: 1/4"=1'-0".

KAL-7982002-INDUSTRIAL DIVERSION CHAMBER I - REMOVALS  
 5/9/2023 10:10 AM - CERRELL  
 5/11/2023 2:30 PM

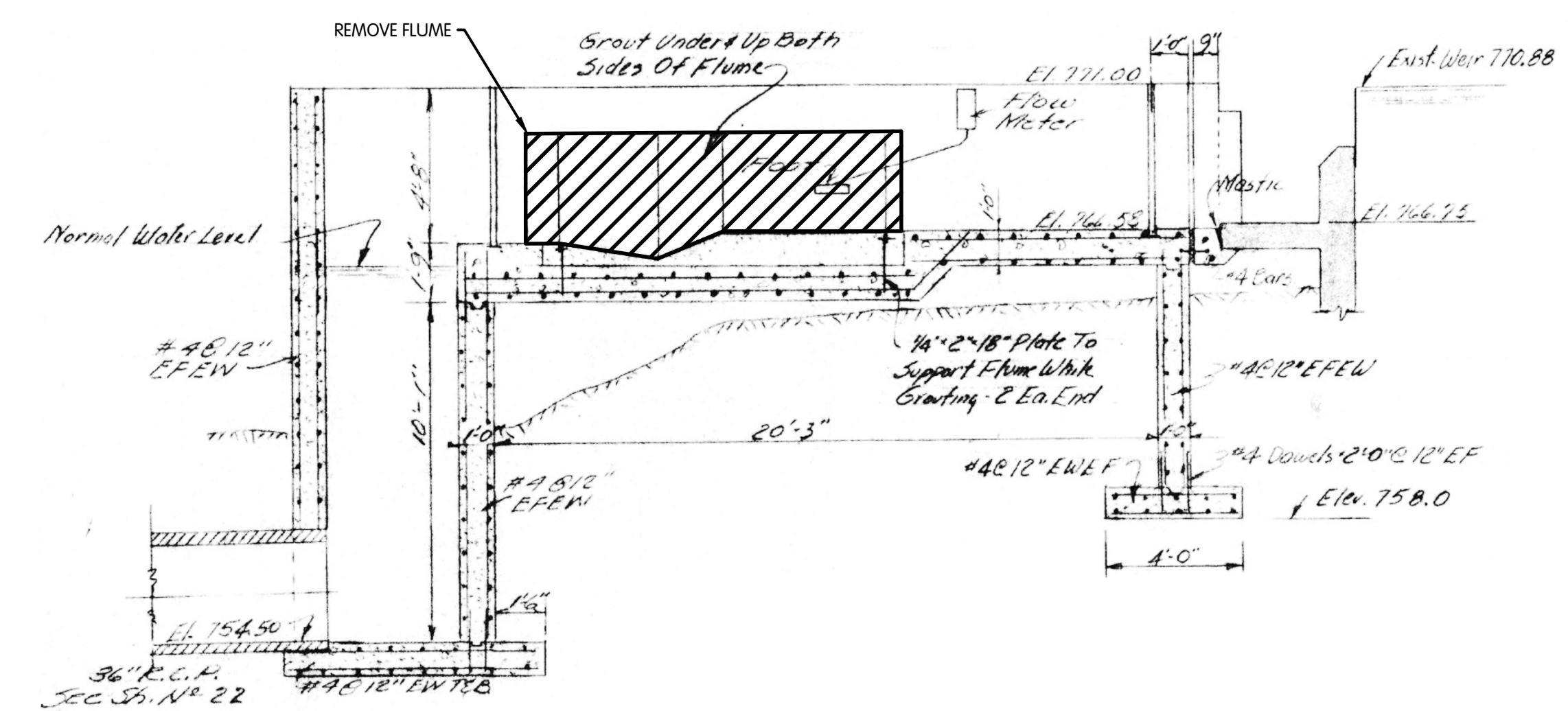
REVISIONS AFTER ISSUED FOR BID  
 NO. DATE

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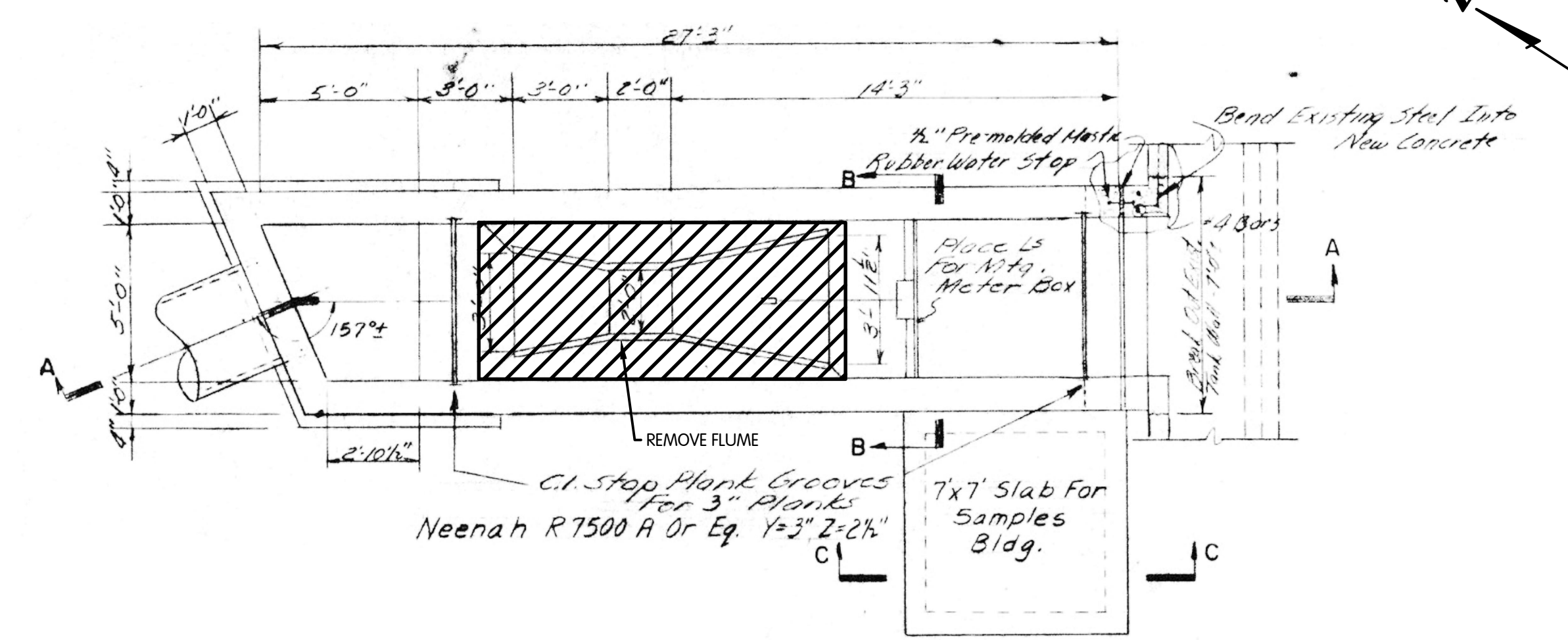
JOB NO.	017-7982.001	
SCALE	AS NOTED	
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE		
DESIGNED	DRAWN	CHECKED
DRC	CJAF	RGE
STATUS	ISSUE FOR BID	
DATE	MAY 2023	
SHEET NO.	R-1.1	
	4 OF 19	



PARSHALL FLUME REMOVALS  
 CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT



**SECTION A-A**



**REMOVAL PLAN VIEW**

- NOTES:
1. ALL ELEVATIONS SHOWN ARE NGVD 29.
  2. VERIFY ALL EXISTING DIMENSIONS, ELEVATIONS AND CONDITIONS AT THE INTERFACE BETWEEN EXISTING AND NEW CONSTRUCTION PRIOR TO CONSTRUCTION. NOTIFY THE ENGINEER OF ANY DISCREPANCIES FOR RESOLUTION.
  3. ESTIMATED SCALE: 1/4" = 1'-0".

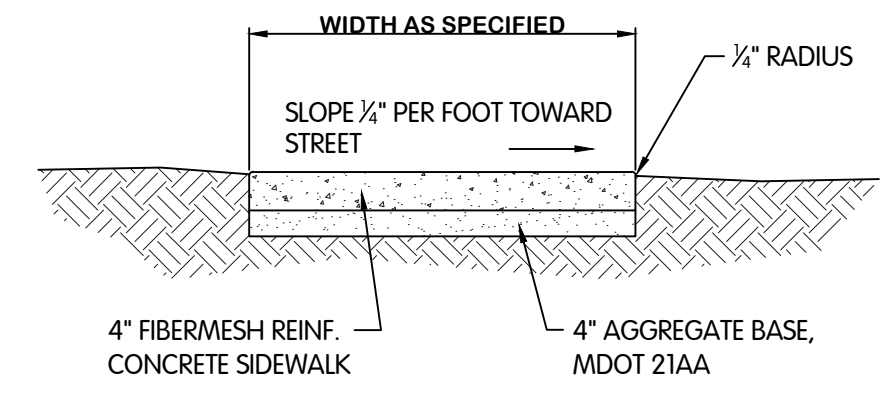
KAL-798200103-PARSHALL FLUME - REMOVALS  
 5/2/2023 3:46 PM - CERRELL  
 5/11/2023 2:30 PM

REVISIONS AFTER ISSUED FOR BID  
 NO. DATE

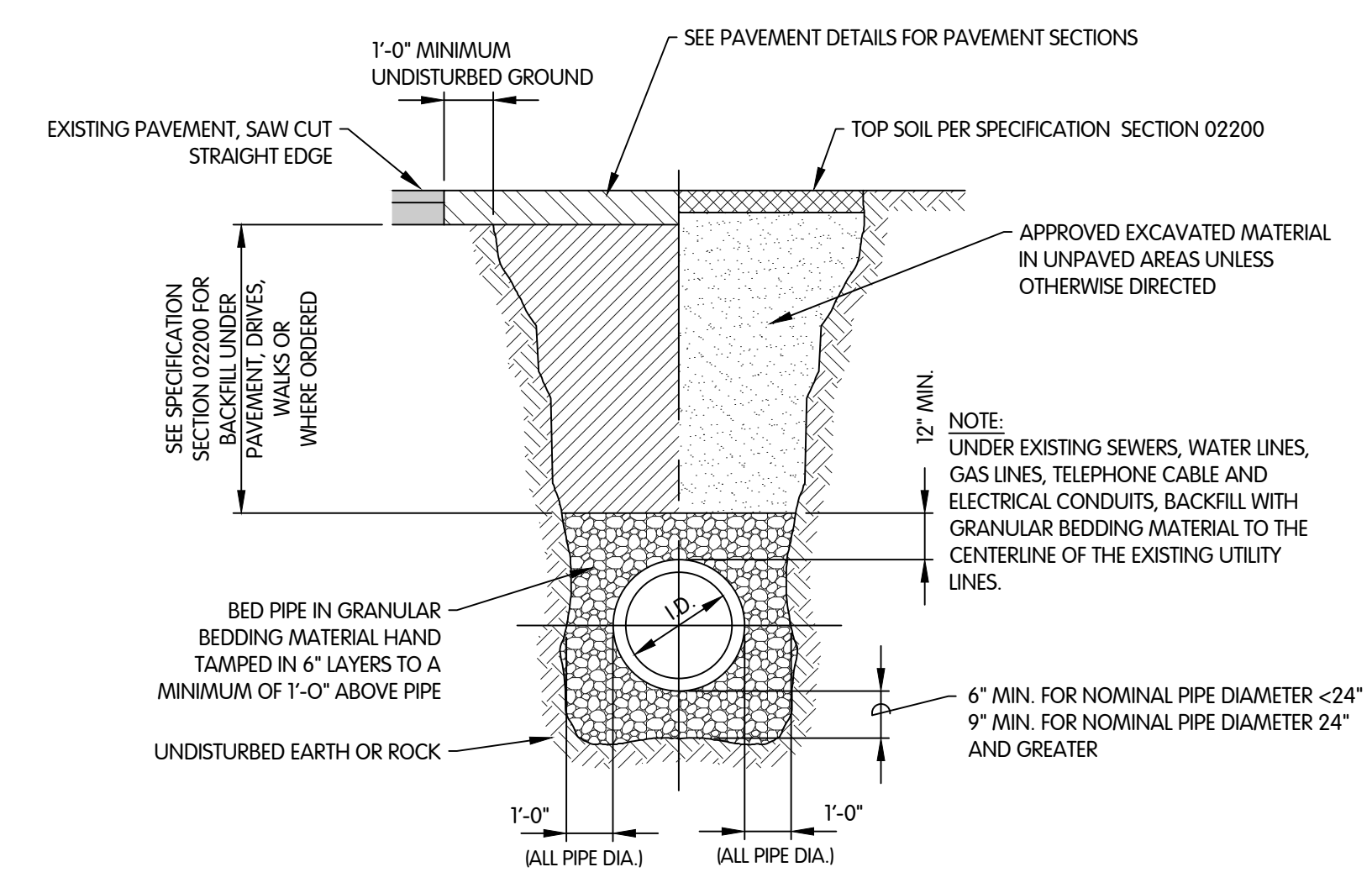
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JOB NO.	017-7982.001	
SCALE	AS NOTED	
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE		
DESIGNED	DRAWN	CHECKED
DRC	CJAF	RGE
STATUS	ISSUE FOR BID	
DATE	MAY 2023	
SHEET NO.	R-1.2	
	5 OF 19	

