



HISTORIC DISTRICT COMMISSION

APPLICATION FOR WORK APPROVAL

City of Detroit - Planning & Development Department
2 Woodward Avenue, Suite 808
Detroit, Michigan 48226

APPLICATION ID

HDC2025-00699

PROPERTY INFORMATION**ADDRESS(ES):** Various**HISTORIC DISTRICT:** Boston-Edison**SCOPE OF WORK: (Check ALL that apply)**

☐ Windows/ Doors	☐ Walls/ Siding	☐ Painting	☐ Roof/Gutters/ Chimney	☐ Porch/Deck/Balcony	☒ Other
☐ Demolition	☐ Signage	☐ New Building	☐ Addition	☐ Site Improvements (landscape, trees, fences, patios, etc.)	

BRIEF PROJECT DESCRIPTION:

The Project may include the following Work as issued by DWSD on an as-needed basis:

1. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
2. Replacement of sewer services and installation of new cleanout at the property line.
3. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.

APPLICANT IDENTIFICATION**TYPE OF APPLICANT:** Contractor**NAME:** Gordon Pearosn**COMPANY NAME:** N/A**ADDRESS:** 2 Woodward Ave**CITY:** Detroit**STATE:** MI**ZIP:** 48226**PHONE:** +1 (313) 224-9970**EMAIL:** pearsong@detroitmi.gov**I AGREE TO AND AFFIRM THE FOLLOWING:**

- ☒ I understand that the failure to upload all required documentation may result in extended review times for my project and/or a denied application.
- ☒ I understand that the review of this application by the Historic District Commission does not waive my responsibility to comply with any other applicable ordinances including obtaining appropriate permits (building, sign, etc.) or other department approvals prior to beginning the work.
- ☒ I hereby certify that the information on this application is true and correct. I certify that the proposed work is authorized by the owner of record and I have been authorized to make this application as the property owner(s) authorized agent.

DocuSigned by:

Gordon Pearosn

N/A


150715F48A864FC...

11/14/2025

SIGNATURE

DATE

2 Woodward Ave

Detroit

MI

48226

+1 (313) 224-9970

pearsong@detroitmi.gov

Questions? Contact us at hdc@detroitmi.gov or (313)224-1762

NOTE: Based on the scope of work, additional documentation may be required. See www.detroitmi.gov/hdc for scope-specific requirements.

PROJECT DETAILS – TELL US ABOUT YOUR PROJECT

Instructions: Add project details using the text box in each section. If your details exceed the space provided, attach the details via the attachment icon for that section.

ePLANS PERMIT NUMBER: (only applicable if you've already applied for permits through ePLANS)	N/A

GENERAL

1. DESCRIPTION OF EXISTING CONDITION <i>Please tell us about the current appearance and conditions of the areas you want to change. You may use a few sentences or attach a separate prepared document on the right. (For example, "existing roof on my garage is covered in gray asphalt shingles in poor condition.")</i>	
2. PHOTOGRAPHS <i>Help us understand your project. Please attach photographs of all areas where work is proposed.</i>	
3. DESCRIPTION OF PROJECT <i>In this box, tell us about what you want to do at the areas described above in box #1. (For example, Install new asphalt shingle roofing at garage.)</i>	
4. DETAILED SCOPE OF WORK <i>In this box, please describe all steps necessary to complete the work described in box #3. (For example, "remove existing shingles, replace wood deck as necessary, replace wood eaves, install roof vents, replace rotted fascia boards, paint, clean worksite.")</i>	
5. BROCHURES/CUT SHEETS <i>Please provide information on the products or materials you are proposing to install. For example, a brochure on the brand and color of the shingles proposed.</i>	

ADDITIONAL DETAILS

9. OTHER <i>Please provide any additional details. HDC Staff may ask you to submit additional information at a later time depending on your project.</i>	

Information for Page 1 of the COA PDF Document

Project Address: City wide

Historic District:

Description of Work:

The Project may include the following Work as issued by DWSD on an as-needed basis:

1. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
2. Replacement of sewer services and installation of new cleanout at the property line.
3. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.
4. Performing site cleanup and restoration including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
5. CCTV of the lateral after installation from newly installed cleanout to the point of connection to the private structure.
6. All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

With the Conditions That: To be completed by HRD.

Information for Page 2 of the COA PDF Document

Description of Work: Refer to the description provided above.

With the Conditions That: To be completed by HRD

Information for Page 3 of the COA PDF Document

Address: N/A

Historic District: N/A

Scope of Work: Others including site restoration

Brief Project Description:

- A. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
- B. Replacement of sewer services and installation of new cleanout at the property line.
- C. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.
- D. Performing site cleanup and restoration including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
- E. CCTV of the lateral after installation from newly installed cleanout to the point of connection to the private structure.
- F. All labor, equipment, and material for the entirety of the Contract shall be provided by the

Applicant Identification: To be completed by HRD

I Agree to and Affirm the Following: To be completed by HRD

Information for Page 4 of the COA PDF Document

ePlans Permit Number: To be completed by HRD

Description of Existing Condition: The work will be performed in the public ROW and mostly in alleyways. The condition of the sewer services will be determined through the CCTV inspection of sewers.

Photographs: Photos of the sewers and services will be available after each sewer and service is inspected.

Description of Project: The Project is intended to replace cave-ins caused by failed/collapsed sewer services in the public ROW.

Detailed Scope of Work:

- 7. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
- 8. Replacement of sewer services and installation of new cleanout at the property line.
- 9. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.
- 10. Performing site cleanup and restoration, including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.

11. CCTV of the lateral after installation from newly installed cleanout to the point of connection to the private structure.
12. All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

Brochures/Cut Sheets: DWSD's specifications require the awarded contractor to submit brochures/cut sheets for the products to be used on the project. However, here are some descriptions of the resiliency of the products to be used on the project.

DWSD shall incorporate resilient design techniques and material performance into construction projects to increase a structure's ability to withstand adverse weather and changing natural hazards. To achieve this standard, the use of corrosion-resistant, stronger, and durable materials has been specified in project specifications.

The project's scope of work involves construction for external spot repairs and sewer lateral connections, both of which utilize resilient materials. Below is a summary:

- **PVC SDR26 Pipe:** This non-rigid pipe is resilient due to its flexibility, which allows it to withstand ground movement from freeze-thaw cycles and settling without cracking. It is also corrosion-resistant, preventing degradation from chemicals in sewage and ensuring a long service life.
- **Flexible Couplings:** The use of flexible couplings, which conform to ASTM C1173, accommodates movement at joints, maintaining a watertight seal. This is crucial for preventing stormwater infiltration, which can overload the system during heavy rain events.
- **Saddles and Metal Parts:** **Saddles** for connecting sewer laterals, along with associated metal components like bands, are made of corrosion-resistant materials such as stainless steel to ensure long-term integrity in the sewer environment.
- **Grouting:** The project specifies hydraulic cement and chemical grouts to seal holes and joints as needed, and it effectively eliminates infiltration thereby contributing to climate resilience.
- **Repair Mortars:** The specifications include specialized repair mortars that are non-shrinking, impermeable, and resistant to hydrogen sulfide, a common cause of deterioration in sewer infrastructure.

The combination of these materials and techniques creates a resilient system designed to withstand both internal chemical degradation and external environmental stress, aligning with the project's goal of resisting adverse weather and changing natural hazards

Information for Page 5 of the COA PDF Document

Additional Details: Additional details for specific questions can be made available

Other: N/A

Information for Page 6 of the COA PDF Document

Background/Description of Environment: To be completed by HRD. Note that the work will generally be performed in City of Detroit

Information for Page 7 of the COA PDF Document

Services to be Performed:

- Cleaning and inspection of public sewers to determine the condition of services.
- Replacement of failed/collapsed sewer services and public sewer segments associated with the replacement of the service.
- Performing site cleanup and restoration, including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
- CCTV of the lateral after installation from the newly installed cleanout to the point of connection to the private structure.
- All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

Inside Work Only: N/A

Inside Work and Outside Work:

- Cleaning and inspection of public sewers to determine the condition of services.
- Replacement of failed/collapsed sewer services and public sewer segments associated with the replacement of the service.

- Performing site cleanup and restoration, including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
- CCTV of the lateral after installation from the newly installed cleanout to the point of connection to the private structure.
- All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

Information for Pages 8 through 22 of the COA PDF Document

Exhibit H Price and Payment Procedure

1.11 UNIT PRICE SCHEDULE

The measurement and payment descriptions of this section provide a summary of the pay items. Please refer to the individual technical specifications for additional details on general requirements, materials, and execution.

Mobilizations/Demobilization

- a. The Contractor shall furnish all necessary personnel, equipment, labor, and materials for movement of equipment and personnel to the project site.
- b. The lump sum unit price bid for Mobilization/Demobilization will not be more than 5% of the total of all other bid items of the original proposal excluding any provisional allowance and will include submittal of construction quality plan, insurance and bonds, schedule of values with proposed payment schedule including a project breakdown of all Lump Sum items, shop drawings, progress schedule, Site cleaning, dust control, field office, staging area, construction layout and staking, erosion and sediment control, and Demobilization costs including punch list completion, removal of equipment and final site clean-up.
- c. Items included in the lump sum Schedule of Values including Site cleaning, field office, staging area and others listed above must adhere to the requirements of the specifications when performed in order to be accepted for payment.
- d. Contractor to submit schedule of values for Mobilization/Demobilization item subject to approval by the Owner.
- e. Contractor shall include all costs of mobilization and demobilization for any scheduled winter

shutdown or other planned work stoppage as listed in the Contract Documents in the cost of this bid item.

- f. Combined payment for Mobilization and the corresponding schedule of values will equal two-thirds (67%) of the pay items for Mobilization/Demobilization. Combined payment for Demobilization and the corresponding schedule of values shall equal one-third (33%) of the pay items for Mobilization/Demobilization.
- g. Payment for Demobilization costs will be made in conjunction with the demobilization of the Site including punch list completion, removal of equipment and final site clean-up, subject to the Contractor's compliance with the requirements specified in the Contract Documents.

Traffic Control

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for traffic control including furnishing, installing, maintaining, relocating, replacing defective items and removal of the following: traffic control devices, temporary hot-mix asphalt, temporary stone, plating, and temporary pavement marking for the purposes of traffic control and restoring public access shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price "Traffic Control...LS" complete in place.
- c. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Safety Program

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the submittal of the Contractor Safety Program as described in the technical specifications including but not limited to the Project Specific Safety Plan, Emergency Response Plan, and personnel training shall be included in the cost of the pay item.
- b. This item shall include the Project Specific Safety Plan preparation, submittal, and all coordination and resubmittals associated with the reviews until final approval.
- c. The accepted quantities for this work will be paid for at the contract unit price "Safety Program...LS" complete in place.
- d. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Pre-Construction Site Documentation

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for pre-construction site documentation as described in the technical specifications including resident notifications, photographic documentation, and site video shall be included in the cost of the pay item.

- b. The accepted quantities for this work will be paid for at the contract unit price “Pre-Construction Site Documentation...LS” complete in place.
- c. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Sidewalk, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sidewalk removal including saw cutting, removing, hauling, and disposal of existing subgrade, sidewalk base material and sidewalk shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. Payment under this item will include sidewalk removal to full depth of existing sidewalk and ADA ramps regardless of depth of existing sidewalk.
- d. The accepted quantities for this work will be paid for at the contract unit price “Sidewalk, Rem...SYD” complete in place.

Sidewalk, Conc, 4 inch

Sidewalk, Conc, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sidewalk installation including preparation of subgrade; furnishing and compacting sidewalk base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete sidewalk shall be included in the cost of the pay item. Removal of existing sidewalk shall be paid for separately.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Sidewalk, Conc...SYD” complete in place.

ADA Ramp, w/Curb

- a. The costs of materials, labor, equipment, and all other incidental materials including preparation of subgrade; furnishing and compacting sidewalk base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing,

sealing concrete sidewalk, and detectable warning tiles necessary for the installation of ADA ramp shall be included in the cost of the pay item.

- b. Payment under this item will include all ADA sidewalk, ramps, and attached curb.
- c. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- d. The accepted quantities for this work will be paid for at the contract unit price “ADA Ramp, w/ Curb...SYD” complete in place.

Curb, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of curb removal including saw cutting, removing, hauling, and disposal of curb shall be included in the cost of the pay item.
- b. Removal of integral curbs including all saw cutting will be included in the payment of this item.
- c. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- d. The accepted quantities for this work will be paid for at the contract unit price “Curb, Rem...LFT” complete in place.

Curb, Conc

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of Concrete Curb including preparation of subgrade; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete curb shall be included in the cost of the pay item. Removal of existing curb shall be paid for separately.
- b. Integral curb, when poured with roadway pavement or sidewalk will be included in the cost of this pay item and will be paid for on a linear foot basis for curb installed. ADA, ramp with integral curb will be paid for separately.
- c. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- d. The accepted quantities for this work will be paid for at the contract unit price “Curb, Concrete...LFT” complete in place.

Curb and Gutter, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of curb and gutter removal including saw cutting, removing, hauling, and disposal of curb and gutter shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. The accepted quantities for this work will be paid for at the contract unit price “Curb and Gutter, Rem...LFT” complete in place.

Curb and Gutter, Conc

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of Concrete Curb and Gutter including preparation of subgrade; furnishing and compacting aggregate base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete curb shall be included in the cost of the pay item. Removal of existing curb shall be paid for separately.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Curb and Gutter, Conc...LFT” complete in place.

Driveway, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of driveway removal of various thicknesses including saw cutting, removing, hauling, and disposal of existing subgrade, aggregate base and pavement shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. Payment under this item will apply to full depth of existing driveway for both residential and commercial driveways.
- d. The accepted quantities for this work will be paid for at the contract unit price “Driveway, Rem...SYD” complete in place.

Driveway, Conc, 4 inch

Driveway, Conc. 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of residential driveway installation including preparation of subgrade; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete driveway shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Driveway, Conc...SYD” complete in place.

Pavement Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of alley, roadway or any other quantifiable pavement removal of various thicknesses to full depth of pavement including saw cutting, removing, hauling, and disposal of existing aggregate base, concrete base, and pavement with or without reinforcement outside of approved water and sewer structure and pipe trench limits shall be included in the cost of the pay item.
- b. Trench limits are as defined in the Pavement Restoration Standard Detail as the maximum trench width excavation plus additional width to extend to existing concrete base joint limits.
- c. Payment under this item will only be made for additional pavement removals located outside any approved water main and sewer trench limits as defined in this pay item and in the Pavement Restoration Detail. Surface, base, and trench removals to the full depth and width required to replace the concrete base from existing roadway joint to joint will be included in applicable structure and pipe items for water main and sewer as listed in the measurement and payment descriptions.
- d. No extra payment will be made under this item for removal of pavement due to the expansion of trench width by the Contractor for the purpose of benching or sloping beyond the acceptable trench limits.
- e. This item will include removal of concrete paved alley and concrete paved roadway outside the approved trench limits or as directed by the Engineer.
- f. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- g. The accepted quantities for this work will be paid for at the contract unit price “Pavement, Removal...SYD” complete in place.

Aggregate Base, No. 22A, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the

furnishing, placing and compacting of aggregate base shall be included in the cost of the pay item.

- b. The accepted quantities for this work will be paid for at the contract unit price “Aggregate Base, No. 22A, 6 inch...SYD” complete in place.

Concrete Base, 8 inch

Concrete Base, 10 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of concrete base installation including furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete base shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. When restoring within Detroit DPW right of way, the pavement removal outside of the approved trench will be measured to comply with DPW pavement requirements which state that the removal and replacement of concrete base must be from existing joint to joint.
- d. The accepted quantities for this work will be paid for at the contract unit price “Concrete Base...SYD” complete in place.

HMA Pavement, Rem, Milling, 2 inch Depth up to 4 inch Depth

- a. The costs of materials, labor, equipment and all other incidental materials necessary for the removal of HMA pavement materials including milling, hauling, and disposal shall be included in the cost of the pay item.
- b. Milling shall be performed in accordance with Detroit DPW requirements which state to mill HMA pavement beyond the area of the trench pavement removal in order to determine location of underlying concrete base pavement joints and shall be a minimum width of one lane, full roadway, or as shown on the plans.
- c. Milling within the trench limit is included in the cost of water main pipe and shall not be paid for separately.
- d. Payment for HMA Pavement removal via milling will only be made for actual pavement milled beyond the trench limits of any excavated trench.
- e. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, Removal, Milling...SYD” complete in place.

HMA Pavement, 36A, 1.5 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing tack coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. Permanent pavement markings are to be furnished and installed following the acceptance of HMA Pavement installation and are to be in accordance with Michigan Manual on Uniform Traffic Control Devices and MDOT Pavement and Standard Marking Plans and MDOT Standard Specifications Section 811. A survey of existing pavement markings prior to the Work shall be taken with final placement to be in-kind or as stated in the standards listed herein. The cost of all permanent pavement markings will be included in the cost of this pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 36A, 1.5 inch...SYD” complete in place.

HMA Pavement, 13A, 2 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing prime coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 13A, 2 inch...SYD” complete in place.

HMA Pavement, 5E3, 1.5 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing tack coat; furnishing, placing, compacting HMA pavement; and furnishing and placing permanent pavement markings shall be included in the cost of the pay item.
- b. Permanent pavement markings are to be furnished and installed following the acceptance of HMA Pavement installation and are to be in accordance with Michigan Manual on Uniform Traffic Control Devices and MDOT Pavement and Standard Marking Plans and MDOT Standard Specifications Section 811. A survey of existing pavement markings prior to the Work shall be taken with final placement to be in-kind or as stated in the standards listed herein. The cost of all permanent pavement markings will be included in the cost of this pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 5E3...SYD” complete in place.

HMA Pavement, 4E3, 2 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing prime coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 4E3, 2 inch...SYD” complete in place.

Concrete Paving, 9 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of concrete paving installation including preparation of subgrade; furnishing dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete paving shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The costs of material testing as described in the technical specifications including but not limited to concrete testing, compaction testing, and any associated field tests, lab tests or fees shall be included in the cost of the pay item.
- d. The accepted quantities for this work will be paid for at the contract unit price “Concrete Paving...SYD” complete in place.

Structure, Adjust Existing Casting to Grade

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the adjustment of existing structure casting to grade including removal and disposal of existing surface and furnishing, placing and compacting backfill shall be included in the cost of the pay item.
- b. In addition to structure adjustments indicated in the restoration drawings, all ‘replace adjusters’ and ‘frame/cover adjustments’ indicated in the drawings shall be paid for under this pay item.
- c. Payment under this item will include up to two (2) vertical feet of casting adjustment. Adjustment greater than this depth will be paid for under applicable chimney repair or replacement items.
- d. Adjustment of casting to finished grade of newly installed structures or existing structures within the sewer or manhole replacement alignment will not be paid for under this item and will be included in the cost of applicable manhole installation items. Structure, adjust existing

casting to grade will only be paid for under this item as indicated on the plans or when the existing frame and cover are to be adjusted outside the boundaries of trench excavation for proposed or existing structure work.

- e. Adjustment of existing casting to finished grade shall be made with adjustment rings per the manhole rehabilitation specification.
- f. Locating and exposing of buried manholes beneath six (6) inches or greater of pavement or hard surfaces will be paid for separately under Manhole, Locate and Raise to Grade.
- g. The accepted quantities for this work will be paid for at the contract unit price for “Structure, Adjust Existing Casting to Grade...EA” complete in place.

Mulched Seeding

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of mulched seeding installation including furnishing, placing, grading and watering topsoil and seed shall be included in the cost of the pay item.
- b. Costs associated with the maintenance of mulched seeding as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Mulched Seeding...SYD” complete in place.

Sodding

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sod installation including furnishing, placing, grading and watering topsoil and seed shall be included in the cost of the pay item.
- b. Costs associated with the maintenance of sod as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Sodding...SYD” complete in place.

Wood Fence, Remove and Replace, 4 foot **Wood Fence, Remove and Replace, 6 foot**

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the

specifications shall be included in the cost of the pay item.

- c. The accepted quantities for this work will be paid for at the contract unit price “Wood Fence, Remove and Replace...LFT” complete in place.

**Chain Link Fence, Remove and Replace, 4 footChain
Link Fence, Remove and Replace, 6 foot**

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Chain Link Fence, Remove and Replace...LFT” complete in place.

**Vinyl Fence, Remove and Replace, 4 footVinyl
Fence, Remove and Replace, 6 foot**

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Vinyl Fence, Remove and Replace...LFT” complete in place.

Tree, Install

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of tree installation including but not limited to furnishing trees, clearing, excavation, removal of existing roots, preparation of subsoil, placing and preparing topsoil, planting, backfill, landscape edging, trimming, watering, fertilizing, applying herbicides and pesticides, installing erosion control measures during installation, tree stabilization, maintenance of trees, and warranty shall be included in the cost of the pay item.
- b. All trees greater than 6 inches in diameter that were removed due to work shall be replaced on a 1:1 basis. Plant new trees as close to the original location as possible. Contractor shall choose which tree species to plant in each replacement tree location, making sure that planting conditions comply with the notes stated in the planting schedule and the specifications.

- c. Location of tree installation shall be as directed by the Engineer. Trees shall only be installed on private property or city ROW. Trees shall not be installed above existing sewers or within sewer easements.
- d. Costs associated with the installation and maintenance of trees as prescribed in the specifications shall be included in the cost of the pay item.
- e. The accepted quantities for this work will be paid for at the contract unit price “Tree, Install...EA” complete in place.

Tree. Remove, 6 inch to 18 inch Diameter Tree.
Remove, Greater than 18 inch Diameter

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of tree removal of trees 6 inch or greater in diameter including but not limited to clearing, excavation, hauling, removal of existing roots and backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal of trees 6 inch or greater as prescribed in the specifications shall be included in the cost of the pay item. No payment will be made under this item for trees under 6 inches in diameter. All payment for trees removed under 6 inches in diameter will be included in the clearing and grubbing of applicable sewer, water or other installation and removal items.
- c. The approved method of tree diameter measurement will be the diameter at breast height (DBH), in which the tree diameter measurement is taken 4.5 feet above the ground for measurement and payment purposes.
- d. The accepted quantities for this work will be paid for at the contract unit price “Tree, Remove...EA” complete in place.

Sewer, Video Inspection, Circular and Non-Circular, Less than 18 inch Height

Sewer, Video Inspection, Circular and Non-Circular, Greater than 18 inch to 24 inch Height

- a. The costs of all equipment, labor, products, materials, cleaning, digital video recordings, and inspection reports will be included in the cost of sewer video inspection.
- b. Any flow control to remove standing water and debris shall be incidental to the contract.
- c. Contractor shall be responsible for fully cleaning the sewer segment within the manhole to manhole segment. This may require multiple passes and the use of any equipment necessary to fully clean the sewer to acceptable standards and remove any debris, obstructions, roots, root balls, grease, and settled deposits. No additional payment will be made for multiple passes or the use of alternate equipment which may be required to fully clean the sewer.
- d. Correction and re-submission of non-compliant submissions will be at Contractors own expense.
- e. No extra payment will be made for video inspection performed more than once on the same section of pipe.
- f. The height of non-circular sewers will be taken as the largest dimension.
- g. The Contractor is responsible for quality control review and final quality of the deliverable for all sewer reports. All deliverables to the Engineer will include all requirements and be delivered to the minimum standard as identified in the specifications. Payment will not be made until the required report submissions are accepted by the Engineer.
- h. The deliverable for this item is a report describing the following:
 - Inspection Detail Information
 - Date and Time of Inspection
 - Pipe Segment Reference Asset ID
 - Start Node
 - End Node
 - Start Location with Description
 - Service Connection Information for All Services Found on a Segment
 - Picture of service connection
 - Footage counter measurement in linear feet
 - The address of the service connection
 - Size of service connection
 - PACP code of largest observable defect, if service connection is defective
 - Percentage values of obstruction of lateral
- i. Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.

- j. Payment under this item will include all reverse setups required in order to obtain a complete inspection.
- k. Sewer inspections will be measured on a length basis for each size and type of sewer and paid for at the Contract Unit Price for “Sewer, Video Inspection...LFT”. Length to be paid for will be the total length of sewer inspected in accordance with this specification, accepted and measured by the Engineer.
- l. Measurement will be made horizontally at grade above the center line of the sewer from start manhole and sewer pipe interface to sewer pipe interface and finish manhole or from start manhole and sewer pipe interface to the point of abandoned inspection as confirmed by the steel tape or calibrated footage counter measurement.

Sewer, Video Inspection, Lateral

- a. The costs of all equipment, labor, and materials to conduct and deliver digital video recordings of private sewer laterals will be included in the cost of sewer video inspection.
- b. Inspections for this item will be conducted only on sewer laterals which have been replaced, during or after they have been replaced.
- c. Inspections for this item shall capture the condition of the private side of sewer lateral, from newly installed cleanout to the point of connection of the structure.
- d. The deliverable for this item is a .mp4 video in the following format:
 - [P/O Number]_[Address]_[Direction]_[YYYYMMDD]_[HHMMSS – 24 hour format].mp4
- e. Any flow control to remove standing water and debris shall be incidental to the contract.
- f. Correction and re-submission of non-compliant submissions will be at Contractors own expense.
- g. No extra payment will be made for video inspection performed more than once on the same section of pipe.
- h. The Contractor is responsible for quality control review and final quality of the deliverable for all sewer reports. All deliverables to the Engineer will include all requirements and be delivered to the minimum standard as identified in the specifications. Payment will not be made until the required report submissions are accepted by the Engineer.
- i. Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.
- j. Payment under this item will include all reverse setups required in order to obtain a complete inspection.

- k. Payment under this item will only be made once inspections have been received and approved by the Engineer.
- l. Sewer inspections will be measured by each inspection completed at the Contract Unit Price for "Sewer, Video Inspection...EA".

Sewer, External Point Repair, 6 inch Sewer,
External Point Repair, 10 inch Sewer,
External Point Repair, 12 inch Sewer,
External Point Repair, 15 inch Sewer,
External Point Repair, 18 inch
Sewer, External Point Repair, 20, 21, 22, & 24 inch

- a. The costs of all equipment, labor, materials, saw cutting, pavement removal, driveway removal, sidewalk removal, curb removal, excavation, excavation support, dewatering excavation, cleaning of existing sewer prior to and following open cut replacement, removal of existing sewer, temporary bulkheads, flow control, bypass pumping, hauling, disposal, grubbing, clearing of brush and trees less than 6 inches in diameter, bedding, backfill, compaction, pipe, pipe gaskets, pipe sleeves, pipe couplings, pre and post open cut replacement CCTV inspection video in accordance with the specifications, and incidentals shall be included in the cost of this item.
- b. This item shall be used to replace portions of public sewers connected to lateral replacements.
- c. Reconnection of sewer laterals within the accepted linear footage of open cut replacement will not be paid for under this item and will be included in the cost of other items
- d. The costs of material testing as described in the technical specifications including but not limited to compaction testing and any associated field tests, lab tests or fees shall be included in the cost of this pay item. The Engineer reserves the right to verify in-situ or lab testing results by enlisting a third-party to perform quality assurance at their discretion.
- e. Maximum payment for surface restoration items to restore open cut replacement trench shall be paid for at trench width as listed in the trench and pavement details in the DWSD standard drawings. No payment for aggregate base, concrete base course, asphalt, or other restoration items will be paid for outside of maximum payment width for the trench unless otherwise approved by the Engineer.
- f. Contractor shall perform CCTV prior to open cut replacement to verify location and length of repair required and to determine if deterioration of the pipe requiring additional repairs are required. CCTV shall take place prior to excavation activities and shall be delivered to the Engineer for approval on repair length and locations within the segment. Post repair CCTV in accordance with the specifications will be required and included in this item for the acceptance of work.

- g. Following open cut replacement, contractor shall be responsible for fully cleaning the sewer segment within the manhole to manhole segment. This may require multiple passes and the use of any equipment necessary to fully clean the sewer to acceptable standards and remove any debris, obstructions, roots, root balls, asphalt, concrete, grease, settled deposits, ingress deposits, encrustation, and vermin. No additional payment will be made for multiple passes or the use of alternate equipment which may be required to fully clean the sewer.
- h. All removals within the trench limits will be included in the cost of this item. Local agencies and permitting authorities may require additional removal and replacement in order to meet local surface roadway restoration requirements. All removals in order to adhere to these requirements will be included in the cost of this item. Installation of restoration items will not be paid for under this item and will be included in the cost of applicable restoration items.
- i. Surface, base, and trench removals to the full depth and width required to replace the concrete and aggregate base in existing concrete base from joint to joint will be included in this pay item.
- j. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- k. The accepted quantities for this work will be paid for at the contract unit price for "Sewer, Open Cut Replacement...LFT" of actual length of repair complete in place. Measurement shall be along the centerline of the sewer.