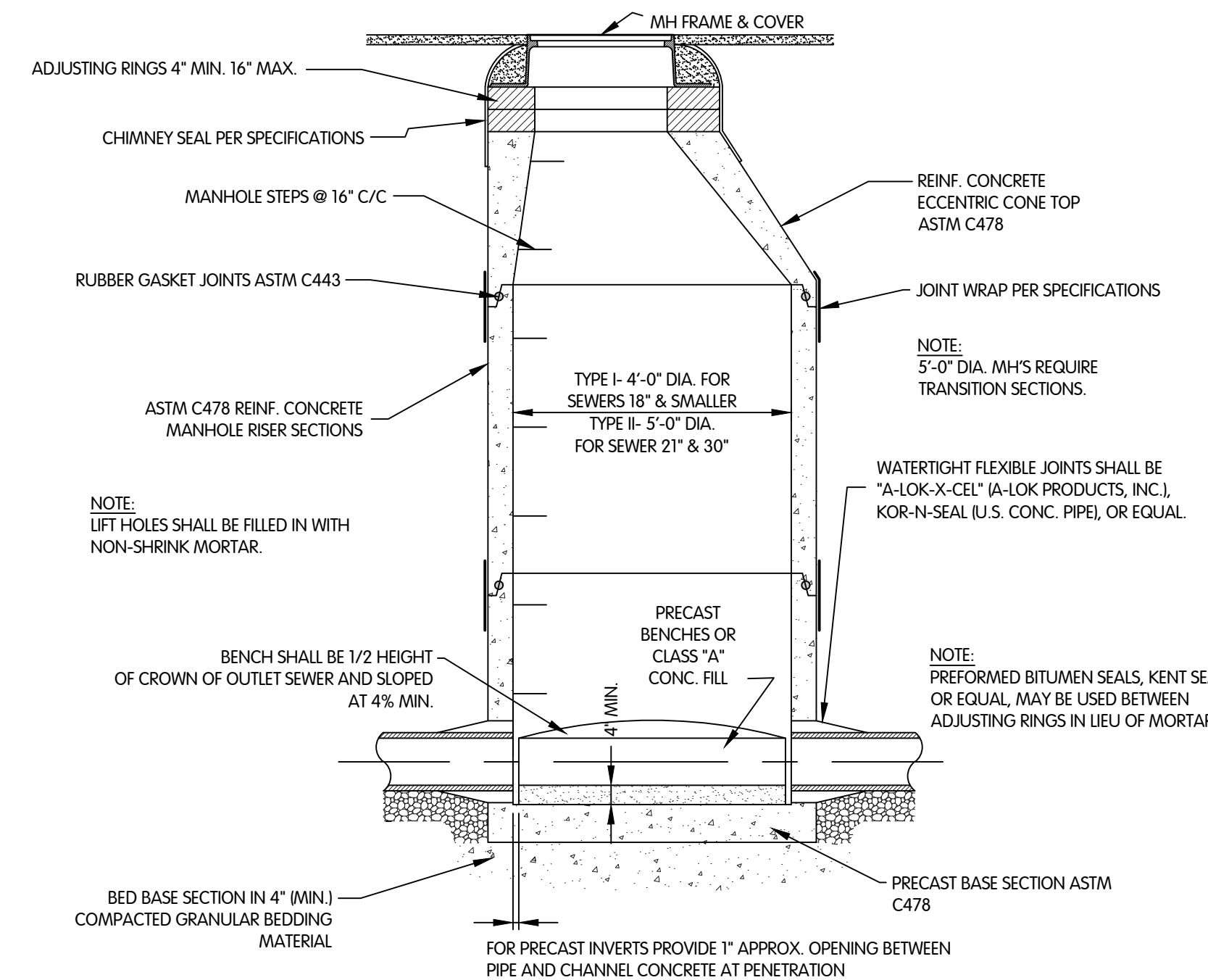




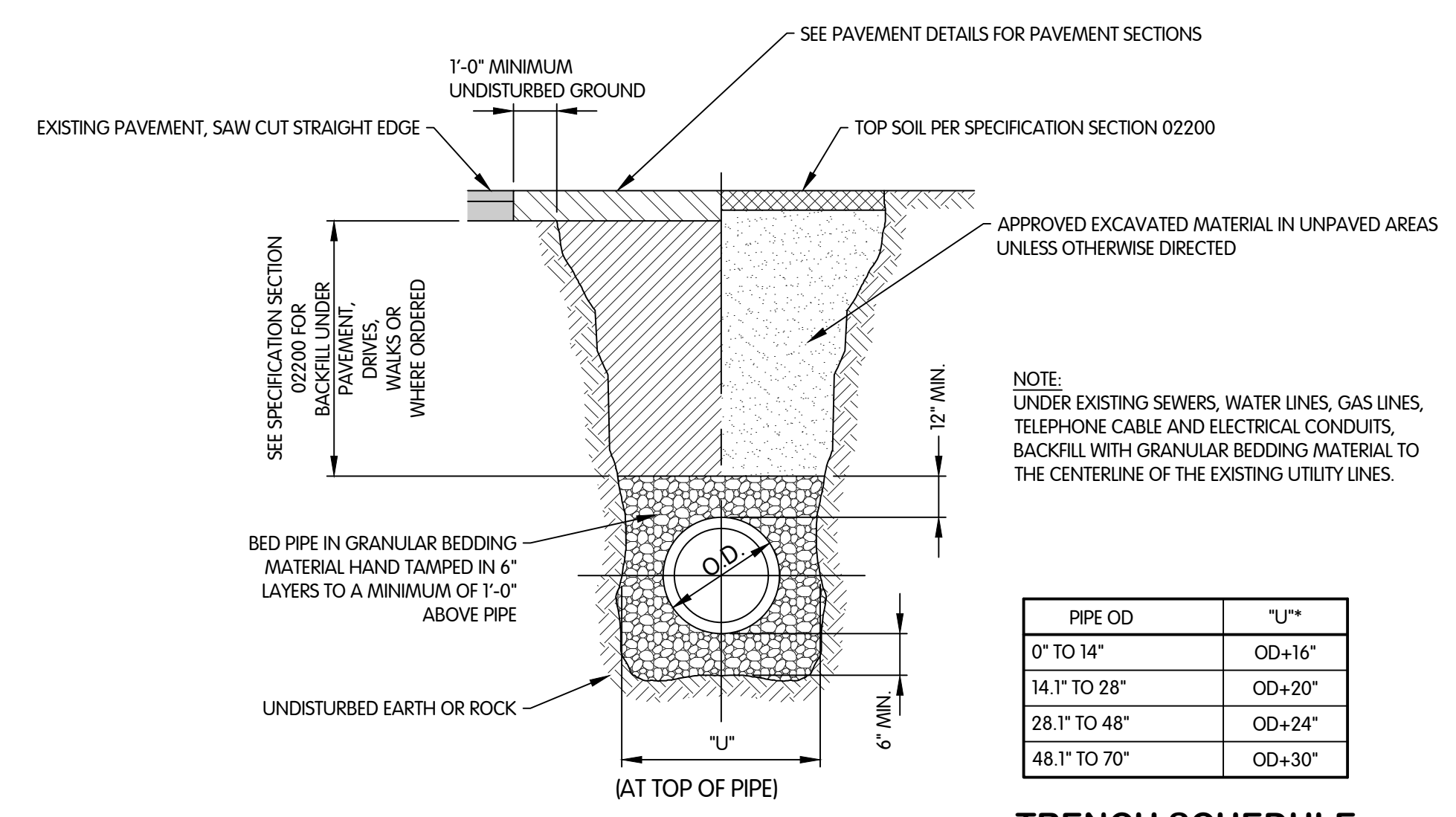
**4" CONCRETE SIDEWALK**  
NTS



**TRENCH DETAIL FOR RIGID PIPE (DIP)**  
NTS



**TYPE I & II MANHOLES**  
NTS

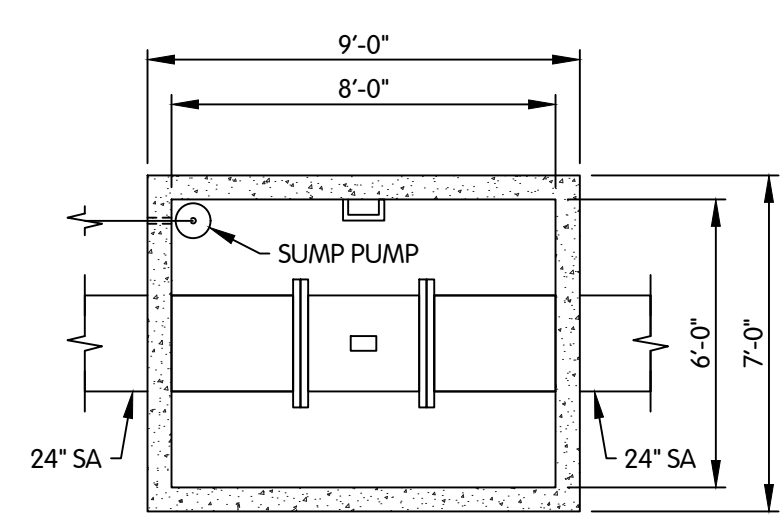


PIPE OD	"U"
0" TO 14"	OD+16"
14.1" TO 28"	OD+20"
28.1" TO 48"	OD+24"
48.1" TO 70"	OD+30"

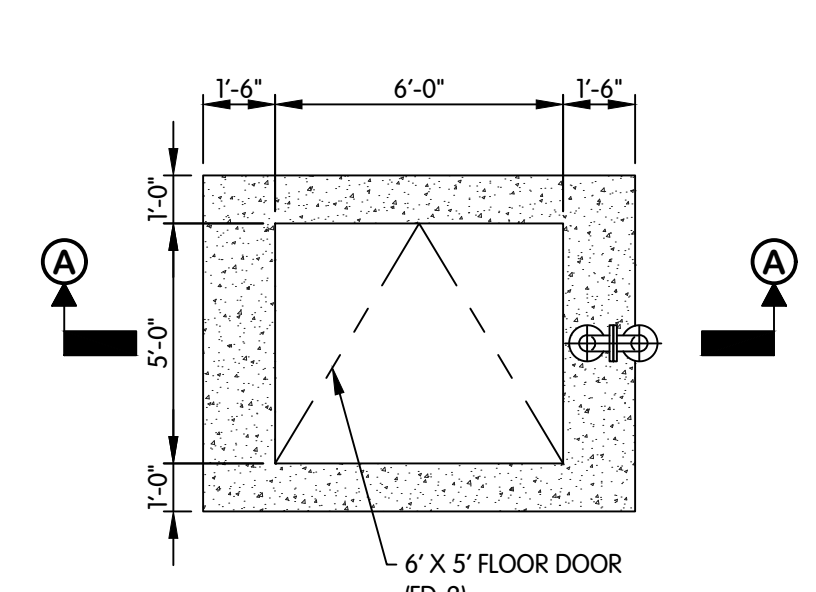
**TRENCH SCHEDULE**

\* NOTE:  
"U" IS THE MINIMUM WIDTH FOR FLEXIBLE PIPES IN ACCORDANCE WITH ASTM D-2321 AND D-2774.

**TRENCH DETAIL FOR FLEXIBLE PIPE**  
NTS

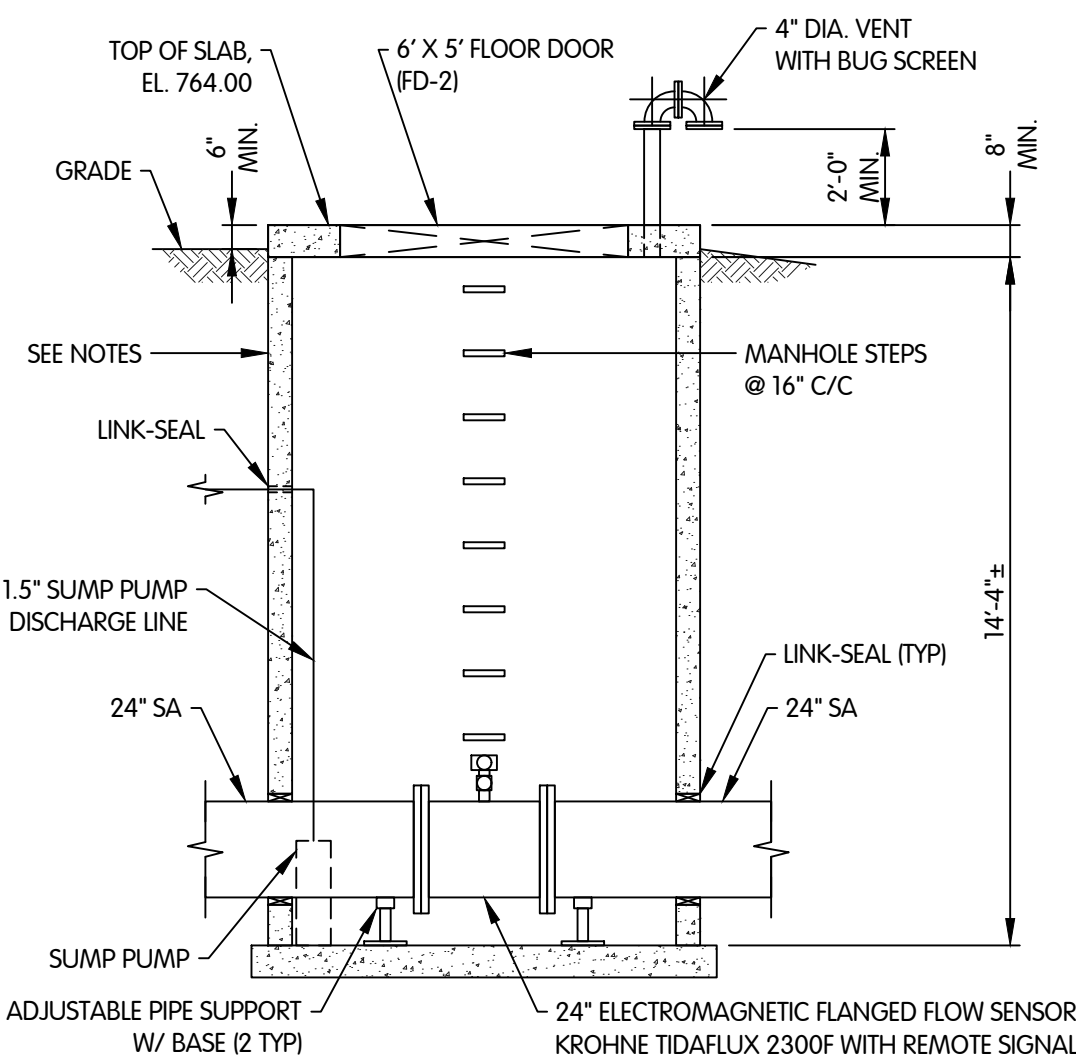


**PLAN ELEVATION 759.00**



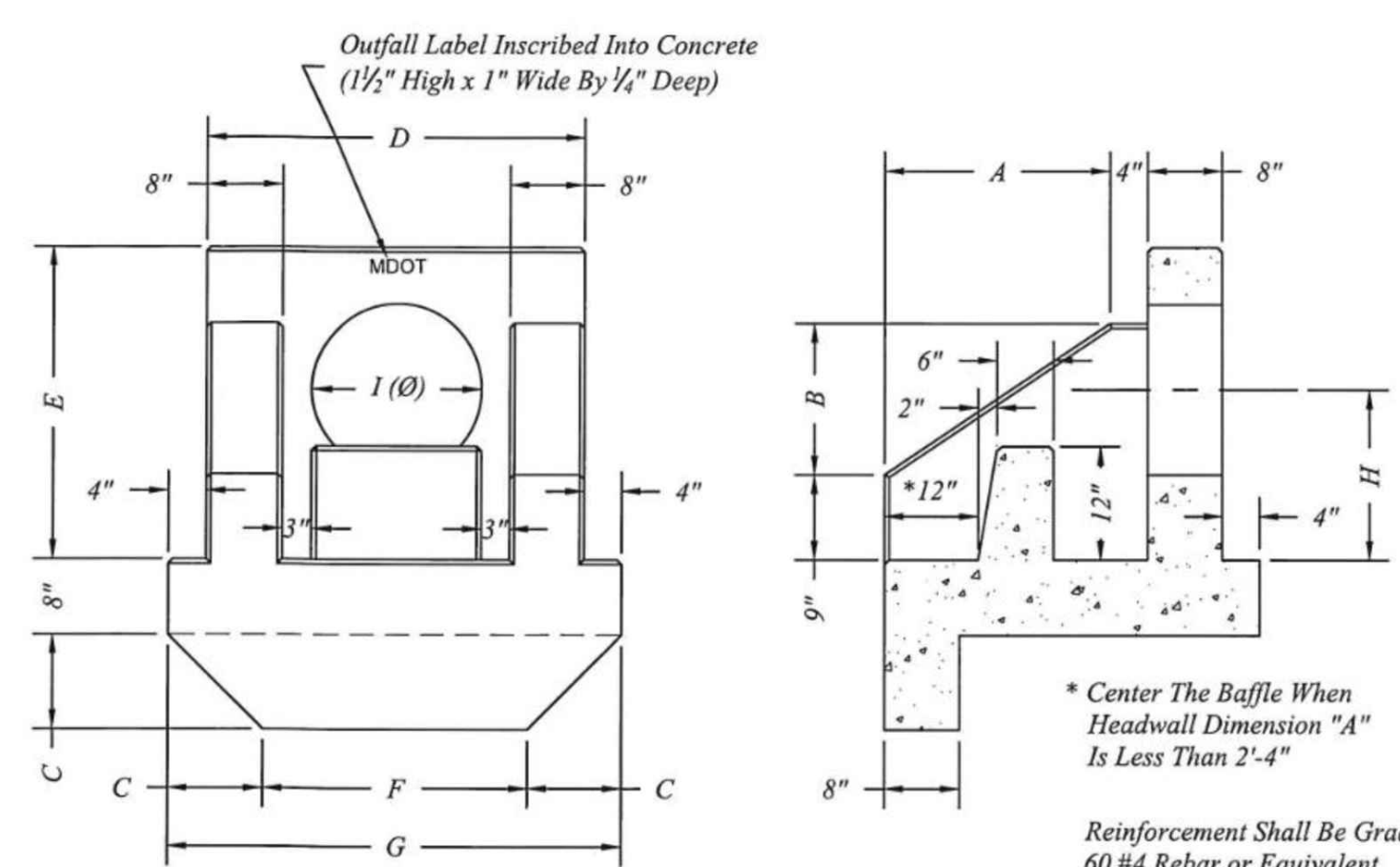
**PLAN VIEW**

- NOTES:
- LIFT HOLES SHALL BE FILLED IN WITH NON-SHRINK MORTAR.
  - PREFORMED BITUMEN SEALS, KENT SEAL OR EQUAL, MAY BE USED BETWEEN ADJUSTING RINGS IN LIEU OF MORTAR.
  - METER VAULT TO BE A PRECAST CONCRETE STRUCTURE.
  - FILL AROUND STRUCTURE WITH SPECIAL BACKFILL.
  - BED BASE SECTION IN 4" (MIN.) COMPACTED GRANULAR BEDDING MATERIAL.
  - CONTRACTOR TO FIRST INSTALL A SPOOL SECTION THE SAME LENGTH AS THE ELECTROMAGNETIC FLOW SENSOR SO THE LINING CONTRACTOR CAN LINE THROUGH THE METER VAULT. ONCE THE LINING IS COMPLETE, THE CONTRACTOR WILL REMOVE THE SPOOL SECTION, CUT THE LINER AT THE FLANGES AND INSTALL THE ELECTROMAGNETIC FLOW SENSOR.



**METER VAULT**  
1/4" = 1'-0"

**SECTION VIEW A-A**

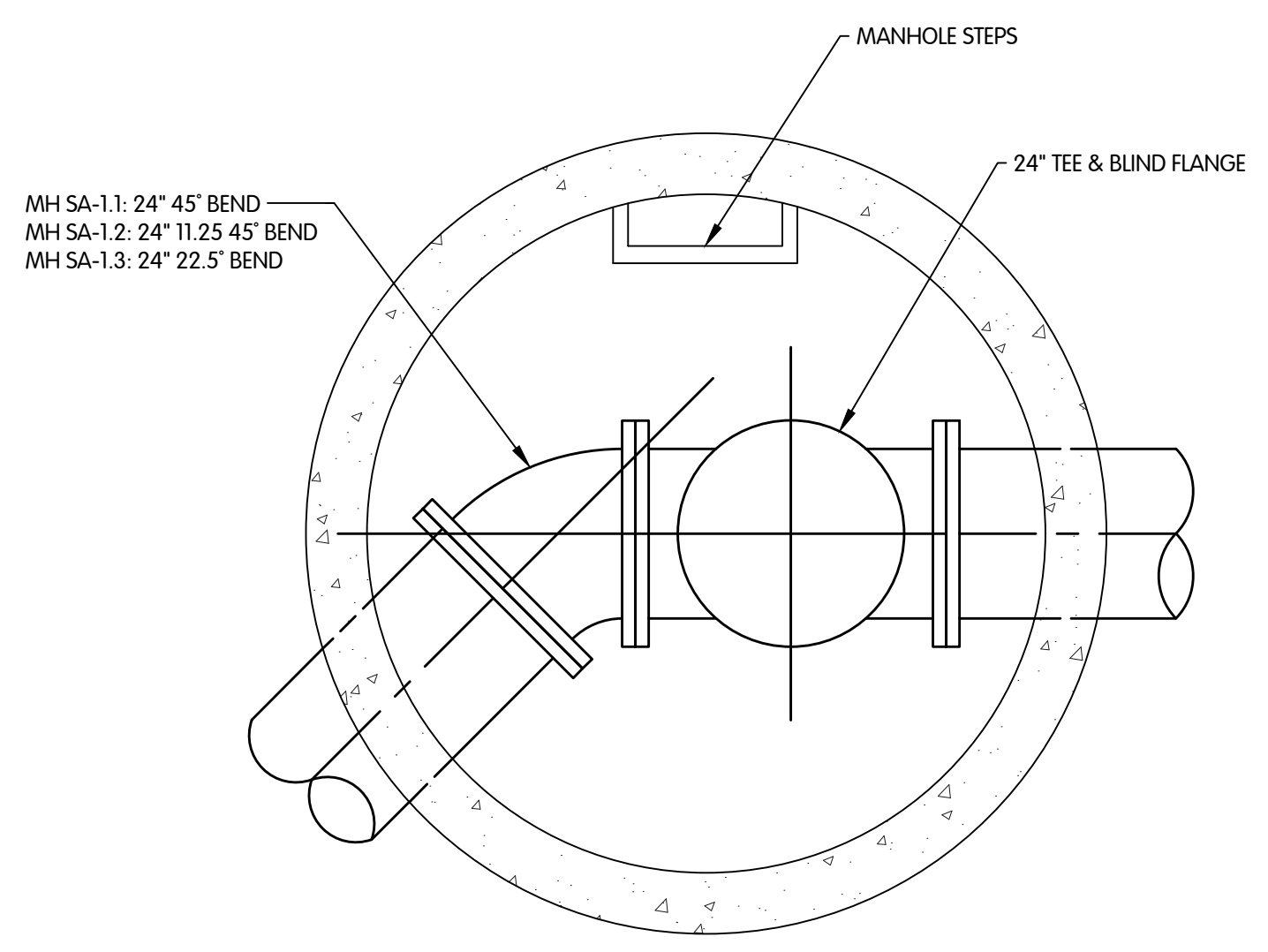


Outlet Headwall Dimensions										
Dia	A	B	C	D	E	F	G	H	I (Ø)	Weight
30"	4'-3"	2'-10"	1'-4"	4'-10"	4'-3"	2'-10"	5'-6"	2'-3"	42"	7,380

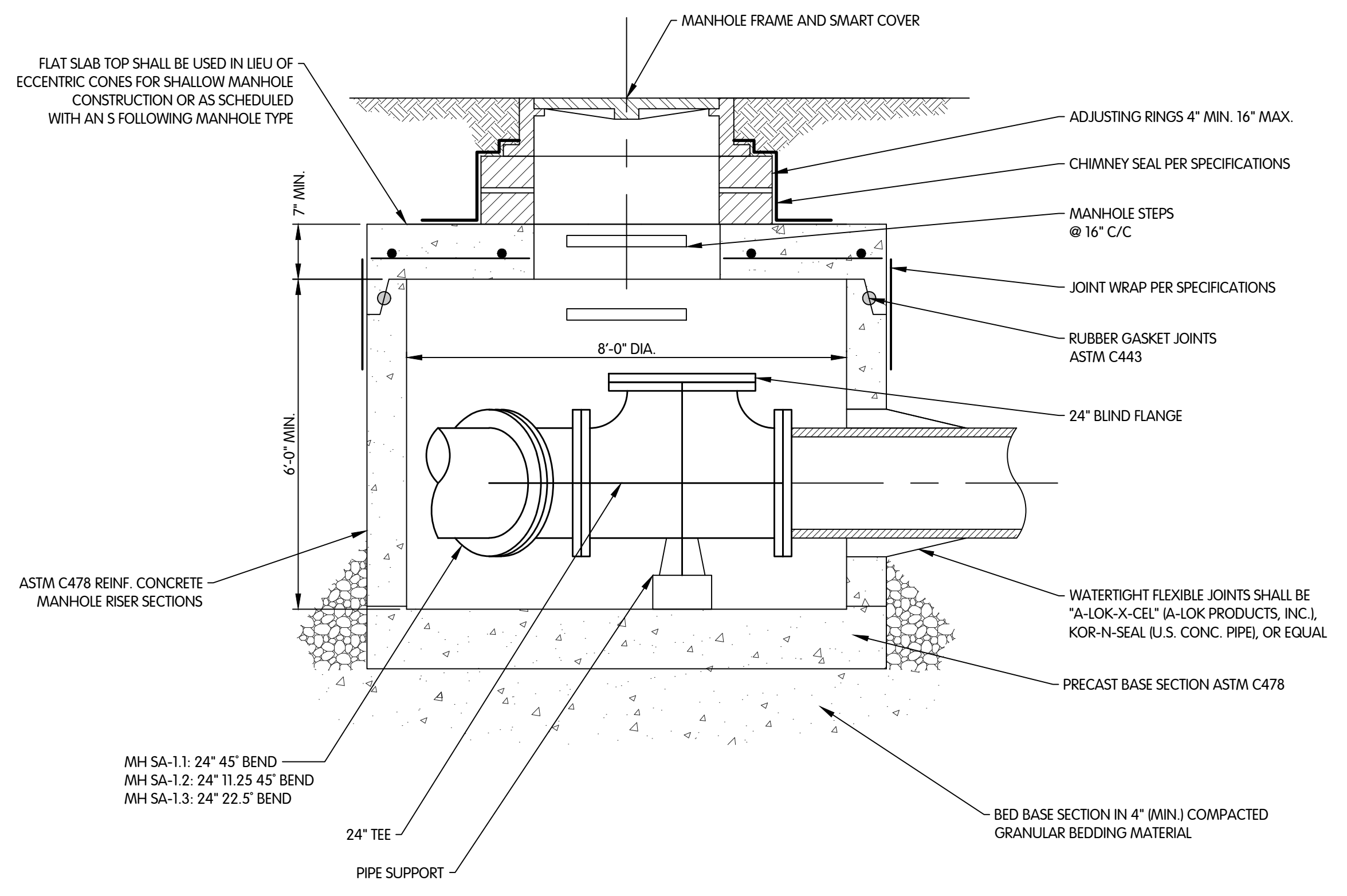
Reinforcement Shall Be Grade 60 #4 Rebar or Equivalent WWF per MDOT Standard Detail R-85-D.