Sewer, Open Cut, Lateral Replacement, Up to 10 foot Depth **Sewer, Open Cut, Lateral Replacement, Greater than 11 foot Depth**

- a. The costs of all equipment, labor, materials, saw cutting, pavement removal, driveway removal, sidewalk removal, curb removal, excavation, excavation support, dewatering excavation, removal of existing lateral, temporary bulkheads, flow control, bypass pumping, hauling, disposal, grubbing, clearing of brush and trees less than 6 inches in diameter, bedding, backfill, compaction, pipe, pipe gaskets, pipe sleeves, cleanout, pipe couplings and incidentals shall be included in the cost of this item.
- b. Reconnection of sewer laterals will be paid for under this item.
- c. The costs of material testing as described in the technical specifications including but not limited to compaction testing and any associated field tests, lab tests or fees shall be included in the cost of this pay item. The Engineer reserves the right to verify in-situ or lab testing results by enlisting a third-party to perform quality assurance at their discretion.
- d. Maximum payment for surface restoration items to restore open cut replacement trench shall be paid for at the trench width of 5 feet. No payment for aggregate base, concrete base course, asphalt, or other restoration items will be paid for outside of maximum payment width for the trench unless otherwise approved by the Engineer.
- e. All removals within the trench limits will be included in the cost of this item. Local agencies

and permitting authorities may require additional removal and replacement in order to meet local surface roadway restoration requirements. All removals in order to adhere to these requirements will be included in the cost of this item. Installation of restoration items will not be paid for under this item and will be included in the cost of applicable restoration items.

- f. Surface, base, and trench removals to the full depth and width required to replace the concrete and aggregate base in existing concrete base from joint to joint will be included in this pay item.
- g. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- h. The accepted quantities for this work will be paid for at the contract unit price for "Sewer, Open Cut, Lateral Replacement...LF" of replacement complete in place.

ALLOWANCES

Permit Allowance

Contaminated Material Allowance

Provisional Allowance

PART 2 - PRODUCTS - Not

Used PART 3 - EXECUTION -

Not Used

END OF SECTION 01 20 00

Information for Page 23 of the COA PDF Document

Required Material Specs: The awarded contractor is required to provide submittals for materials to be used on the project before work begins. However, a sample list of specifications for materials is provided below.

- 03 30 00 Cast-in-Place Concrete
- 03 20 00 Cast-in-Place Concrete
- 31 23 23.33 Flowable Fill
- 32 31 13 Chain Link Fences and Gates

- 32 31 29 Wood Fences and Gates
- 32 11 23 Aggregate Base Coarse
- 32 12 16 Asphalt Paving
- 32 13 13 Concrete Paving
- 32 92 19 Seeding
- 32 93 00 Plants
- 33 01 30.18 Security Clearances and Communications
- 33 01 30.30 Sanitary Sewer Pipeline Inspection (Replaces 33 01 30.23)
- 33 01 30.31 Manhole Inspection (Replaces 33 01 30.17)
- 33 01 30.32 Sanitary Sewer Pipeline Cleaning (Replaces 33 01 30.19)
- 33 01 30.81 Manhole Rehabilitation

Information for Page 24 of the COA PDF Document

Historic District Commission Project Review Request

Completed Building Permit Application: N/A

Refer to **Information for Page 4 of the COA PDF Document** above for the rest.

Information for Page 25 of the COA PDF Document

Property Information: N/A. HRD shall provide input if required.

Information for Page 26 of the COA PDF Document

Identification: N/A. HRD shall provide input if required.

Information for Page 27 of the COA PDF Document

Historic District Commission Review and Permit Process: FYI per HRD.

Information for Page 28 of the COA PDF Document

DWSD Fix It Letter: This letter may not be required since the work will be in the public ROW.

Information for Pages 29 through 31 of the COA Document

List of Items of Work from Bid Schedule:



Item No.	Description
1	Mobilization/Demob
2	Traffic Control
3	Safety Program
4	Pre-Construction Site Documentation
5	Sidewalk, Rem
6	Sidewalk, Conc, 4 inch
7	Sidewalk, Conc, 6 inch
8	ADA Ramp, w/ Curb
9	Curb, Rem
10	Curb, Conc
11	Curb and Gutter, Rem
12	Curb and Gutter, Conc
13	Driveway, Rem
14	Driveway, Conc, 4 inch
15	Driveway, Conc, 6 inch
16	Pavement, Rem
17	Aggregate Base, No. 22A, 6 inch
18	Concrete Base, 8 inch
19	Concrete Base, 10 inch
20	HMA Pavement, Rem, Milling, 2 inch Depth up to 4 inch Depth
21	HMA Pavement, 36A, 1.5 inch
22	HMA Pavement, 13A, 2 inch
23	HMA Pavement, 5E3, 1.5 inch
24	HMA Pavement, 4E3, 2 inch
25	Concrete Paving, 9 inch
26	Structure, Adjust Existing Casting to Grade
27	Mulched Seeding

28	Sodding
29	Wood Fence, Remove and Replace, 4 foot
30	Wood Fence, Remove and Replace, 6 foot
31	Chain Link Fence, Remove and Replace, 4 foot
32	Chain Link Fence, Remove and Replace, 6 foot
33	Vinyl Fence, Remove and Replace, 4 foot
34	Vinyl Fence, Remove and Replace, 6 foot
35	Tree, Install
36	Tree, Remove, 6 inch to 18 inch Diameter
37	Tree, Remove, Greater than 18 inch Diameter
38	Sewer Video Inspection, Less than 18 inch Height
39	Sewer Video Inspection, 18 inch to 24 inch Height
40	Sewer, Video Inspection, Lateral
41	Sewer, External Point Repair, 6 inch
42	Sewer, External Point Repair, 10 inch
43	Sewer, External Point Repair, 12 inch
44	Sewer, External Point Repair, 15 inch
45	Sewer, External Point Repair, 18 inch
46	Sewer, External Point Repair, 20, 21, 22 & 24 inch
47	Sewer Lateral Replacement, Greater than 5' to 10' in Depth
48	Sewer Lateral Replacement, Greater than 10' to 20' in Depth
49	Permit Allowance
50	Contaminated Material Allowance
51	Provisional Allowance

Information for Pages 32 through 38 of the COA PDF Document

Alley Sinkhole Project Billing: The billings will be submitted by the contractor(s) through eBuilder for review and processing by DWSD and shall be based on the Schedule of Values.

Information for Pages 39 through 40 of the COA PDF Document

Invoice Requirements:

- Project Name, Number, Invoice Period, and Invoice Number
- Billing submitted by SOV line items
- Construction Progress Schedule revised and current
- Monthly Safety Reports
- Certified Payroll
- Vendors and Subcontractor(s) Partial Waivers

- Completed work quantities with appropriate unit of measure

Invoice Support Documentation:

- CCTV files
- Detail Quantity Sheet signed by contractor field representative and DWSD Inspection Team Leader and/or inspector.
- DWSD Daily Inspection Reports
- Photos
- Valid Certificate of Insurance (COI)

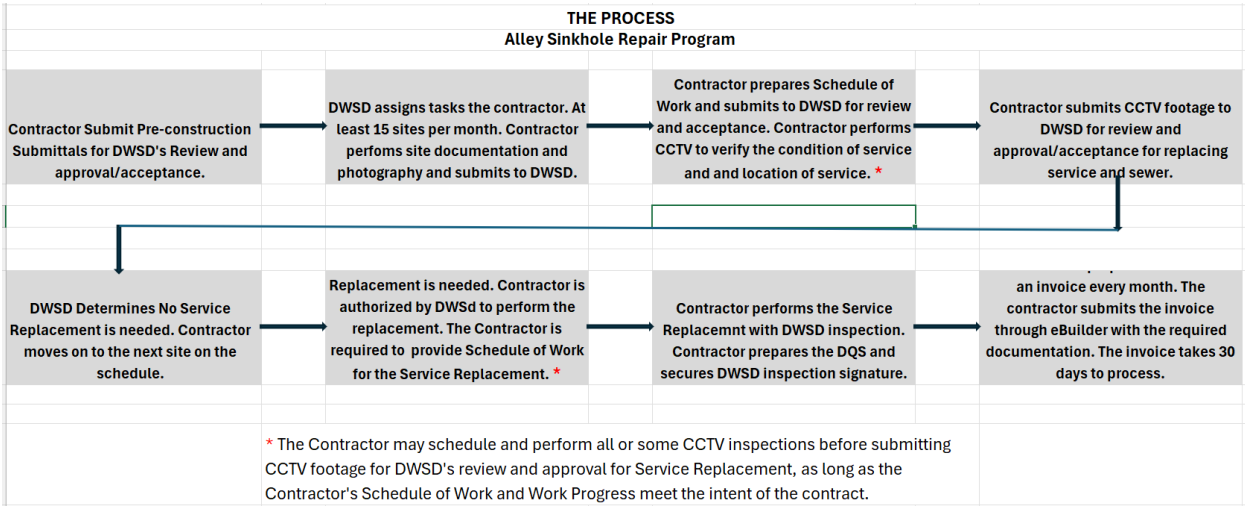
Reference: N/A. This project will use eBuilder for invoicing and general project management, and documentation. No Smartsheet shall be used.

Information for Page 41 of the COA PDF Document

Environmental Concern Fix It Letter: N/A

Information for Page 42 of the COA PDF Document

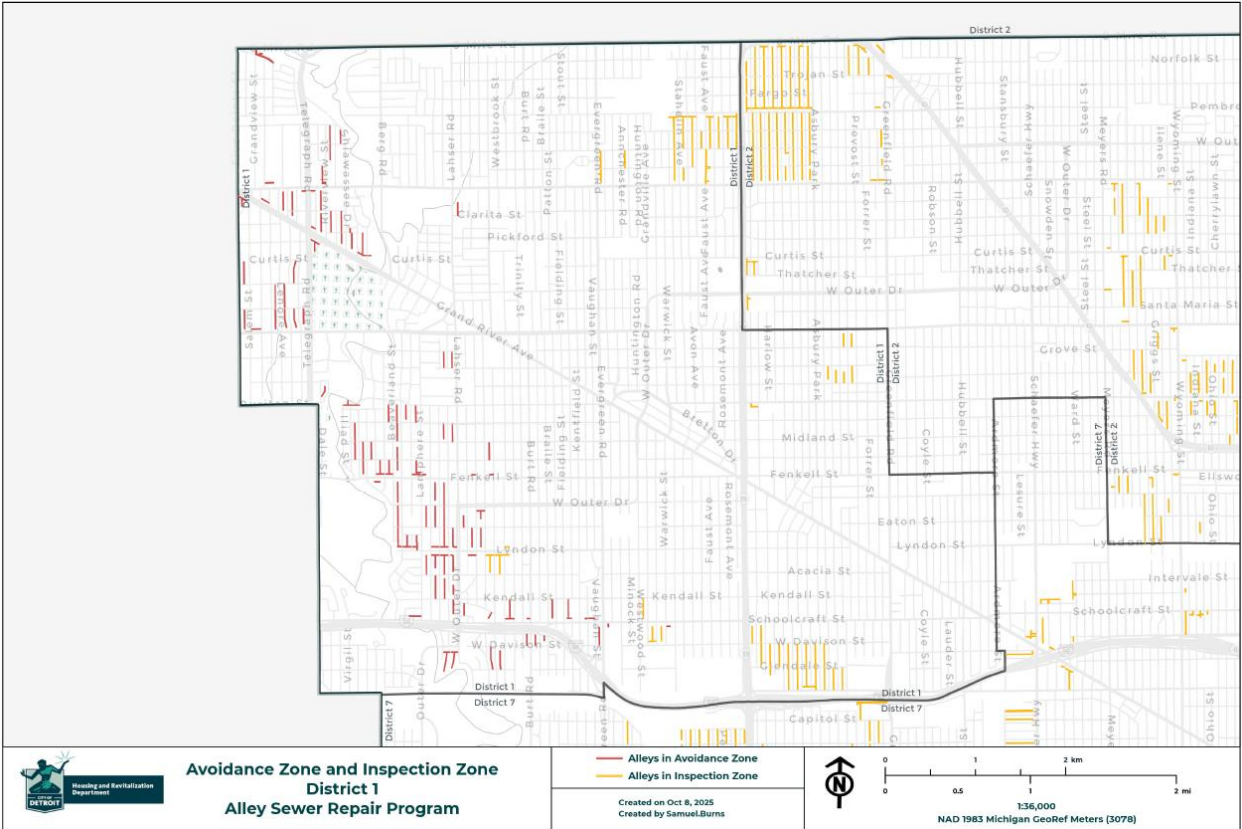
The Process: Refer to the insert below.

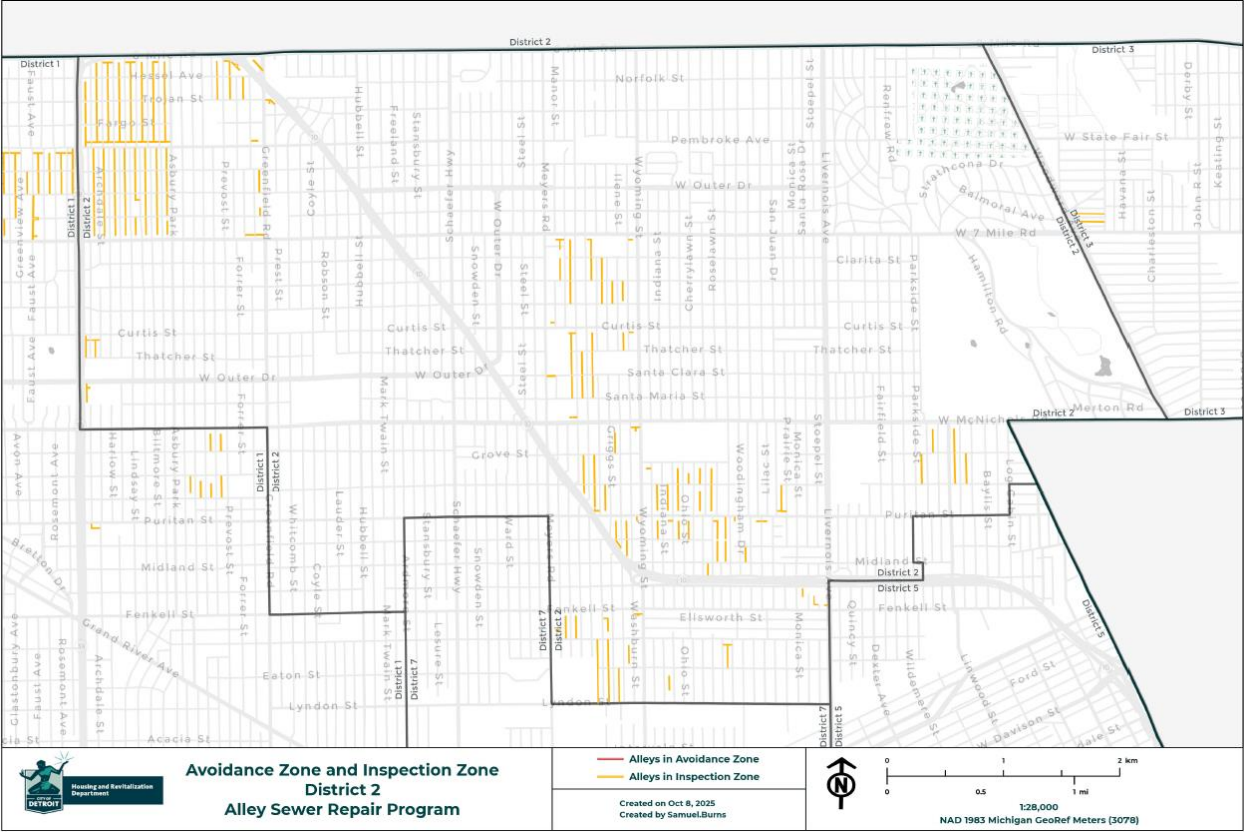


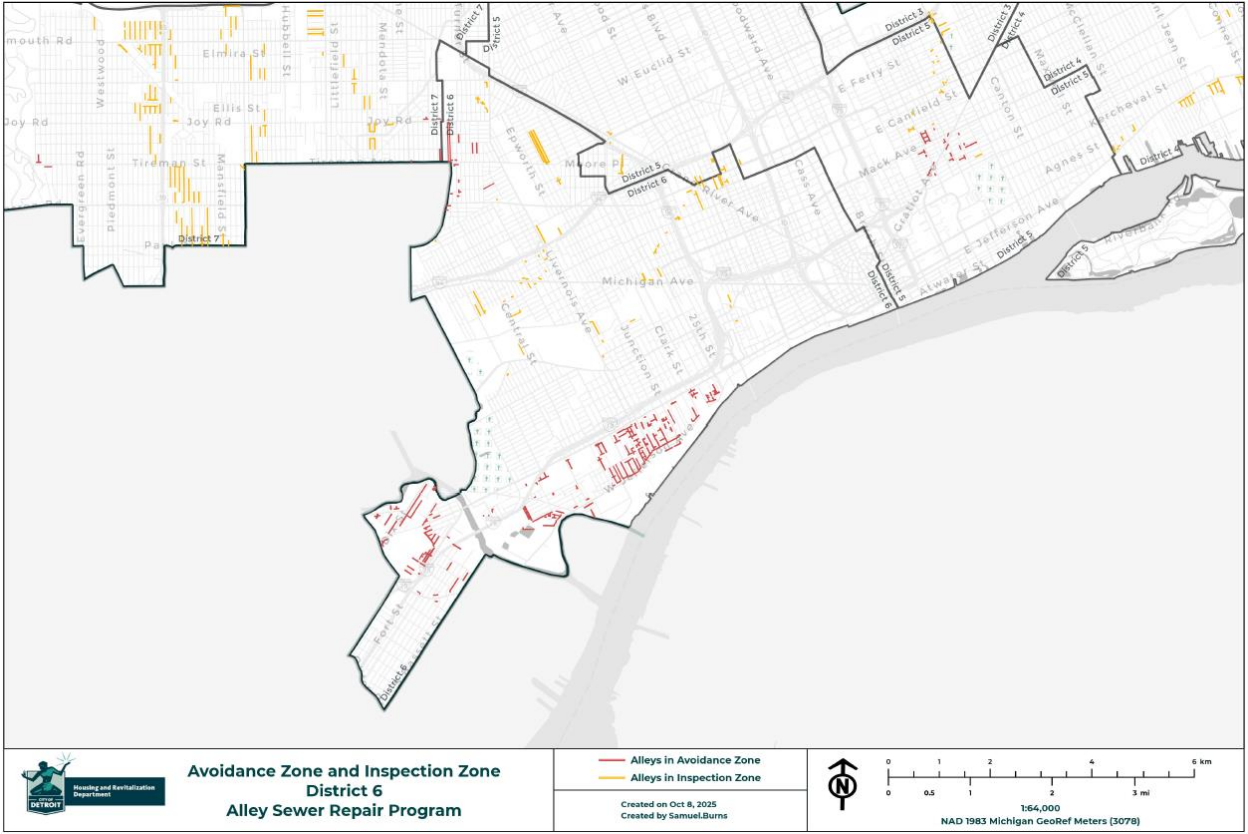
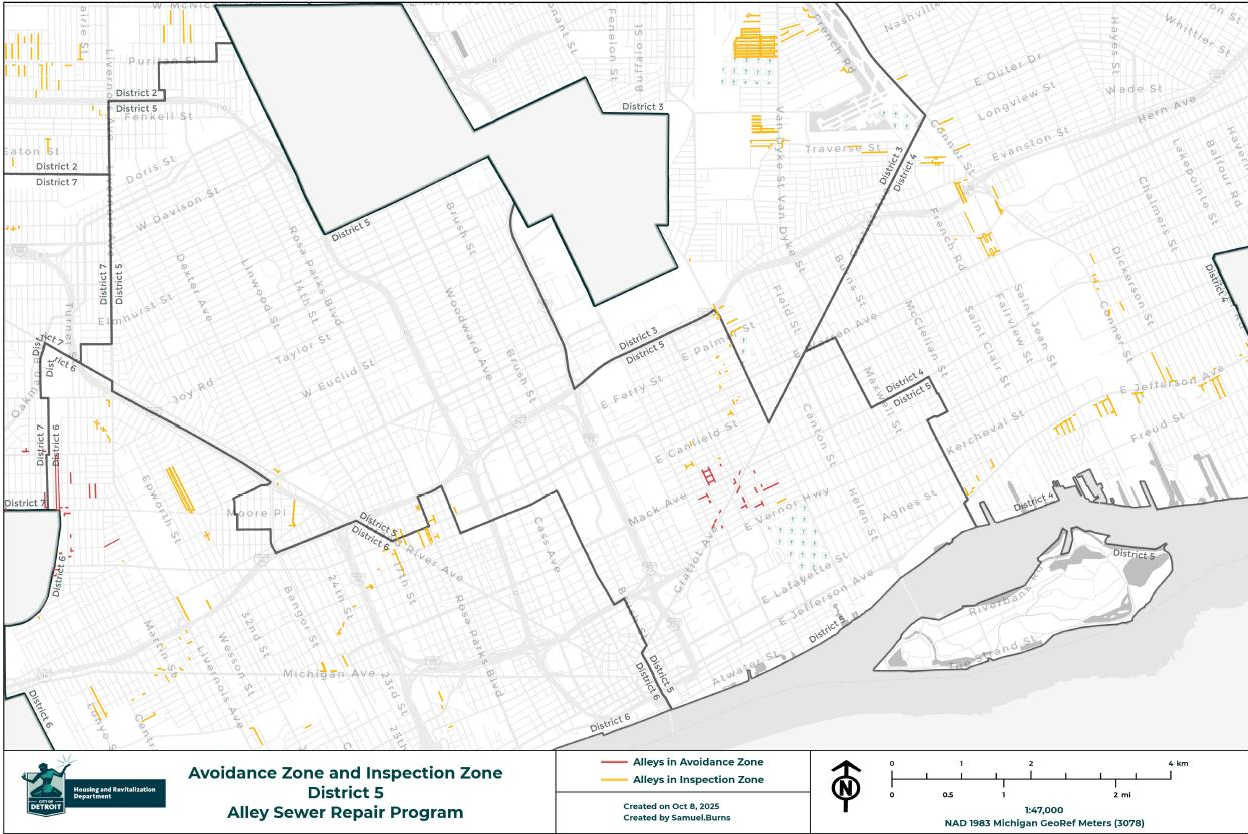
Information for Page 43 of the COA PDF Document

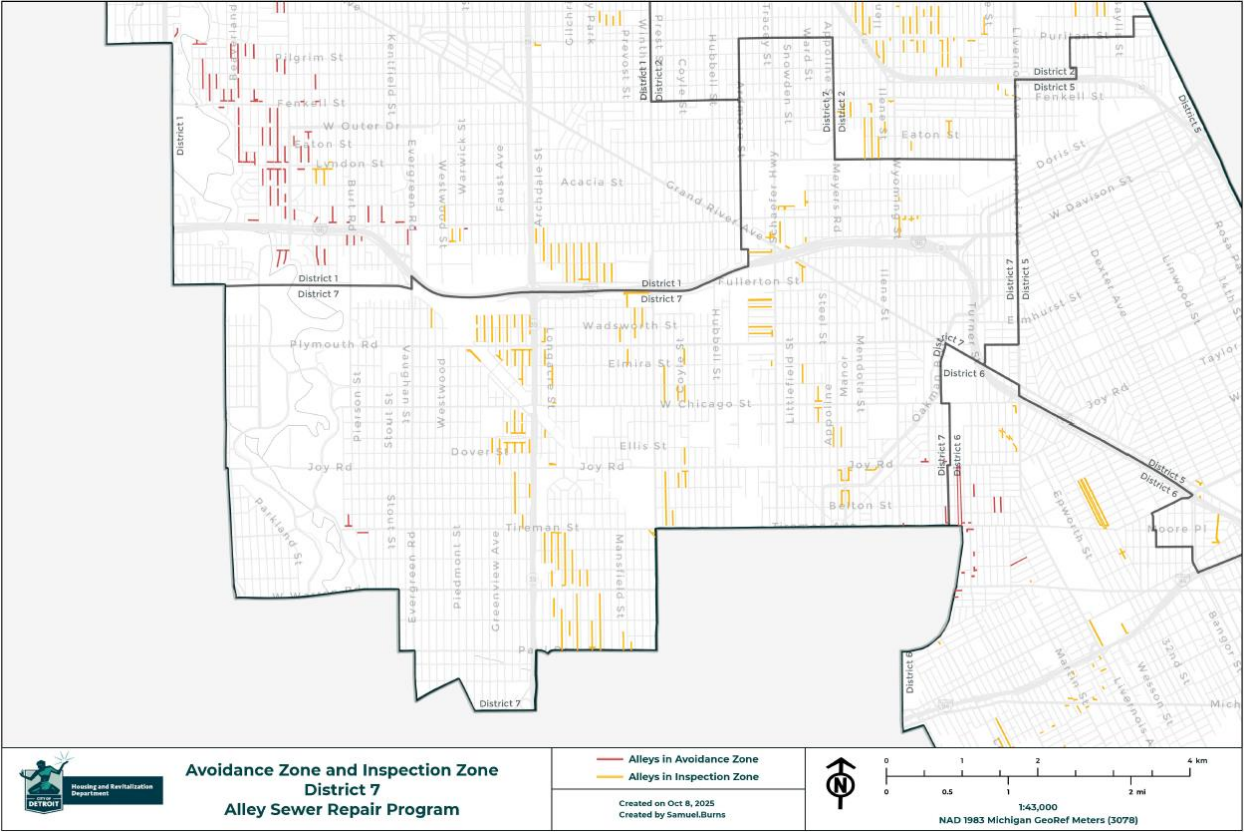
Work Acceptance Form: The work acceptance will be done through the daily inspection/field verification of work, validating post sewer and service replacement by means of CCTV submittals.

Information for Pages 44 through 50 of the COA PDF Document









CITY OF DETROIT

Mike Duggan, Mayor

REQUEST FOR BIDS NO. XXXXXX

PROJECT NO. DWS-973

TECHNICAL SPECIFICATIONS

FOR

INSPECTION AND REPAIR OF ALLEY SEWERS IN THE CITY OF DETROIT
AS-NEEDED

Book 2 of 2



BOARD OF WATER COMMISSIONERS

Michael Einheuser, Chairperson
Mary E. Blackmon, Vice Chairperson
Lane Coleman
John Henry Davis
Linda D. Forte
Jane C. Garcia
Jonathan C. Kinloch

Gary Brown
Director
Mohamad Farhat, P.E.
Chief Engineer

Samuel Smalley, P.E.
Deputy Director
Istakur Rahman
Chief Financial Officer

March 2025

CITY OF DETROIT

Mike Duggan, Mayor

SPECIAL SPECIFICATIONS

For DWS-973



BOARD OF WATER COMMISSIONERS

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Chief Engineer

Samuel Smalley, P.E.
Deputy Director
Istakur Rahman
Chief Financial Officer

March 2025

City of Detroit
Water and Sewerage Department - Engineering Division
Special Specifications

The following Special Specification Sections shall replace the associated Standard Specifications Sections. The DWSD Standard Specifications (dated May 2023) are incorporated by reference. The Standard Specifications can be found on DWSD's website.

01 11 00	Summary of Work
01 14 00	Work Restrictions
01 20 00	Price and Payment Procedures
01 30 00	Administrative Requirements
01 31 27	Project Management Communications
01 32 16	Construction Progress Schedule
01 32 25	GPS Structure Documentation
01 33 00	Submittal Procedures
01 35 29	Safety Program
01 40 00	Quality Requirements
01 52 00	Temporary Facilities
01 55 26	Traffic Control
01 57 13	Erosion Control Sedimentation and Containment of Construction Materials
01 57 15	Temporary Sewer Bypass Pumping
01 57 33	Temporary Security Measures
01 70 00	Execution and Closeout Requirements
01 78 39	Electronic Project Record Documentation
02 01 20	Protecting Existing Underground Utilities
02 22 30	Pre-Construction Video and Photographic Record
02 61 13	Excavation and Handling offContaminated Materials
03 10 00	Concrete Forming
03 20 00	Concrete Reinforcing
03 25 00	Concrete Accessories
03 30 00	Cast-in-Place Concrete
03 31 00	Construction and Expansion Jointss
03 39 00	Concrete Curing
31 10 00	Site Clearing
31 23 16.26	Rock Removal
31 23 19	Dewatering
31 23 23.33	Flowable Fill
31 23 33	Trenching and Backfill
31 50 00	Excavation Support Systems

City of Detroit
Water and Sewerage Department- Engineering Division
Special Specifications

32 11 23	Aggregate Base Courses
32 12 16	Asphalt Paving
32 13 13	Concrete Paving
32 13 14	Permeable Concrete
32 31 13	Chain Link Fences and Gates
32 31 29	Wood Fences and Gates
32 92 19	Seeding
32 93 00	Plants
33 01 30.18	Security Clearances and Communications
33 01 30.30	Sewer Pipeline Inspection for Condition Assessment
33 01 30.60	Spot Repair of Existing Sewers
33 01 30.31	Manhole Inspection for Condition Assessment
33 01 30.32	Sewer Cleaning for Condition Assessment
33 01 30.81	Manhole Rehabilitation
33 31 11	Public Sanitary Sewerage Gravity Piping

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contract description.
2. Contractor's use of Site.
3. Work sequence.
4. Permits.
5. Specification conventions.