Contractor To Complete Connection Between Pipe and Outlet Headwall w/Mortar Meeting MDOT 2012 Standard Specification for Construction, Section 702.

**OUTLET HEADWALL**  
NTS



**SECTIONAL PLAN**  
1/2" = 1'-0"



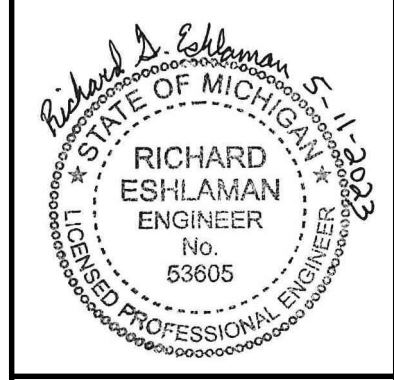
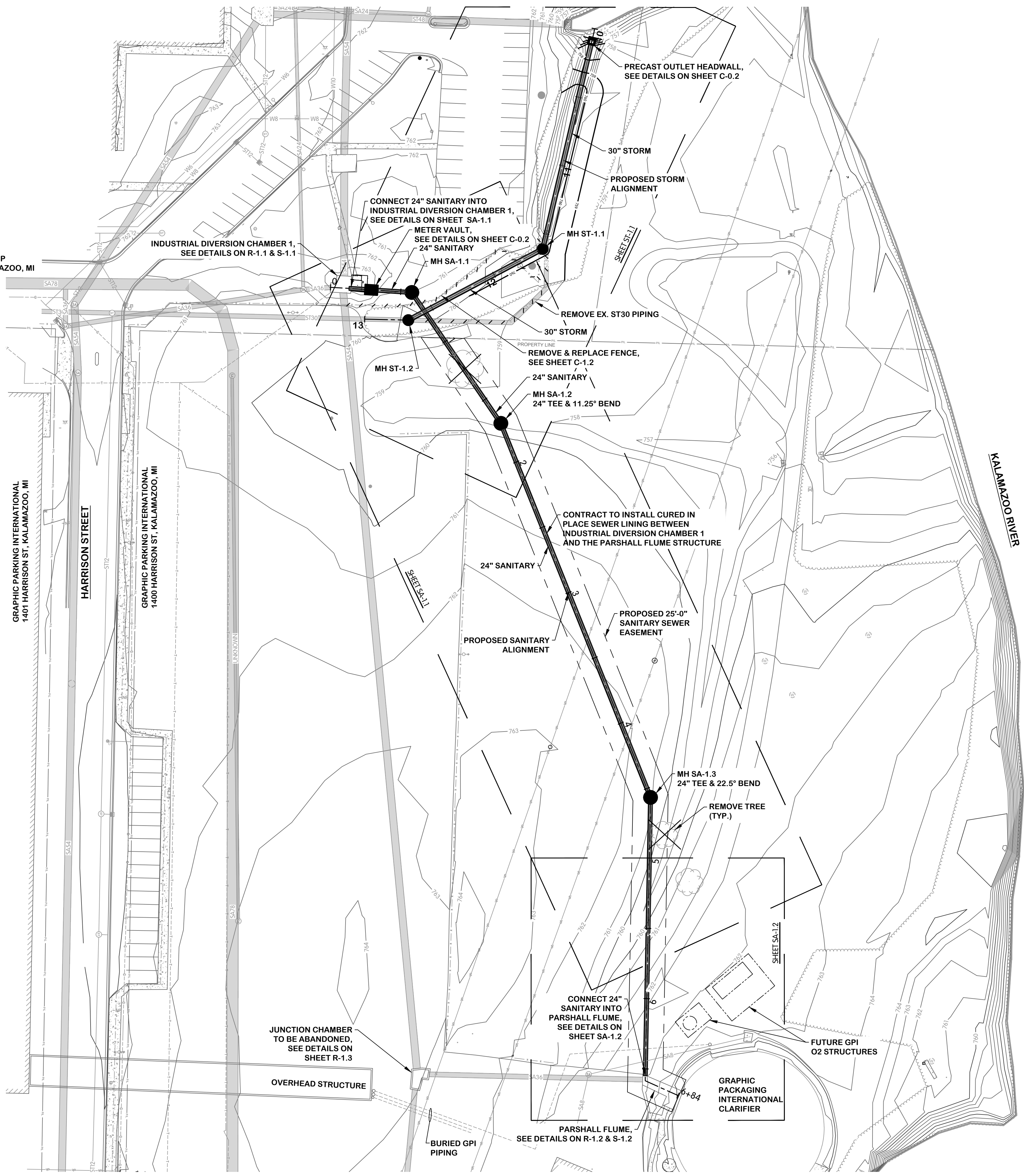
- NOTES:
- LIFT HOLES SHALL BE FILLED IN WITH NON-SHRINK MORTAR.
  - PREFORMED BITUMEN SEALS, KENT SEAL OR EQUAL, MAY BE USED BETWEEN ADJUSTING RINGS IN LIEU OF MORTAR.

**MANHOLE STRUCTURES SA-1.1, SA-1.2 & SA-1.3**  
1/2" = 1'-0"



KAL-7982001005-SITE PLAN AND SHEET KEY  
 5/10/2023 2:54 PM - CFERRELL  
 5/11/2023 2:30 PM

CITY OF KALAMAZOO - KWRP  
 1415 HARRISON ST, KALAMAZOO, MI



**SITE PLAN AND SHEET KEY**

CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

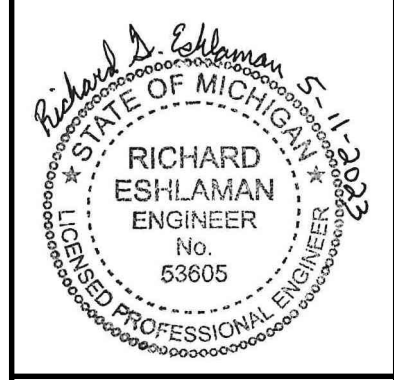
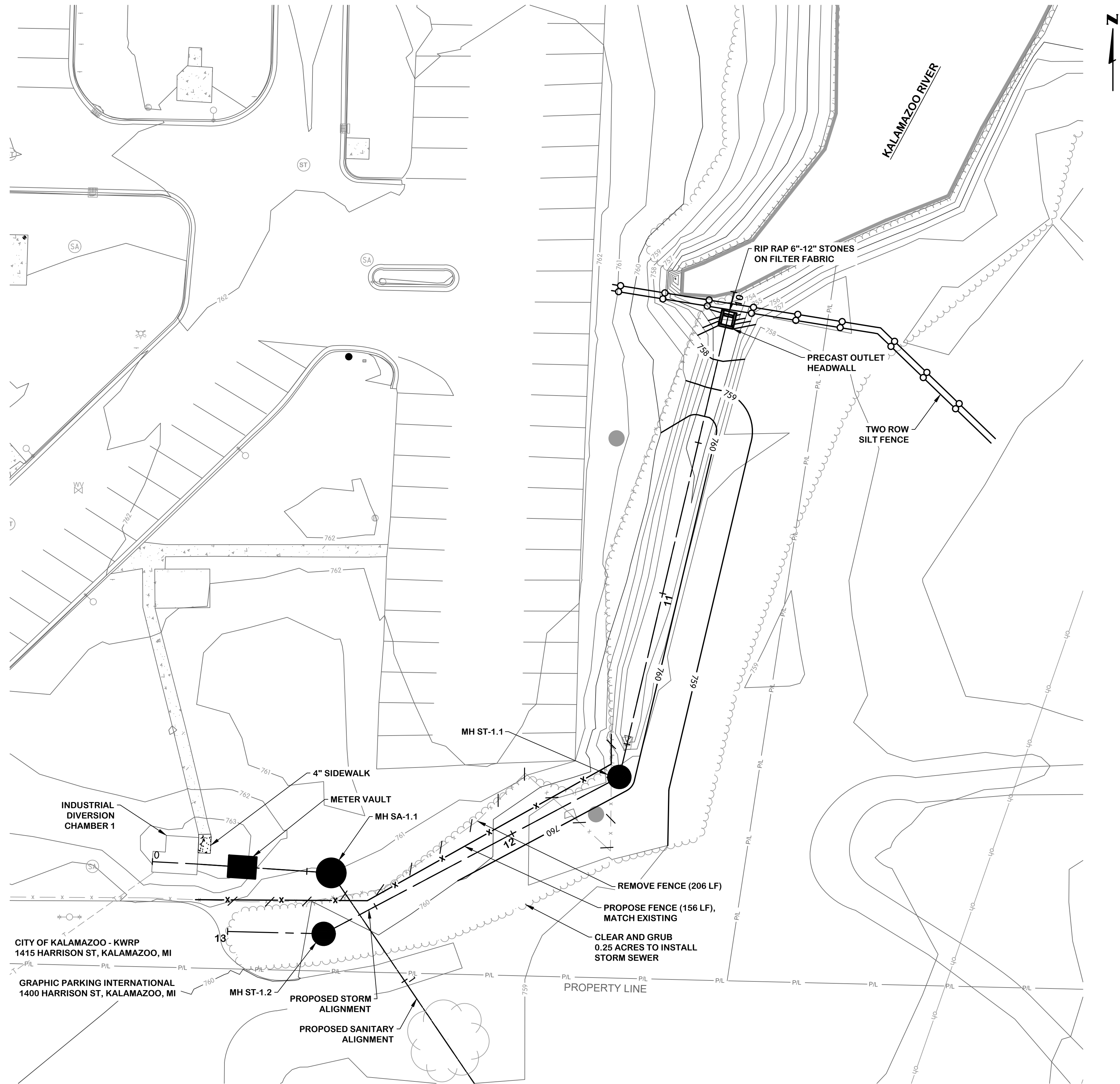
NO.	DATE	REVISIONS AFTER ISSUED FOR BID
1		
2		
3		
4		

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JOB NO.	017-7982.001
SCALE	1:40
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE	
DESIGNED	RGE
DRAWN	CJAF
CHECKED	RGE
STATUS	ISSUE FOR BID
DATE	MAY 2023
SHEET NO.	C-1.1
	9 OF 19

KAL-798200105-GRADING AND EROSION CONTROL - PARTIAL SITE PLAN  
 5/10/2023 3:12 PM - CFERRELL  
 5/11/2023 2:30 PM



GRADING AND EROSION CONTROL  
 PARTIAL SITE PLAN

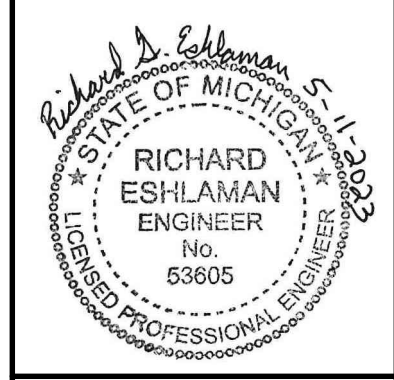
CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1			
2			
3			
4			

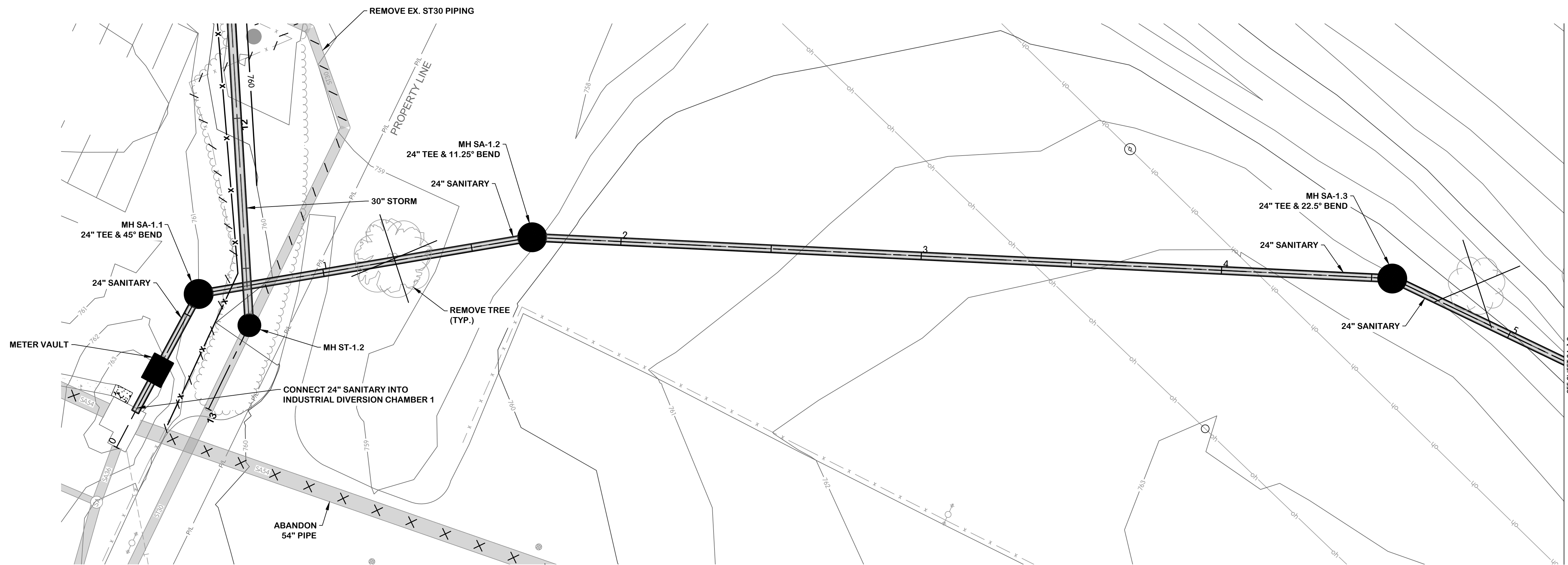
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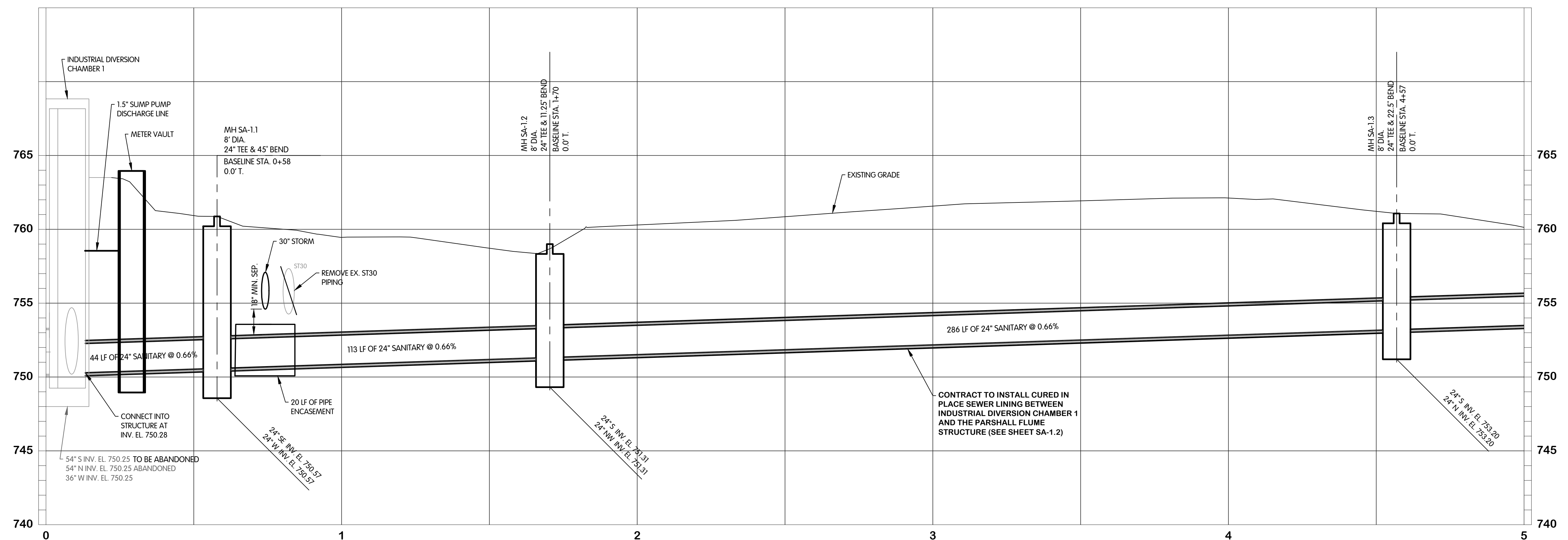
JOB NO.	017-7982.001	
SCALE	1:20	
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE		
DESIGNED	DRAWN	CHECKED
RGE	CJAF	RGE
STATUS	ISSUE FOR BID	
DATE	MAY 2023	
SHEET NO.	C-1.2	
	10 OF 19	



SANITARY  
 PLAN AND PROFILE  
 STA. 0+00 TO 5+00  
 CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT



**SANITARY  
STA. 0+00 TO 5+00**



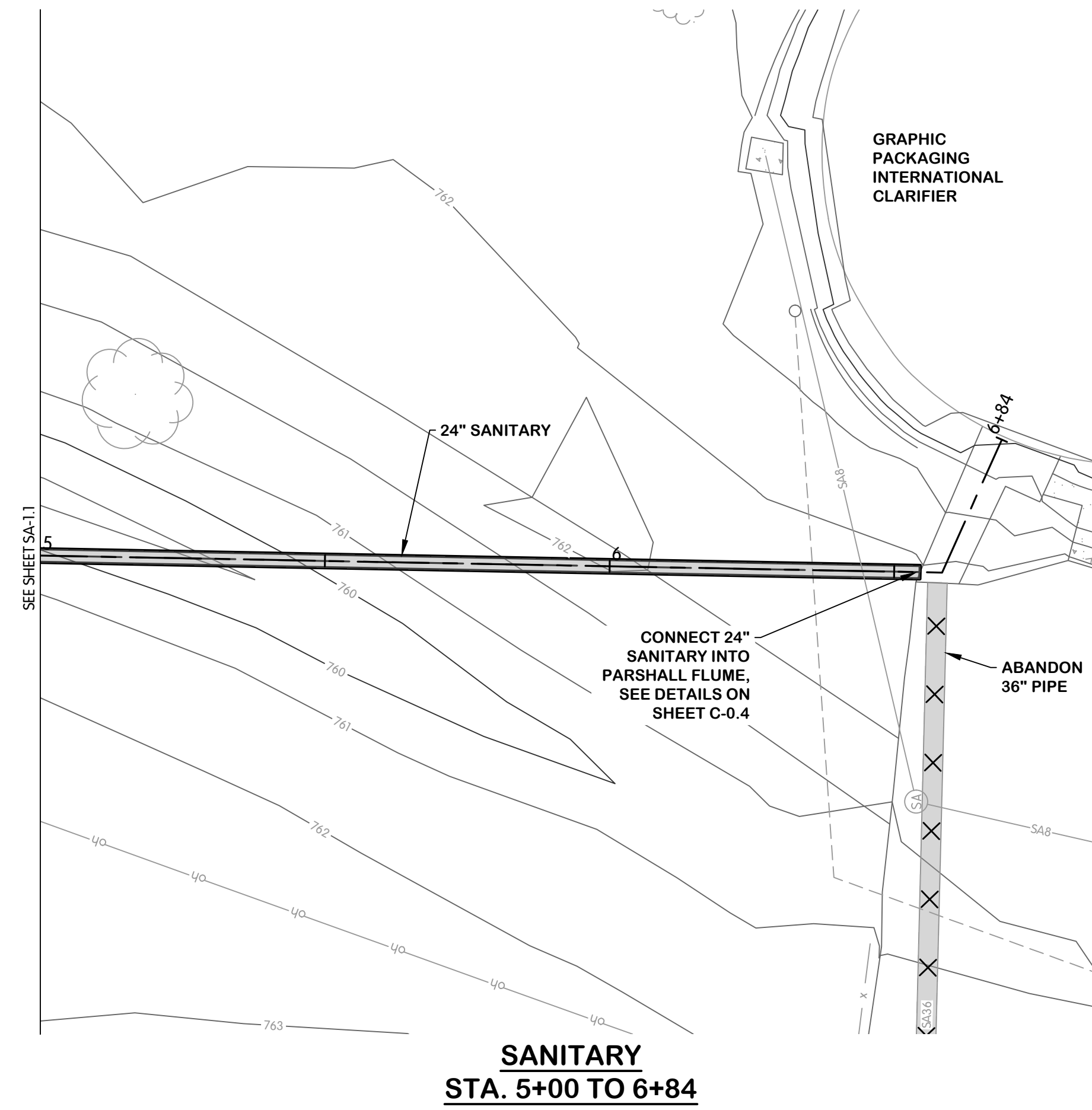
KAL-7982001SA02-SANITARY - PLAN & PROFILE STA. 0+00 TO 5+00  
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 5/11/2023 2:30 PM

REVISIONS AFTER ISSUED FOR BID  
 NO. 1  
 DATE

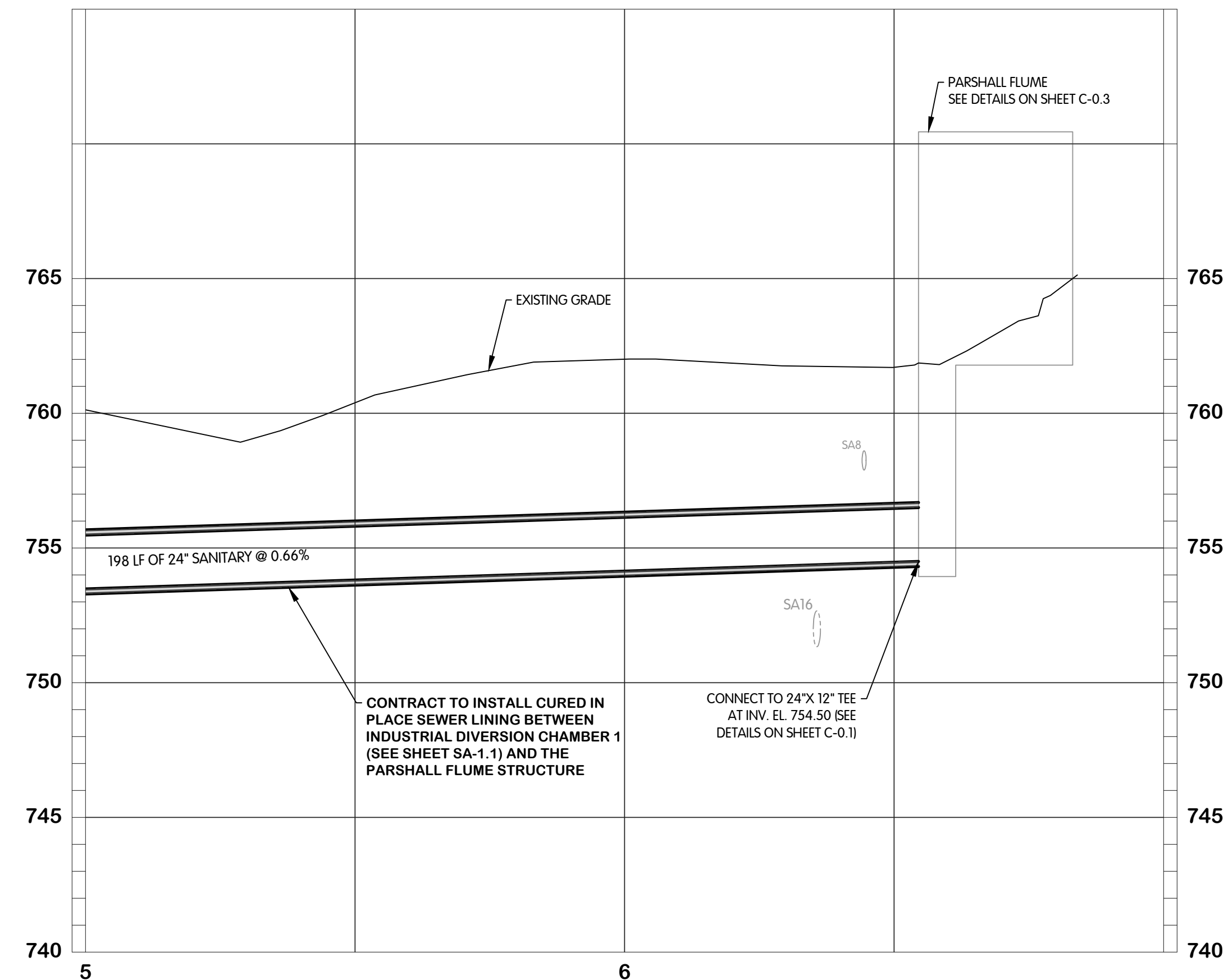
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 www.jheng.com

JOB NO. 017-7982.001  
 SCALE 1"=20'H,  
 1"=4' V  
 THIS LINE SCALES V WHEN  
 PLOTTED TO INDEX SCALE  
 DESIGNED RGE DRAWN CJAF CHECKED RGE  
 STATUS: ISSUE FOR BID  
 DATE: MAY 2023  
 SHEET NO.  
**SA-1.1**  
 11 OF 19

KAL-798200(SA03)-SANITARY - PLAN & PROFILE STA 5+00 TO 6+84  
 5/10/2023 3:11 PM - CERRELL  
 5/11/2023 2:30 PM

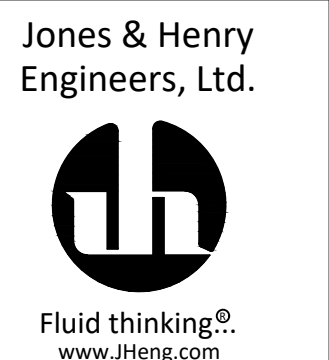


**SANITARY  
 STA. 5+00 TO 6+84**



**SANITARY  
 PLAN AND PROFILE  
 STA. 5+00 TO 6+84**  
 CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

NO. 1 2 3 4 5 6 7 8 9 10  
 DATE  
 REVISIONS AFTER ISSUED FOR BID

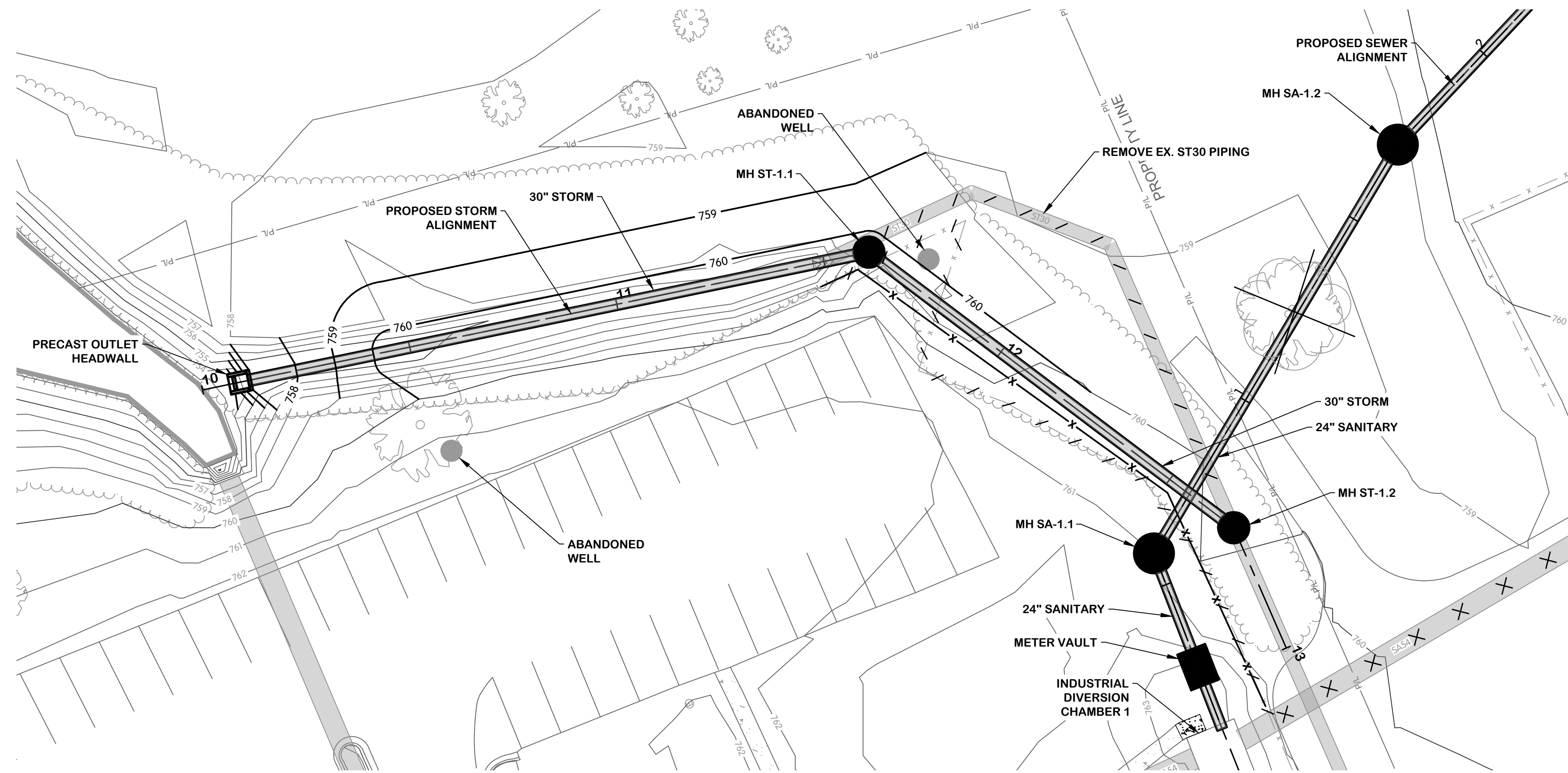


JOB NO. 017-7982.001  
 SCALE 1"=20'H,  
 1"=4'V  
 THIS LINE SCALES IF WHEN  
 PLOTTED TO NOTED SCALE  

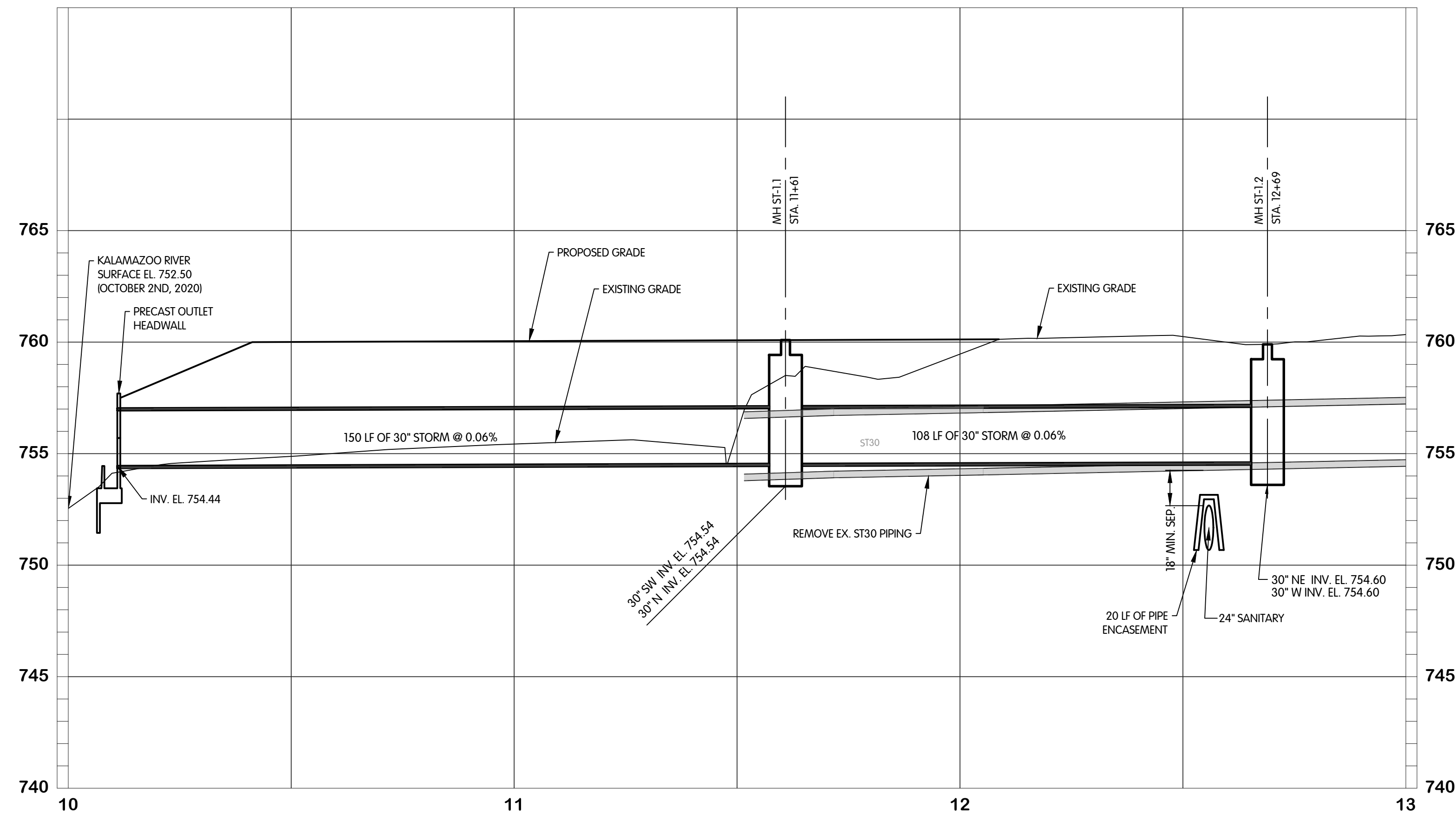
DESIGNED	DRAWN	CHECKED
RGE	CJAF	RGE

 STATUS: ISSUE FOR BID  
 DATE: MAY 2023  
 SHEET NO.

**SA-1.2**  
 12 OF 19



**STORM  
STA. 10+00 TO 13+00**

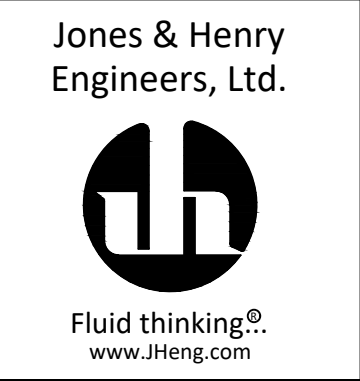


KAL-7982001-01-STORM - PLAN & PROFILE STA. 10+00 TO 13+00  
 5/10/2023 3:11 PM - CERRELL  
 5/11/2023 2:30 PM



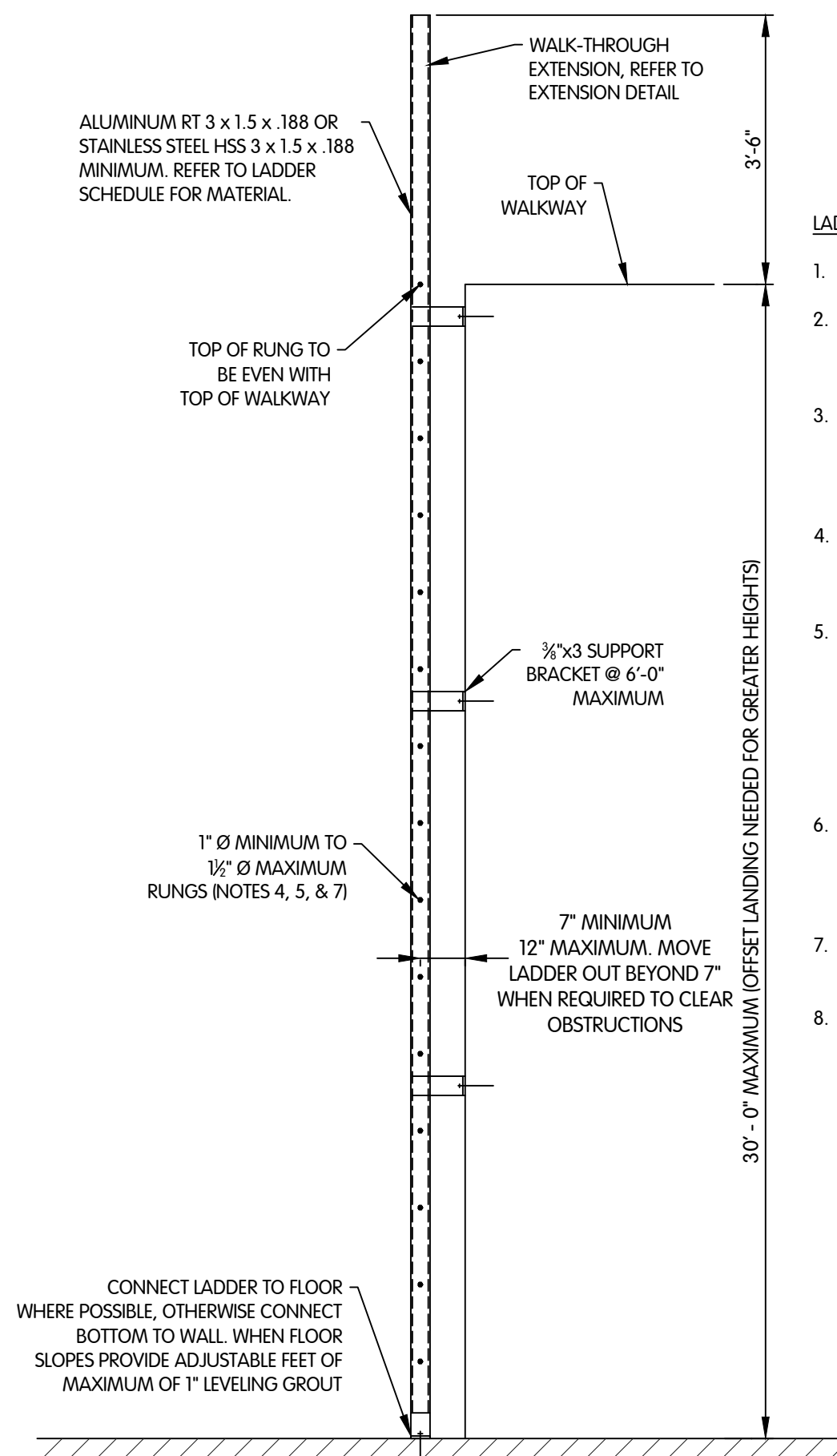
**STORM  
PLAN AND PROFILE  
STA. 10+00 TO 13+00**  
 CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