1.2 CONTRACT DESCRIPTION

- A. Perform Work of Contract under unit price Contract with Owner according to Conditions of Contract.
- B. Description of Work included in the Project will be as presented in the Advertisement, Bid Schedule, and/or Drawings.

1.3 CONTRACTOR'S USE OF SITE

A. Limit use of Site to allow:

1. Owner occupancy.
2. Work by Others, if any, as listed in the Contract Documents.
3. Use of Site by the public within public right-of-way.

B. Construction Operations: Limited to areas indicated in the Contract Documents.

C. Time Restrictions for Performing Work: Comply with Section 01 14 00 – Work Restrictions.

D. Sound Level Restrictions: Sound pressure level measured at boundary of Site shall not exceed 90 dBA.

1.4 CLEANING OF SITE

- A. On a daily basis, following completion of the Work (pipe installation, concreting and asphaltting, spreading top soil, or sodding and seeding) and prior to leaving the Site, the Contractor shall thoroughly clean the roadway and remove the excess material from the roadway so that it is not deposited in the roadway drainage system.



- B. When directed by the Engineer, but not less than weekly, the Contractor shall sweep the streets with a street sweeper. The sweeper shall have a main broom, conveyor, sprinkler system, and a storage hopper. This requirement shall apply to any streets or roads in the vicinity of the Work that are affected by the Contractor's construction or hauling operations, and as well as to streets or roads in which the Work is located. Should the Contractor neglect his duties in maintaining the proper street or road cleanliness, the Owner has the authority to take necessary steps to perform such cleaning and will charge the Contractor for those costs.
- C. The Contractor shall at all times keep the street pavement and right-of-way and any public or private premises temporarily occupied for purposes of Work under this Contract free from accumulations of waste material or rubbish caused by the Contractors employees or the Work. This requirement shall apply to any streets in vicinity of the Work which are affected by the Contractor's construction or hauling operations, as well as to streets in which the Work is located. If the Contractor shall fail to keep any street cleaned of debris resulting from their operations, and therefore creating a public nuisance, they shall be notified in writing by the Engineer to clean the street and remove the nuisance immediately. If, within 24 hours after the receipt of such notice, the Contractor shall have failed to clean such street satisfactorily, the Engineer shall order the street cleaned by the Department of Public Works or such other agency and all costs of such cleaning shall be paid by the Contractor.
- D. Dirt, mud, construction materials or other debris deposited on public sidewalks or streets as the result of spilling, tracking by the wheels of trucks or construction equipment or by other actions of the Contractor, his employees or subcontractors shall be immediately removed by the Contractor.

1.5 MATERIAL STORAGE

- A. Comply with Section 01 52 00 Temporary Facilities for all temporary staging area requirements for material, equipment, and supplies.
- B. Materials delivered on the street shall be neatly and compactly stored in such a manner as to cause the least inconvenience to adjacent property owners and the general public.
- C. Working and storage areas shall be promptly restored to their original conditions as soon as the required construction work has been completed at the particular location and shall not be used as a storage area for unneeded material or construction equipment.
- D. All materials delivered and stored in close proximity to the working area shall be properly barricaded and protected maintaining a safe Site for workers and the general public.
- E. Only materials and construction equipment currently being used may be stored at the construction site and within the jurisdictional right-of-way.



1.6 WORK SEQUENCE

- A. Construct Work in phases during construction period. Coordinate construction schedule and operations with the Engineer.

1.7 PERMITS

- A. Acquire necessary permits for construction of Work as listed in the Contract Documents.

1.8 SPECIFICATION CONVENTIONS

- A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.9 STANDARD SPECIFICATIONS AND DETAILS

- A. These Specifications include Sections that may or may not be directly relevant to the Work of this Contract as described in the Contract Documents. Some Specifications are included for reference and will only be relevant if the Specification topic is encountered or required over the course of the Work as a result of the Contractor's performance and Site conditions.
- B. DWSD Standard Specifications (dated May 2023) as listed on the DWSD website shall be referenced and used as relevant to the performance of the Contract Work.
- C. DWSD Standard Details may be included for reference in the Drawings or Contract Documents. All DWSD Standard Details as listed on the DWSD website shall be used and referenced as relevant to the performance of the Contract Work.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 11 00



01 11 00 - 3
SUMMARY OF WORK
DWSD Special Specification
March 2025

SECTION 01 14 00 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements.
2. Private Land.
3. Planned Construction Locations.
4. Open Excavations.
5. Test Pits.
6. Cooperation within this Contract.
7. Protection of Construction and Equipment.
8. Precautions during Adverse Weather.
9. Confined Space Entry.

1.2 REQUIREMENTS

A. Coordination:

1. Furnish personnel, equipment, and construction aids that will be efficient, appropriate, and sufficient to secure a satisfactory quality of work as defined by the Specification and a rate of progress that will ensure the completion of the Work within the time stipulated in the Contract Documents.
2. Coordinate with MISS DIG (811) and other Agencies having jurisdiction over property or structures in and around the construction area and locate all utilities potentially affected by the Work.
3. If at any time, Contractor's resources appear to the Engineer to be inefficient, inappropriate, or insufficient to achieve the required quality or rate of progress of the Work, the Engineer may ask the Contractor to increase the efficiency, change the character, or increase the number of personnel and equipment to meet the schedule of the Contract. Failure of the Engineer to give such direction shall in no way relieve the Contractor of its obligations to secure the required quality or rate of progress of Work.

B. Hours of Work:

1. Contractor may normally prosecute the Work during the daylight hours of any weekday excluding holidays, providing that the operations are conducted as to not create a public nuisance or disturb the peace. The Contractor may only perform the Work during the daylight hours and no earlier than 7 AM or later than 7 PM. However, should the Contractor be stopped, by order of a public authority, from working at times that are contrary to or in



violation of any law, ordinance, permit, or license, the Contractor shall not be entitled to an extension of time due to such stoppages.

2. At the beginning of Work, Contractor shall notify the Engineer in writing, of the days and hours that will constitute a normal work week. Whenever the Contractor intends to depart from the specified work week, the Contractor must request approval in writing so that the Engineer may review the request for approval and make the necessary arrangements to have required inspectors assigned to the Work. The request shall be made at least two (2) calendar days prior to the requested deviation from the specified work week. If an emergency arises that would require work to be performed outside of the normal working hours of the specified work week to save or protect life or property, the requirements of the request for approval would be waived. Notify the Engineer as soon as the Contractor determines that an emergency exists that necessitates a change in or extension of the normal hours of work. However, the Contractor's determination of the existence of an emergency is subject to review and revision by the Engineer.

C. Shutdowns:

1. A Shutdown shall be defined as a portion of the normal operation of a unit or conduit that has to be suspended or taken out of service in order to perform the specified Work. For each shutdown, compile an inventory of labor and materials required to perform tasks, an estimate of the time required, including time for the Owner to take down and start up the unit or conduit, and a written description of steps required to complete all tasks. The inventory, the estimate, and written procedures shall be submitted to the Engineer for review 30 calendar days prior to the proposed start date of the shutdown. Request, in writing from the Engineer, approval for each shutdown a minimum of 14 calendar days prior to the proposed shutdown date. No shutdown shall be initiated until the inventory of materials and labor is verified by the Engineer on site prior to the proposed start date.
2. The Work required herein and any other Work required by the Engineer that may interrupt the normal operations shall be accomplished at such times that will be convenient to the Owner whether during the nighttime hours or during weekend hours. The Contractor shall include in its bid price all overtime and premium time required for performing any work associated with these shutdowns.
3. Have on hand and located in close proximity to the Work area, all temporary and permanent tools, equipment, spare parts, and materials necessary to complete each Work category without interruptions. Adequate numbers of personnel shall be scheduled for each shutdown, so that the Work shall be accomplished within the specified time frame. The Engineer shall be satisfied that Contractor has complied with these requirements, to the fullest extent possible, before shutdowns will be authorized.
4. If Contractor's procedures cause an unscheduled shutdown of the facilities, perform all Work necessary to immediately re-establish satisfactory operation. Notify the Engineer, in writing, immediately of any unscheduled shutdown. Permit Owner's personnel to work with Contractor's personnel, as deemed necessary by the Owner, to maintain the facilities in continuous satisfactory operation. Fines levied by regulatory agencies resulting from unscheduled shutdowns or interruptions of continued safe and satisfactory operation of the facilities shall be the Contractor's responsibility, if it is demonstrated that Contractor was negligent in the Work or did not exercise proper precautions in conducting the Work.



5. Shutdowns of Electrical and Control Systems: Contractor and the Owner shall each lock out and tag circuit breakers and switches operated by the Owner and shall check cables and wires to be sure that they are de-energized to ground potential before Work begins. Upon completion of the Work, remove the locks and tags and notify the Engineer that the facilities are available for use. The Owner will then remove its locks and place facilities back into use. The Contractor shall supply own locks. Locks shall be checked at the beginning of each shift. Contractor shall comply with the Owner's Lockout/Tagout procedure. Shutdowns for any electrical wiring or I&C cables shall be coordinated with the Owner.

D. General Requirements:

1. Develop a program in cooperation with the Engineer to provide for the construction and putting into service the new work in the most orderly manner possible and in coordination with continued operations of the facilities and all ongoing construction projects at the time of construction of this Project.
2. Adhere to such program except as deviations therefrom are expressly permitted in writing by the Engineer.
3. Plan all work of connecting with, cutting into, and reconstructing existing pipes or structures so as not to interfere with the operation and maintenance of the existing facilities. Schedule work that will affect operation of existing facilities for the shortest possible time and when the demands on the facilities best permit such interference, even though it may be necessary to work outside of normal working hours to meet these requirements.
4. For water-main work, dewater process and utility pipelines back to the nearest closed valve at the beginning of each piping shutdown.
5. Provide all appropriate means and methods to ensure that water services in the areas and facilities associated with this Project are maintained uninterrupted during construction.
6. Make minor modifications in such work relating to existing structures as may be necessary, without additional compensation.
7. Before starting any work that may interfere with the operation of the existing facilities, do all possible preparatory work and see that all tools, materials, and equipment to be installed are made ready and at hand.
8. Conduct construction operations in the most orderly manners such that these operations:
 - a. Interfere as little as possible with the operations of the existing facilities and other ongoing Construction Contracts.
 - b. Does not damage existing equipment, structures, etc., or cause disruption to the operations of the existing facilities.
9. Make no claim for additional compensation by reason of delay or inconvenience in adapting construction operations to the need for continuous operations of the existing facilities.
10. Not begin any portion of Work that will interfere with continued operations of the facilities until such schedule is accepted and approved in writing by the Engineer.
11. Contact the Systems Control Center fourteen (14) days prior to any required 'Sewer Shutdown' or 'Manned Entry' required within the sewer. Complete an Equipment Shutdown Request form and call 313-267-6000 to inform Systems Control of the planned



shutdown and entry. Equipment Shutdown Request form is found attached to this Specification.

1.3 PRIVATE LAND

- A. Do not enter or occupy private land outside of the designated construction area or property limits, except as specified in the Contract Documents.
- B. Provide the Engineer with copies of any agreements made by the Contractor with private landowners or other government agencies (i.e., Detroit Land Bank) to occupy or use their property.
- C. Take photographs and/or video to document existing private land conditions and post construction conditions. The photographic documentation shall comply with Section 02 22 30 Pre-Construction Video and Photographic Record.

1.4 PLANNED CONSTRUCTION LOCATIONS

- A. The Work shall be installed substantially as indicated on the Drawings and in the Contract Documents.
- B. Where pipe fittings or other items are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve the Contractor from installing different or additional items where required to complete the Work.

1.5 OPEN EXCAVATIONS

- A. Comply with all requirements of MISS DIG Public Act 174 including contacting MISS DIG, hand excavation near utilities, and contacting 911 in case of emergency.
- B. Contractor shall schedule in advance with the Engineer all open excavations and coordinate in such a way to minimize disruption and provide full restoration as soon as possible.
- C. Excavations shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926 Subpart P-Excavations, and OSHA requirements. Contractor shall safeguard all open excavations by providing barricades, caution signs, lights, and other means to prevent accidents to persons or damage to property. Contractor shall provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Contractor shall remove bridges provided for access during construction when no longer required. The length of an open trench shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench not remain open overnight.



- D. Take precautions to prevent injury to personnel due to open trenches. All trenches, excavated materials, equipment, or other obstacles that could be dangerous to the public, shall be well lit at night.

1.6 TEST PITS

- A. Excavate and Backfill test pits for the purpose of locating underground pipelines or structures in advance of the construction in accordance with Project Specifications and Drawings.
- B. Immediately backfill test pits after their purpose has been satisfied and restore and maintain the surface in accordance with Project Specifications and Drawings.

1.7 COOPERATION WITHIN THIS CONTRACT

- A. Contractor and its subcontractors shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting, patching, drilling, and fitting shall be carried out by the trade or subcontractors having jurisdiction, unless otherwise indicated herein or directed by the Engineer.
- C. Phase the Work so that all chases or openings for the installation of its own or any other contractor's or subcontractor's work are available to prevent delays. Contractor or its subcontractor shall properly set all sleeves or forms delivered to the work area in ample time to prevent delays. Contractor or its subcontractor shall accurately locate all chases, openings, and sleeves and shall be the proper size and shape. Contractor shall consult with the Engineer and any other contractors and subcontractors related to this Work.
- D. In case of failure to leave or cut all such openings or have all such sleeves provided and set in the proper time, cut them or set them afterwards at no additional expense to the Owner. In so doing, confine the cutting to the smallest extent possible consistent with the Work to be done. In no case shall piers or structural members be cut without the written consent of the Engineer.
- E. Carefully fit around, close up, repair, patch, and point around the Work specified herein to the satisfaction of the Engineer.
- F. Contractor shall carefully perform all of the Work using workers competent to do such work and with the proper tools. Power tools shall not be used except where the type of tool proposed can be used without damage to any Work or structures and without inconvenience or interference to the operation of any facilities. The Contractor is entirely responsible for such damage, inconvenience, or interference resulting from the use of such tools.
- G. Do not alter or permit any worker or subcontractor to alter the Work of any other contractor or subcontractors working on said job, except with written consent of the other contractor or subcontractors whose Work is to be altered or with the written consent of the Engineer. All cutting, patching, or repairing made necessary by the negligence, carelessness, or incompetence



of the Contractor or any of its subcontractors, shall be the responsibility of the Contractor and shall be done by or at the expense of the Contractor.

1.8 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. In accordance with the Contract Documents, carefully protect all newly constructed Work. Contractor shall also minimize wheeling, walking, or placing heavy loads on the Site, and reconstruct, at its own expense, any portions of the Site that are damaged.
- B. Protect all structures in a manner approved by the Engineer. If, in the final inspection of the Work, any defects, faults, or omissions are found, Contractor shall repair or remove and replace the defects, faults, or omissions, utilizing specified materials and workmanship, without extra compensation for the materials and labor required. Maintain and repair the construction and other Work undertaken herein for the warranty period described in the Contract Document or until the end of the maintenance period, whichever is longer.
- C. Take all necessary precautions to prevent damage to any part of the Work due to water pressure during and after construction until such Work is accepted by the Engineer.

1.9 WINTER SHUTDOWN PROVISIONS

- A. The winter shutdown requirements as listed below will pertain to water main and sewer Capital Improvement Plan (CIP) Contracts. All other Contracts shall be excluded from winter shutdown provisions, unless otherwise notified by the Engineer.
- B. Due to the extreme inconvenience to Detroit Water and Sewerage customers and the public in general, and also due to the impossibility of performing prompt, permanent restoration during the winter season, work on water main and sewer CIP Contracts shall be temporarily halted after the second week of November or as authorized by the Engineer. The Contract work shall promptly resume during the third week of April of the following year or as authorized by the Engineer.
- C. All requests to continue Work during the winter season shall be submitted via request for information (RFI) for approval from the Engineer at least thirty (30) days prior to winter shutdown. The RFI shall include as a minimum:
 - 1. Anticipated winter work schedule.
 - 2. Scope of work.
 - 3. Number of crews.
- D. The following items shall be completed by the Contractor prior to winter shutdown:
 - 1. All Contractor's equipment shall be removed from the Site.
 - 2. All pipe and materials not incorporated in the Work shall be removed from the Site.



3. Hard surfaces, where permanent restoration has not been made, shall have stone and cold patch installed subject to approval by the Engineer.
 - a. All hard surfaces must be restored within 30 days per the Contract unless otherwise stated in the Contract Documents.
 4. All berm areas where mulched seeding has not been placed shall be rough graded and left free of depressions and piles of soil.
 5. Repair of all known water main leaks.
 6. Pumping out of all hydrants that were used.
 7. Cleaning out of catch basins where required.
- E. The above list is not inclusive. The Site(s) shall be made safe to the general public and abandoned in a manner to protect the Work. All winter shutdown provisions shall be performed to the satisfaction of the Engineer. All winter shutdown provisions are incidental to the cost of the Contract and no additional payment shall be allowed.

1.10 PRECAUTIONS DURING ADVERSE WEATHER

- A. Take all necessary precautions in reasonable anticipation of and during adverse weather so that the Work may be done properly and satisfactory in all respects. Protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means. All protection during adverse weather must be securely fastened.
- B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will occur, and proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means resulting in a moist or a dry atmosphere according to the particular requirements of the Work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used. Provide suitable means of protection to prevent freezing below slabs and any other Concrete Work to frost heave. This shall include all existing and new facilities. If the Contractor decides to continue working in cold weather, the Contractor shall be responsible for following all cold-weather provisions as specified in the Contract Documents.

1.11 CONFINED SPACE ENTRY

- A. Follow applicable confined-space entry procedures.
- B. At the preconstruction meeting, submit to the Engineer a copy of the Contractor's Safety Plan for confined-space entry in accordance with current OSHA and MIOSHA requirements. Prior to entry into any confined space, submit to the Engineer a copy of the daily entry permit in accordance with current OSHA and MIOSHA requirements.
- C. Perform all Work in accordance with the latest edition of Construction Safety Standards as adopted by the Michigan Department of Labor Construction Safety Standards for Occupational Health.



- D. Perform all Work in accordance with the latest edition of Michigan Department of Environment, Great Lakes, and Energy Occupational Health Standard for Construction.
- E. Comply with the latest edition of the requirements, specifications, and standards as provided for under the Michigan Occupational Safety and Health Act., as amended and in force at the date thereof, and all other applicable Owner requirements and Federal, State and Local requirements, ordinances, statutes, and laws.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials for construction aids.
- B. Utilize new or used materials for construction aids only if they are suitable for the intended purpose and do not violate requirements of applicable laws, ordinances, codes, and standards.
- C. Maintain facilities and equipment in first-class condition.

2.2 CONSTRUCTION AIDS

- A. Provide construction aids and equipment necessary to facilitate the execution of the Work, such as scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment. Refer to respective sections for particular requirements for each trade.
- B. When permanent stair framing is in place, provide temporary treads, platforms, and railings for use by construction personnel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Consult with the Engineer, review site conditions and factors that will affect construction procedures and identify necessary construction aids.
- B. Determine if adjacent properties and public facilities will be affected by execution of the Work and develop strategies to address impacts.

3.2 INSTALLATION

- A. Installation: According to OSHA/MIOSHA standards and manufacturer's instructions.



3.3 REMOVAL

- A. Completely remove temporary materials, equipment, and services when construction needs can be met by use of permanent construction and at the completion of the Work. Remove foundations and underground construction aids. Grade areas of the site affected by temporary installations to required elevations and slopes and clear fire area.
- B. Clean and repair any damage caused by installation or use of temporary facilities. Restore permanent facilities used for temporary purposes to original condition unless otherwise specified.

END OF SECTION 01 14 00



01 14 00 - 9
WORK RESTRICTIONS
DWSD Special Specification
March 2025



Detroit Water & Sewerage Department

735 Randolph Street, Detroit, MI 48226-2830

Utility SHUTDOWN REQUEST (ESR) /

Utility Address (Intersection):			
Utility Out of Service:			
Impact of Shutdown:			
Start Date & Time:			
Reason for Access / Shutdown:			
Additional Remarks:			
Traveling Operator Required: ☐ Yes/ ☐ No			

REQUESTOR		☐ Approved ☐ Not Approved	
Signature:		Name:	Mazin Malallah
Name:		SIGNATURE & DATE	
Title:		Title:	Field Engineering/Team Leader
Company:		E. Mail:	malallahM@detroitmi.gov
E. Mail:			

For all Contracts Managed by Field Eng.

☐ Approved ☐ Not Approved		☐ Approved ☐ Not Approved	
Name:	Mohamad Jaber	Name:	Sam Smalley
SIGNATURE & DATE		SIGNATURE & DATE	
Title:	Field Engineering/ Supervisor	Title:	Asset Manager
E. Mail	jaberM@Detroitmi.gov	E. Mail	Fax:

For all Shutdowns Affecting Water Treatment Plants

☐ Approved ☐ Not Approved	
If Required	
Name:	Biren Saparia
SIGNATURE & DATE	
Title:	SCC Manager
E. Mail	

Notes:
1. Requests must be submitted 3 days in advance

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Permit allowances
2. Provisional allowances
3. Contaminated Material allowances
4. Schedule of Values
5. Application for Payment
6. Change procedures
7. Defect assessment
8. Unit prices
9. Measurement and Payment General Notes
10. Unit Price Schedule

1.2 PERMIT ALLOWANCES

- A. If required, the Contract will include a stipulated sum/price for reimbursement of acquired permits as a permit allowance.
- B. Cost of permit acquired by Contractor and applicable taxes are included in permit allowances. Any cost the Contractor deems necessary for overhead, profit, and other expenses on account of a permit allowance must be included elsewhere as part of the bid in the total Contract price.
- C. Contractor Responsibilities:
 1. Arrange for and acquire all necessary permits as stated in the Contract documents.
 2. Upon delivery, promptly inspect products for completeness, damage, and defects.
- D. Payment under permit allowances will be on an actual-cost basis. The receipts for permits that have been secured by the Contractor shall be presented to the Owner for reimbursement.
- E. At closeout of Contract, funds remaining in the permit allowance will be credited to Owner by Change Order.

1.3 PROVISIONAL ALLOWANCES

- A. If required, the Contract will include a stipulated sum/price for use upon Owner's instruction as a provisional allowance.



- B. Contractor's costs for products, delivery, installation, labor, payroll, taxes, equipment rental, overhead, and profit will be included in Construction Change Authorizations authorizing expenditure of funds from this provisional allowance. Insurance and Bond premiums shall be included elsewhere in the bid and are not redeemable in the provisional allowance.
- C. Funds will be drawn from provisional allowance only by a Construction Change Authorization.
- D. At closeout of Contract, funds remaining in the provisional allowance will be credited to Owner by Change Order.

1.4 CONTAMINATED-MATERIAL ALLOWANCES

- A. If required, included in the Contract will be a stipulated sum/price for reimbursement of payment associated with the removal of contaminated material via a contaminated material allowance.
- B. Requirements for the handling, hauling, disposal, and all associated costs and fees of hazardous waste materials, non-hazardous waste materials, and petroleum contaminated soils will be included in the reimbursement cost of the contaminated-material allowance. If chemicals of concern found in groundwater are of a nature or concentration that necessitates handling the groundwater as hazardous material, reimbursement of costs will be provided under the contaminated material allowance.
- C. All costs for products, delivery, installation, labor, payroll, taxes, equipment, equipment rental, overhead, profit, field monitoring, on-site testing and laboratory testing for contaminated materials will be included elsewhere in the bid in the total Contract price and will not be included in the reimbursement via contaminated material allowance.
- D. Payment under contaminated material allowances will be on an actual-cost basis. The receipts for all reimbursement costs for the handling, hauling, disposal, and all associated costs and fees that have been incurred by the Contractor shall be presented to the Owner for reimbursement.
- E. At closeout of Contract, funds remaining in contaminated material allowance will be credited to Owner by Change Order.

1.5 SCHEDULE OF VALUES

- A. Within the deadline established in the Contract Documents, the Contractor shall submit a Schedule of Values for review and acceptance.
- B. Use Unit Price Schedule of this specification. Identify each line item with number and title of major bid item followed by a schedule of values for payment including division of all Lump Sum items into a schedule of values for payment.
- C. Revise Unit Price Schedule to list approved Change Orders and Construction Change Authorizations with each Application for Payment.



1.6 APPLICATION FOR PAYMENT

- A. Content and Format: Transmit application for payment as specified in the Agreement. Use Schedule of Values for listing items in Application for Payment.
- B. Payment Period: In accordance with the agreement between Owner and Contractor.
- C. Substantiating Data: When Engineer requires substantiating information, submit data justifying dollar amounts in question.
- D. Include the following as mandatory with each Application for Payment:
 - 1. Partial release of liens from all Subcontractors and vendors.
 - 2. An affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 - 3. Construction Progress Schedule revised and current as specified in Section 01 32 16 – Construction Progress Schedule.
 - 4. Monthly Safety Reports as specified in Section 01 35 29 – Safety Program.
 - 5. Updated Schedule of Submittals as specified in Section 01 33 00 – Submittal Procedures.

Include the following with each Application for Payment if requested by the Engineer:

- 1. Current construction photographs specified in Section 01 33 00 - Submittal Procedures.
- 2. Record Documents as specified in 01 70 00 – Execution and Closeout Requirements, for review by Owner, which will be returned to Contractor.
- 3. Affidavits attesting to off-Site stored products.
- 4. Test reports and documentation.
- 5. Updated Schedule of Submittals.
- 6. Application for Payment Bid Items supporting documentation, submittals, acceptance of work documents, etc.

1.7 CHANGE PROCEDURES

- A. Submittals: Submit the name of an individual who is authorized to receive change documents and is responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Engineer of any error, inconsistency, omission, or apparent discrepancy.
- C. Allot time in construction scheduling for liaison with Engineer and establish procedures for handling Requests for Interpretations (RFIs) and clarifications.
 - 1. Use e-Builder for requesting interpretations.
 - 2. Engineer will respond with a direct answer on e-Builder or via a Field Order.



- D. Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on a Field Order form.
- E. Contractor shall submit a Change Proposal to propose changes on the Work. The Contractor shall submit the request for change to the Engineer, describing the proposed change and its full effect on the Work. Contractor shall include a statement describing reason for the change and the effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on the Work by separate or other Contractors.
- F. Work Change Directive: Engineer may issue Work Change Directives, signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. The directive will describe changes in the Work and designate method of determining any change in Contract Sum/Price or Contract Time.
- G. Stipulated Sum/Price Change Order: Based on Work Change Directive and Contractor's price quotation or Contractor's request for Change Order as approved by Engineer.
- H. Unit Price Change Order: For Contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of that which are not predetermined, the Contractor shall execute Work under Work Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.
- I. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.
- J. Contractor shall maintain detailed records of Work done on time and material basis and provide full information required for evaluation of proposed changes and to substantiate costs for changes in the Work.
- K. Document each quotation for change in Project Cost or Time with sufficient data to allow evaluation of quotation.
- L. Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
- M. Correlation of Contractor Submittals:
 - 1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
 - 2. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of Work affected by the change and resubmit.
 - 3. Promptly enter changes in Record Documents.



1.8 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct appropriate remedy or adjust payment.
- C. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.
- D. The Engineer's authority to assess defects and identify payment adjustments is final.
- E. Payment will not be made for unacceptable products for any of the following reasons:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from transporting vehicle.
 - 4. Products placed beyond lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected products.

1.9 UNIT PRICES

- A. Authority: Measurement methods are delineated as indicated below in the unit price schedule.
- B. Take measurements and compute quantities. Engineer may verify measurements and quantities.
- C. Unit Quantities: Quantities and measurements indicated on Bid Schedule are for Contract purposes only. Actual quantities provided shall determine payment.
 - 1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at contracted unit sum/prices.
 - 2. When the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities and Unit Prices in the Bid Schedule) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Bid Schedule, Owner or Contractor may claim a Contract Price adjustment.
- D. Payment includes full compensation for (1) required labor, products, tools, equipment, plant and facilitates, transportation, services, and incidentals; (2) erection, application, or installation of item of the Work; and (3) overhead and profit.
- E. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.



F. Measurement of Quantities:

1. Weigh Scales: Inspected, tested, and certified by applicable State weights and measures department within past year.
2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
3. Metering Devices: Inspected, tested, and certified by applicable State department within past year.
4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel, or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
5. Measurement by Volume: Measured by cubic dimension using mean length, width, and height or thickness.
6. Measurement by Area: Measured by square dimension using mean length and width or radius.
7. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
8. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

1.10 MEASUREMENT AND PAYMENT GENERAL NOTES

All associated costs for these items shall be included in the total price of the Contract and among the bid items included in the bid schedule. Owner will not pay for the following items separately:

A. Insurance and Bonds

1. The costs of all required insurance and bonds as listed in the bid schedule and the Contract documents will not be paid for separately and shall be included in the unit prices of this Contract.

B. Field Office

1. If the Contractor wishes to operate out of a field office for any portion of the Work the costs will be included within the unit prices of this Contract.

C. Traffic Control

1. The costs of all materials, labor, and equipment for traffic control and closures will not be paid for separately and shall be included in the unit prices of this Contract.

D. Security Clearances and Communications

1. All Contractor requirements for security clearances and communications as identified in the condition assessment portions of Section 33 01 30.18 will not be paid for separately and shall be included in the unit prices of this Contract.
2. The Engineer will provide the Contractor with print-ready door hanger files it has identified as necessary to properly inform the community of Work planned. All door hangers will be printed and delivered by the Contractor.



E. Miscellaneous Field Activities

1. Any flow control to temporarily retain flow or to remove standing water is incidental to the contract.
2. The use of the cleaning equipment in conjunction with the CCTV camera inspection shall not be considered an additional cleaning pass but is incidental to the contract.
3. Time spent searching for and locating a manhole is incidental to the contract.
4. Time spent exposing buried manholes in unpaved areas to a depth of two (2) feet is incidental to the contract.
5. Time spent backfilling buried manholes at the confirmation of the Engineer that have been exposed in unpaved areas to a depth of two (2) feet and restoration for full reinstatement of all items including, but not limited to seeding and sod for backfilled manhole locations is incidental to the contract.
6. Trees smaller than six (6) inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall be removed as part of the work and is incidental to the contract.
7. Time spent clearing restricted alleyways or easements to enable the mobilization of inspection and cleaning equipment is incidental to the contract.
8. All costs associated with protection of hydrants for water supply are incidental to the contract.

1.11 UNIT PRICE SCHEDULE

The measurement and payment descriptions of this section provide a summary of the pay items. Please refer to the individual technical specifications for additional details on general requirements, materials, and execution.

Mobilizations/Demobilization

- a. The Contractor shall furnish all necessary personnel, equipment, labor, and materials for movement of equipment and personnel to the project site.
- b. The lump sum unit price bid for Mobilization/Demobilization will not be more than 5% of the total of all other bid items of the original proposal excluding any provisional allowance and will include submittal of construction quality plan, insurance and bonds, schedule of values with proposed payment schedule including a project breakdown of all Lump Sum items, shop drawings, progress schedule, Site cleaning, dust control, field office, staging area, construction layout and staking, erosion and sediment control, and Demobilization costs including punch list completion, removal of equipment and final site clean-up.
- c. Items included in the lump sum Schedule of Values including Site cleaning, field office, staging area and others listed above must adhere to the requirements of the specifications when performed in order to be accepted for payment.
- d. Contractor to submit schedule of values for Mobilization/Demobilization item subject to approval by the Owner.
- e. Contractor shall include all costs of mobilization and demobilization for any scheduled winter



shutdown or other planned work stoppage as listed in the Contract Documents in the cost of this bid item.

- f. Combined payment for Mobilization and the corresponding schedule of values will equal two-thirds (67%) of the pay items for Mobilization/Demobilization. Combined payment for Demobilization and the corresponding schedule of values shall equal one-third (33%) of the pay items for Mobilization/Demobilization.
- g. Payment for Demobilization costs will be made in conjunction with the demobilization of the Site including punch list completion, removal of equipment and final site clean-up, subject to the Contractor's compliance with the requirements specified in the Contract Documents.

Traffic Control

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for traffic control including furnishing, installing, maintaining, relocating, replacing defective items and removal of the following: traffic control devices, temporary hot-mix asphalt, temporary stone, plating, and temporary pavement marking for the purposes of traffic control and restoring public access shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price "Traffic Control...LS" complete in place.
- c. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Safety Program

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the submittal of the Contractor Safety Program as described in the technical specifications including but not limited to the Project Specific Safety Plan, Emergency Response Plan, and personnel training shall be included in the cost of the pay item.
- b. This item shall include the Project Specific Safety Plan preparation, submittal, and all coordination and resubmittals associated with the reviews until final approval.
- c. The accepted quantities for this work will be paid for at the contract unit price "Safety Program...LS" complete in place.
- d. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Pre-Construction Site Documentation

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for pre-construction site documentation as described in the technical specifications including resident notifications, photographic documentation, and site video shall be included in the cost of the pay item.



- b. The accepted quantities for this work will be paid for at the contract unit price “Pre-Construction Site Documentation...LS” complete in place.
- c. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Sidewalk, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sidewalk removal including saw cutting, removing, hauling, and disposal of existing subgrade, sidewalk base material and sidewalk shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. Payment under this item will include sidewalk removal to full depth of existing sidewalk and ADA ramps regardless of depth of existing sidewalk.
- d. The accepted quantities for this work will be paid for at the contract unit price “Sidewalk, Rem...SYD” complete in place.

Sidewalk, Conc, 4 inch

Sidewalk, Conc, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sidewalk installation including preparation of subgrade; furnishing and compacting sidewalk base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete sidewalk shall be included in the cost of the pay item. Removal of existing sidewalk shall be paid for separately.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Sidewalk, Conc...SYD” complete in place.

ADA Ramp, w/Curb

- a. The costs of materials, labor, equipment, and all other incidental materials including preparation of subgrade; furnishing and compacting sidewalk base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing,



- sealing concrete sidewalk, and detectable warning tiles necessary for the installation of ADA ramp shall be included in the cost of the pay item.
- b. Payment under this item will include all ADA sidewalk, ramps, and attached curb.
- c. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- d. The accepted quantities for this work will be paid for at the contract unit price “ADA Ramp, w/ Curb...SYD” complete in place.

Curb, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of curb removal including saw cutting, removing, hauling, and disposal of curb shall be included in the cost of the pay item.
- b. Removal of integral curbs including all saw cutting will be included in the payment of this item.
- c. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- d. The accepted quantities for this work will be paid for at the contract unit price “Curb, Rem...LFT” complete in place.

Curb, Conc

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of Concrete Curb including preparation of subgrade; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete curb shall be included in the cost of the pay item. Removal of existing curb shall be paid for separately.
- b. Integral curb, when poured with roadway pavement or sidewalk will be included in the cost of this pay item and will be paid for on a linear foot basis for curb installed. ADA, ramp with integral curb will be paid for separately.
- c. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- d. The accepted quantities for this work will be paid for at the contract unit price “Curb, Concrete...LFT” complete in place.



Curb and Gutter, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of curb and gutter removal including saw cutting, removing, hauling, and disposal of curb and gutter shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. The accepted quantities for this work will be paid for at the contract unit price “Curb and Gutter, Rem...LFT” complete in place.

Curb and Gutter, Conc

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of Concrete Curb and Gutter including preparation of subgrade; furnishing and compacting aggregate base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete curb shall be included in the cost of the pay item. Removal of existing curb shall be paid for separately.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Curb and Gutter, Conc...LFT” complete in place.

Driveway, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of driveway removal of various thicknesses including saw cutting, removing, hauling, and disposal of existing subgrade, aggregate base and pavement shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. Payment under this item will apply to full depth of existing driveway for both residential and commercial driveways.
- d. The accepted quantities for this work will be paid for at the contract unit price “Driveway, Rem...SYD” complete in place.

Driveway, Conc, 4 inch



Driveway, Conc, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of residential driveway installation including preparation of subgrade; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete driveway shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Driveway, Conc...SYD” complete in place.

Pavement Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of alley, roadway or any other quantifiable pavement removal of various thicknesses to full depth of pavement including saw cutting, removing, hauling, and disposal of existing aggregate base, concrete base, and pavement with or without reinforcement outside of approved water and sewer structure and pipe trench limits shall be included in the cost of the pay item.
- b. Trench limits are as defined in the Pavement Restoration Standard Detail as the maximum trench width excavation plus additional width to extend to existing concrete base joint limits.
- c. Payment under this item will only be made for additional pavement removals located outside any approved water main and sewer trench limits as defined in this pay item and in the Pavement Restoration Detail. Surface, base, and trench removals to the full depth and width required to replace the concrete base from existing roadway joint to joint will be included in applicable structure and pipe items for water main and sewer as listed in the measurement and payment descriptions.
- d. No extra payment will be made under this item for removal of pavement due to the expansion of trench width by the Contractor for the purpose of benching or sloping beyond the acceptable trench limits.
- e. This item will include removal of concrete paved alley and concrete paved roadway outside the approved trench limits or as directed by the Engineer.
- f. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- g. The accepted quantities for this work will be paid for at the contract unit price “Pavement, Removal...SYD” complete in place.

Aggregate Base, No. 22A, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the



furnishing, placing and compacting of aggregate base shall be included in the cost of the pay item.

- b. The accepted quantities for this work will be paid for at the contract unit price “Aggregate Base, No. 22A, 6 inch...SYD” complete in place.

Concrete Base, 8 inch
Concrete Base, 10 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of concrete base installation including furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete base shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. When restoring within Detroit DPW right of way, the pavement removal outside of the approved trench will be measured to comply with DPW pavement requirements which state that the removal and replacement of concrete base must be from existing joint to joint.
- d. The accepted quantities for this work will be paid for at the contract unit price “Concrete Base...SYD” complete in place.

HMA Pavement, Rem, Milling, 2 inch Depth up to 4 inch Depth

- a. The costs of materials, labor, equipment and all other incidental materials necessary for the removal of HMA pavement materials including milling, hauling, and disposal shall be included in the cost of the pay item.
- b. Milling shall be performed in accordance with Detroit DPW requirements which state to mill HMA pavement beyond the area of the trench pavement removal in order to determine location of underlying concrete base pavement joints and shall be a minimum width of one lane, full roadway, or as shown on the plans.
- c. Milling within the trench limit is included in the cost of water main pipe and shall not be paid for separately.
- d. Payment for HMA Pavement removal via milling will only be made for actual pavement milled beyond the trench limits of any excavated trench.
- e. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, Removal, Milling...SYD” complete in place.



HMA Pavement, 36A, 1.5 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing tack coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. Permanent pavement markings are to be furnished and installed following the acceptance of HMA Pavement installation and are to be in accordance with Michigan Manual on Uniform Traffic Control Devices and MDOT Pavement and Standard Marking Plans and MDOT Standard Specifications Section 811. A survey of existing pavement markings prior to the Work shall be taken with final placement to be in-kind or as stated in the standards listed herein. The cost of all permanent pavement markings will be included in the cost of this pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 36A, 1.5 inch...SYD” complete in place.

HMA Pavement, 13A, 2 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing prime coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 13A, 2 inch...SYD” complete in place.

HMA Pavement, 5E3, 1.5 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing tack coat; furnishing, placing, compacting HMA pavement; and furnishing and placing permanent pavement markings shall be included in the cost of the pay item.
- b. Permanent pavement markings are to be furnished and installed following the acceptance of HMA Pavement installation and are to be in accordance with Michigan Manual on Uniform Traffic Control Devices and MDOT Pavement and Standard Marking Plans and MDOT Standard Specifications Section 811. A survey of existing pavement markings prior to the Work shall be taken with final placement to be in-kind or as stated in the standards listed herein. The cost of all permanent pavement markings will be included in the cost of this pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 5E3...SYD” complete in place.



HMA Pavement, 4E3, 2 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing prime coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 4E3, 2 inch...SYD” complete in place.

Concrete Paving, 9 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of concrete paving installation including preparation of subgrade; furnishing dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete paving shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The costs of material testing as described in the technical specifications including but not limited to concrete testing, compaction testing, and any associated field tests, lab tests or fees shall be included in the cost of the pay item.
- d. The accepted quantities for this work will be paid for at the contract unit price “Concrete Paving...SYD” complete in place.

Structure, Adjust Existing Casting to Grade

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the adjustment of existing structure casting to grade including removal and disposal of existing surface and furnishing, placing and compacting backfill shall be included in the cost of the pay item.
- b. In addition to structure adjustments indicated in the restoration drawings, all ‘replace adjusters’ and ‘frame/cover adjustments’ indicated in the drawings shall be paid for under this pay item.
- c. Payment under this item will include up to two (2) vertical feet of casting adjustment. Adjustment greater than this depth will be paid for under applicable chimney repair or replacement items.
- d. Adjustment of casting to finished grade of newly installed structures or existing structures within the sewer or manhole replacement alignment will not be paid for under this item and will be included in the cost of applicable manhole installation items. Structure, adjust existing



casting to grade will only be paid for under this item as indicated on the plans or when the existing frame and cover are to be adjusted outside the boundaries of trench excavation for proposed or existing structure work.

- e. Adjustment of existing casting to finished grade shall be made with adjustment rings per the manhole rehabilitation specification.
- f. Locating and exposing of buried manholes beneath six (6) inches or greater of pavement or hard surfaces will be paid for separately under Manhole, Locate and Raise to Grade.
- g. The accepted quantities for this work will be paid for at the contract unit price for “Structure, Adjust Existing Casting to Grade...EA” complete in place.

Mulched Seeding

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of mulched seeding installation including furnishing, placing, grading and watering topsoil and seed shall be included in the cost of the pay item.
- b. Costs associated with the maintenance of mulched seeding as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Mulched Seeding...SYD” complete in place.

Sodding

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sod installation including furnishing, placing, grading and watering topsoil and seed shall be included in the cost of the pay item.
- b. Costs associated with the maintenance of sod as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Sodding...SYD” complete in place.

Wood Fence, Remove and Replace, 4 foot

Wood Fence, Remove and Replace, 6 foot

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the



specifications shall be included in the cost of the pay item.

- c. The accepted quantities for this work will be paid for at the contract unit price “Wood Fence, Remove and Replace...LFT” complete in place.

Chain Link Fence, Remove and Replace, 4 foot

Chain Link Fence, Remove and Replace, 6 foot

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Chain Link Fence, Remove and Replace...LFT” complete in place.

Vinyl Fence, Remove and Replace, 4 foot

Vinyl Fence, Remove and Replace, 6 foot

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Vinyl Fence, Remove and Replace...LFT” complete in place.

Tree, Install

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of tree installation including but not limited to furnishing trees, clearing, excavation, removal of existing roots, preparation of subsoil, placing and preparing topsoil, planting, backfill, landscape edging, trimming, watering, fertilizing, applying herbicides and pesticides, installing erosion control measures during installation, tree stabilization, maintenance of trees, and warranty shall be included in the cost of the pay item.
- b. All trees greater than 6 inches in diameter that were removed due to work shall be replaced on a 1:1 basis. Plant new trees as close to the original location as possible. Contractor shall choose which tree species to plant in each replacement tree location, making sure that planting conditions comply with the notes stated in the planting schedule and the specifications.



- c. Location of tree installation shall be as directed by the Engineer. Trees shall only be installed on private property or city ROW. Trees shall not be installed above existing sewers or within sewer easements.
- d. Costs associated with the installation and maintenance of trees as prescribed in the specifications shall be included in the cost of the pay item.
- e. The accepted quantities for this work will be paid for at the contract unit price “Tree, Install...EA” complete in place.

Tree, Remove, 6 inch to 18 inch Diameter

Tree, Remove, Greater than 18 inch Diameter

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of tree removal of trees 6 inch or greater in diameter including but not limited to clearing, excavation, hauling, removal of existing roots and backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal of trees 6 inch or greater as prescribed in the specifications shall be included in the cost of the pay item. No payment will be made under this item for trees under 6 inches in diameter. All payment for trees removed under 6 inches in diameter will be included in the clearing and grubbing of applicable sewer, water or other installation and removal items.
- c. The approved method of tree diameter measurement will be the diameter at breast height (DBH), in which the tree diameter measurement is taken 4.5 feet above the ground for measurement and payment purposes.
- d. The accepted quantities for this work will be paid for at the contract unit price “Tree, Remove...EA” complete in place.



Sewer, Video Inspection, Circular and Non-Circular, Less than 18 inch Height
Sewer, Video Inspection, Circular and Non-Circular, Greater than 18 inch to 24 inch Height

- a. The costs of all equipment, labor, products, materials, cleaning, digital video recordings, and inspection reports will be included in the cost of sewer video inspection.
- b. Any flow control to remove standing water and debris shall be incidental to the contract.
- c. Contractor shall be responsible for fully cleaning the sewer segment within the manhole to manhole segment. This may require multiple passes and the use of any equipment necessary to fully clean the sewer to acceptable standards and remove any debris, obstructions, roots, root balls, grease, and settled deposits. No additional payment will be made for multiple passes or the use of alternate equipment which may be required to fully clean the sewer.
- d. Correction and re-submission of non-compliant submissions will be at Contractors own expense.
- e. No extra payment will be made for video inspection performed more than once on the same section of pipe.
- f. The height of non-circular sewers will be taken as the largest dimension.
- g. The Contractor is responsible for quality control review and final quality of the deliverable for all sewer reports. All deliverables to the Engineer will include all requirements and be delivered to the minimum standard as identified in the specifications. Payment will not be made until the required report submissions are accepted by the Engineer.
- h. The deliverable for this item is a report describing the following:
 - Inspection Detail Information
 - Date and Time of Inspection
 - Pipe Segment Reference Asset ID
 - Start Node
 - End Node
 - Start Location with Description
 - Service Connection Information for All Services Found on a Segment
 - Picture of service connection
 - Footage counter measurement in linear feet
 - The address of the service connection
 - Size of service connection
 - PACP code of largest observable defect, if service connection is defective
 - Percentage values of obstruction of lateral
- i. Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.



- j. Payment under this item will include all reverse setups required in order to obtain a complete inspection.
- k. Sewer inspections will be measured on a length basis for each size and type of sewer and paid for at the Contract Unit Price for “Sewer, Video Inspection...LFT”. Length to be paid for will be the total length of sewer inspected in accordance with this specification, accepted and measured by the Engineer.
- l. Measurement will be made horizontally at grade above the center line of the sewer from start manhole and sewer pipe interface to sewer pipe interface and finish manhole or from start manhole and sewer pipe interface to the point of abandoned inspection as confirmed by the steel tape or calibrated footage counter measurement.

Sewer, Video Inspection, Lateral

- a. The costs of all equipment, labor, and materials to conduct and deliver digital video recordings of private sewer laterals will be included in the cost of sewer video inspection.
- b. Inspections for this item will be conducted only on sewer laterals which have been replaced, during or after they have been replaced.
- c. Inspections for this item shall capture the condition of the private side of sewer lateral, from newly installed cleanout to the point of connection of the structure.
- d. The deliverable for this item is a .mp4 video in the following format:
 - [P/O Number]_[Address]_[Direction]_[YYYYMMDD]_[HHMMSS – 24 hour format].mp4
- e. Any flow control to remove standing water and debris shall be incidental to the contract.
- f. Correction and re-submission of non-compliant submissions will be at Contractors own expense.
- g. No extra payment will be made for video inspection performed more than once on the same section of pipe.
- h. The Contractor is responsible for quality control review and final quality of the deliverable for all sewer reports. All deliverables to the Engineer will include all requirements and be delivered to the minimum standard as identified in the specifications. Payment will not be made until the required report submissions are accepted by the Engineer.
- i. Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.
- j. Payment under this item will include all reverse setups required in order to obtain a complete inspection.



- k. Payment under this item will only be made once inspections have been received and approved by the Engineer.
- l. Sewer inspections will be measured by each inspection completed at the Contract Unit Price for "Sewer, Video Inspection...EA".

Sewer, External Point Repair, 6 inch
Sewer, External Point Repair, 10 inch
Sewer, External Point Repair, 12 inch
Sewer, External Point Repair, 15 inch
Sewer, External Point Repair, 18 inch
Sewer, External Point Repair, 20, 21, 22, & 24 inch

- a. The costs of all equipment, labor, materials, saw cutting, pavement removal, driveway removal, sidewalk removal, curb removal, excavation, excavation support, dewatering excavation, cleaning of existing sewer prior to and following open cut replacement, removal of existing sewer, temporary bulkheads, flow control, bypass pumping, hauling, disposal, grubbing, clearing of brush and trees less than 6 inches in diameter, bedding, backfill, compaction, pipe, pipe gaskets, pipe sleeves, pipe couplings, pre and post open cut replacement CCTV inspection video in accordance with the specifications, and incidentals shall be included in the cost of this item.
- b. This item shall be used to replace portions of public sewers connected to lateral replacements.
- c. Reconnection of sewer laterals within the accepted linear footage of open cut replacement will not be paid for under this item and will be included in the cost of other items
- d. The costs of material testing as described in the technical specifications including but not limited to compaction testing and any associated field tests, lab tests or fees shall be included in the cost of this pay item. The Engineer reserves the right to verify in-situ or lab testing results by enlisting a third-party to perform quality assurance at their discretion.
- e. Maximum payment for surface restoration items to restore open cut replacement trench shall be paid for at trench width as listed in the trench and pavement details in the DWSD standard drawings. No payment for aggregate base, concrete base course, asphalt, or other restoration items will be paid for outside of maximum payment width for the trench unless otherwise approved by the Engineer.
- f. Contractor shall perform CCTV prior to open cut replacement to verify location and length of repair required and to determine if deterioration of the pipe requiring additional repairs are required. CCTV shall take place prior to excavation activities and shall be delivered to the Engineer for approval on repair length and locations within the segment. Post repair CCTV in accordance with the specifications will be required and included in this item for the acceptance of work.



- g. Following open cut replacement, contractor shall be responsible for fully cleaning the sewer segment within the manhole to manhole segment. This may require multiple passes and the use of any equipment necessary to fully clean the sewer to acceptable standards and remove any debris, obstructions, roots, root balls, asphalt, concrete, grease, settled deposits, ingress deposits, encrustation, and vermin. No additional payment will be made for multiple passes or the use of alternate equipment which may be required to fully clean the sewer.
- h. All removals within the trench limits will be included in the cost of this item. Local agencies and permitting authorities may require additional removal and replacement in order to meet local surface roadway restoration requirements. All removals in order to adhere to these requirements will be included in the cost of this item. Installation of restoration items will not be paid for under this item and will be included in the cost of applicable restoration items.
- i. Surface, base, and trench removals to the full depth and width required to replace the concrete and aggregate base in existing concrete base from joint to joint will be included in this pay item.
- j. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- k. The accepted quantities for this work will be paid for at the contract unit price for “Sewer, Open Cut Replacement...LFT” of actual length of repair complete in place. Measurement shall be along the centerline of the sewer.

Sewer, Open Cut, Lateral Replacement, Up to 10 foot Depth
Sewer, Open Cut, Lateral Replacement, Greater than 11 foot Depth

- a. The costs of all equipment, labor, materials, saw cutting, pavement removal, driveway removal, sidewalk removal, curb removal, excavation, excavation support, dewatering excavation, removal of existing lateral, temporary bulkheads, flow control, bypass pumping, hauling, disposal, grubbing, clearing of brush and trees less than 6 inches in diameter, bedding, backfill, compaction, pipe, pipe gaskets, pipe sleeves, cleanout, pipe couplings and incidentals shall be included in the cost of this item.
- b. Reconnection of sewer laterals will be paid for under this item.
- c. The costs of material testing as described in the technical specifications including but not limited to compaction testing and any associated field tests, lab tests or fees shall be included in the cost of this pay item. The Engineer reserves the right to verify in-situ or lab testing results by enlisting a third-party to perform quality assurance at their discretion.
- d. Maximum payment for surface restoration items to restore open cut replacement trench shall be paid for at the trench width of 5 feet. No payment for aggregate base, concrete base course, asphalt, or other restoration items will be paid for outside of maximum payment width for the trench unless otherwise approved by the Engineer.
- e. All removals within the trench limits will be included in the cost of this item. Local agencies



and permitting authorities may require additional removal and replacement in order to meet local surface roadway restoration requirements. All removals in order to adhere to these requirements will be included in the cost of this item. Installation of restoration items will not be paid for under this item and will be included in the cost of applicable restoration items.

- f. Surface, base, and trench removals to the full depth and width required to replace the concrete and aggregate base in existing concrete base from joint to joint will be included in this pay item.
- g. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- h. The accepted quantities for this work will be paid for at the contract unit price for “Sewer, Open Cut, Lateral Replacement...LF” of replacement complete in place.

ALLOWANCES

Permit Allowance

Contaminated Material Allowance

Provisional Allowance

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 20 00



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PRICE AND PAYMENT PROCEDURES
DWSD Special Specification
March 2025

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coordination and Project Conditions.
- B. Pre-Construction Meeting.
- C. Site Mobilization Meeting.
- D. Progress Meetings.
- E. Pre-Installation Meetings.
- F. Close-Out Meeting.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. Coordination Drawings: Coordinate all portions of Work. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important.
- E. In addition to other meetings specified in this Section, hold regular weekly coordination meetings with personnel and Subcontractors to ensure coordination of Work.
- F. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.



- H. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRE-CONSTRUCTION MEETING

- A. Engineer will schedule and preside over meeting after Notice of Award.
- B. Attendance Required: Owner, Engineer, Design Consultant(s), Contractor, Contractor Quality Control Manager, Contractor Safety Manager, Superintendent, Project Manager, major Subcontractors, appropriate governmental agency representatives, utility representatives, and others as deemed appropriate by the Owner, Engineer, or Contractor.
- C. Minimum Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of Subcontractors and Suppliers, list of products, schedule of values, and Progress Schedule.
 - 5. Submission of list of future submittals as required per the Contract Documents and the Specifications.
 - 6. Designation of personnel representing parties in Contract, Field Engineer/Representative, and Engineer.
 - 7. Communication procedures.
 - 8. Procedures and processing of requests for interpretations, field decisions, submittals, substitutions, Applications for Payments, proposal request, Change Orders, and Contract closeout procedures.
 - 9. Projected Scheduling including mobilization.
 - 10. Regulatory requirements affecting project.
 - 11. Public Outreach.
 - 12. Critical Work Sequencing.
 - 13. Use of premises for work and storage areas.
 - 14. Security, safety, and housekeeping procedures.
 - 15. Procedures for laboratory testing of material requirements.
 - 16. Project close-out requirements.
 - 17. Application for Payment requirements - frequency and reporting period and required supporting documentation.
- D. Contractor: Record minutes and distribute to participants within two (2) days after meeting.

1.4 SITE-MOBILIZATION MEETING

- A. Engineer will schedule and preside over meeting at Project Site prior to Contractor occupancy.



- B. Attendance Required: Engineer, Owner, Contractor, special consultants, major Subcontractors, and others as deemed appropriate by the Owner, Engineer, or Contractor.
- C. Minimum Agenda:
 - 1. Use of premises by Owner and Contractor.
 - 2. Owner's requirements.
 - 3. Construction facilities and controls.
 - 4. Field office requirements and location.
 - 5. Material Storage.
 - 6. Staging Area.
 - 7. Temporary Utilities.
 - 8. Survey/Staking.
 - 9. Security and housekeeping procedures.
 - 10. Community Outreach.
 - 11. Schedules.
 - 12. Procedures for testing.
 - 13. Procedures for maintaining record documents.
 - 14. Schedule project specific software training.
 - 15. Requirements for startup of equipment.
 - 16. Inspection and acceptance of equipment put into service during construction period.
- D. Contractor: Record minutes and distribute to participants within two (2) days after meeting.

1.5 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at no less than monthly intervals.
- B. The Engineer will schedule meetings, prepare agenda with copies for participants, and preside over meetings.
- C. Attendance Required: Project superintendent, Contractor, major Subcontractors, Suppliers, professional consultants, Engineer, Owner, and others as deemed appropriate by the Owner, Engineering, or Contractor to address agenda topics for each meeting.
- D. Minimum Agenda:
 - 1. Safety Minute
 - 2. Minutes and Action Items from last meeting
 - 3. Safety reports
 - 4. Work performed since last meeting
 - 5. Work to be performed by next meeting
 - 6. Planned vs. Actual progress
 - 7. Issues impeding planned progress
 - 8. Submittals (Open, Upcoming, Outstanding)
 - 9. Processes (Open, Upcoming, Outstanding)



10. Visitors to the site (since last meeting)
11. QA Inspection Report Findings
12. Other relevant issues
13. Action Items

- E. Contractor: Record minutes and action items, and distribute to participants within two (2) days after meeting.