REVISIONS AFTER ISSUED FOR BID  
 NO. 1  
 DATE



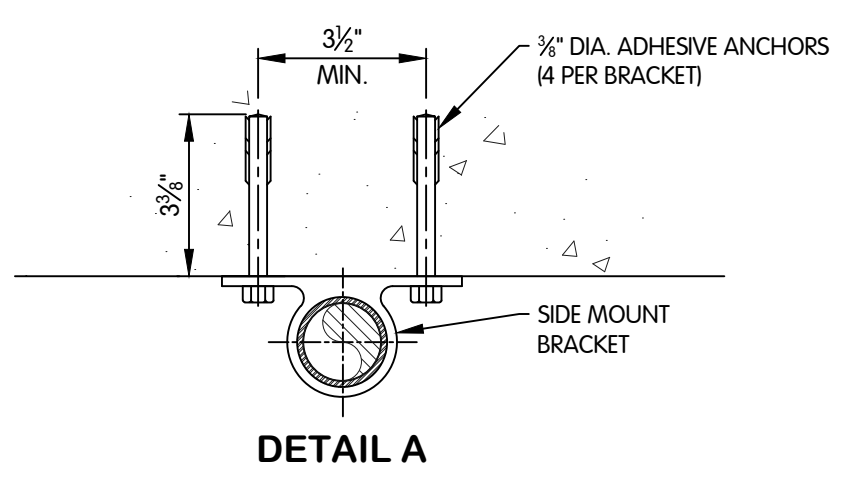
JOB NO. 017-7982.001  
 SCALE 1"=20'H,  
 1"=4'V  
 THIS LINE SCALES V WHEN  
 PLOTTED TO NOTED SCALE  
 DESIGNED RGE DRAWN CJAF CHECKED RGE  
 STATUS: ISSUE FOR BID  
 DATE: MAY 2023  
 SHEET NO.

**ST-1.1**  
 13 OF 19



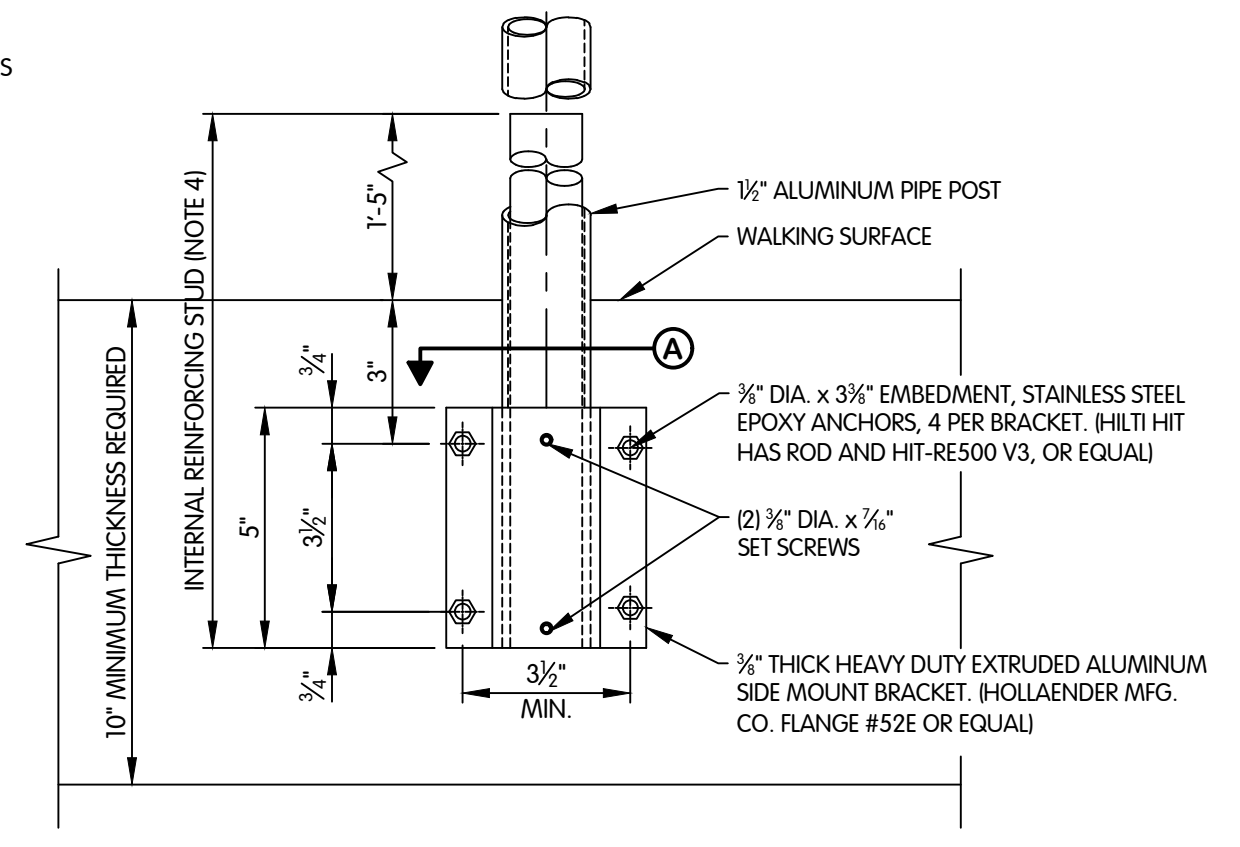
**TYPICAL LADDER SECTION**  
1/2" = 1'-0"

- LADDER NOTES:**
- ALL CONSTRUCTION TO BE WELDED.
  - SUPPORT BRACKET FASTENER:  
A. TO CONCRETE, USE 3/4" DIA. METER X 5" EMBEDMENT EXPANSION ANCHORS.
  - EACH RUNG OR STEP SHALL BE CAPABLE OF SUPPORTING A SINGLE CONCENTRATED LOAD OF 300 LBS. APPLIED IN THE MIDDLE OF THE RUNG OR STEP.
  - RUNGS SHALL BE SPACED NOT LESS THAN 10" APART AND NOT MORE THAN 12" APART AS MEASURED BETWEEN THE CENTERS OF THE RUNGS.
  - EACH FIXED LADDER SHALL BE CAPABLE OF RESISTING AT LEAST TWO LOADS OF 300 LBS. EACH CENTERED BETWEEN ANY TWO CONSECUTIVE ATTACHMENTS PLUS ANY ANTICIPATED LOADS DUE TO ICE BUILD-UP, WINDS, AND RIGGING IMPACT LOADS RESULTING FROM THE USE OF LADDER SAFETY DEVICES (IF APPLICABLE).
  - RUNGS SHALL BE CORRUGATED, KNURLED, DIMPLED, OR COATED WITH SKID RESISTANT MATERIAL OR OTHERWISE TREATED TO MINIMIZE SLIPPING. ADHESIVE GRIT TAPE IS NOT ACCEPTABLE.
  - INTERIOR STEEL LADDERS TO BE PAINTED SAFETY YELLOW.
  - LADDERS RUNGS SHALL BE 18" WIDE BETWEEN THE RAILS. LADDER EXTENSION WALK-THROUGH SHALL BE 24" WIDE BETWEEN THE RAILS.



**DETAIL A**

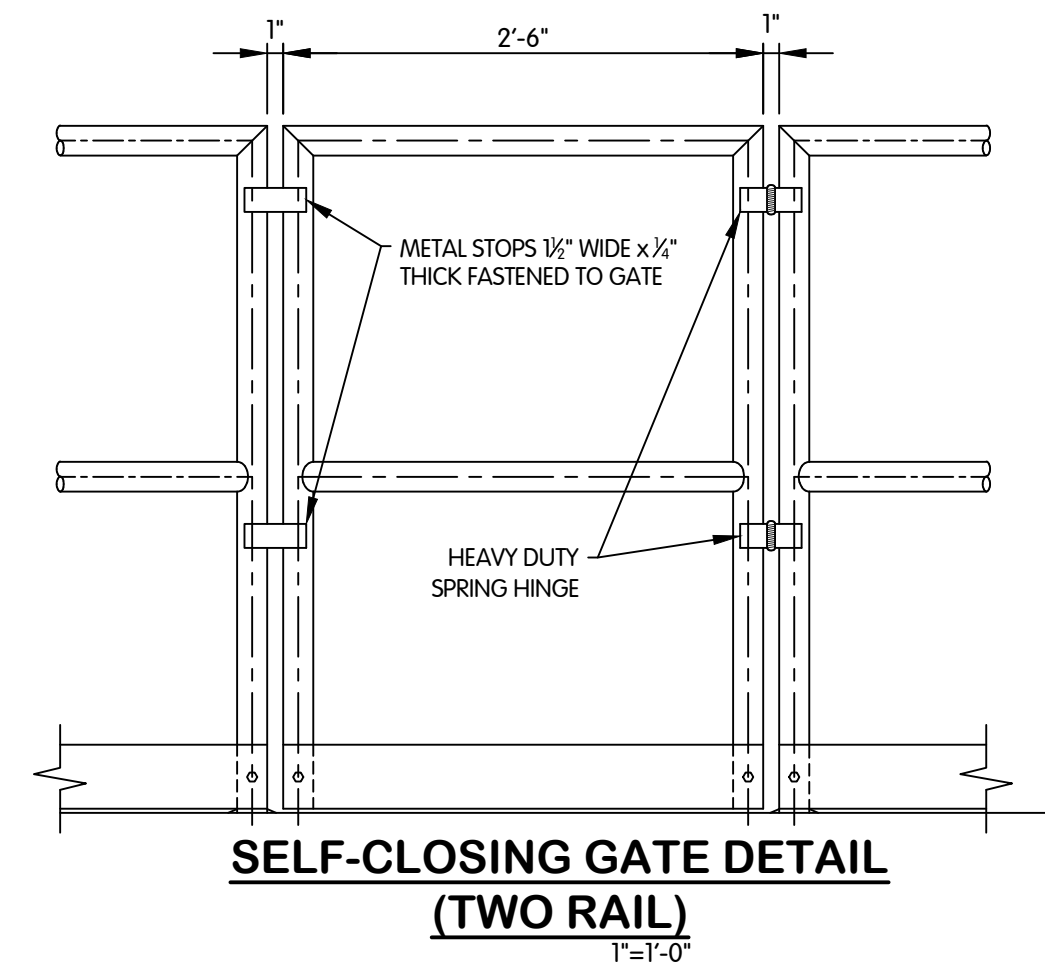
NOTE:  
RAILING POSTS AT CORNERS TO BE LOCATED 6" MIN. FROM CENTER OF POST TO EDGE OF CONCRETE.



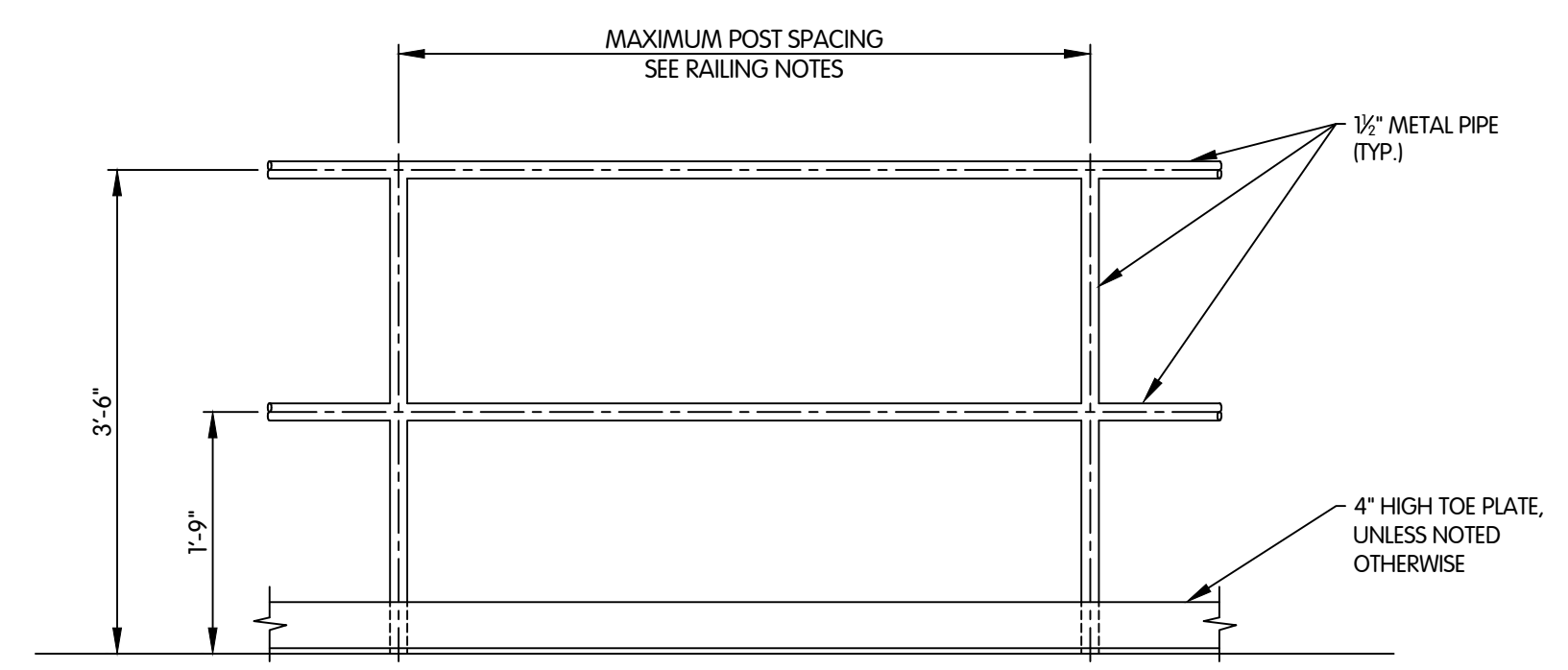
**TYPE A ALUMINUM RAILING POST**  
3/4" = 1'-0"

- RAILING BASE CONNECTION NOTES:**
- PROVIDE COAL TAR PAINT OR NEOPRENE GASKET BETWEEN ALUMINUM SURFACES IN CONTACT WITH CONCRETE, MASONRY, OR DISSIMILAR METALS.
  - ANCHORS FASTENERS:  

RAILING MATERIAL	FASTENER
CARBON STEEL	ZINC PLATED CARBON STEEL
ALUMINUM	STAINLESS STEEL
STAINLESS STEEL	STAINLESS STEEL
  - POST BRACKET MATERIAL SHALL MATCH POST MATERIAL, UNLESS NOTED OTHERWISE.
  - POST SHALL BE REINFORCED WITH INTERNAL METAL STUD WHEN REQUIRED BY ENGINEERED DESIGN. STUD SHALL BE WELDED TO POST TO ACT AS ONE MEMBER.

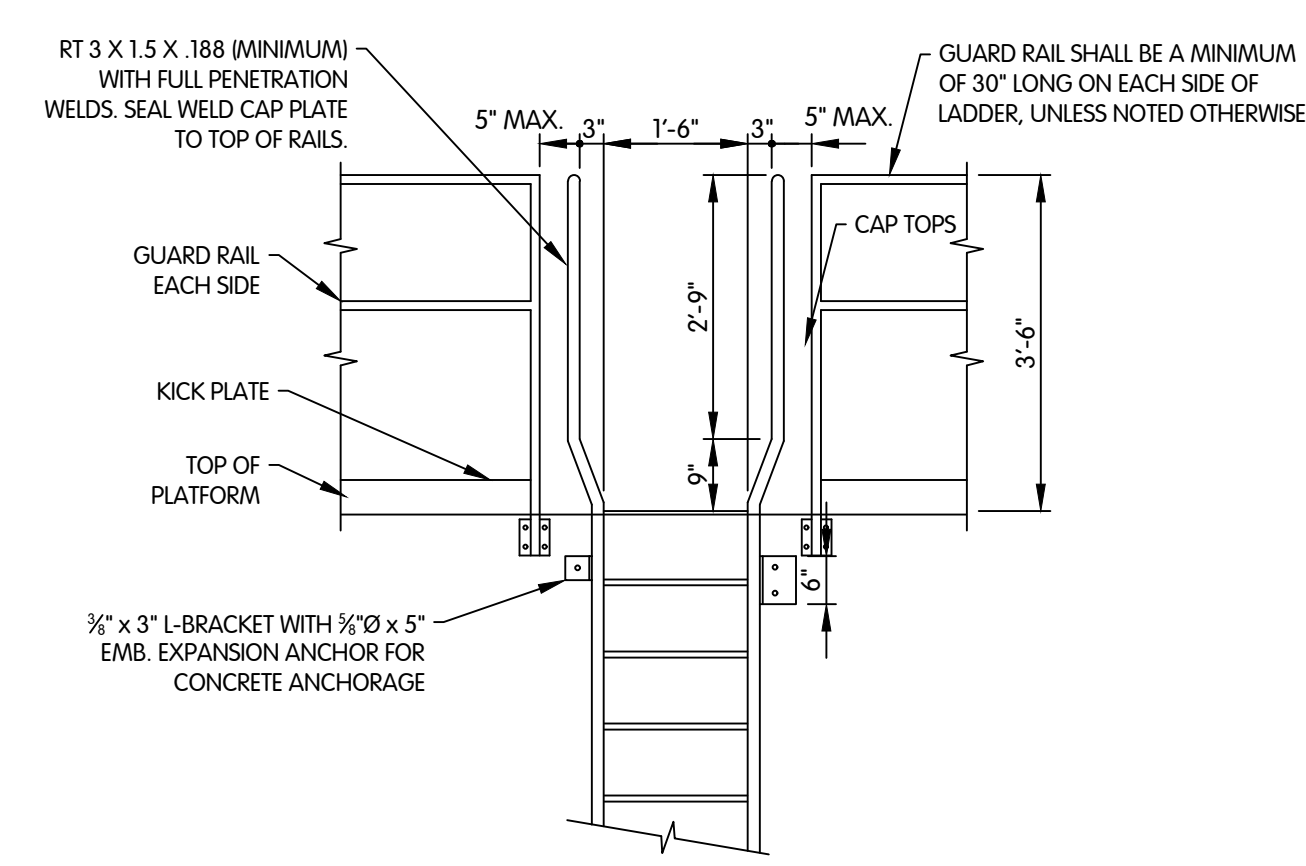


**SELF-CLOSING GATE DETAIL (TWO RAIL)**  
1" = 1'-0"



**GUARD RAILING, STANDARD**  
3/4" = 1'-0"

- RAILING NOTES:**
- GUARD RAILING SHALL BE STANDARD.
  - MAXIMUM RAILING POST SPACING SHALL BE 5'-0"
- |                    | H = 34" | H = 42" |
|--------------------|---------|---------|
| WITHOUT STUD       |         |         |
| STEEL - SCH. 40    | 4'-6"   | 4'-0"   |
| ALUMINUM - SCH. 40 | 4'-6"   | 3'-0"   |
| ALUMINUM - SCH. 80 | 5'-0"   | 4'-0"   |
| WITH STUD          |         |         |
| STEEL - SCH. 40    | 5'-0"   | 5'-0"   |
| ALUMINUM - SCH. 40 | 5'-0"   | 5'-0"   |
- REFER TO POST BASE CONNECTION DETAILS FOR ADDITIONAL POST SPACING RESTRAINTS AND STUD INSERT REQUIREMENTS.