1.6 PRE-INSTALLATION MEETINGS

- A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific Section.
- C. Contractor to notify Engineer four (4) days in advance of meeting date.
- D. Prepare agenda and preside over meeting:
 1. Review conditions of installation, preparation, and installation procedures.
 2. Review coordination with related Work.
- E. Contractor: Record minutes and distribute to participants within two (2) days after meeting.

1.7 CLOSE-OUT MEETING

- A. Schedule Project Close-Out Meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.
- B. Attendance Required: Contractor, major Subcontractors, Engineer, Owner, and others appropriate to agenda.
- C. Contractor to notify Engineer four (4) days in advance of meeting date.
- D. Minimum Agenda:
 1. Start-up of facilities and systems.
 2. Operations and maintenance manuals.
 3. Testing, adjusting, and balancing.
 4. System demonstration and observation.
 5. Operation and maintenance instructions for Owner's personnel.
 6. Contractor's inspection of Work.
 7. Contractor's preparation of an initial "punch list."
 8. Procedure to request Engineer inspection to determine date of Substantial Completion.
 9. Completion time for correcting deficiencies.
 10. Inspections by authorities having jurisdiction.



11. Certificate of Occupancy and transfer of insurance responsibilities.
12. Partial release of retainage.
13. Final cleaning.
14. Preparation for final inspection.
15. Closeout Submittals:
 - a. Project record documents.
 - b. Operating and maintenance documents.
 - c. Operating and maintenance materials.
 - d. Affidavits.
16. Final Application for Payment.
17. Contractor's demobilization of Site.
18. Maintenance.

E. Contractor: Record minutes and distribute to participants within two (2) days after meeting.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 30 00



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ADMINISTRATIVE REQUIREMENTS
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SECTION 01 31 27 – PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Summary.
- B. Users.
- C. Communications.
- D. Record Keeping.
- E. Equipment and Internet Connection.

1.2 SUMMARY

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Project Management Communications Software:
 - 1. The Contractor is required to utilize e-Builder Construction Program Management Software for all project management documentation and correspondence, including but not limited to: RFIs, NCRs, submittals, requests to add subcontractors, shutdown requests, design submittals, meeting minutes, pay applications, change proposals, change orders, close-out documentation, etc.
 - 2. The website, www.e-Builder.net, is an internet-based software system with controlled access through licensed accounts. The software is designed for contract management between the Owner and the Contractor to act in accordance with their respective roles. The Contractor shall be responsible for possessing the materials and broadband internet connection for accessing the website to fully comply with the specifications. Contact e-Builder for further information at www.e-builder.net or 1-800-580-9322.
 - 3. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
 - 4. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited.
 - 5. The Owner will provide the Contractor with two (2) licenses and initial software training for the selected Project representatives at no cost. Except for the two (2) licenses and initial training, the Owner assumes no responsibility for any real or potential costs associated with the use of e-Builder® by the Contractor and the project participants. The Contractor may at their expense purchase additional licenses from e-Builder® which the Owner will allow access to the contract. The named parties will be provided to the Engineer within three (3) working days of the signed Agreement. In the event of personnel changes experienced by the Contractor, the licenses can be reassigned by the Contractor with approval of the Engineer. Upon completion of the contract all licenses will be removed from the system.



6. Contractor and Subcontractors shall have the responsibility for visiting the Project website on a daily basis, and as necessary to be kept fully apprised of Project developments, for correspondence, assigned tasks and other matters that transpire on the site.
7. The e-Builder® website is used to facilitate electronic communication between the Contractor and the Owner. The e-Builder® system allows enhanced reporting capabilities whereby providing transparency, visibility, and collaboration to the Owner and the Contractor for more timely and responsive partnering. The e-Builder® website will manage RFIs, contract documents, submittals, shop drawings, working drawings, meeting minutes, pay applications, and other forms of documentation and communication required by the contract documents and at the discretion of the Owner. This functionality of e-Builder® will allow Contractor participants to create and upload all submittals, shop drawings, working drawings, RFI's, issue log entries and any other contract documents for review. Review and approval of all submittal documents will occur in e-Builder® with all participants notified of the results of reviews via e-Builder® email notifications. Additional functions and exceptions of the website may be made on a case by case basis at the Owner's discretion.
8. In the case of an emergency where the timeframe of a review does not allow it to be processed through e-Builder® the Contractor will be required to retroactively document the submission and approval process through e-Builder®.

C. Copyrights and Ownership:

1. Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.

1.3 USERS

A. Authorized Users:

1. Access to the web site will be by individuals who are licensed users.
2. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.
3. Do not post private or company confidential items in the database.

B. Administrative Users:

1. Administrative users have access and control of user licenses and all posted items.

1.4 COMMUNICATIONS

- A. The use of fax, email and courier communication for this project is discouraged in favor of using e-Builder® where applicable.



1.5 RECORD KEEPING

- A. Except for paper documents which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the e-Builder® web site by licensed users.
- B. The Owner and his representatives and the Contractor and his subcontractors and suppliers at every tier shall respond to documents received in electronic form on the web site and consider them as if received in paper document form.
- C. The Owner and his representatives and the Contractor and his subcontractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
- D. The Owner and his representatives and the Contractor and his subcontractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.

1.6 EQUIPMENT AND INTERNET CONNECTION

- A. In addition to other requirements specified in this Section, the Owner and his representatives, and the Contractor and his subcontractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:
 - 1. Providing suitable computer systems for each licensed user at the user's normal work location with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
 - 2. Operating system and software shall be properly licensed.
 - 3. Internet Explorer or other browser (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
 - 4. Adobe Acrobat Reader (current version is a free distribution for download).
 - 5. Or, users intending to scan and upload to the documents area of e-Builder® should have Adobe Acrobat (current version must be purchased).
 - 6. Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 31 27



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PROJECT MANAGEMENT COMMUNICATIONS
DWSD Special Specification
March 2025

SECTION 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittals.
- B. Quality Assurance.
- C. Network Analysis Schedules.
- D. Review and Evaluation.
- E. Updating Schedules.
- F. Distribution.

1.2 SUBMITTALS

- A. Submit Contractor's qualifications.
- B. Within ten (10) calendar days after Effective Date of the Contract, submit to the Engineer the proposed construction progress schedule electronically.
- C. Schedules shall be provided in Primavera P6 Version 16.2 (or later).
- D. Submit updated construction progress schedule with each Application for Payment.
- E. Schedule Updates:
 - 1. Overall percent complete, projected and actual.
 - 2. Completion progress by listed activity and sub-activity, to within seven (7) calendar days prior to submittal.
 - 3. Changes in Work scope and activities modified since submittal.
 - 4. Delays in submittals or resubmittals, deliveries, or Work.
 - 5. Adjusted or modified sequences of Work.
 - 6. Other identifiable changes.
 - 7. Revised projections of progress and completion.

1.3 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel specializing in CPM scheduling with two (2) years minimum experience in scheduling construction work of complexity comparable to the Project.

1.4 NETWORK ANALYSIS SCHEDULES

- A. All activities and Work performed by subconsultants or subcontractors shall be included.



- B. Reasonable duration shall be assigned to activities shown for permits and licenses from authorities, departments, and any other agency.
- C. Activities shall be logically linked and sequenced with a minimum of lags.
- D. The use of imposed start and finish constraints must be kept to an absolute minimum and only used when a logical constraint is not applicable.
- E. All contractual milestones including interim milestones shall be shown.
- F. Contractor shall strive not to show submittal approval activities by the Owner or Engineer on the critical path unless it is obviously the case.
- G. Provide sufficient and generally accepted durations (or as specified in the Submittal section) for review of submittals by the Engineer.
- H. Interface or coordination activities with other contractors or third parties like permitting or utility agencies shall be shown.
- I. Schedule shall be cost loaded and the cost should match the Schedule of Values (SOV) and contract amount and locations should match the drawings.
- J. Activities shall be scheduled and coded in alignment with the accepted Work Breakdown Structure (WBS).
- K. Retained logic and not Progress Override shall be used as the default setting while calculating the schedule.
- L. The use of positive or negative lags is generally not allowed unless specifically approved in writing by the Engineer.
- M. DWSD will retain ownership of project schedule contingency.
- N. Contractor shall incorporate and factor all weather impacts into the schedule and use only calendar days for the project and activity calendar unless DWSD specifically allows the use of other calendars like a 5-day work week calendar.
- O. If the Contract specifies a contract duration and the contractor submits an early completion schedule, no claims shall be entertained under any circumstances until the contract duration is exceeded.
- P. Delay claims shall be accompanied by a Time Impact analysis schedule clearly showing the Contractor and Owner caused delays in the schedule.
- Q. Project Total Float shall be a project shared resource and shall be used by whoever reaches and uses it as long as there is no gross abuse in its usage.



- R. Illustrate order and interdependence of activities and sequence of the Work; how start of any given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.
- S. Illustrate complete sequence of construction by activity, identifying Work of separate stages. Indicate dates for submittals and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.
- T. Schedule Layout to include the following:
 - 1. Activity ID.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum fifteen (15)-day intervals. Status of critical activities.
 - 4. Earliest start date.
 - 5. Earliest finish date.
 - 6. Actual start date.
 - 7. Actual finish date.
 - 8. Latest start date.
 - 9. Latest finish date.
 - 10. Total and free float; accrue float time to Owner and to Owner's benefit.
 - 11. Monetary value of activity, keyed to Schedule of Values.
 - 12. Percentage of activity completed.
 - 13. Responsibility.

1.5 REVIEW AND EVALUATION

- A. Participate in joint review and evaluation of schedules with the Engineer at each submittal.
- B. Evaluate Project status to determine Work behind schedule and Work ahead of schedule.
- C. After review, revise schedules incorporating results of review and resubmit within fourteen (14) calendar days.

1.6 UPDATING SCHEDULES

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update schedules to depict current status of Work.
- C. Upon approval of a Change Order, include the change in the next schedule submittal.
- D. Indicate changes required to maintain Date of Substantial Completion.



1.7 DISTRIBUTION

- A. Schedules to be submitted via e-Builder in native file format, (Primavera P6 .xer/.xml) with all accompanying role and resource data. Schedules shall also be submitted in PDF format.

1.8 LOOK-AHEAD PROGRESS SCHEDULE

- A. Contractor shall supply a three (3) week look-ahead schedule at least once a week to represent a snapshot of the Construction Progress Schedule and focus on the most immediate activities. Look-ahead schedule may be submitted in PDF format for ease of review and discussion.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 32 16



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CONSTRUCTION PROGRESS SCHEDULE
DWSD Special Specification
May 2024

SECTION 01 32 25 – GPS STRUCTURE DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for Contractor to collect, document, validate and submit accurate and complete Global Positioning System (GPS) spatial data, in formats compatible with Geographic Information System (GIS) as defined in this specification.
2. Requirements for submittal of GPS survey data.
3. Guidelines for performing GPS data collection prior to initiating CCTV, manhole or catch basin inspection or other inspection or investigative activities.

1.2 SUBMITTALS

A. Sample Survey Report: Prior to initiating the Work, the Contractor shall submit to the Engineer the following documentation for compliance:

1. Sample Report of each GPS survey asset type for review at least one (1) month before beginning the survey work. The Sample Report shall include:
 - a. One (1) copy of the data.
 - b. One (1) geodatabase containing GPS survey data and attached photos.
 - c. Sample observation photos.
 - d. GPS Data Submittal Tracking Spreadsheet. A template is provided at the end of the Specification.

If the contents of the Sample Report are incomplete, defective or not of adequate quality, the Contractor shall correct deficiencies and re-perform the survey at the Contractor's expense. The Contractor shall use the Sample Report submissions accepted by the Engineer as a template for subsequent submissions. No GPS survey work is to be performed until the Sample Report has been accepted by the Engineer.

- ##### B. The Contractor shall provide the equipment, software and technical resources to successfully complete all GPS data collection, validation and delivery as outlined in this specification. The Contractor shall be provided access to DWSD's ArcGIS Online environment and associated Esri Field Maps application. The Contractor shall only use the Esri Field Maps App for collecting GPS data. When the Contractor encounters an unmapped asset in the field that does not have a corresponding Asset ID, the Contractor shall use the Esri Field Maps App to generate an Asset ID following the process outlined in Section 3.1.



A. Bi-weekly GPS data submittals:

1. Bi-weekly GPS data submittals shall be completed within two (2) weeks of the completion of a work area.
2. For the bi-weekly GPS data submittals, submit one (1) copy of the data.
3. For the bi-weekly GPS data submittals, provide two separate geodatabases containing GPS survey data and attached photos for water and sewer assets.
4. For the bi-weekly GPS data submittals, provide sample observations photos for each survey. If the image data are defective or not of adequate quality as specified herein, the Contractor shall re-take and resubmit the photograph(s) at the Contractor's expense.
5. For the bi-weekly GPS data submittals, the Contractor shall submit a GPS Data Submittal Tracking Spreadsheet. A template of the tracking spreadsheet is provided at the end of the Specification.

B. Final Project Report upon substantial completion of work activities.

C. Data deliverables will be reviewed for compliance with the Contract, which may include, but is not limited to:

1. Verification of spatial accuracy (and associated feature-level metadata).
2. Verification of attribute data accuracy and consistency, including checks for valid domain values, population of required fields (such as Asset ID), validation of geometry, and review of the topological relationships between features in the data deliverable. Any errors in spatial location (within the specified spatial accuracy) or attribute value shall result in that feature being identified as being in error. If the features of any single feature class within a data deliverable do not meet the 99% confidence level, the complete data deliverable shall be rejected.

D. Datasets shall be resubmitted as required to address any comments until fully approved, and then considered the Final. New features shall not be added to resubmitted data deliverables except as required to resolve deficiencies or address other comments.

1.3 QUALITY ASSURANCE

- A. The Contractor is required to implement and execute a quality control or reliability assessment procedure in order to show compliance to specified guidelines or standards (i.e. positional accuracy, content accuracy, completeness, data format adherence, and data integrity assurance). The GPS and GIS data provided by the Contractor shall be error free. The Contractor shall be prepared to entirely re-survey those areas that do not meet the compliance standard at their own cost.



PART 2 - PRODUCTS

2.1 DELIVERABLE FORMAT

- A. DWSD will provide to the Contractor the DWSD GPS Survey geodatabase schema (Esri File Geodatabase format) as outlined in Section 2.3 of this specification, which shall be used as a template for the collection of all GPS data. The Contractor shall not make any modifications to the database structure or schema as provided by DWSD.
- B. All GPS data deliverables shall be provided by the Contractor as a File Geodatabase on a flash drive, portable hard drive, or through an approved file transfer or FTP site.
- C. If approved for use, the flash drive or portable hard drive shall be readable by a personal computer running the latest version of the Microsoft Windows operating system.
- D. The use of CDs or DVDs for data transfer shall not be approved.

2.2 DELIVERABLE CONTENT

- A. Features shall be delivered with GPS coordinates that match the existing or as-built conditions.
- B. GPS data shall be provided as follows:
 - 1. All horizontal data shall be captured, collected and managed within the Michigan State Plane South Coordinate System, North American Datum (NAD) 1983, HARN (EPSG 2898), with the parameters as outlined below:
 - a. Projection: Lambert Conformal Conic
 - b. Standard Parallel 1: 43.66666666666666
 - c. Standard Parallel 2: 42.1
 - d. Latitude of Origin: 41.5
 - e. Central Meridian: -84.36666666666666
 - f. False Easting: 13123359.58
 - g. False Northing: 0
 - 2. All vertical measurements for the above GPS datasets shall be recorded based on the North American Vertical Datum of 1988 (NAVD 88) and measured in feet above datum.
- C. Spatial coordinates shall be accurate to within 0.2 feet horizontally and 0.2 feet vertically, unless otherwise noted.
- D. Name each GPS Survey Submittal according to the following file specification:
[Contractor Name]_[P/O Number]_GPS_Survey_Submittal_[Number]
 e.g., ACME_DWS-999_GPS_Survey_Submittal_001



- E. The contractor shall provide separate geodatabases for water and sewer assets. The Contractor shall organize data accordingly within the following folder structure when providing GPS Survey data submittals:
 - 1. Geodatabases (folder)
 - 2. Photos (folder)
 - a. Sewer Assets
 - b. Water Assets
 - 3. GPS Data Submittal Tracking Spreadsheet
- F. Final Project Report – Submit a final project report including the following information:
 - 1. One geodatabase containing all surveyed assets.
 - 2. A brief description of the work (i.e. purpose, target accuracy, location, etc.).
 - 3. A key map showing the project area and a description of any GPS Reference Stations used.
 - 4. A summary of the project including planning, field data collection equipment, methods and parameters (i.e. GPS receiver settings/defaults), data processing methods and parameters (i.e. post-processing settings/defaults), and any project problems, anomalies, or deviations from the requirements as outlined in this Specification.
 - 5. An explanation of the deliverables (digital and hard copy) including formats, naming conventions, etc.
 - 6. A copy of all field notes (digital only).
 - 7. Final GPS Data Submittal Tracking Spreadsheet.

2.3 GEODATABASE STRUCTURE

- A. Contractor shall match utilize data types, valid values and/or domains for all applicable fields in the GPS Asset Survey feature class of the DWSD GPS Survey geodatabase schema. This includes the use of correct Asset IDs for all DWSD assets located using GPS. The “P/O Number” shall be the Project Number, e.g., DWS-999.
- B. Name the GPS Survey geodatabase according to the following file specification:
[Contractor Name]_[P/O Number]_GPS_Survey_Sewer or Water Submittal_[Number].gdb.
 e.g., ACME_DWS-999_GPS_Survey_Sewer Submittal_001.gdb
- C. The following required fields must be populated for all features captured within the GPS Asset Survey feature class of the DWSD GPS Survey geodatabase:
 - A. Asset ID
 - B. Asset Type
 - C. Asset Size
 - D. Asset Status
 - E. Location Description
 - F. GPS Date
 - G. GPS Status
 - H. Northing



- I. Easting
- J. Elevation
- K. Horizontal Accuracy
- L. Vertical Accuracy
- M. Position of Dilution of Precision (PDOP)
- N. Horizontal Dilution of Precision (HDOP)
- O. Vertical Dilution of Precision (VDOP)
- P. Fix Type
- Q. Correction Age
- R. Station ID
- S. Number of Satellites
- T. Neighborhood
- U. P/O Number
- V. Comments

2.4 DIGITAL PHOTOGRAPHS

- A. Contractor shall provide at least two digital photographs, one capturing physical address, intersection or nearest landmark that can be used to readily identify the location of the feature and a second photo should be captured for each asset which is centered on the cover or top of structure for the asset. The digital photographs shall be provided in each bi-weekly submittal.
- B. The digital photos shall be of sufficient resolution, clarity, brightness and picture quality such that it is easy to discern the feature. In the cases in which an asset is not easily seen due to vegetation or other obstacles surrounding the asset, spray paint the cover or stake a flag next to the asset to help make the feature identifiable in the photo.
- C. The digital photos shall be provided in JPEG format. The photos shall be named such that the filename of each photograph is associated with the Asset ID of the feature and its associated GIS feature via the Attachments related table in the DWSD GPS Survey geodatabase.
- D. Name the location photo according to the following file specification: **[Asset ID]_1.jpg**, e.g., WWMH0000003063_1.jpg
- E. Name the cover photo according to the following file specification: **[Asset ID]_2.jpg**, e.g., WWMH0000003063_2.jpg

2.5 DATA OWNERSHIP

- A. All data submitted during this project becomes the property of the Owner upon initial submission.
- B. The Contractor shall not distribute any of the GPS data that contributed to the GPS datasets without written approval from the Owner.



PART 3 – EXECUTION

3.1 DATA COLLECTION

- A. For sewer condition assessment projects, GPS data collection must be performed on the sewer assets prior to initiating CCTV, manhole or catch basin inspection or other inspection or investigative activities on the same assets. To the extent possible, the GPS survey should be performed on the horizontal center of the asset (e.g., center of the manhole cover, catch basin, water valve, etc.). For hydrants, the GPS survey point should be captured at ground elevation on the north side of the hydrant, with the survey pole vertically flush with the hydrant.
- B. All GPS collected locations must be tracked using the existing Asset IDs maintained in the current DWSD GIS geodatabase for each relevant feature class. The contractor shall compare the features in the existing GIS feature class against the GPS locations and assign the GPS location the correct Asset ID. For new features not currently recorded in the GIS database or for features which cannot be located in the field the following procedures should be followed:
 - 1. For assets existing in the current GIS but not found in the field, the Contractor shall assign these features an Asset Status of “Not Found.”
 - 2. For features which are located in the field but do not exist in the GIS database, the contractor shall collect the GPS location and all required attributes of these features and assign a status of “Unmapped Asset.”
 - 3. The Asset ID will be auto-generated in the Esri Field Maps App.
- C. The Contractor shall request and receive for their use the DWSD GPS Survey geodatabase schema. This schema shall be used to collect, validate and deliver all data, and no modifications to the schema should be made. Required fields and a description of the data to be collected is outlined in Section 2.3 of this Specification.
- D. All data collected must be delivered in the provided DWSD GPS Survey geodatabase schema (.gdb) as feature classes and attachment tables. Any changes made to the DWSD GPS Survey geodatabase schema shall result in a rejection of the submittal.
- E. Type and size of manhole, catch basin, valve covers, and hydrants shall be documented and submitted with GPS location elevation data.
- F. Brief description of manhole, lamp hole, junction chamber, catch basin, valve cover, and hydrant location (street, sidewalk, berm, etc.) shall be documented and included in the Location Description field of the GPS Asset Survey feature class.
- G. If an existing feature with a known Asset ID is inaccessible and/or the GPS information cannot be retrieved (parked cars, gated yards, etc.) or there is a lack of signal caused by multipath errors (heavy vegetation, electrical wires, buildings, weather, or other conditions) the Contractor shall note this in the Asset Status field by assigning them a value of “Unable to Access.” The Contractor shall determine if the collection of the structure can be achieved at a later date and shall return to the site to collect the data.



- H. Any unmapped assets GPS surveyed in the field shall be reported to DWSD on a daily basis. It shall be the responsibility of the Contractor to coordinate their work and incorporate the newly mapped assets and corresponding Asset IDs into their sewer pipe and manhole inspections.
- I. If a previously unmapped manhole or catch basin is found through another condition assessment process under this Contract (i.e., buried manhole found in CCTV inspection that is raised to grade), the contractor shall return to GPS survey these assets in accordance with this specification.

END OF SECTION 01 32 25



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GPS STRUCTURE DOCUMENTATION
DWSD Special Specification
May 2024

[illegible]

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Definitions.
2. Submittal Procedures.
3. Construction Progress Schedules.
4. Proposed Product List.
5. Product Data.
6. Use of electronic CAD files of Project Drawings.
7. Shop Drawings.
8. Samples.
9. Other Submittals.
10. Test Reports.
11. Certificates.
12. Manufacturer's Instructions.
13. Manufacturer's Field Reports.
14. Erection Drawings.
15. Construction Photographs.
16. Contractor Review.
17. Engineer's Review.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.
- B. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

- A. Comply with Section 01 31 27 – Project Management Communications.
- B. Transmit each submittal using approved electronic procedures and forms.
- C. The Contractor is required to utilize e-Builder® Construction Program Management Software for all submittals.



- D. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.
- E. Certify that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.
- F. A Schedule of Submittals shall be prepared and maintained by the Contractor and shall include the required submittals and the time requirements for Engineer's review of the submittals.
 - 1. Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), submit a preliminary Schedule of Submittals. It will be acceptable to the Engineer if it provides a workable arrangement for reviewing and processing the required submittals. At least 10 days before submission of the first Application for Payment, a meeting, attended by the Contractor, Engineer, and others as appropriate, will be held to review the preliminary Schedule of Submittals if it has not yet been accepted by the Engineer. No progress payment will be made to Contractor until an acceptable Schedule of Submittals is submitted to the Engineer.
 - 2. The Schedule of Submittals shall be updated by the Contractor and submitted to the Engineer with every Application for Payment.
 - 3. If the Contract scope is to be performed on an as-needed or emergency basis, all submittals for the potential scope of work as listed in the Contract Documents shall be submitted for approval at the commencement of the Contract for approval.
- G. A preconstruction conference will be held to establish a working understanding of the submitted schedules. The Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
- H. Schedule submittals to expedite Project and delivery to Engineer. Coordinate submission of related items.
- I. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.
- J. Allow space on non-electronic submittals for Contractor stamps.
- K. When revised for resubmission, identify changes made since previous submission.
- L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.



- N. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete or incorrect submittals are not the responsibility of Engineer, and no claim shall be made therefor.
- O. The Engineer will review a submittal or resubmittal a maximum of two (2) times, after which the cost of review shall be borne by the Contractor. The cost of the review shall be equal to the Engineer's full cost.

1.4 PRODUCT DATA

- A. Product Data Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.5 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

- A. Electronic CAD Files of Project Drawings may only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.
- B. Electronic CAD Files of Project Drawings will be distributed only under the following conditions:
 - 1. Use of files is solely at Contractor's risk. The Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve Contractor of responsibilities for measurements, dimensions, and quantities set forth in the Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Engineer of discrepancy and use information in hard-copy Drawings and Specifications.
 - 2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Contractor is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
 - 3. Contractor is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.
 - 4. Contractor shall not hold the Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.



5. Contractor shall understand that even though the Engineer has computer virus scanning software to detect the presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
6. Contractor shall not hold the Engineer responsible for such viruses or their consequences, and shall hold the Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

1.6 SHOP DRAWINGS

- A. Shop Drawings Action Submittal: Submit to the Engineer for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a Professional Engineer responsible for designing components shown on the Shop Drawings:
 1. Include signed and sealed calculations to support design.
 2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- D. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.7 SAMPLES

- A. Samples Action Submittal: Submit to the Engineer for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Samples for Selection as Specified in Product Sections:
 1. Submit to the Engineer for aesthetic, color, and finish selection.
 2. Submit Samples of finishes, textures, and patterns for the Engineer selection.
- C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.
- D. Include identification on each Sample with full Project information.
- E. Submit number of Samples specified in individual Specification Sections; the Engineer will retain two (2) Samples.



- F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.
- G. Samples will not be used for testing purposes unless specifically stated in the individual Specification Sections.
- H. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.8 OTHER SUBMITTALS

- A. Closeout Submittals: Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Informational Submittal: Submit data for Engineer's knowledge as Contract Administrator or for Owner.
- C. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.
- D. Submit all requirements as described in the General Conditions and Supplementary Conditions including but not limited to:
 - 1. Preliminary Schedules.
 - 2. Construction Quality Plan.
 - 3. Environmental Health and Safety Plan.
 - 4. Work Plan.

1.9 TEST REPORTS

- A. Informational Submittal: Submit reports for the Engineer's knowledge as Contract Administrator or for the Owner.
- B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

- A. Informational Submittal: Submit certification by manufacturer, installation or application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.



1.11 MANUFACTURER'S INSTRUCTIONS

- A. Informational Submittal: Submit manufacturer's installation instructions for the Engineer's knowledge as Contract Administrator or for the Owner.
- B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to the Engineer in quantities specified for Product Data.
- C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

- A. Informational Submittal: Submit reports for the Engineer's knowledge as Contract Administrator or for the Owner.
- B. Submit report within five (5) days of observation to Engineer for information.
- C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

- A. Informational Submittal: Submit Drawings for the Engineer's knowledge as Contract Administrator or for the Owner.
- B. Submit Drawings for information assessing conformance with information given and design concept expressed in the Contract Documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by the Engineer or the Owner.

1.14 CONSTRUCTION PHOTOGRAPHS

- A. Comply with Section 01 78 39 – Electronic Project Record Documentation.
- B. Comply with Section 02 22 30 – Pre-Construction Video and Photographic Record.
- C. Provide photographs of site and construction throughout progress of Work.
- D. Submit photographs with each Application for Payment if requested by the Engineer, or monthly if not included with Applications for Payment.
- E. Provide before and after photographs of each portion of the site.



1.15 CONTRACTOR REVIEW AND SUBMITTAL

- A. Review for compliance with Contract Documents and approve submittals before transmitting to the Engineer.
- B. Submittals shall be complete and address:
 - 1. Determination and verification of materials including manufacturer's catalog numbers.
 - 2. Determination and verification of field measurements and field construction criteria.
 - 3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
 - 4. Determination of accuracy and completeness of dimensions and quantities.
 - 5. Confirmation and coordination of dimensions and field conditions at Site.
 - 6. Construction means, techniques, sequences, and procedures.
 - 7. Safety precautions.
 - 8. Coordination and performance of Work of all trades.
- C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.
- D. Do not fabricate products or begin Work for which submittals are required until the Engineer has documented that resubmittal is not required.
- E. Do not make "mass submittals" to Engineer. "Mass submittals" are defined as six (6) or more submittals or items in one day or twenty (20) or more submittals or items in one week.