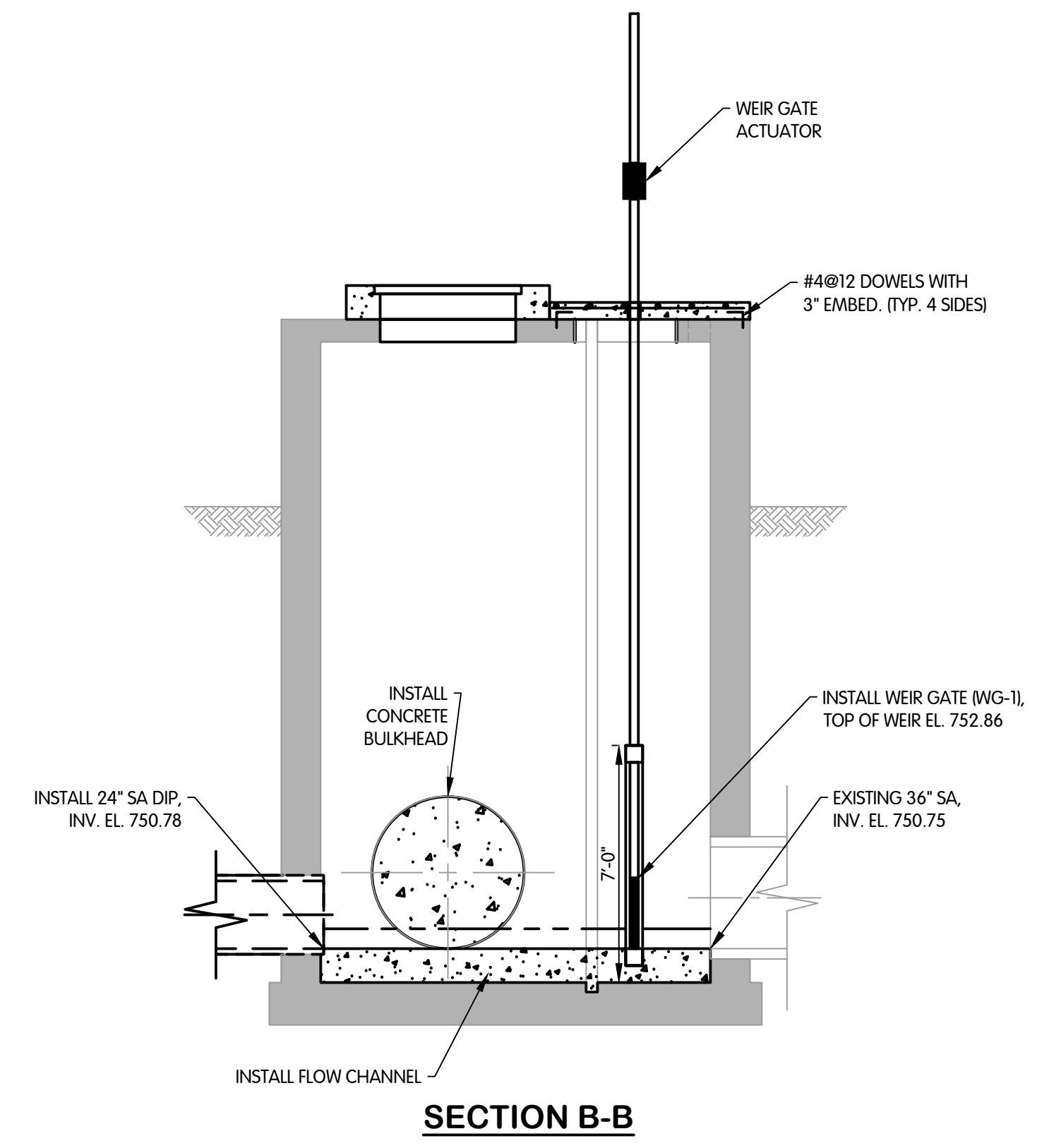
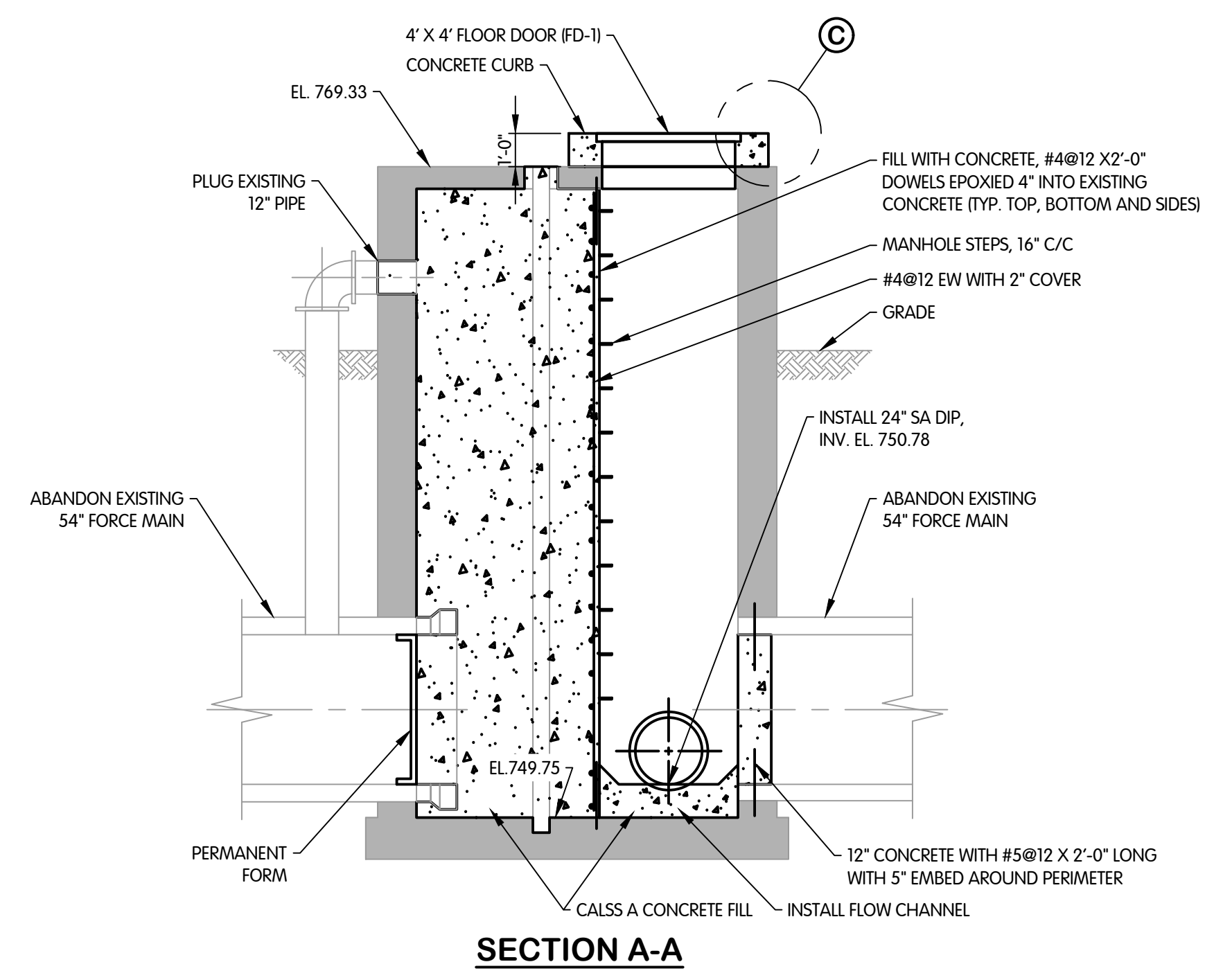
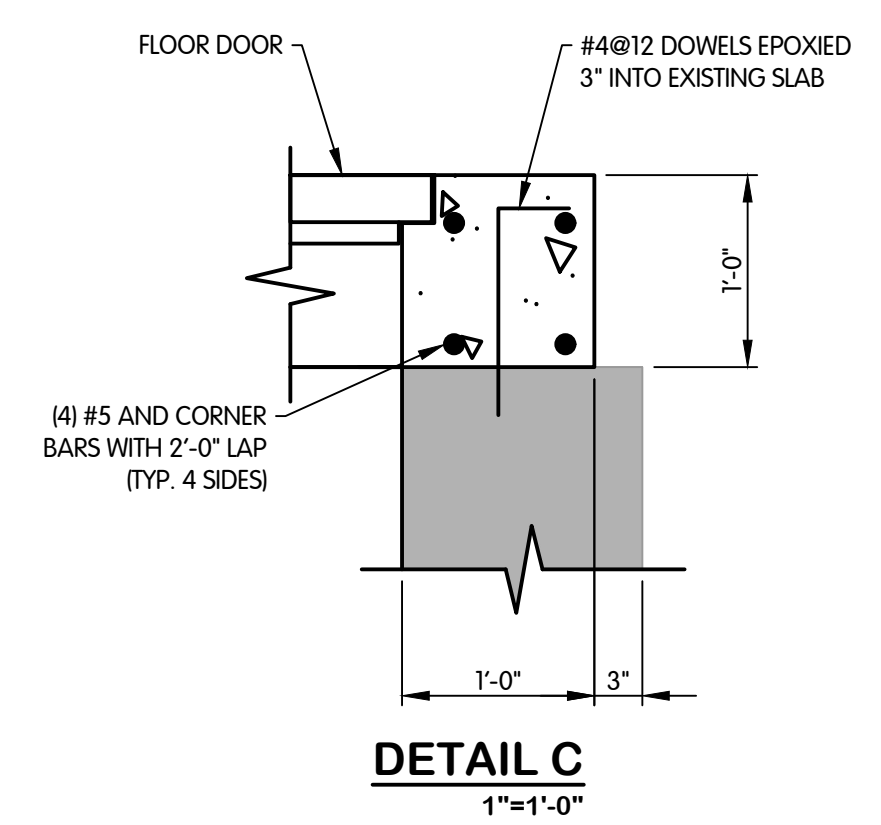
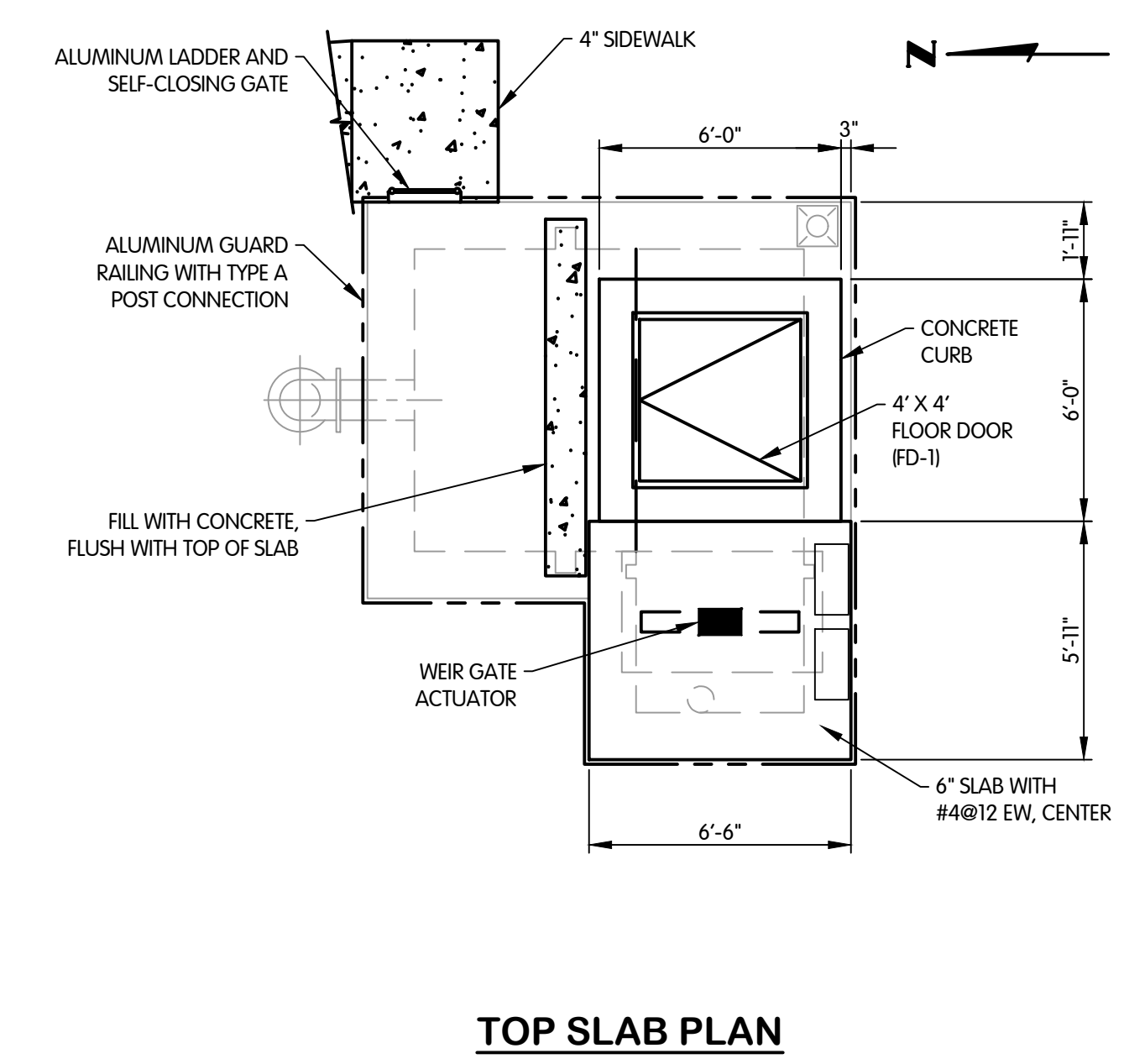
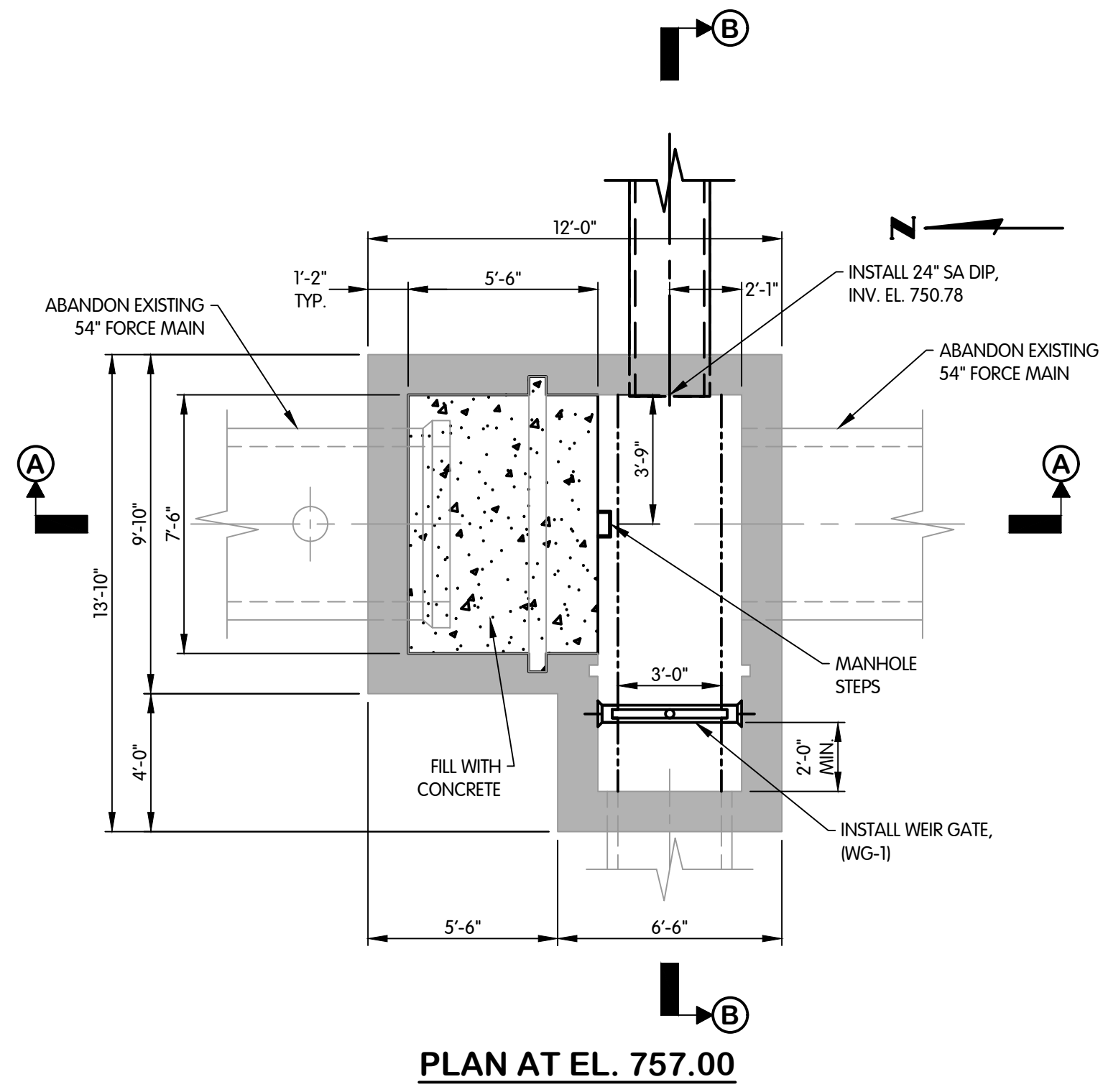


**ALUMINUM LADDER TOP EXTENSION DETAIL**  
1/2" = 1'-0"



INDUSTRIAL DIVERSION CHAMBER I  
SANITARY DETAILS

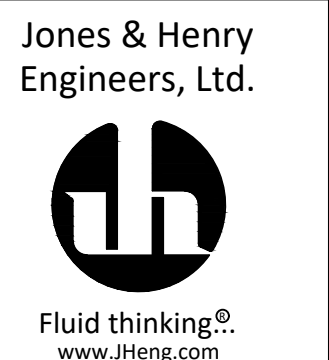
CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT



- NOTES:
- ALL ELEVATIONS SHOWN ARE NGVD 29.
  - VERIFY ALL EXISTING DIMENSIONS, ELEVATIONS AND CONDITIONS AT THE INTERFACE BETWEEN EXISTING AND NEW CONSTRUCTION PRIOR TO CONSTRUCTION. NOTIFY THE ENGINEER OF ANY DISCREPANCIES FOR RESOLUTION.
  - ESTIMATED SCALE: 1/4"= 1'-0".
  - GUARD RAIL AND LADDER NOT SHOWN IN SECTION VIEWS FOR CLARITY.

KAL-798200/GS02-INDUSTRIAL DIVERSION CHAMBER I - PLANS  
5/10/2023 11:50 AM - CFERRELL  
5/11/2023 2:30 PM

NO. 1  
DATE  
REVISIONS AFTER ISSUED FOR BID



JOB NO.	017-7982.001
SCALE	NONE
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE	
DESIGNED	DRC
DRAWN	CJAF
CHECKED	RGE
STATUS	ISSUE FOR BID
DATE	MAY 2023
SHEET NO.	S-1.1
	15 OF 19





### SINGLE-LINE DIAGRAM LEGEND

	30A FRS-R -30 FUSED DISCONNECT SWITCH (SWITCH SIZE, FUSE TYPE AND FUSE SIZE AS SHOWN)		VACUUM CONTACTOR		POWER FACTOR CORRECTION CAPACITOR - (PFCC) (SIZE PER MOTOR MANUFACTURER RECOMMENDATIONS.)
	30A UNFUSED DISCONNECT SWITCH (SWITCH SIZE AS SHOWN)		THREE PHASE AC MOTOR (HORSEPOWER AS SHOWN)		HIGH OR MEDIUM VOLTAGE FUSED CUTOUT (SIZE AS SHOWN)
	40A THERMAL-MAGNETIC CIRCUIT BREAKER OR MOTOR CIRCUIT PROTECTOR-MCP (TRIP SIZE AS SHOWN)		CURRENT TRANSFORMER WITH AMMETER SWITCH, AND AMMETER (RATIO AS SHOWN)		CABLE LIMITER (SIZE AS SHOWN)
	CB HIGH OR MEDIUM VOLTAGE CIRCUIT BREAKER		CURRENT TRANSFORMER WITH SHORTING BLOCK (RATIO AS SHOWN)		STAND-BY GENERATOR (SIZE AS SHOWN) WITH FIELD PROTECTION CIRCUIT BREAKER (TRIP SIZE AS SHOWN)
	12470 1000KVA 480Y/277V LIGHTING OR POWER TRANSFORMER, THREE PHASE UNLESS NOTED OTHERWISE (CONNECTION, SIZE & RATING AS SHOWN)		POTENTIAL TRANSFORMER WITH VOLTMETER SWITCH, AND VOLTMETER		VARIABLE FREQUENCY DRIVE WITH A BY-PASS OPTION (SHOWN WITH INTEGRAL EXTERNAL DISCONNECT HANDLE)
	FULL VOLTAGE NON-REVERSING MOTOR STARTER WITH OVERLOADS (FVNR)		LIGHTNING ARRESTER (VOLTAGE RATING AS SHOWN)		CP = CONTROL PANEL SSRVS = SOLID STATE REDUCED VOLTAGE STARTER (SHOWN WITH INTEGRAL EXTERNAL DISCONNECT HANDLE)
	FULL VOLTAGE REVERSING MOTOR STARTER WITH OVERLOADS (FVR)		TRANSIENT VOLTAGE SURGE SUPPRESSOR (TVSS)		DPM
	TWO SPEED MOTOR STARTER WITH OVERLOADS		GROUND CONNECTION		WHM
			LINE OR LOAD REACTOR		AUTOMATIC TRANSFER SWITCH (ATS)
			KIRK KEY (DASHED LINES TO INTERLOCKED DEVICES)		MANUAL TRANSFER SWITCH (MTS)
			DRAWOUT FOR SWITCHGEAR OR MOTOR CONTROL CENTER		

### SCHEMATIC LEGEND

	OPEN CONTACTS WITH TIME-DELAY CLOSING		TEMPERATURE SWITCH CLOSING ON RISING TEMPERATURE		NORMALLY OPEN MOMENTARY ACTION PUSH-BUTTON SWITCH (SHOWN WITH ONLY 1 CIRCUIT)
	CLOSED CONTACTS WITH TIME-DELAY OPENING		TEMPERATURE SWITCH OPENING ON RISING TEMPERATURE		NORMALLY CLOSED MOMENTARY ACTION PUSH-BUTTON SWITCH (SHOWN WITH ONLY 1 CIRCUIT)
	OPEN CONTACTS WITH TIME-DELAY OPENING		LIMIT SWITCH NORMALLY OPEN		PUSH-TO-TEST PILOT LIGHT WITH COLORED LENS CAP R - RED G - GREEN A - AMBER W - WHITE B - BLUE CL - CLEAR
	CLOSED CONTACTS WITH TIME-DELAY CLOSING		LIMIT SWITCH NORMALLY OPEN - HELD CLOSED		ZERO SPEED SWITCH (NORMALLY OPEN)
	FLOW SWITCH CLOSING ON INCREASE IN FLOW		LIMIT SWITCH NORMALLY CLOSED		ZERO SPEED SWITCH (NORMALLY CLOSED)
	FLOW SWITCH OPENING ON INCREASE IN FLOW		LIMIT SWITCH NORMALLY CLOSED - HELD OPEN		
	LIQUID LEVEL SWITCH CLOSING ON RISING LEVEL		FOOT SWITCH OPENS BY FOOT PRESSURE		
	LIQUID LEVEL SWITCH OPENING ON RISING LEVEL		FOOT SWITCH CLOSING BY FOOT PRESSURE		
	PRESSURE OR VACUUM SWITCH CLOSING ON RISING PRESSURE		MUSHROOM HEAD, MAINTAINED ACTION (PUSH-PULL) PUSH BUTTON SWITCH (SHOWN WITH ONLY 1 CIRCUIT)		
	PRESSURE OR VACUUM SWITCH OPENING ON RISING PRESSURE		2 - POSITION, MAINTAINED ACTION SELECTOR SWITCH		
			3 - POSITION, MAINTAINED ACTION SELECTOR SWITCH H - O - A: HAND-OFF-AUTOMATIC L - O - R: LOCAL-OFF-REMOTE PCS: PLANT CONTROL SYSTEM PLC: PROGRAMMABLE LOGIC CONTROLLER		
			INDICATES ITEMS IN A SEPARATE COMMON ENCLOSURE		
			CONTACTOR COIL M - MOTOR STARTER CONTACTOR MF - MOTOR STARTER FORWARD CONTACTOR MR - MOTOR STARTER REVERSE CONTACTOR ML - MOTOR STARTER LOW SPEED CONTACTOR MH - MOTOR STARTER HIGH SPEED CONTACTOR SC - MOTOR STARTER STARTING CONTACTOR RC - MOTOR STARTER RUN CONTACTOR BP - BYPASS CONTACTOR CC - CAPACITOR CONTACTOR LC - LIGHTING CONTACTOR IC - ISOLATION CONTACTOR C - GENERAL CONTACTOR		
			CONTROL RELAY COIL CR - INSTANTANEOUS CONTROL RELAY TR - TIME DELAY RELAY		
			MOTOR STARTER OVERLOAD RELAY N.C. CONTACT		
			SOLENOID COIL SV - SOLENOID VALVE		
			ELAPSED TIME METER		

### GENERAL ELECTRICAL ABBREVIATIONS

PVC - POLYVINYL CHLORIDE  
RGS - RIGID GALVANIZED STEEL  
PVC/RGS - PVC COATED RGS

### MOTOR STARTER ABBREVIATIONS

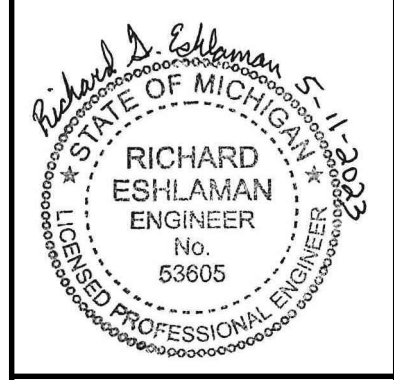
FVNR - FULL VOLTAGE, NON-REVERSING  
FVR - FULL VOLTAGE REVERSING  
TS1W - TWO SPEED, ONE WINDING  
TS2W - TWO SPEED, TWO WINDING  
TSR1W - TWO SPEED REVERSING, ONE WINDING  
TSR2W - TWO SPEED REVERSING, TWO WINDING

### ELECTRICAL PLAN LEGEND

	GROUND WIRE		THREE PHASE AC MOTOR (HORSEPOWER AS SHOWN)
	DIRECT BURIAL CABLE		MOTOR OPERATED VALVE, 3 PHASE, WITH MAGNETIC STARTER AND CONTROLS
	CONDUIT CONCEALED		MOTOR OPERATED VALVE, 1 PHASE, WITH MAGNETIC STARTER AND CONTROLS
	CONDUIT EXPOSED		GROUND ROD WITH CADWELD CONNECTION
	CONDUIT IN CONCRETE DUCT BANK		PP = POWER POLE, LP = LIGHT POLE
	HOMERUN		AIR TERMINAL (LIGHTNING PROTECTION)
	CONDUIT TURNS UP		STROBE LIGHT (F = FIRE ALARM, G = GAS ALARM)
	CONDUIT TURNS DOWN		HEAT DETECTOR - RATE OF RISE/FIXED TEMPERATURE
	CAPPED CONDUIT (FUTURE USE)		SMOKE DETECTOR - IP = PHOTOELECTRIC, I = IONIZATION)
	CONDUIT TEE		PULL STATION - FIRE ALARM
	CADWELD CONNECTION		HORN, BELL, OR SIREN
	B = BUSWAY		HORN/STROBE COMBINATION
	C = CABLE TRAY		CAPACITOR
	S		CONTROL STATION
	S <sub>2</sub>		BOX - JUNCTION, TERMINAL, PULL OR HAND HOLE
	S <sub>3</sub>		ELECTRIC MANHOLE
	S <sub>4</sub>		TRANSFORMER (SEE SINGLE LINE FOR SIZE & TYPE)
	S <sub>P</sub>		LIGHTING CONTACTOR
	S <sub>K</sub>		FLOW TRANSMITTER
	5		LEVEL TRANSMITTER
	3		PRESSURE TRANSMITTER
	5		TEMPERATURE TRANSMITTER
	6, 8		ANALYSIS TRANSMITTER (I.E. OXYGEN, TURBIDITY)
	4, 6, 8		INDICATOR - PRESSURE, FLOW, LEVEL, DENSITY, ANALYSIS
			DENSITY TRANSMITTER
			LIMIT (POSITION) SWITCH
			PRESSURE SWITCH
			TEMPERATURE SWITCH (I.E. MOTOR THERMO PROTECTOR)
			CONVEYOR CABLE SWITCH
			SPEED SWITCH
			FLOW SWITCH
			LEVEL SWITCH
			MOISTURE SENSOR
			TORQUE SWITCH
	MCC		VIBRATION SWITCH
			LOAD CELL
			TRANSMITTER SENSING ELEMENT - LEVEL, FLOW, DENSITY, PRESSURE, ANALYSIS
	UPS		SOLENOID
	EPP		THERMOSTAT
	CP		HEATER IN MOTOR
			PHOTOELECTRIC CELL
			GAS DETECTOR WITH CONTROL PANEL (GAS TYPE AS SHOWN)
			THERMOCOUPLE
			PNEUMATIC VALVE OPERATOR
			CURRENT TO PRESSURE TRANSDUCER

### ELECTRICAL NOTES

- STRUCTURAL MATERIALS ARE NOT SHOWN ON ELECTRICAL DRAWINGS. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS.
- ALL ELECTRICAL EQUIPMENT ELEVATIONS SHOWN ARE TO BOTTOM OF DEVICE OR PANEL, UNLESS OTHERWISE NOTED.
- NUMBER SHOWN (I.E. 11735), INDICATES A SPECIFICATION REFERENCE FOR ITEMS OTHER THAN DIVISION 16. THE ELECTRICAL ITEM UNDER THIS REFERENCE IS SUPPLIED BY ANOTHER PART OF THE CONTRACT. UNLESS OTHERWISE NOTED IN THAT SPECIFICATION, THE CONTRACTOR SHALL INSTALL AND WIRE THE ITEM PER THE DRAWINGS AND DIVISION 16 SPECIFICATIONS.
- CONTROL WIRING SHALL CONFORM TO ALL REQUIREMENTS AS SHOWN ON THE P & ID DRAWINGS WHETHER SHOWN ON THE ELECTRICAL DRAWINGS OR NOT.
- WHERE LINES ARE SHOWN CONNECTING ELECTRICAL EQUIPMENT, THEY ARE NOT INTENDED AS CONDUIT ROUTING. CONTRACTOR SHALL ROUTE ALL CONDUIT RUNS (SHOWN OR NOT) PER DIVISION 16 SPECIFICATIONS.
- WP INDICATES WATERPROOF. LETTER ON OR NEXT TO LIGHT FIXTURE INDICATES TYPE, PER SECTION 16510. NUMBER WITH LIGHT FIXTURE OR RECEPTACLE INDICATES CIRCUIT NUMBER.
- GFCI INDICATES A CIRCUIT BREAKER OR RECEPTACLE WITH A 6 MA GROUND FAULT CIRCUIT INTERRUPTER. GFEPD INDICATES A CIRCUIT BREAKER OR RECEPTACLE WITH A 30 MA GROUND FAULT EQUIPMENT PROTECTION DEVICE.
- FOR BELOW GRADE CONDUIT PENETRATIONS THROUGH EXISTING EXTERIOR CONCRETE WALLS, PROVIDE TYPE A CONDUIT SLEEVE FOR PVC CONDUIT. FOR RGS OR PVC-COATED RGS CONDUIT, PROVIDE TYPE B CONDUIT SLEEVE THROUGH CONCRETE WALLS, AND TYPE C CONDUIT SLEEVE THROUGH EXISTING CONCRETE WALLS.
- FOR ABOVE GRADE CONDUIT PENETRATIONS THROUGH EXTERIOR CONCRETE WALLS, PROVIDE TYPE C CONDUIT SLEEVE. FOR MASONRY WALLS PROVIDE TYPE F CONDUIT SLEEVE.
- FOR CONDUIT PENETRATIONS THROUGH EXISTING CONCRETE FLOORS AND WALLS BETWEEN ADJACENT NON-CLASSIFIED (NON-HAZARDOUS) AREAS, PROVIDE TYPE C CONDUIT SLEEVES FOR ALL CONDUIT TYPES. FOR SIMILAR PENETRATIONS THROUGH CONCRETE FLOORS AND WALLS, PROVIDE TYPE D CONDUIT SLEEVES FOR ALL CONDUIT TYPES.
- FOR CONDUIT PENETRATIONS THROUGH CONCRETE FLOORS AND WALLS SEPARATING CLASSIFIED (HAZARDOUS) AREAS FROM NON-CLASSIFIED (NON-HAZARDOUS) AREAS, PROVIDE TYPE G CONDUIT SLEEVES. FOR SIMILAR PENETRATIONS THROUGH MASONRY WALLS, PROVIDE TYPE H CONDUIT SLEEVE. FOLLOW MECHANICAL SEAL MANUFACTURER'S RECOMMENDATIONS TO MEET 3-HOUR FIRE RESISTANCE REQUIREMENTS.
- LEGENDS ARE FOR REFERENCE ONLY AND DOES NOT MEAN THAT ALL ITEMS ARE USED.



ELECTRICAL LEGEND  
CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

DATE: \_\_\_\_\_  
REVISIONS AFTER ISSUED FOR BID

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JOB NO. 017-7982.001

SCALE NONE

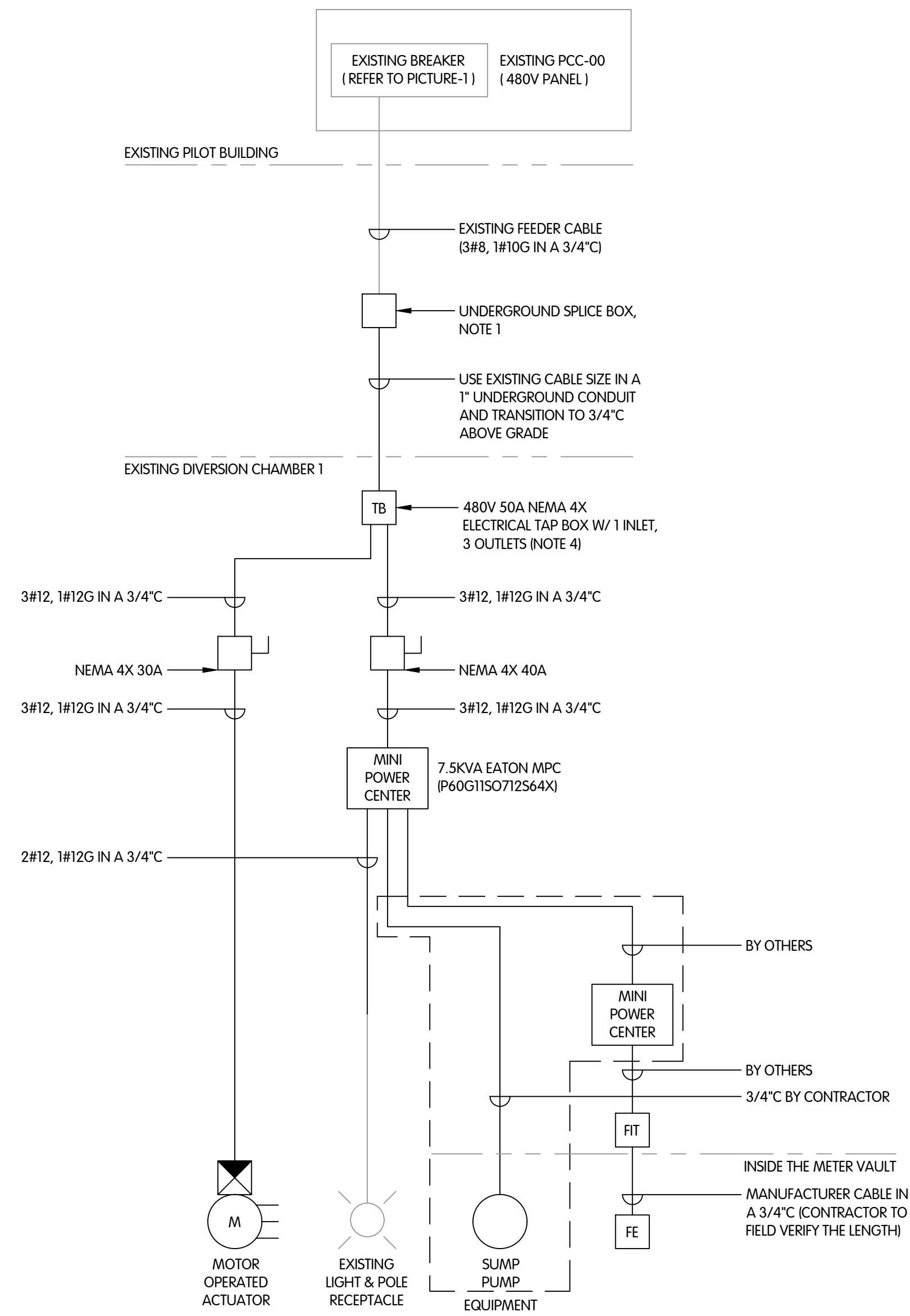
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STATUS: ISSUE FOR BID