1.16 ENGINEER'S REVIEW OF CONTRACTOR SUBMITTALS

- A. Engineer will review submittals in accordance with review times specified in approved Schedule of Submittals. If "mass submittals" are received, Engineer's review time will be extended as necessary to perform proper review. Engineer will review "mass submittals" based on priority determined by Engineer.
- B. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.
- C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.
- D. Return of Submittal does not authorize changes to Contract requirements unless accompanied by Change Order or Work Change Directive.



PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 33 00



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SUBMITTAL PROCEDURES
DWSD Special Specification
May 2024

SECTION 01 35 29 – SAFETY PROGRAM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation and implementation of the Contractor's safety provisions for the Work.

B. Related Requirements:

1. Section 01 33 00 – Submittal Procedures.
2. Section 01 57 33 – Temporary Security Measures.
3. Section 31 50 00 – Excavation Support Systems.

1.2 SUBMITTALS

- A. Within ten (10) days after Effective Date of the Contract, submit a copy of the Contractor's corporate EH&S Management Plan, certified by an officer of the company and the Contractor's Safety Manager.

- B. Submit thirty (30) days prior to the start of any field work:

1. Project Specific Safety Plan.
2. Emergency Response Plan.
3. Description of any prior arrangements made with local authorities or emergency service providers (fire, police, ambulance) to be implemented in the event of an emergency.
4. A resumé of the Safety Manager's qualifications and experience. Include a description of the Safety Manager's education, safety and first aid training, safety conferences attended, and experience.

- C. Submit, for information only, monthly reports by the Safety Manager; and copies of accident reports, OSHA citations, and accident claims as specified herein.

1.3 SAFETY AND PROTECTION

- A. Comply with safety and protection requirements in the Contract Documents.

- B. Comply with all requirements of MISS DIG Public Act 174 including contacting MISS DIG, hand excavation near utilities, and contacting 911 in case of emergency.



1. If a utility is damaged resulting in the escape of any flammable, toxic, or corrosive gas or liquid, or endangering life, health, or property, the Contractor shall call 911 and provide immediate notice to the utility owner or utility operator. The Contractor shall also take reasonable measures to protect the excavator, those in immediate danger, the general public, and the environment until the utility owner or utility operator, or emergency first responders, have arrived and taken control of the site.
- C. Comply with all Occupational Safety and Health Act (OSHA) requirements and other similar applicable safety laws or codes in the performance under this Contract.

1.4 PROJECT SPECIFIC SAFETY PLAN

- A. Clearly define and document all risks associated with the Work. Assess the risks posed to the Contractor's work force, the Engineer, and the Owner in the construction of potentially hazardous aspects of the Work. Use this assessment in devising safe systems of work and document these safe systems in a Project Specific Safety Plan (PSSP) to be implemented throughout the construction. Include the list of risks as defined in the PSSP.
- B. The PSSP shall be provided for regular, weekly safety meetings and safety training programs for all personnel engaged in the Work.
- C. The PSSP shall address the availability and maintenance of safety and rescue equipment. Equipment shall include such items as fire extinguishers, first aid kits, safety ropes and harnesses, stretchers, breathing apparatus, resuscitators, gas detectors, equipment required by law, and any other equipment deemed necessary by the Contractor.
- D. The PSSP shall include a Confined Space Entry (CSE) Program, including identification of the primary rescue team.
- E. The PSSP shall include requirements to obtain a permit for Hot Work (non-electrical).
- F. The PSSP shall include requirements for Lockout-Tagout practices for work on motor driven equipment or electrical systems.
- G. The PSSP shall be designed and operated to correct safety hazards and violations as they are discovered and reported.
- H. The PSSP shall include requirements that the project site be drug and alcohol-free. The PSSP shall specify that all Contractor workers and those of its subcontractors participate in a drug testing program. The PSSP shall document drug testing protocols for how Contractor tests and screens employees and its subcontractor including the requirements and frequency of testing.
- I. Provide certified statement that all workers on the project have adhered to the requirements of the testing protocols and have met the criteria for passing the drug screen. Update the required documentation upon changes to the Contractor's program, or its workforce.



- J. The PSSP shall include requirements for safety precautions associated with working during a pandemic.

1.5 SAFETY TRAINING

- A. All Contractor personnel shall complete MISS DIG training certification and provide proof of certification to the Engineer prior to starting the Work.
- B. Train all persons working on the site so they are able to carry out their tasks and duties safely and in a manner that will not endanger either their own health or the health of others. Instruct persons when first employed on the site in the hazards inherent in the site, precautions to be taken, the form of construction, and emergency procedures.
- C. Reinforce safety and emergency training by periodic practice drills.
- D. Document employee safety training to establish that the Contractor has a structured program of training; that the training is held on a planned basis; and that all members of the work force receive the training.

1.6 EMERGENCY RESPONSE PLAN

- A. Prepare an Emergency Response Plan to be implemented in the event of a serious injury or general emergency (such as fire, explosion, collapse) to ensure a rapid, coordinated, and effective response. The Contractor shall implement the Plan.
- B. The Emergency Response Plan shall:
 - 1. Identify key personnel and define their roles and responsibilities.
 - 2. List telephone numbers for key personnel.
 - 3. Identify the emergency command center.
 - 4. Establish lines of communication between the incident location and the command center.
 - 5. Identify internal and external support services to be called upon in the event of an emergency (rescue team, fire, police, ambulance).
 - 6. Provide a plan of action to speed the transfer of injured persons from working areas and to ensure that ambulances can reach access points quickly.
 - 7. Define procedures for emergency evacuation for ensuring that injured persons are not left behind or unaccounted for.
 - 8. Provide immediate notification of the Owner in the event of an emergency.

1.7 PUBLIC SAFETY

- A. Install surveillance equipment and employ a watchman if required by the Contract, or if deemed necessary by the Contractor to safeguard the work, equipment, or the public.



- B. Install and maintain trench safety systems in accordance with Specification Section 31 50 00 – Excavation Support Systems and as set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P (current edition).
- C. Maintain railings, barricades, steel plates, or other barriers at openings, obstructions, or other hazards in roadways, walkways, and other travel ways accessible to the public. Place flashing lights and proper signs as necessary to provide adequate warning to the public day and night.
- D. Maintain secure fencing around worksites, equipment, or materials stockpiles to prevent unauthorized entry.

1.8 SAFETY MANAGER

- A. Employ a Safety Manager qualified in areas of safety related to the Work under this Contract with the minimum requirements as set forth in the bidding documents. Such person(s) shall report directly to a corporate officer and shall be assigned full time to the Contract and be present at the worksite or field offices. Safety Manager must be authorized to enforce compliance with the Contractor's Safety Program.
- B. The Safety Manager or a qualified and approved deputy officer shall be on site at all times.
- C. The Safety Manager shall be conversant with corporate safety policy, management operational instructions, regulations, legislation, and current best practice and how these relate to site safety.
- D. The Safety Manager shall be capable of identifying the existing and predictable hazards in the areas surrounding the project or those working conditions at the project that are dangerous to employees or are unsanitary. The Safety Manager shall have the authority to make prompt corrective measures to eliminate those hazards.
- E. The Safety Manager's duties shall include:
 - 1. Hazard recognition, accident prevention, new employee orientation (including subcontractors), and supervising a safety program.
 - 2. Posting appropriate notices regarding safety and health regulations at locations that afford maximum exposure to affected personnel and posting appropriate instructions and warning signs with regard to hazardous areas or conditions.
 - 3. Maintaining safety records and current copies of all pertinent safety rules and regulations.
- F. The Safety Manager shall submit a monthly report, for information only, to the Owner with each Application for Payment, providing the following information:
 - 1. Summary of routine site safety inspections, deficiencies noted, and disposition of such deficiencies.
 - 2. Site visits by OSHA and other regulatory enforcement agencies.
 - 3. Certification of new employee orientation.



4. Safety meeting topics and reports.
5. Status of lost-time injuries.
6. Status of citations.
7. Major equipment problems.

1.9 NOTIFICATIONS TO OWNER

- A. Notify the Owner immediately, by telephone, e-mail, or messenger, of any injury or damage, or of any emergency threatening life, limb, or property, resulting from the Work.
- B. Provide a preliminary accident report to the Owner, in writing, describing any accident involving injury to persons or damage to the Work or property, within 24 hours of the event.
- C. Follow any preliminary accident report with a summary accident report to the Owner, in writing, describing known details of the accident, and corrective actions to be taken to reduce the possibility of recurrence, to be submitted within two weeks of the event.
- D. Submit to the Owner, within two (2) days of receipt, a copy of any citations concerning safety aspects of the project received from OSHA or any other regulatory enforcement agency.
- E. Submit to the Owner, within two days of receipt, a report of any claim against the Contractor or Subcontractor resulting from an accident, giving full details of the claim, including investigation and restitution.

1.10 QUALITY ASSURANCE

- A. Safety requirements of the Contract Documents represent the minimum measures for performance of the Work. Implement additional safety measures as necessary to protect persons and property from injury that may result from construction operations or from the passage of the general public through the work zones.
- B. The Contractor's obligations to ensure safety under this Contract shall be executed in such a manner that they are understood and carried out by all, including non-English speaking employees.
- C. Compliance with health and safety requirements shall be the responsibility of the Contractor's managers and work force at every level.
- D. The Owner may bring to the Contractor's attention any apparent deficiencies in his compliance with the Contractor's safety program. These deficiencies shall be corrected within 24 hours of notice. A report describing the deficiency and corrective action taken by the Contractor shall be submitted within 48 hours.
- E. The Owner's review of submittals required under this Section are for the purpose of determining general conformance with Contract requirements and shall not be construed to alter the Contractor's responsibility for safety as defined in the Contract Documents.



PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION 01 35 29



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SAFETY PROGRAM
DWSD Special Specification
May 2024

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittals.
- B. Quality Control.
- C. Defective Work.
- D. Construction Quality Plan.
- E. Tolerances.
- F. References.
- G. Labeling.
- H. Mock-Up Requirements.
- I. Testing and Inspection Services.
- J. Manufacturers' Field Services.

1.2 SUBMITTALS

- A. Construction Quality Plan. Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review a Construction Quality Plan defining the quality control measures, standards and processes required to confirm that all performed work meets specified quality requirements. The Construction Quality Plan shall include, as a minimum, the items listed below:
 - 1. Describe the Contractor's quality control organization with lines of authority and reporting structure.
 - 2. The names, qualifications (in resume format), duties, responsibilities, and authorities of the Construction Quality Manager and all members of his/her staff.
 - 3. A copy of a letter to the Construction Quality Manager signed by a principal officer of the Contractor's firm which describes the responsibilities of the Construction Quality Manager and establishes his/her authority.
 - 4. Contractor's procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents.
 - 5. Verification and acceptance testing procedures for each specific performance test required in the Specifications.
 - 6. A mechanism for the Contractor to respond to NCRs which may be issued by the Engineer or Owner.
 - 7. Proposed method for reporting achievement of quality control milestones, including proposed reporting formats (sample forms), as required.
 - 8. Samples of Quality Control forms applicable for the project considered.



9. A list of the major elements of work and the quality control tasks, measurements, tests, and inspections associated with each major element.
10. Construction Quality personnel qualifications (in resume form) including copies of each member's applicable certificates of training and/or qualification.
11. Qualifications and resumes of independent testing laboratories and principal laboratory personnel to be used in the work by the Construction Quality Manager.

During the progress of the Work, Contractor shall not replace any Construction Quality personnel specified in the approved Construction Quality Plan without written approval of the Engineer.

At least 10 days before submission of the first Application for Payment, a conference, attended by the Contractor, Engineer, and others as appropriate, will be held to review the Construction Quality Plan if it has not yet been accepted by the Engineer. No progress payment will be made to Contractor until an acceptable Construction Quality Plan is submitted to the Engineer.

1.3 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- C. Perform Work using persons qualified to produce required and specified quality.
- D. Products, materials, and equipment may be subject to inspection by Engineer or Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.
- E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- F. The Engineer will conduct at least one Quality Audit each construction season to review Contractor quality activities and documentation, and compliance with the Construction Quality Plan. The specific Audit date will be selected at the Engineer's discretion. The Contractor will be provided at least 7 (seven) days advance notice and shall assist by providing requested quality control documentation to verify compliance, and by making staff available during the Audit. All Contractor costs for the cooperation with the Quality Audit and providing requested documentation shall be included in the contract unit prices and no extra payment will be made.

1.4 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.



- B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.5 STANDARDS

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with standards by date of issue current as of the date of the Contract Documents except where a specific date is established by code or specified.
- C. Obtain copies of standards and maintain on Site when required by product Specification Sections.
- D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Engineer before proceeding. If Contractor proceeds without receiving clarification from Engineer, Contractor shall be responsible for any necessary corrective work or rework as determined to be necessary by the Engineer.
- E. Neither contractual relationships, duties, or responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference in reference documents.

1.6 LABELING

- A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.
- C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

1.7 MOCK-UP REQUIREMENTS

- A. Tests shall be performed under provisions identified in this Section and identified in individual product Specification Sections.



- B. Assemble and erect specified or indicated items with specified or indicated attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mockups shall be comparison standard for remaining Work.
- D. Where mockup has been accepted by Engineer and is specified in product Specification Sections to be removed, remove mockup and clear area when directed to do so by Engineer.

1.8 TESTING AND INSPECTION SERVICES

- A. Employ and pay for services of an independent testing firm or laboratory acceptable to Owner to perform specified testing.
 - 1. Before starting Work, submit testing laboratory name, address, and telephone number, and names of full-time specialist and responsible officer for approval by the Engineer.
 - 2. Submit copy of report of laboratory facilities' inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.
 - a. Laboratory certifications may also be accepted from a national recognized laboratory certification program such as AASHTO LAP/LIP/AAP or MDOT pre-qualifications.
- B. Independent firm shall perform tests, inspections, and other services specified in individual Specification Sections and as required by Engineer, Owner, or authorities having jurisdiction.
 - 1. Laboratory: Authorized to operate in the State of Michigan.
 - 2. Laboratory Staff: Maintain full-time specialist on staff to review services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections, and source quality control may occur on or off Project Site. Perform off-Site testing as required by the Specifications, Engineer, or Owner.
- D. Reports shall be submitted by independent firm to Engineer, Contractor, and authorities having jurisdiction, indicating observations and results of tests and compliance or noncompliance with Contract Documents.
 - 1. Submit final report indicating correction of Work previously reported as non-compliant.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Engineer and independent firm 24 hours before expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional Samples and tests required for Contractor's use.



- F. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work according to requirements of Contract Documents.
- G. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by the same independent firm.
- H. Testing Agency Responsibilities:
 - 1. Test Samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at Site. Cooperate with Engineer and Contractor in performance of services.
 - 3. Perform indicated sampling and testing of products according to specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Engineer and Contractor of observed irregularities or nonconformance of Work or products.
 - 6. Perform additional tests required by Engineer.
 - 7. Attend preconstruction meetings and progress meetings when required by the Engineer.
- I. Testing Agency Reports: After each test, promptly submit copies of report to the Engineer, Contractor, and authorities having jurisdiction. When requested by Engineer, provide interpretation of test results. Include the following:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and Specification Section.
 - 6. Location in Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.
- J. Limits on Testing Firm:
 - 1. Testing Firm or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Testing Firm or laboratory may not approve or accept any portion of the Work.
 - 3. Testing Firm or laboratory may not assume duties of Contractor.
 - 4. Testing Firm or laboratory has no authority to stop the Work.

1.9 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment as applicable, and to initiate instructions when necessary.



- B. Submit qualifications of observer to Engineer thirty (30) days in advance of required observations. Observer is subject to approval of Engineer or Owner.
- C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 40 00



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SECTION 01 52 00 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:

1. Temporary Electricity.
2. Communication Services.
3. Temporary Water Service.

B. Construction Facilities:

1. Field Offices and Sheds.
2. Staging Area.
3. Vehicular Access.
4. Parking.
5. Progress Cleaning and Waste Removal.

C. Temporary Controls:

1. Water Control.
2. Dust Control.

1.2 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required from utility source as needed for construction operation.

1.3 COMMUNICATION SERVICES

- A. Telephone Service: Provide, maintain, and pay for telephone service to field office and Architect'/Engineer's field office at time of Project mobilization and until completion of Work.
- B. Internet Service: Provide, maintain, and pay for broadband Internet service rated at 150 Mbps to field office and Engineer's field office at time of Project mobilization. Provide desktop computer with Microsoft operating system and appropriate office function software, modem, and printer.

1.4 TEMPORARY WATER SERVICE

- A. Provide and pay for potable quality water service as needed to maintain specified conditions for construction operations.



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- B. Provide containerized, tap-dispenser, bottled-water drinking–water units, including paper supply. Provide electric water coolers to maintain dispensed water temperature between 45 and 55° F.

1.5 FIELD OFFICES AND SHEDS

- A. The Contractor shall be responsible for acquiring and maintaining any permits for the site which a field office or shed is located. The Contractor furnish written evidence to the Engineer of all permits and the landowner’s permission for use of the land. Such evidence will include all terms, conditions, considerations and payments for the use of the land.
- B. Field Office: Weathertight, with lighting, a minimum of 10 duplex electrical outlets, heating, cooling, and ventilating equipment, and equipped with sturdy furniture including chairs, conference table, drawing rack, filing cabinets, drawing display table and permanent sanitary facilities.
- C. Field office should be equipped with built-in toilet, wash tub sink, and be connected to existing underground facilities.
- D. Provide space for Project meetings, with table and chairs to accommodate ten persons. Meeting space shall be equipped with a projector or TV with necessary cables capable of projecting a laptop display for meeting purposes. The TV or effective projector screen size shall be a minimum of 48 inches measured corner to corner diagonally.
- E. Provide separate private office, similarly, equipped and furnished, for use of the Engineer.
- F. Locate field offices and sheds a minimum distance of 30 feet from existing and new structures.
- G. Do not use permanent facilities being constructed for field offices or for storage.
- H. Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors.
 - 1. Construction: Structurally sound, secure, weathertight enclosures for office and storage spaces. Maintain during progress of Work; remove enclosures when no longer needed.
 - 2. Thermal Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
 - 3. Exterior Materials: Weather-resistant, finished in one color acceptable to Engineer.
 - 4. Interior Materials in Field Offices: Sheet-type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
 - 5. Lighting for Field Offices: 50 ft-C at desktop height; exterior lighting at entrance doors.



- 6. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.
- I. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain 68° F heating and 76° F cooling.
- J. Preparation: Fill and grade Sites for temporary structures sloped for drainage away from buildings.
- K. Installation:
 - 1. Install field office spaces ready for occupancy at least 30 days prior to any field activity.
 - 2. Employee Residential Occupancy: Not allowed on Owner's property.
- L. Maintenance and Cleaning:
 - 1. Weekly janitorial services for field offices; periodic cleaning and maintenance for sheds and storage areas.
 - 2. Maintain walks free of mud, water, snow, debris, and the like.
- M. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas to same or better condition as original condition.

1.6 STAGING AREA

- A. The Contractor shall be responsible for securing a staging area within the vicinity of the Work to store materials, equipment, and supplies. Only materials and construction equipment currently being used may be stored at the construction site and within the jurisdictional right of way.
- B. The Contractor may wish to contact the Detroit Land Bank Authority (DLBA) to locate opportunities for staging areas near the Site.
- C. The Contractor shall furnish written evidence to the Engineer of the landowner's permission for use of the land. Such evidence will include all terms, conditions, considerations and payments for the use of the land.
- D. After the Contractor's Work is complete, the Contractor shall furnish written evidence to the Engineer that the land used by the Contractor for his operations have been restored to the satisfaction of the land owner.

1.7 VEHICULAR ACCESS

- A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load-bearing capacity to accommodate unimpeded traffic for construction purposes.



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- B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- C. Extend and relocate vehicular access as Work progress requires and provide detours as necessary for unimpeded traffic flow.
- D. Locate as indicated on Drawings or approved by Engineer.
- E. Provide unimpeded access for emergency vehicles. Maintain 20 foot-wide driveways with turning space between and around combustible materials.
- F. Provide and maintain access to fire hydrants and control valves free of obstructions.
- G. Provide and maintain access to all residential and commercial access points and driveways.
 - 1. Temporary materials such as steel plating, cold patch, and granular material shall be installed and maintained until such time that permanent restoration allows for full access to the residential or commercial property.
- H. Provide means of removing mud from vehicle wheels before entering streets.

1.8 PARKING

- A. Provide temporary surface parking areas to accommodate construction personnel.
- B. Locate where shown on the drawings.
- C. If Site space is not adequate, provide additional off-site parking.
- D. Use of designated areas of existing on-Site streets and driveways used for construction traffic is permitted. Tracked vehicles are not allowed on paved areas, unless they are slated for replacement as part of the project.
- E. Use of designated areas of existing parking facilities by construction personnel is permitted.
- F. Do not allow heavy vehicles or construction equipment in parking areas.
- G. Designate and reserve three parking spaces for Engineer.
- H. Permanent Pavements and Parking Facilities:
 - 1. Bases for permanent roads and parking areas may be used for construction traffic.
 - 2. Avoid traffic loading beyond paving design capacity. Tracked vehicles are not allowed.
- I. Maintenance:
 - 1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, ice, and the like.



2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.

J. Removal/Repair:

1. Remove temporary materials and construction before Substantial Completion.
2. Repair existing facilities damaged by use, to original condition.

- K. Mud from Site vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.9 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, before enclosing spaces.
- C. Broom and vacuum clean interior areas before starting surface finishing and continue cleaning to eliminate dust.

1.10 FIRE-PREVENTION FACILITIES

- A. Prohibit smoking within buildings under construction and demolition. Designate area on-site where smoking is permitted. Provide approved ashtrays in designated smoking areas.
- B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

1.11 WATER CONTROL

- A. Grade Site to drain. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.
- B. Protect Site from puddles or running water. Provide water barriers as required to protect Site from soil erosion.

1.12 DUST CONTROL

- A. Execute Work by methods that minimize raising dust from construction operations.



- B. Provide positive means to prevent airborne dust from dispersing into atmosphere.
- C. Comply with the City of Detroit Fugitive Dust Ordinance (Ordinance No. 32-17) requirements during Construction.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 52 00



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SECTION 01 55 26 – TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. All Work under this section shall be in accordance with the general and specific requirements of the City of Detroit Department of Public Works - Traffic Engineering Division, Wayne County, Michigan Department of Transportation (MDOT) Standard Specifications for Construction, and MDOT “Michigan Manual of Uniform Traffic Control Devices” (MMUTCD).
- B. Maintain and protect vehicular and pedestrian traffic and the Work in accordance with the provisions of this Section.
- C. Coordinate Work under this Contract with authorities having jurisdiction.
- D. Prior to starting any Work, a traffic maintenance plan shall be submitted for approval to the City of Detroit or authority having jurisdiction.
- E. This Work includes installing and maintaining the planned detour(s) as per the drawings.
- F. Load Restrictions: Comply with all legal load restrictions when hauling materials on public roads.
 - 1. Operate equipment of a weight or so loaded as to not cause damage to structures, roadway, and other infrastructure.
 - 2. Do not exceed legal load limits unless permitted by the Engineer or jurisdiction having authority.
- G. Haul Roads: Prior to hauling equipment or materials, provide written notification to the Engineer of the specific roads for the haul route.
 - 1. Do not use off-road vehicles on bases or pavements unless permitted by the Engineer.
 - 2. Do not haul on concrete pavement, base, or structures before the expiration of the curing period.
 - 3. If the Engineer determines that haul route roads were properly used during construction to haul equipment and materials and that the haul route roads were damaged, then the Engineer may order the Contractor to perform immediate and practical repairs to ensure reasonably normal traveling conditions.
 - 4. The Contractor shall not file a claim for delays or other impacts to the Work caused by disputes with the local authorities regarding the use of local roads as haul routes. The Contractor shall save the Owner harmless for any closures or hauling restrictions outside the Project limits beyond the control of the Owner.



1.2 SUBMITTALS

- A. Submit a traffic maintenance plan for each Work area, no later than five (5) working days prior to mobilization, to the Engineer for review and approval.
- B. Submit an “ADA Work Plan” for sidewalk and ADA ramp construction at least two (2) weeks prior to any sidewalk ramp closures or removals. The Work Plan must address pedestrian access and detours and clearly outline the access and routes around site. Ramp closures up to 96 hours are permitted. The Engineer will have seven (7) calendar days to review the Work Plan for approval or provide comments for revisions required to obtain approval. Do not proceed with the Work until the Engineer has approved the Work Plan.

PART 2 - PRODUCTS

2.1 BARRICADES, ARROW BOARDS, TEMPORARY PAVEMENT MARKINGS, AND TEMPORARY SIGNS

- A. Barricades, Arrow Boards, Temporary Pavement Markings, Temporary Signs, and other traffic control devices shall be in accordance with the current editions of the MDOT Standard Specifications for Construction and the MMUTCD.

PART 3 - EXECUTION

3.1 TRAFFIC FACILITIES AND TRAFFIC CONTROL – GENERAL

- A. Construct and maintain facilities for vehicular and pedestrian traffic as required for the Project, including all detours, temporary walks, roads, bridges, culverts, and traffic control devices.
- B. During the progress of Work, the Contractor shall make provisions for both vehicular and foot traffic on any public road and shall indemnify and save harmless the Owner from any expense whatsoever due to his operations over said roadways.
- C. The provisions of this Section shall not in any way relieve the Contractor of any legal responsibilities or liabilities for the safety of the public. The Contractor shall provide and maintain safeguards, safety devices, and protective equipment and take any other needed actions that may be necessary to protect the public and property in connection with the Work. The Contractor shall restore all original pavement markings, signs, and traffic control devices.



3.2 LOCAL TRAFFIC

- A. For local traffic, the Contractor shall provide and maintain in a safe condition, including snow and ice removal, such drives, temporary roadways, bypasses, sidewalks, or temporary structures as may be necessary to provide vehicular and pedestrian ingress and egress for the residents and facilities adjacent to the improvements. Temporary approaches and crossings of intersecting highways shall also be provided and maintained in a safe condition.
- B. The Contractor shall provide free access to all municipal, commercial, residential entrances, fire hydrants, and water and gas valves located in the Work vicinity. The Contractor shall lay and maintain temporary driveways, bridges, and trench crossings, which the Engineer deems necessary to maintain access to driveways and to reasonably accommodate the public at no additional cost to the Owner.

3.3 THROUGH TRAFFIC

- A. During construction, the Contractor shall maintain the planned detour for through traffic. Emergency vehicles (police, ambulance, fire, etc.) shall be the only through traffic allowed. The Contractor must make allowances for the safe and timely passage of these emergency vehicles.
- B. When the street affected by Project construction is being used by traffic, including periods of suspension of the Work, the Contractor shall maintain by the use of labor, equipment, and materials, that portion of the street being used, such that it is smooth, free from holes, ruts, ridges, bumps, and dust. The street being used shall be provided with the necessary outlets to drain freely.
- C. The jurisdictional authorities shall have the right to enter the area of Work where the Contractor is responsible for maintaining traffic to remove snow and ice and place abrasives at their own expense, as necessary. The Contractor shall be responsible for the removal of abrasives, 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 Contractor shall lay and maintain temporary ramps, bridges, and trench crossings, such as in the opinion of the Engineer are necessary to accommodate through traffic and the general public.

3.4 TRAFFIC CONTROL

- A. The specifications, installation, maintenance, and operation of all traffic controls and traffic control devices (e.g., signs, barricades, lights, and traffic regulators) shall conform to the requirements of the MMUTCD. Traffic control devices shall be provided with suitable supports of sufficient strength and stability.
- B. Faces of construction signs, barricades, vertical panels, and drum banks shall be suitably reflectorized complying with MDOT standards.
- C. Barricades and channelizing devices such as cones, vertical panels, hazard markers, and drums shall be highly visible. They shall also be protected by adequate advance warning devices and by



suitable lighting or reflectorization at night (between the hours of sunset to sunrise). All such devices shall be provided by the Contractor.

- D. Detour signs, traffic control signs, barricades, construction lighting, etc., shall be replaced whenever damaged, stolen, or vandalized.
- E. Detour signs when not in use shall either be removed or covered to avoid motorist confusion.
- F. Equipment and material stored on the street shall be marked at all times. At night, any such material or equipment stored between the side ditches or within five (5) feet behind any raised curbs, shall be clearly outlined with dependable lighted devices that are approved by the Engineer. In addition, the Contractor shall provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic.
- G. Furnish traffic regulators, warning lights, signs, and barricades as necessary to protect vehicular and pedestrian traffic within the Work limits.
- H. 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 existing signs or 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 maintaining agency. Routine maintenance of existing traffic control devices will remain the responsibility of the maintaining agency. 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 MMUTCD. The Contractor shall restore all relocated or modified signs to the position and condition which existed prior to construction.
- I. When an existing signal operation must be interrupted for a period, the Contractor shall provide a temporary traffic control method approved by the Engineer and the jurisdictional authority maintaining the signal.
- J. Whenever it is necessary for the Contractor to divert the flow of traffic from its normal channel into another channel, the channel for such diverted traffic shall be clearly marked by the Contractor with cones, drums, barricades, vertical panels, pavement markings, or flashing arrow panels. This method of marking shall also be used where Work is being done adjacent to the part of the street or highway in use by the public or where Work is being done on the shoulder where the roadway is being used by the public. During darkness hours, barricades and drums shall be supplemented with yellow flashing or steady burning electric warning lights in accordance with the MMUTCD.
- K. The Contractor shall obtain the approval of the Engineer and the jurisdictional authorities before closing a traffic lane or establishing a one-way traffic operation.
- L. Maintenance during Construction:
 - 1. Maintain the Work and detour routes throughout the course of construction. The Contractor is responsible for any damage done by its equipment.



2. Maintain the previous courses or subgrade during all construction operations when placing a course upon other courses of embankment, base, subgrade, concrete or asphalt pavement, or other similar items previously constructed. This maintenance includes, but is not limited to, draining, re-compacting, re-grading, or if destroyed, the removal of Work previously accepted by the Engineer.

- M. If the Contractor fails to maintain roadways or structures at any time, the Engineer will immediately notify the Contractor of such noncompliance. If the Contractor fails to remedy unsatisfactory maintenance within 24 hours after receipt of such notice, the Engineer may immediately proceed to maintain the Project and deduct the entire cost of this maintenance from monies due to the Contractor on the Contract.

3.5 PEDESTRIAN OR NON-MOTORIZED FACILITIES

- A. Maintain all facilities in accordance with The Americans with Disability Act (ADA) requirements. Provide facilities equivalent to or better than the route a person would have encountered prior to construction activities.
- B. Close and detour any sidewalk ramps and crosswalk areas to pedestrian traffic that are impacted by the Work. Cover pedestrian signal heads when the crosswalk or ramp is affected.
- C. Keep sidewalk areas clear of any equipment or materials at all times the sidewalks are open to pedestrian traffic.

3.6 PAVEMENT MARKING OPERATIONS

- A. Moving marking operations shall be performed by a truck equipped with necessary flashers and warning signs and shall be protected by a similarly equipped trailing vehicle(s) separated a sufficient distance to provide advance warning to overtaking traffic. The marking operation should use the extreme left or right lane when possible. Where three (3) or more lanes exist, the operation shall allow traffic to pass on one side only.
- B. Stationary marking operations in intersections, school zones, gores and other areas shall be protected with traffic control devices such as advance warning signs and cones.

3.7 TRAFFIC REGULATION

- A. Whenever one (1) lane, two (2) way traffic is established, at least two (2) traffic regulators shall be used unless otherwise permitted by the Engineer, and signs, cones, barricades and other traffic control devices shall be erected by the Contractor in accordance with the MMUTCD. Traffic control devices shall be reflectorized. The Contractor shall maintain positive and quick means of communication between the traffic regulators at opposite ends of the restricted area.
- B. Traffic regulators shall be equipped according to the standards for traffic regulation contained in the MMUTCD. A reflectorized Stop/Slow paddle shall be used, red flags are allowed for



emergency situations only. At night, traffic regulator stations shall be adequately illuminated and traffic regulators may use a red glow cone in addition to the Stop/Slow paddle as approved by the Engineer.

- C. The control and regulation of traffic by the traffic regulators and performance of their duties shall conform to the standards in the MMUTCD. In lieu of using flaggers or to supplement the flaggers, the Contractor may furnish, install, and operate a temporary traffic signal or signals to regulate traffic, in accordance with a written agreement approved by the Engineer and the jurisdictional authorities.

3.8 GENERAL MAINTENANCE OF TRAFFIC

- A. Unless otherwise permitted, directed, or ordered by the Engineer, traffic shall be specifically maintained as follows:
 - 1. A minimum of one (1) lane for emergency vehicles is to be provided at all times on all streets affected by this Project. Provide temporary access for emergency vehicles through the site during the full road closure periods as specified below.
 - 2. During paving operation, one (1) lane of traffic must be maintained at all times. Traffic regulators are required to direct traffic where a one (1) lane, two (2) way configuration is maintained.
 - 3. All trenches and openings shall be backfilled as soon as possible or as specified, and the pavement restored.
 - 4. The Contractor shall confer with the Engineer, jurisdictional authorities, local property owners, and others who may be affected by the Project before starting any Work at locations affecting said parties; carrying out of this Work with respect to traffic maintenance shall be covered by agreements reached at such conferences.
 - 5. The location, design, and construction of driveways, roads, and access and egress points for construction equipment vehicles to access public streets, which may be required by the Contractor for construction on easements and other locations, shall be approved by the Engineer. All such points shall be provided with adequate warning signs.
 - 6. No parking or standing of vehicles on streets will be permitted.
 - 7. The Contractor shall provide dust control on all streets in this Project, per the City of Detroit Fugitive Dust Ordinance (Ordinance No. 32-17), to the satisfaction of the Engineer.
- B. During Work progress, the Contractor shall accommodate both vehicular and pedestrian traffic as provided in these Specifications and as indicated on the drawings. Access to fire hydrants and water valves shall always be maintained. The Contractor's truck and equipment operations on public streets shall be governed by all local traffic ordinances, regulations of the Fire and Police Departments, and all corresponding jurisdictional authorities. The Contractor shall provide access for emergency equipment and operations to the work site during non-working hours and shall provide any assistance required by police, fire, or other officials during working hours.
- C. Small street openings necessary for manholes, alignment holes, sewer connection, or other purposes will be permitted. Such holes shall not be open longer than necessary and shall be done



to the satisfaction of the Engineer. Small openings shall be covered with steel plates at pavement level and be secured in place when Work is not performed.

- D. The Contractor is responsible for informing the local Fire Department in advance of street obstruction and detours so the Fire Department can plan for servicing the area in case of an emergency. The Contractor shall also notify the governing Police Department and the Engineer at least one (1) week prior to obstructing any street. All notifications should be made in writing or via email with the Engineer included in the distribution list.
- E. Road Detours: The Contractor shall provide and maintain all temporary roadways as required due to his operations or as required under "Road Permits" or otherwise specified or shown on the plans.

END OF SECTION 01 55 26



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TRAFFIC CONTROL
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March 2025

SECTION 01 57 13 - EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide all work and take all measures necessary to control soil erosion resulting from construction operations, prevent flow of sediment from construction site, and contain construction materials (including excavation and backfill) within protected working area as to prevent damage to any stream or wetlands.

1.2 STANDARDS

Comply with the latest edition of the following standards, except as modified herein:

- A. Michigan Department of Environment, Great Lakes and Energy (EGLE):
 - 1. Soil Erosion and Sedimentation Control; Part 91 of the Natural Resources and Environmental Protection Act 451 (NREPA).
- B. Wayne County Department of Public Services Engineering Division:
 - 1. Wayne County Soil Sedimentation Control Ordinance No. 2001-759.

1.3 SUBMITTALS

- A. If work will disturb more than one (1) acre of land or is within 500 feet of a lake or stream, a Soil Erosion and Sedimentation Control Permit shall be obtained from the local soil erosion agency per MCL Part 91 of Act 451.
- B. For all projects, submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- C. At least ten (10) days prior to any field activity, submit an Erosion and Sedimentation Control Plan to the Engineer for review and approval, and include the following:
 - 1. Description and location of the limits of proposed earth changes.
 - 2. Timing and sequence of proposed earth changes.
 - 3. Description, location, and details of proposed temporary erosion and sedimentation control measures including any dewatering operations.
 - 4. Description, location, and details of proposed permanent erosion and sedimentation control measures.



5. A program proposal for the maintenance of erosion and sedimentation control facilities both during and after construction. The facilities, which are to remain after project completion, shall include a designation of the party responsible to carry out maintenance.
6. Statement of the site plan indicating who is responsible for maintenance of the soil erosion controls and that “the soil erosion controls will be inspected and maintained weekly and within 24 hours after every storm event.”

1.4 QUALITY ASSURANCE

- A. Comply with the requirements specified in Section 01 40 00 – Quality Requirements.
- B. Use Best Management Practices, including use of water diversion structures, diversion ditches, settling basins, and sediment traps.
- C. Operations shall be restricted to areas of work indicated on drawings or in the GIS and the area which must be entered for construction of temporary or permanent facilities.
- D. If construction materials are washed away during construction, remove materials from fouled areas.
- E. Limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations. The Engineer has the authority to direct the Contractor to take immediate permanent or temporary pollution control measures to prevent contamination of any stream or wetlands, including construction of temporary berms, dikes, dams, sediment basins, sediment traps, slope drains, sod inlet filters, vegetative buffer strips, and use of temporary mulches, mats, or other control devices or methods to control erosion.

PART 2 - PRODUCTS

2.1 EROSION CONTROL BLANKETS

- A. Hay, straw, or other suitable material selected from the Michigan Department of Transportation (MDOT) Qualified Products List.
- B. Top and bottom photodegradable, biodegradable, or natural fiber netting.
- C. Use hardwood stakes or staples on slopes greater than 1:3. Spaced per manufacturer recommendations.
- D. Use mulch blankets with netting on top side on slopes flatter than 1:2. Use mulch blankets as permanent stabilization treatment for ditches with slopes between 0.5 percent and 1.5 percent.



- E. Use high velocity blankets with netting on top and fibers in contact with soil on slopes 1:2 or greater. Use high velocity mulch blanket as permanent stabilization treatment for ditches with slopes between 1.5 percent and 3.0 percent.

2.2 INLET FILTER FABRIC

- A. Geotextile filter fabric wrapped around the grate of a low point inlet structure or protected by an inlet filter insert in the structure.
- B. Products: Siltsack Type B, Inlet Pro Sediment Bag, Dandy Curb Sack, Basin Bag, or an approved equivalent.

2.3 SILT FENCE

- A. Geotextile filter fabric from MDOT Qualified Products List with hardwood support system.
- B. Reduce the velocity of sheet flow to a non-erosive level and retain suspended soil particles from leaving the construction site.
- C. Install along a contour line of equal elevation on a slope.
- D. Maximum sheet flow path of 100 feet.
- E. Overlap sections of silt fence according to the drawings.
- F. Excavate 6-inch by 6-inch trench and backfill and compress tail of geotextile filter fabric into it; 6 inches of pea stone may be placed on the flap if the ground is frozen, and the fabric shall be trenched in as soon as the ground has sufficiently thawed.
- G. Install drain guard around catch basins and storm inlets as shown on Erosion and Sedimentation Control Plan.

2.4 CHECK DAM

- A. Permission from the governmental agency responsible for maintenance of the ditch shall be obtained prior to installation.
- B. Ditch shall only be partially blocked to minimize the loss in ditch flow capacity. Maximum blockage shall not exceed 50 percent.
- C. Rip rap shall be 2 to 4 inches in size for ditch grades less than 2 percent and 3 to 12 inches for ditch grades greater than 2 percent.
- D. Base shall be at least twice the height of the dam.



- E. Remove when upstream areas contributing flow are stabilized; thus, allowing the ditch to function as designed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not discharge chemicals, fuels, lubricants, bitumen, raw sewage or other harmful waste into or alongside any body of water or into natural or man-made channels.
- B. Design erosion and sediment controls to handle peak runoff resulting from 10-year, 24-hour storm events.
- C. Inspect and maintain these control measures and ensure their proper function and adequate sediment storage at all times. Remove sediment once it reaches 50 percent of the capacity of the structure or when it reaches 1/3 the height of the fence. Sediment collected shall be disposed of off-site at no additional cost to the Owner.

3.2 INSTALLATION

- A. Take steps to minimize erosive loss and resultant offsite sedimentation from the site and from stored piles of excavated spoils, topsoil, sand, gravel, and aggregate.
- B. Use soil erosion techniques such as ground cover vegetation and seeding, compaction, rip rap, silt fence, and erosion control blankets where there is erosion potential.
- C. Provide sedimentation control measures, such as inlet filter fabric, at affected existing or new storm drains prior to clearing, grubbing, or grading.
- D. Construct earth berms or diversions to intercept and divert runoff water from critical areas.
- E. Discharge silt-laden water from excavations onto filter fabric mat or baled hay or straw sediment traps. Ensure that only sediment-free water is allowed to flow to watercourses.
- F. Do not place excavated soil material adjacent to watercourse in a manner that will cause it to wash away.
- G. Prevent damage to vegetation by excessive watering or silt accumulation in the discharge area.
- H. Do not dump spoiled material into any streams, wetlands, surface waters, or unspecified locations.
- I. Prevent indiscriminate, arbitrary, or capricious operation of equipment in streams, wetlands or surface waters.



- J. Do not pump silt-laden water from trenches or excavations into surface waters, streams, wetlands, or natural or man-made channels leading thereto.
- K. Prevent damage to vegetation adjacent to or outside of construction area limits.
- L. Do not dispose of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, wash water from concrete trucks or hydroseeders, or any other pollutant in streams, wetlands, surface waters, or natural or man-made channels leading thereto, or unspecified locations.
- M. Do not alter flow line of any stream unless indicated or specified.
- N. Positive dust control measures shall be taken at all times. Comply with the City of Detroit Fugitive Dust Ordinance (Ordinance No. 32-17) requirements during construction.
- O. All mud, dirt, and debris tracked onto existing roads from the Site shall be promptly removed.
- P. All temporary erosion control facilities shall be removed at the completion of construction.

END OF SECTION 01 57 13



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EROSION CONTROL, SEDIMENTAATION AND
CONTAINMENT OF CONSTRUCTION MATERIALS
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SECTION 01 57 15 - TEMPORARY SEWER BYPASS PUMPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for implementing a temporary pumping system for diverting existing flow around the Work area for duration of the work performed in the sewer.
- B. Related Requirements:
 - 1. Section 02 01 20 - Protecting Existing Underground Utilities.
 - 2. Section 03 60 00 - Grouting.
 - 3. Section 31 23 33 - Trenching and Backfill.

1.2 QUALITY ASSURANCE

- A. Use only materials that are suitable for sewer piping systems.
- B. Perform leakage and pressure tests on discharge piping before operation. Notify the Engineer 24 hours prior to testing. Should any liquid or solid matter from the bypass pump system be spilled, discharged, leaked or otherwise deposited into the open environment immediately clean up and disinfect the affected area. Notify the Engineer and perform required cleanup at no additional cost to the Owner.
- C. At a minimum, maintain and inspect temporary pumping system at the beginning and end of each shift that pumps are operating. Responsible operator shall be on site at all times when pumps are operating.
- D. Keep and maintain spare parts for pumps and piping on site, as required.
- E. Maintain adequate hoisting equipment and accessories on site for each pump.
- F. Maintain daily maintenance and inspection logs.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures:
 - 1. Detailed bypass pumping plan and description of proposed pumping system. Indicate number, size, material, location and method of installation of suction and discharge piping, size of pipeline or conveyance system to be bypassed, staging area for pumps, site access point, and expected flow.



- a. Size and location of manhole or access points for suction and discharge hose or piping.
 - b. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill, if buried.
 - c. Temporary pipe supports and anchoring required.
 - d. Thrust and restraint block sizes and locations.
 - e. Sewer plugging method and type of plugs.
 - f. Weir locations, heights and materials.
 - g. Bypass pump sizes, capacity, number of each size to be on site and power requirements.
 - h. Backup pump, power and piping equipment.
 - i. Calculations of static lift, friction losses, and flow velocity. Pump curves showing pump operating range.
 - j. Design plans and computation for access to bypass pumping locations indicated on drawings.
 - k. Calculations for selection of bypass pumping pipe size.
 - l. Method of noise control for each pump and/or generator.
 - m. Method of protecting discharge manholes or structures from erosion and damage.
 - n. Method of preventing odors from being generated above normal levels.
 - o. Schedule for installation and maintenance of bypass pumping lines.
 - p. Procedures to monitor upstream mains for backup impacts.
 - q. Procedures for setup and breakdown of pumping operations.
 - r. Cold weather operational plan as appropriate to protect equipment and pipes from freezing.
 - s. Alarm system that will allow prompt determination of either excessive sewer surcharging or loss of bypassing piping integrity during operation.
 - t. Plan to address wet weather flows if they are encountered.
 - u. Emergency plan detailing procedures to be followed in event of pump failures, sewer overflows, service backups, and sewage spillage.
2. Certification by a Professional Engineer (PE) that the bypass system will meet requirements of codes and regulatory agencies having jurisdiction.

1.4 CONTRACTORS RESPONSIBILITY FOR OVERFLOWS AND SPILLS

- A. Schedule and perform Work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation. Should any liquid or solid matter from the bypass pump system be spilled, discharged, leaked or otherwise deposited into the open environment, Contractor shall immediately notify Owner and, at Contractor's expense, immediately clean up and disinfect the affected area.

1.5 DELIVERY AND STORAGE

- A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and following manufacturer's recommendations.



- B. Inspect all material and equipment for proper operation before initiating Work.
- C. Material found to be defective or damaged due to manufacturer or shipment:
 - 1. When Engineer deems repairable: Repair as recommended by manufacturer.
 - 2. When Engineer deems not repairable: Replace as directed by Engineer before initiating Work.

PART 2 - PRODUCTS

- A. Discharge, Suction, and Bypass Pipes: As approved by Engineer.
 - 1. Discharge piping: Determine according to flow calculations and system operating calculations submittal.
 - 2. Suction piping: Determine according to pump size, flow calculations, and manhole depth following manufacturer's specifications and recommendations.
 - 3. Homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
- B. Flexible Hoses and Associated Couplings and Connectors:
 - 1. Suitable for intended service per the specifications herein and as approved by Engineer.
 - 2. Rated for external and internal loads anticipated by the pump selected for use, including test pressure expected during leakage and pressure tests.
 - 3. When subject to traffic loading, compose system, such as traffic ramps or covers, install system and maintain H-20 loading requirements while in use or as directed by the Engineer.
- C. Valves and Fittings: Determine according to flow calculations, pump sizes previously determined, and system operating pressures.
- D. Plugs: Select and install according to size of line to be plugged, pipe and manhole configurations, and based on specific site conditions.
- E. Additional plugs: Make available in the event a plug fails. Plugs shall be inspected before use for defects which may lead to failure.
- F. Neither aluminum "irrigation type" piping nor glued PVC piping will be permitted.

2.2 EQUIPMENT

- A. Pumps:
 - 1. Fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in priming system.
 - 2. Electric or diesel powered.



3. Constructed to allow dry running for long periods of time to accommodate cyclical nature of effluent flows.
4. Provide:
 - a. Necessary stop/start controls for each pump.
 - b. One standby pump of equal size of primary pump which shall be online and isolated by individual valves and ready for immediate use in the event of failure of primary pump or an emergency.
 - c. Noise control shall be utilized as a means to reduce noise to a level as specified in 01 11 00 – Summary of Work.

2.3 DESIGN REQUIREMENTS

- A. Provide pipeline plugs, weirs, discharge piping and pumps of adequate size to divert the encountered dry weather flow.
- B. Temporary bypass system shall be capable of operation 24 hours per day if necessary.

2.4 PERSONNEL

- A. Contractor shall at all times of pump operation when a weir or plug is installed in the sewer, have personnel to operate and monitor the pump(s) including during non-working hours.

PART 3 - EXECUTION

- A. Maintain copy of emergency plan on site for duration of project.
- B. Determine location of bypass pumping system in order to minimize disturbance to existing utilities. Field locate existing utilities in proposed bypass area. Obtain approvals for placement within public or private property. Obtain Engineer's approval of locations prior to construction.

3.2 INSTALLATION AND REMOVAL

- A. Provisions and requirements shall be submitted to the Engineer before starting construction.
- B. Remove manhole sections or make connections to existing sewer and construct temporary bypass pumping structures at access locations to provide adequate suction conduit.
- C. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of Work, remove in a manner that permits the sewage flow to slowly return to normal without surge, or causing other major disturbances downstream.



- D. Weirs shall be installed and removed so as not to cause structural damage to the sewers or manholes. Drill holes shall be filled as per Section 03 60 00 - Grouting.
- E. When working inside manholes or force mains, exercise caution. Follow OSHA, Local, State and Federal requirements. Take required measures to protect workforce against sewer gases and/or combustible or oxygen-deficient atmosphere.
- F. Installation of Bypass Pipelines:
 - 1. Lay bypass out of traveled way in manner to protect the bypass from damage.
 - 2. When bypass pipeline crosses local streets and private driveways, place in roadway ramps.
 - 3. When roadway ramps cannot be used, place bypass in trenches and cover with temporary pavement as approved by Engineer.
- G. During bypass pumping operation, protect sewer lines from damage inflicted by equipment.
- H. Upon completion of bypass pumping operations, remove piping, restore property to preconstruction condition and restore pavement.

END OF SECTION 01 57 15



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TEMPORARY SEWER BYPASS PUMPING
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SECTION 01 57 33 – TEMPORARY SECURITY MEASURES

PART 1 - GENERAL

1.1 SCOPE

- A. Implement a security program during construction to prevent unauthorized entry into the Work areas; theft of small tools, equipment and materials; and willful destruction of property.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 SECURITY

- A. Security at the site(s) shall be the sole responsibility of the Contractor. All materials necessary to provide any and all measures of security above and beyond those shown on the drawings or specified in the Contract Documents shall be at no additional cost to the Owner. Any materials stolen from the site shall be replaced by the Contractor at no additional cost to the Owner.
- B. Until Substantial Completion of the Project, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part thereof by the action of the elements, from vandalism or from any other cause, whether arising from the execution or from the non-execution of the Work. Rebuild, repair, restore, and make good all injuries or damages to any portion of the Work before Substantial Completion.
- C. Safely guard all Work, materials, Equipment, and property from loss, theft, damage, and vandalism. Safely guard the City's property and other private property or adjacent property from damage or loss in connection with the performance of the Work.
- D. Make no Claim of any kind against the City for damage resulting from trespass.
- E. Make good all damage to property of City and others arising from its failure to provide adequate security.
- F. If temporary fencing or barricades are breached or removed for purposes of construction, provide and maintain temporary construction fencing accepted equal to the existing in a manner satisfactory to the Engineer.
- G. Maintain Building and Site security at all times within the Work limits of this Contract and locations directly affected by the Project or the Work.



- H. Provide temporary weather tight enclosures for all exterior openings. If required to maintain security and to protect the Contractor's and Owner's interest, employ watchmen at no extra cost to the Owner.

END OF SECTION 01 57 33



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TEMPORARY SECURITY MEASURES
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SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Field Engineering.
2. Closeout Procedures.
3. Starting of Systems.
4. Demonstration and Instructions.
5. Project Record Documents.
6. Operation and Maintenance Data.
7. Manual for Materials and Finishes.
8. Manual for Equipment and Systems.
9. Spare Parts and Maintenance Products.
10. Product Warranties and Product Bonds.
11. Maintenance Service.
12. Examination.
13. Preparation.
14. Installation.
15. Cutting and Patching.
16. Protecting Installed Construction.
17. Final Cleaning.

1.2 FIELD ENGINEERING

- A. Employ a Land Surveyor registered in the State of Michigan and acceptable to the Engineer or Owner.
- B. Locate and protect survey control and reference points. Promptly notify the Engineer of any discrepancies discovered.
- C. Control datum for survey is indicated on Drawings or in GIS.
- D. Verify setbacks and easements; confirm Drawing dimensions and elevations.
- E. Provide field engineering services. Establish elevations, lines, and levels using recognized engineering survey practices.
- F. Maintain a complete and accurate log of control and survey work as Work progresses.
- G. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.



- H. Promptly report to the Engineer any loss or destruction of reference point, or any relocation required because of changes in grades or other reasons.
- I. Replace dislocated or displaced survey control points based on the original survey control. Make no changes without prior written notice to the Engineer.

1.3 CLOSEOUT PROCEDURES

- A. Prerequisites to Substantial Completion: Complete the following items before requesting Certification of Substantial Completion, either for the entire Work or for portions of the Work:

1. Submit maintenance manuals, Project record documents, digital images of construction photographs, and other similar final record data in compliance with this Section.
2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reasons for being incomplete, and date of anticipated completion for each item. Include a copy of the list with the request for Certificate of Substantial Completion.
4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
6. Make final change-over of locks and transmit keys directly to Owner. Coordinate with DWSD Security and Advise Owner's personnel of change-over in security provisions.
7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
8. Perform final cleaning according to this Section.

- B. Substantial Completion Inspection:

1. When Contractor considers Work to be substantially complete, submit to the Engineer:
 - a. Written certificate that Work, or designated portion, is substantially complete.
 - b. List of items to be completed or corrected (initial punch list).
2. After receipt of request for substantial inspection, the Engineer will promptly make an inspection to determine whether the Work or designated portion of the Work is substantially complete.
3. Should the Engineer determine that the Work is not substantially complete:
 - a. The Engineer will notify Contractor in writing, stating reasons for its opinion.
 - b. Contractor shall remedy deficiencies in the Work and send a second written request for Substantial Completion to the Engineer.
 - c. The Engineer will re-inspect Work.



- d. Redo and Inspection of Deficient Work: Repeated until the Work passes the Engineer's inspection.
 4. When the Engineer finds that the Work is substantially complete, the Engineer will:
 - a. Prepare a Certificate of Substantial Completion accompanied by the Contractor's list of items to be completed or corrected as verified and amended by the Engineer and Owner (final punch list).
 - b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate.
 5. After Work is substantially complete, Contractor shall:
 - a. Allow Owner occupancy of the Project under the provisions stated in the Certificate of Substantial Completion.
 - b. Complete Work listed for completion or correction within time period stipulated.
- C. Prerequisites for Final Completion: Complete the following items before requesting final acceptance and final payment.
1. When Contractor considers the Work to be complete, submit written certification that:
 - a. Contract Documents have been reviewed.
 - b. Work has been examined for compliance with Contract Documents.
 - c. Work has been completed according to Contract Documents.
 - d. Work is completed and ready for final inspection.
 2. Contractor shall submit the following:
 - a. Final punch list indicating all items have been completed or corrected.
 - b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
 - d. Accounting statement for final changes to Contract Sum.
 - e. Contractor's affidavit of payment of debts and claims.
 - f. Contractor affidavit of release of liens.
 - g. Consent of surety to final payment.
 3. Perform final cleaning for Contractor-soiled areas according to this Section.
- D. Final Completion Inspection:
1. After receipt of request for final inspection, the Engineer will promptly make an inspection to determine whether the Work or designated portion is complete.
 2. Should the Engineer consider the Work to be incomplete or defective:
 - a. The Engineer will notify the Contractor in writing, listing incomplete or defective Work.



- b. Contractor shall remedy stated deficiencies and send second written request to the Engineer that Work is complete.
- c. The Engineer will re-inspect Work.
- d. Redo and Inspection of Deficient Work: Repeated until Work passes the Engineer's inspection.

1.4 STARTING OF SYSTEMS

- A. Coordinate schedule for startup of various equipment and systems.
- B. Notify the Engineer seven (7) days prior to startup of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute startup under supervision of manufacturer's representative or Contractor's personnel as specified.
- G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.
- H. Submit a written report according to Section 01 33 00 – Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two (2) weeks prior to date of Substantial Completion.
- B. Video Recordings: Provide high-quality color digital video recordings of demonstration and instructional sessions. Video recordings shall comply with Section 02 22 30 – Pre-Construction Video and Photographic Record. Engage commercial videographer to record sessions. Include classroom instructions, demonstrations, board diagrams, and other visual aids. Include menu navigation.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.
- D. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.



- E. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- G. Required instruction time for each item of equipment and system is specified in individual Specification Sections.

1.6 PROJECT RECORD DOCUMENTS

- A. Comply with requirements for electronic project documentation found in Section 01 78 39 – Electronic Project Record Documentation.
- B. Record actual revisions to the Work on the record documents.
- C. Maintain one set of the following record documents on-site during installation and until completion of construction:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, product data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- D. Ensure that entries are complete and accurate, enabling future reference by Owner.
- E. Store record documents separate from documents used for construction.
- F. Record information concurrent with construction progress, not less than weekly.
- G. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates used.
 - 3. Changes made by Addenda and modifications.
- H. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
 - 1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
 - 2. Include locations of concealed elements of the Work.
 - 3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.