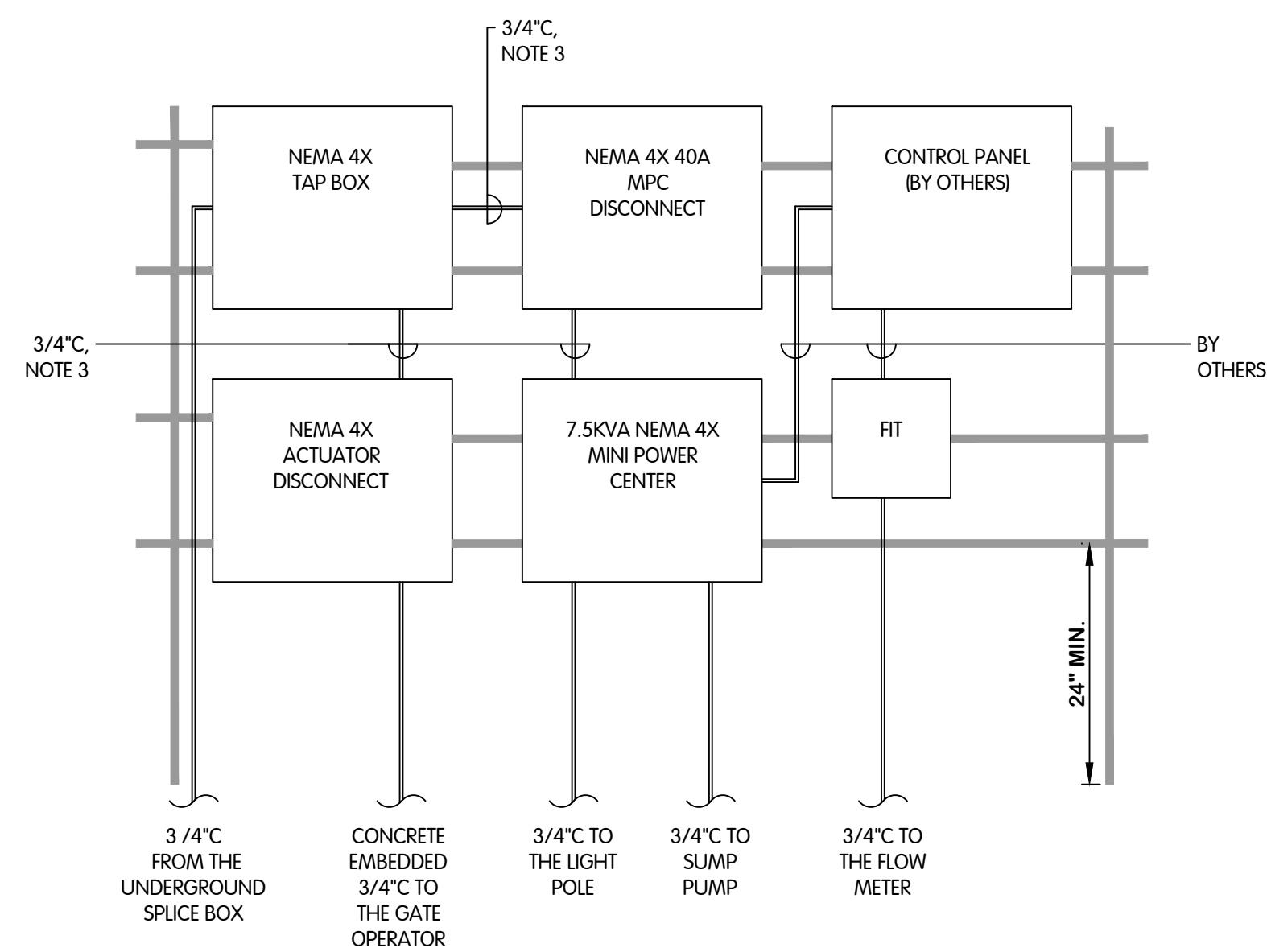
DATE: MAY 2023

SHEET NO. E-0.1

17 OF 19



**ONE-LINE DIAGRAM**



**EQUIPMENT RACK DETAIL**  
NTS

- NOTES:
- CONTRACTOR SHALL EXTEND THE EXISTING FEEDER CABLE USING A SPLICE BOX (BY QUAZITE OF SIZE 11L X 9"W X 6-3/4"D) AT THE DIVERSION CHAMBER #1 TO THE NEW ACTUATOR.
  - REFER TO PHOTOS ON THIS DRAWING SHEET FOR REFERENCE.
  - CONDUITS ARE SHOWN ONLY FOR DIAGRAMMATIC REFERENCE. CONTRACTOR SHALL INSTALL CONDUITS AS PER APPROVED OUTDOOR INSTALLATIONS.
  - CONTRACTOR SHALL INSTALL A TAP BOX WITH 3 OUTLETS TO FACILITATE WIRING FOR FUTURE FLOW METER/SUMP PUMP OR FLUME THAT IS TO BE PROVIDED AND INSTALLED BY OTHERS THROUGH A MINI POWER ZONE.

480V FEEDER BREAKER IN PCC-00 INSIDE PILOT BUILDING FEEDING THE INDUSTRIAL DIVERSION CHAMBER 1



**PICTURE-1**



CONTRACTOR SHALL REMOVE THE EXISTING JUNCTION BOX, SPLICE THE CABLES AND EXTEND THE CONDUIT AND WIRE TO THE NEW TAP BOX

**PICTURE-2**

KAL-7982002-ELECTRICAL SINGLE LINE DIAGRAM AND DETAILS  
5/11/2023 12:37 PM - CFERRELL  
5/11/2023 2:31 PM



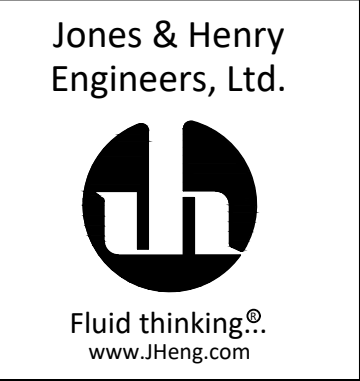
ELECTRICAL SINGLE LINE DIAGRAM AND DETAILS

CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT

DESIGNED: LR  
DRAWN: CJAF  
CHECKED: RGE

STATUS: ISSUE FOR BID  
DATE: MAY 2023

SHEET NO.: E-1.1  
18 OF 19



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JOB NO.: 017-7982.001

SCALE: NONE

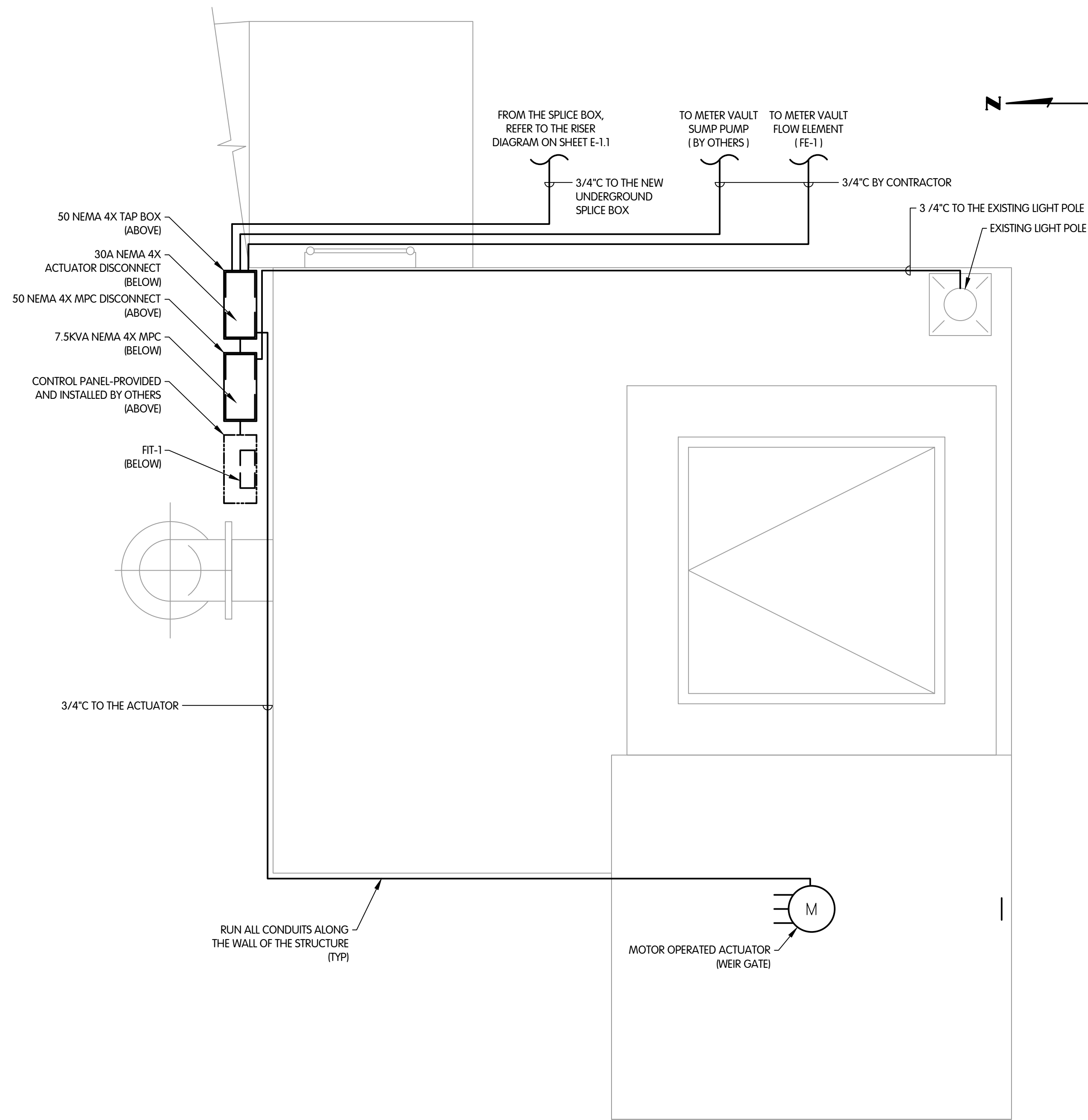
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE

REVISIONS AFTER ISSUED FOR BID



INDUSTRIAL DIVERSION CHAMBER I  
ELECTRICAL PLAN

CITY OF KALAMAZOO, MI - KALAMAZOO/GPI EFFLUENT SEWER REALIGNMENT



**PLAN VIEW**

- NOTES:
1. CONTRACTOR SHALL INSTALL ALL THE ELECTRICAL EQUIPMENT ON A RACK AGAINST THE WALL OF THE STRUCTURE. REFER TO THE EQUIPMENT RACK DETAIL ON SHEET E-1.1.
  2. REFER TO SPEC 16005 SECTION 2.08 AND 3.10 FOR SPLICE BOX/ SPLICING DETAILS.
  3. ALL ELEVATIONS SHOWN ARE NGVD 29.
  4. VERIFY ALL EXISTING DIMENSIONS, ELEVATIONS AND CONDITIONS AT THE INTERFACE BETWEEN EXISTING AND NEW CONSTRUCTION PRIOR TO CONSTRUCTION. NOTIFY THE ENGINEER OF ANY DISCREPANCIES FOR RESOLUTION.
  5. ESTIMATED SCALE: 3/4" = 1'-0".

KAL-7982001-INDUSTRIAL DIVERSION CHAMBER I - ELECTRICAL PLAN  
5/11/2023 1:08 PM - CERRELL  
5/11/2023 2:31 PM

NO.	DATE	REVISIONS AFTER ISSUED FOR BID	BY
1			
2			
3			
4			

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JOB NO.	017-7982.001	
SCALE	AS NOTED	
THIS LINE SCALES IF WHEN PLOTTED TO NOTED SCALE		
DESIGNED	DRAWN	CHECKED
LR	CJAF	RGE
STATUS:	ISSUE FOR BID	
DATE:	MAY 2023	
SHEET NO.	E-1.2	
	19 OF 19	

**APPENDIX E  
SPECIAL PROVISIONS**



**THE CITY OF KALAMAZOO  
DEPARTMENT OF PUBLIC SERVICES  
WASTEWATER DIVISION**

**SPECIAL PROVISIONS**

**GPI EFFLUENT SEWER  
REALIGNMENT**

**Bid Reference #: 91345-004.0**

**CITY OF KALAMAZOO**

**SPECIAL PROVISION**

**FOR**

***Ductile Iron Sewer Material Advance Purchase***

City of Kalamazoo

1 of 4

May 2023

**a. Description**

**General**

For the unit price per linear foot bid for the various sewer main, the Contractor shall do all work necessary to construct complete ready for service the sewer system and test the sewer as shown on the plans and as specified, except for work which is specifically included under other contract items. This project is a unique project. The sanitary sewer will be constructed similar to a water main project by using ductile iron pipe bends and fittings as shown on the plans. All work shall be done in accordance with section 823 of the 2020 MDOT Standard Specifications for Construction and City of Kalamazoo Standard Specifications for Water Main and Service Installation 2021 available at kalamazoocity.org, unless otherwise specified herein.

**b. Materials**

Ductile Iron pipe, restrained joints, fittings, polyethylene encasement and associated appurtenances listed below shall be supplied new by the City of Kalamazoo from their selected supplier at no cost to the Contractor. The Contractor shall be responsible for coordinating delivery of materials by contacting the City's specified supplier a minimum of 10 working days prior to desired delivery. In advance of material delivery, a centralized delivery yard shall be established by the Contractor and agreed upon with the City and City's material supplier on or adjacent to the project site. The contractor shall supply any materials not explicitly listed below that are necessary to construct the project. These materials shall be incidental to construction. No second hand or salvaged materials shall be allowed or supplied. All supplied products shall be **"Buy American"** unless otherwise specified and shall comply with the conditions of this section.

Contractor shall review the plans and list of City supplied materials during bidding and throughout construction. If Contractor believes additional quantities will be required, Contractor shall immediately notify the City in writing, and the City shall provide the materials at no cost to the Contractor. City shall not be responsible for any downtime or construction delays associated with insufficient materials being available during construction as the Contractor shall notify the City of foreseen insufficient materials during the bid period. Contractor shall be responsible for all delays and downtime associated with Contractor supplied materials, and shall purchase, provide, and install materials not explicitly listed below that are necessary to construct the project as designed.

All City provided materials, not used during construction, shall be returned to the City within one week of sewer installation completion, unless otherwise directed by the City's project manager. The Contractor shall be responsible for transporting any excess material from the project site to 415 E. Stockbridge Ave., Kalamazoo, MI. This includes, but is not limited to, partial and full sticks of pipe, partial and full rolls of copper (including tag ends of copper services), valves, fittings, gaskets, bolts, etc.

City provided materials shall be used efficiently and waste from cutting pipes, etc. shall be minimized. City provided materials shall be handled with care and protected from damage, vandalism and thievery. City shall not be responsible for providing additional materials due to theft or mishandling by Contractor.

Contractor shall provide 2 year warranty as described in the City of Kalamazoo Standard Specifications for Water Main and Service Installation. Warranty shall cover all City and Contractor provided parts and materials; and associated contractor labor costs.

Contractor and Engineer shall track City provided material delivery and usage on a daily basis.

Unit pricing is included below for the for the City's procurement of materials for the Contractor to account for sales and use tax per the Michigan Department of Treasury RAB 2016-18. Sales and use tax pricing shall be included in the major items of work.

<b>MATERIAL COST ITEM</b>	<b>QUANTITY</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>EXTENDED PRICE</b>
24-inch DIP Class 52	720	LF	\$171.25	\$123,300.00
24-inch DIP FLANGED TEE	3	EA	\$12,815.50	\$38,446.50
24-inch X 12-inch MJ TEE	1	EA	\$5,423.00	\$5,423.00
24-inch X BLIND FLANGE	3	EA	\$3,445.00	\$10,335.00
24-inch 45 DEGREE BEND	3	EA	\$8,808.00	\$26,424.00
24-inch 11.25 DEGREE BEND	2	EA	\$7,695.00	\$15,390.00
24-inch 22.5 DEGREE BEND	1	EA	\$5,719.00	\$5,719.00
24-inch MEGAFLANGE ADAPTER	9	EA	\$1,910.00	\$17,190.00
NLA 24 304 SS 150# RR FF 1/8 FLG P	9	EA	\$2,700.00	\$24,300.00
24-inch MJ 90 DEGREE BEND	1	EA	\$6,035.00	\$6,035.00
24-inch MEGALUG F/DI	6	EA	\$507.00	\$3,042.00
24-inch MJ BLT & GSKT PK L/GLAND	6	EA	\$96.25	\$577.50
12-inch MEGALUG F/DI	5	EA	\$98.50	\$492.50
12-inch MJ BLT & GSKT PK L/GLAND	5	EA	\$28.42	\$142.10
12-inch CLASS 52 TYTON JT PIPE	36	LF	\$71.90	\$2,588.40
12-inch MJ CLASS 153 90 DEG BEND L/A	1	EA	\$635.50	\$635.50
<b>TOTAL PRICE</b>				<b>\$ 280,040.50</b>

**c. Measurement and Payment**

1. Payment for sewers shall be measured based on the sizes and trench details required, along the centerline of the pipe, with no deductions for fittings. The unit price of sewer, DI, includes the cost of the following:
  - a. Excavation and backfill;
  - b. Dewatering operations (trench and/or pipe), including pretreatment to remove sediment;
  - c. Hydrostatic testing;
  - d. All material **not supplied** by the City, labor and equipment necessary to remedy an unsatisfactory hydrostatic test, including removing and replacing any backfill;
  - e. Installing fittings, gaskets, bracing or sheeting, blocking and miscellaneous items for installing pipe and reconnecting to the existing Municipal system
2. The City of Kalamazoo may withhold payment and/or final acceptance until the City of Kalamazoo accepts the as-built plans.
3. The cost of dewatering of trenches, pipe, or both associated with alterations to the Municipal sewer system, is included in the unit price for relevant items of work.
4. The cost of excavating, disposing of excess material, and providing, placing, and compacting the backfill, is included in the unit price for related items of work.
5. The cost of removing or abandoning existing water mains, gate valve boxes, and other appurtenances to provide clearance for the proposed sanitary sewer or roadway, is included in the unit price for relevant items of work.

<u>Labor Cost Pay Item</u>	<u>Pay Unit</u>
24-inch DIP CLASS 52	LF
24-inch DIP FLANGED TEE	EA
24-inch X 12-inch MJ TEE	EA

24-inch X BLIND FLANGE	EA
24-inch 45 DEGREE BEND	EA
24-inch 11.25 DEGREE BEND	EA
24-inch 22.5 DEGREE BEND	EA
24-inch MEGAFLANGE ADAPTER	EA
NLA 24 304 SS 150# RR FF 1/8 FLG P	EA
24-inch MJ 90 DEGREE BEND	EA
24-inch MEGALUG F/DI	EA
24-inch MJ BLT & GSKT PK L/GLAND	EA
12-inch MEGALUG F/DI	EA
12-inch MJ BLT & GSKT PK L/GLAND	EA
12-inch CLASS 52 TYTON JT PIPE	LF
12-inch MJ CLASS 153 90 DEG BEND L/A	EA

The cost of excavating, disposing of excess material, and providing, placing and compacting the backfill, including concrete encasement is included in the unit price for related items of work.

The cost of removing or abandoning existing sewer to provide clearance for the proposed sewer, is included in the unit price for relevant items of work.

The cost for dewatering of trenches, pipe, or both associated with alterations to the Municipal Sewer System is included in the unit price for relevant items of work.