4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
 5. Identify and locate existing buried or concealed items encountered during the Project.
 6. Measured depths of foundations in relation to finish floor datum.
 7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 9. Field changes of dimension and detail.
 10. Details not on original Drawings.
- I. Submit electronic files of legible marked-up documents using PDF or CAD software to the Engineer on completion of the Work and prior to final payment by DWSD.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit in PDF composite electronic indexed file.
- B. Submit data bound in 8-1/2 x 11-inch text pages, three (3) D side ring binders with durable covers.
- C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab title clearly printed under reinforced laminated plastic tabs.
- E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 1. Part 1: Directory, listing names, addresses, and telephone numbers of the Engineer, Contractor, Subcontractors, and major equipment suppliers.
 2. Part 2: Operation and Maintenance Instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - g. Safety precautions to be taken when operating and maintaining or working near equipment.



3. Part 3: Project documents and certificates, including the following:
 - a. Shop Drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Originals of warranties and bonds.
 - e. Pressure testing reports.
 - f. Disinfection reports and bacteriological results.

1.8 MANUAL FOR MATERIALS AND FINISHES

- A. Submit two (2) copies of preliminary draft or proposed formats and outlines of contents before start of the Work. The Engineer will review the draft and return one (1) copy with comments.
- B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit documents within ten (10) days after acceptance.
- C. Submit one (1) copy of completed volumes before Substantial Completion. The Draft copy will be reviewed and returned after Substantial Completion, with Engineer's comments. Revise content of document sets as required prior to final submission.
- D. Submit two (2) sets of revised final volumes within ten (10) days after final inspection and the Engineer finds that the Work is complete.
- E. Submit in PDF the composite electronic indexed file of the final manual within ten (10) days after final inspection and the Engineer finds that the Work is complete.
- F. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom-manufactured products.
- G. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- H. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- I. Additional Requirements: As specified in individual product Specification Sections.
- J. Include listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.



1.9 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit two (2) copies of preliminary draft or proposed formats and outlines of contents before start of the Work. Engineer will review draft and return one (1) copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes before Substantial Completion. Draft copy will be reviewed and returned after Substantial Completion, with Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit two (2) sets of revised final volumes within ten (10) days after final inspection and the Engineer finds that the Work is complete.
- E. Submit in PDF composite electronic indexed file of final manual within ten (10) days after final inspection and the Engineer finds that the Work is complete.
- F. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- G. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- H. Include color-coded wiring diagrams as installed.
- I. Finished electrical coordination studies.
- J. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.
- K. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- L. Include servicing and lubrication schedule and list of lubricants required.
- M. Include manufacturer's printed operation and maintenance instructions.
- N. Include sequence of operation by controls manufacturer.
- O. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- P. Include control diagrams by controls manufacturer as installed.



- Q. Include Contractor's coordination drawings with color-coded piping diagrams as installed.
- R. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- S. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- T. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.
- U. Additional Requirements: As specified in individual product Specification Sections.
- V. Include listing in table of contents for design data with tabbed dividers and space for insertion of data.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.
- B. Deliver to location as specified by Engineer; obtain receipt prior to final payment.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten (10) days after completion of applicable item of Work.
- B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include table of contents and assemble in three D side ring binder with durable cover.
- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten (10) days after acceptance.
 - 2. Make other submittals within ten (10) days after date of Substantial Completion, prior to final Application for Payment.



3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten (10) days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components as indicated in Specification Sections.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.



3.3 INSTALLATION

- A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one (1) set of manufacturer's installation instructions at Project Site during installation and until completion of construction.
- B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
 - 1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
 - 2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
 - 3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Engineer for final decision.
- E. Allow for expansion of materials and building movement.
- F. Climatic Conditions and Project Status: Store and protect delivered equipment and materials according to manufacturer instructions; Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
 - 1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
 - 2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.
- G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
 - 1. Refer questionable mounting heights choices to Engineer for final decision.
 - 2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.
- H. Adjust operating products and equipment to ensure smooth and unhindered operation.
- I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

- A. Employ skilled and experienced installers to perform cutting and patching.



- B. Submit written request in advance of cutting or altering elements affecting:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and nonconforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.
- E. Cut masonry and concrete materials using masonry saw or core drill.
- F. Restore Work with new products according to requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- I. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated material, to full thickness of penetrated element.
- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- K. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.



- D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

- A. Execute final cleaning prior to requesting final acceptance. Employ experienced personnel or professional cleaning firm.
- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; and vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.
- D. Clean filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean Site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION 01 70 00



01 70 00 - 13
EXECUTION AND CLOSEOUT REQUIREMENTS
DWSD Special Specification
March 2025

SECTION 01 78 39 - ELECTRONIC PROJECT RECORD DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for Contractor to collect, document, and provide accurate and complete spatial data, in formats compatible with GIS as defined in this specification, for all features being designed and constructed as part of the Project.
2. Provide interim GIS deliverables as Project progresses and complete and final GIS datasets upon completion of construction.

B. Related Requirements:

1. Section 02 22 30 – Pre-Construction Video and Photographic Record
2. Section 33 01 30.16 – Sanitary Sewer Pipeline Inspection
3. Section 33 05 07.13 – Utility Directional Drilling
4. Section 33 14 13 – Public Water Utility Distribution Piping
5. Section 33 14 17 – Water Services
6. Section 33 14 17.81 – Lead Service Line Replacement
7. Section 33 31 11 – Public Sanitary Sewerage Gravity Piping

1.2 STANDARDS

Except as modified herein, comply with the latest version of the following standard:

A. International Organization for Standardization:

COORDINATION

A. Comply with Section 01 30 00 - Administrative Requirements

1.3 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Provide interim GIS deliverables as the project progresses and complete and final GIS datasets upon completion of the construction. Schedule of deliveries is described in more detail below.
- C. Upon receipt of a data deliverable, the Owner will perform a data review which may include but not be limited to verification of spatial accuracy, attribute data accuracy, a check for omissions,



duplications, inconsistencies, validation of geometry, and review of the topological relationships between features in the data deliverable. Any errors in spatial location (within the specified spatial accuracy) or attribute value will result in that feature being identified as being in error. If the features of any single feature class within a data deliverable do not meet the 99% confidence level, the complete data deliverable will be rejected.

- D. Content of resubmitted data deliverables shall not change except to address the deficiencies identified. New features shall not be added to resubmitted data deliverables except as required to resolve deficiencies.

1.4 CLOSEOUT SUBMITTALS

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.

1.5 QUALITY ASSURANCE

- A. Define quality control and quality assurance procedures to be employed in the development and review of GIS data. The GIS data provided by the Contractor shall be error free. Contractor data review processes shall follow quality assurance procedures and standards as specified in ISO/DIS 19157 Geographic Information - Quality Evaluation Procedures (ISO9000).
- B. Maintain one copy of each standard affecting the Work of this Section on Site.

1.6 QUALIFICATIONS

- A. Licensed Professional: Professional Engineer or Professional Surveyor experienced in performing specified Work and licensed in the State of Michigan.

PART 2 - PRODUCTS

2.1 DELIVERABLE FORMAT

- A. All GIS data deliverables shall be provided on a flash drive, portable hard drive, or through a Box folder. Each submittal shall have the main folder clearly labeled with the project name and the date of the delivery.
- B. The flash drive or portable hard drive shall be readable by a personal computer running the latest version of the Microsoft Windows operating system.
- C. Each project folder deliverable shall contain two sub folders. The first folder shall be named "Geodatabase _SP" and it shall contain a single geodatabase as described in this Section. The geodatabase shall be compatible with older versions of ArcGIS Desktop (going back no further



than 10.3.1) as well as the most recent production release (not beta-release) of ArcGIS. The second folder shall be named “Photos” and it shall contain all digital photos for the deliverable as described in this Section.

- D. To facilitate logging and tracking of deliverable review, a text file shall be provided in the root folder of the main deliverable folder. The contents of this text file shall include the following:
1. Original Delivery Date: <date when version 1 of this deliverable was submitted>.
 2. Deliverable Title: <contractor specified title that remains constant for all revisions>.
 3. Deliverable Number: <Sequential delivery number>. <Revision number>.
 4. Contact Person: <Name, phone, e-mail>.

2.2 DELIVERABLE CONTENT

- A. GIS features shall be delivered with coordinates that match the actual, as-built conditions. The distance between two points on the ground shall equal the distance shown in the drawing or feature class. All subsurface (underground) features shall be depicted as if they were on the surface.
- B. GIS data shall be provided as follows:
1. The dataset shall be provided in the Michigan State Plane South coordinate system. This dataset shall be provided in geodatabase format and placed in the “Geodatabase_SP” folder described above. It shall meet the following requirements:
 - a. Coordinates shall be recorded in decimal international survey feet.
 - b. Horizontal coordinates shall be based on the North American Datum of 1983 (NAD83) HARN and the Geographic Reference System 1980 (GRS 80) ellipsoid.
 2. All vertical measurements for the above GIS datasets shall be recorded based on “North American Vertical Datum of 1988 (NAVD 88)” and measured in feet above datum.
- C. Spatial coordinates shall be accurate to within 0.1-foot horizontally and 0.5-foot vertically, unless otherwise noted in the data dictionary.
- D. Subsurface features shall have surveyed locations acquired before backfill. Photographs of the exposed feature shall be submitted per this specification section.

2.3 GEOMETRY

- A. The geometry of all features provided in the data deliverable shall match the geometry type specified in the Data Dictionary (e.g., point, line, polygon). Complex geometry types (e.g., true curves, donuts, etc.) shall be converted to simple geometry so that the delivered data meet the spatial accuracy described above. Contractor shall notify Owner if it is not possible to accurately represent the feature using simple geometry types.



- B. The features shall be represented by valid geometry.
- C. Additional geometry rules for lines are listed below.
 - 1. Two or more line features of the same feature type (e.g., road centerline) shall be split so that line segments begin and end at intersections, bridges, and tunnels.
 - 2. End-vertices of connecting or intersecting line segments shall be collocated (i.e., be snapped to the same location with identical X, Y coordinates).
 - 3. Line features shall contain an appropriate number of intermediate vertices placed at intervals such that the line feature does not stray from the actual feature by more than ½ the positional accuracy limit.
 - 4. Lines shall be “broken” where the characteristics of a feature changes.
 - a. Storm water drainage pipes shall be broken at manholes or where the pipe diameter or material changes.
 - b. Water main lines may only be split at fittings (tee, cross, reducer/increaser, tap), TSV valves, at valves where ‘Operated By’ changes, and at special cases represented with a feature or attribute change (contract number, material, install date, 20’ or large replacement, status, work order). All line segments should be merged that do not adhere to the above split rules.
 - c. Gravity mains may be split at manholes or reducer fittings. Other split rules for gravity mains pending DWSD approval.
 - 5. When building a network of linear features where direction is significant (e.g., surface drainage hydrography, storm drainage network, sanitary sewer network, and road centerlines), draw linear objects in the direction of flow, or traffic.
- D. Additional geometry rules for polygons are listed below.
 - 1. Polygons (or individual lines that enclose to define an area) shall be closed by snapping the line endpoint vertices to an identical X, Y coordinate.
 - 2. Adjacent polygons sharing an edge shall have the same collocated vertices along that edge. This rule applies to adjacent features of the same type (e.g., pavement sections) and adjacent features of different feature types (e.g., roadway vs. parking).
- E. The features shall pass the topological rules described below. These rules ensure the spatial relationship of features in the same and different feature classes.
 - 1. Polygonal feature classes should satisfy the following topology rules: Shall be larger than cluster tolerance; shall not overlap; shall not intersect; shall not have gaps; shall not have dangles.
 - 2. Line features should satisfy the following topological rules: shall be larger than cluster tolerance (1-foot); shall not overlap; shall not intersect.
 - 3. Point features should satisfy the following topological rules: None.



2.4 GEODATABASE STRUCTURE

- A. Contractor shall provide a feature class for any known features of the types, listed in the DWSD GIS Data Dictionary, located within the Project boundaries. All feature classes shall be stored within the feature dataset. The names of the feature classes shall exactly match the names listed in the Data Dictionary, including spelling, capitalization, and spacing.
- B. Each feature class shall contain the attribute fields described in the Data Dictionary, that will be provided to the Contractor. The definition of the attribute fields (e.g., name, data type, length, domain, etc.) shall match the definition contained within the Data Dictionary.
- C. All attribute values shall be populated with a non-null value, except as noted in the Data Dictionary.
- D. Contractor shall submit a schema change request to the Owner. The Owner will make any schema changes to feature classes that already exist in the Owner's database. This includes:
 - 1. Any fields added.
 - 2. Any fields removed.
 - 3. Any new or updated domains.
 - 4. Any new or updated subtypes.
- E. Contractor shall request to be on an e-mail chain or receive copies of schema changes made by the Owner.

2.5 DIGITAL PHOTGRAPHS

- A. Requirements of this Section are in addition to Section 02 22 30 – Pre-Construction Video and Photographic Record.
- B. Contractor shall provide at least one digital photo showing the physical extent of each feature, where possible within reasonable effort. The digital photo shall be provided at the same time as the initial data delivery of a feature.
- C. The digital photos shall be of sufficient resolution, clarity, brightness and picture quality such that it is easy to discern the feature.
- D. The digital photos shall be provided in JPEG, TIFF, or another format acceptable to the Owner. The photos shall be named such that the filename of each photograph is associated with the Feature ID of the feature and its associated PhotoPoint, as described in the Data Dictionary.



2.6 METADATA

- A. Each feature class in a submittal shall include complete metadata that follows the “Content Standard for Digital Geospatial Metadata (CSDGM), Vers.2 (FGDC-STD-001-1998).” Metadata shall be validated as part of Contractor’s Quality Control procedure.

PART 3 - EXECUTION

3.1 SUBMITTAL SCHEDULE

- A. Contractor shall provide deliverables as described below.
 - 1. As-Designed GIS Data: Submit as required by Specification 01 33 00 – Submittal Procedures
 - 2. As-Built GIS Data: Prior to close-out of associated permits, Contractor shall provide a GIS data deliverable that contains as-built data for features covered by that permit. This As-Built GIS Data deliverable shall be accepted by the Owner as a prerequisite for permit close-out. For features not requiring permits, the As-Built GIS Data deliverable shall be delivered within 90 days of construction completion of said feature.
- B. If a feature is modified or somehow altered in a way that affects the spatial or attribute data after GIS data have been submitted, a revised GIS feature description shall be submitted within 90 days of the revision. The Data Dictionary provides guidance on how to identify these data edits.
- C. If a feature that has already been described in a GIS submittal is removed, an additional submittal shall be made within 90 days of its removal. The Data Dictionary provides guidance on how to identify these data deletions.

3.2 DATA OWNERSHIP

- A. All data submitted during this project becomes the property of the Owner upon initial submission.
- B. The Contractor shall not distribute any of the GIS data or any draft data that contributed to the final GIS datasets without written approval from DWSD.

END OF SECTION 01 78 39



SECTION 02 01 20 - PROTECTING EXISTING UNDERGROUND UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing and plugging abandoned lines.
2. Compaction.
3. Alternative support methods.
4. Protecting thrust blocks.

B. Related Requirements:

1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 31 23 33 – Trenching and Backfill.
3. Section 31 23 23.33 – Flowable Fill.
4. Section 33 14 13 – Public Water Utility Distribution Piping.
5. Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.
6. Section 33 42 00 – Stormwater Conveyance.

1.2 SUBMITTALS

A. Submit the following shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

1. Record drawings to include record survey coordinates and elevations.
2. Proposed locations for test pits.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 40 00 – Quality Requirements.

1.4 PROJECT/SITE CONDITIONS

A. Proposed utilities will be indicated on the drawings, but the right is reserved by the Owner, acting through the Engineer, to make such modifications in location as may be found desirable to avoid interference with existing utilities.



PART 2 - PRODUCTS

2.1 MATERIALS

- A. Except as indicated, or as specifically authorized by the Engineer, where existing utilities to remain must be removed, reconstruct utilities with new material of the same size, type, and quality as that removed.
- B. Refer to the following sections for acceptable water main or sewer materials for DWSD owned utilities:
 - 1. Section 33 14 13 – Public Water Utility Distribution Piping.
 - 2. Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.
 - 3. Section 33 42 00 – Stormwater Conveyance.
- C. Compression Coupling: ASTM C425, compression couplings. Use at least two lengths of pipe in crossing the trench section.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Notify MISS DIG (811) at least 3 days but not more than 14 calendar days before digging operations are scheduled to begin. Do not dig unless all utilities have been marked by MISS DIG (811).
 - 1. Contractor shall be required to enter MISS DIG tickets for all work requiring excavation. When entering the ticket, the following information must be added to the “Locate Info” field. Contractor shall enter “*ENG*” followed by “:Contract Number*”. Example of entry for a Contract with Contract Number 917: *ENG*:917*, followed by a description requesting utility location markings that encompasses the entire work area.
- B. Notify the Michigan Department of Transportation (MDOT):
 - 1. Underground ITS Infrastructure Staking Request. Download and complete MDOT Form 5300, MDOT Underground ITS Infrastructure Staking Request Form (<http://mdotcf.state.mi.us/public/webforms/public/5300.pdf>).
 - 2. Underground Electrical Infrastructure Staking Request. Download and complete MDOT Form 5300A, MDOT Metro Region Underground Electrical Infrastructure Staking Request Form. (<http://mdotcf.state.mi.us/public/webforms/public/5300.pdf>).
- C. Notify Detroit Department of Public Works for locating traffic signal conduit, at least three (3) days prior to construction.



- D. Test Pits: Excavate test pits (soft digging) to field verify the locations, depth of bury, diameter, and pipe material of existing underground utilities at crossings and at tie-in points before ordering materials or commencing excavation. Immediately notify the Engineer if conflicts are encountered.

3.2 PREPARATION

- A. Where utilities are parallel to or cross work, but do not conflict with work, notify the utility owner at least three (3) days in advance of construction at the crossing. Coordinate the construction schedule with the utility owner.

3.3 PROCEDURES

- A. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise indicated or specified.
- B. Damage to Utilities to Remain: If existing utilities to remain are damaged by current construction, immediately notify utility owner, and repair to owner's satisfaction. If utilities are found damaged, immediately notify the utility owner.
- C. Cut and Plug Ends: Cut abandoned water & sewer lines and plug the ends. Plug storm drains and sewers with an 8-inch wall of brick and mortar. Cap waterlines with a cast-iron cap or install a 3-foot-long concrete plug. Dispose of the cut pipe as unsuitable material. Abandoned lines shall be filled with flowable fill for their entire length in accordance with Section 31 23 23.33 – Flowable Fill, and as directed by Engineer.
- D. Remove and Reconstruct: Where so indicated in the drawings or as required by the Engineer, remove the utility and after placement of the new water/sewer line, reconstruct the existing utility with new materials. Provide temporary service for the disconnected utility.

3.4 COMPACTION

- A. Protecting Existing Utilities:
 - 1. Backfill and compact under and around utilities. Compaction shall conform to Section 31 23 33 – Trenching and Backfill.
 - 2. Where compaction cannot adequately be performed around utility due to the presence of encroaching existing utilities, utilize flowable fill or Class C Concrete.

3.5 ALTERNATIVE METHODS

- A. All alternative methods must be submitted in writing to the Engineer for approval prior to installation.



1. Reinforced Concrete Beam: Support utilities by a reinforced concrete beam to prevent settlement of the utility line after construction and protect existing utilities.
2. Concrete Support Wall: Support utilities by a concrete support wall to prevent settlement of the utility line after construction and protect existing utilities.
3. Structural Steel Beam: Support utilities by a structural steel beam to prevent settlement of the utility line after construction and to protect existing utilities.

3.6 PROTECTION OF THRUST BLOCKS

- A. The Contractor's attention is called to existing thrust blocks for waterlines and sewer force mains throughout the project whose thrust is in the direction of the new excavation and, therefore, may be affected by the construction. Protect thrust blocks on existing waterlines or sewer force mains in place or shore to resist the thrust by a means accepted by the Engineer and reconstruct. If the thrust blocks are exposed or rendered to be ineffective in the opinion of the Engineer, reconstruct them to bear against firm unexcavated or backfill material.
 1. Provide firm support by backfilling affected portion of the trench for a distance of 2 feet on each side of the thrust block to be reconstructed from the pipe bedding to the pavement subgrade with either:
 - a. Flowable fill. Comply with Section 31 23 23.33 – Flowable Fill.
 - b. Native material compacted to a relative compaction of 95 percent. Comply with Section 31 23 33 – Trenching and Backfill for compaction requirements.
 2. Excavate the backfill material for construction of the thrust block.
 3. Test compaction of the backfill material before pouring any concrete thrust block. Concrete shall conform to Section 03 30 00 – Cast-in-Place Concrete.

3.7 CLOSE-OUT ACTIVITIES

- A. Provide in accordance with Section 01 70 00 – Execution and Closeout Procedures.
- B. Replace in kind street improvements, such as curbs and gutters, barricades, traffic islands, signalization, fences, signs, etc., that are cut, removed, damaged, or otherwise disturbed by the construction.

END OF SECTION 02 01 20



SECTION 02 22 30 – PRE-CONSTRUCTION VIDEO AND PHOTOGRAPHIC RECORD

PART 1 - GENERAL

1.1 GENERAL

- A. Document the pre-construction and post-construction phases of the Project with color audio-video recordings as set forth herein.
- B. Document the stages of construction with digital photographs to illustrate the condition of construction and state of progress.

1.2 SUBMITTALS

- A. Informational: Statement of Qualification (SOQ) for professional videographer.
- B. Pre-Construction Video Recordings capturing Pre-Existing Conditions: Submit three (3) copies, including Project video log, at least thirty (30) calendar days prior to any field activity.
- C. Construction Photographs:
 - 1. Submit one (1) copy of digital construction photographs monthly depicting the various stages of the Project from views and at such times as directed by the Engineer.
 - 2. The number of photographs shall be adequate to indicate the Work being performed and the progress of the Work.
 - 3. The minimum acceptable number of photographs per month shall be fifty (50) plus any others the Contractor, Engineer, or Owner deem necessary to clearly show the Work being performed.

PART 2 - PRODUCTS

2.1 VIDEO MATERIALS

- A. Digital Video Disc (DVD), Universal Serial Bus (USB), or other electronic media acceptable to the Owner.
- B. File format shall be AVU, FLV, WMV, MOV, MP4, or another format acceptable to the Owner.



2.2 PHOTOGRAPHIC MATERIALS

- A. Digital Video Disc (DVD), Universal Serial Bus (USB), or other electronic media acceptable to the Owner.
- B. File format shall be JPEG, TIFF, or another format acceptable to the Owner.

PART 3 - EXECUTION

3.1 AUDIO-VIDEO RECORDINGS

- A. Pre-Construction and Post-Construction Audio-Video Recordings:
 - 1. At least thirty (30) days prior to beginning Work at the Site, perform video survey of the Construction Site, entire roadway, and property adjacent to the Site.
 - 2. Video emphasis shall be directed to the physical condition of existing vegetation, above ground structures (electrical cabinets, telephone cabinets, electric poles, fences, buildings, garages, etc.), surface features (curbs, driveways, ditches, culverts, manholes, gate wells, stop boxes, hydrants, catch basins, etc.), and pavements along construction area. Videos for authorized haul routes and access roads, and areas adjacent to and within the Right-of-Way or easement, and storage and staging areas. Of particular concern shall be the existence and location of any faults, fractures, and defects.
- B. No equipment or materials shall be placed or delivered to the construction area, nor shall Work begin in the area, prior to the pre-construction recording and the Engineer's review and approval of content and quality of video for that area.
- C. Consult with the Engineer on subject matter and vantage points from which video recordings are taken.
- D. If training sessions are required by detailed specification, record video of the session.
- E. Video recording will be by a professional commercial videographer, hired by the Contractor, and experienced in performing pre-construction video surveys for construction documentation.
- F. Video recording shall be done during a time of good visibility. No recording shall be done during periods of visible precipitation or when more than ten (10) percent of the ground area is covered with snow or standing water, unless authorized by the Owner.
- G. The distance from the camera lens to the ground shall be between eight (8) and ten (10) feet to ensure proper perspective. If conventional wheeled vehicles are used, the distance from the camera lens to the ground shall be at least eight (8) feet.



- H. The rate of speed in the general direction of the video recording shall not exceed forty (40) feet per minute. Panning and zoom rates shall be electronically or manually controlled to provide clear viewing during playback.
- I. Houses and buildings shall be identified visually by house number, when visible, in such a manner that structures of the proposed system can be located by reference. In all instances, location shall be identified by audio or visual means at intervals not-to-exceed 100 linear feet in the general direction of travel.
- J. Video Format and Quality:
 - 1. Video:
 - a. 1080 line High-Definition (HD) Video.
 - b. Electronically display the month, day, year, and time of recording, as well as the project contract number.
 - 2. Audio:
 - a. Audio documentation shall be clear, precise, and at a moderate pace.
 - b. Indicate date, Project name, and a brief description of the location of taping, including:
 - 1) Facility name.
 - 2) Street names or easements.
 - 3) Addresses of private property.
 - 4) Direction of coverage, including engineering stationing, if applicable.
 - 3. Documentation of video recordings shall indicate:
 - a. DWSD.
 - b. Unique video number (numbered sequentially).
 - c. Project name and DWSD Contract Number.
 - d. Name of street(s) or easement(s) included.
 - e. Start and end locations by approximate engineering stationing and GPS coordinates.
 - f. Date and time of coverage.
- K. Project Video Log: Maintain an ongoing log that incorporates above-noted documentation information for electronic media on the Project.

3.2 PHOTOGRAPHIC RECORDS

- A. Photography shall be done by a responsible commercial photographic studio skilled and regularly engaged in the business of taking commercial photographs.
- B. Good quality digital color photographs shall be of correct exposure and focus, displaying high resolution and sharpness.
- C. Digital photos shall include captions, descriptions, and key words as necessary for identification.



- D. Photos shall clearly indicate existing site conditions, construction means and methods, structures, crossing utilities, stream and drain crossings, soil erosion and sedimentation control measures, verification of completion, or other project conditions deemed necessary by the Contractor, Engineer, or Owner.
- E. Digital Camera: Minimum sensor resolution of twelve (12) megapixels.
- F. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
- G. Photographs shall have the following title block in the lower right corner of digital photos:
 - 1. Detroit Water and Sewerage Department.
 - 2. Contract Number.
 - 3. Project Title.
 - 4. Address/Location.
 - 5. Photo By: (Firm name of photographer).
 - 6. Date: (When photo was taken).
- H. Identification: Provide the following information with each image description in file metadata tag:
 - 1. Name of Project.
 - 2. Name and contact information for photographer.
 - 3. Name of Engineer.
 - 4. Name of Contractor.
 - 5. Date photograph was taken.
 - 6. Description of vantage point, indicating location, direction (by compass point).
 - 7. Unique sequential identifier keyed to accompanying key plan.

END OF SECTION 02 22 30



SECTION 02 61 13 - EXCAVATION AND HANDLING OF CONTAMINATED MATERIALS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes: The requirements for excavation, handling, temporary storage, and disposal of soil and/or groundwater that is suspected to be contaminated or potentially contaminated material that may be encountered during the course of the Work.
- B. Site Characterization:
 - 1. Known areas of soil or groundwater contamination may be shown in the plans or as a part of the geotechnical report. Areas of soil or groundwater contamination discovered as part of this project shall be handled, stored, and disposed as specified herein.
 - 2. Separate specification requirements have been included for the testing, handling, and disposal of hazardous waste materials; non-hazardous waste materials; and petroleum contaminated soils. If chemicals of concern found in groundwater are of a nature and/or concentration that necessitate handling the groundwater as hazardous material, compensation will be provided under a contaminated material allowance.
- C. Related Requirements:
 - 1. Section 01 35 29 - Safety Program.
 - 2. Section 31 23 33 - Trenching and Backfill.

1.2 DEFINITIONS

- A. Beneficial Use: The use or reuse of a material that meets any of the “beneficial use” definitions of Michigan’s Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act (NREPA) 451 of 1994, as amended.
- B. Contaminated Material: A material that is contaminated with one (1) or more Chemicals of Concern (COCs) at concentrations that exceed applicable regulatory comparison standards.
- C. Hazardous Waste: Hazardous waste as defined under federal Resource Conservation and Recovery Act (RCRA) 40 CFR 261 divided as listed and characteristic hazardous wastes. A waste that exhibits any of the characteristics as identified in NREPA 451 Part 111.
- D. Non-Hazardous Waste: A waste that is not defined as a hazardous waste under federal and State regulations. Non-hazardous waste may include contaminated, but not hazardous waste; solid waste; infectious waste, and construction and demolition debris.



- E. **Petroleum-Contaminated Soil (PCS):** Petroleum contaminated media and debris that fail the test for the Toxicity Characteristic of 40 CFR 261.24 (Hazardous Waste Codes D018 through D043 only) and are subject to the Underground Storage Tank (UST) site corrective action regulations under 40 CFR 280 are excluded from the definition of hazardous waste under 40 CFR 261.4(b)(10) and Michigan R299.9204(2)(l).
- F. **Unclassified Material:** Material that has not been tested or classified.
- G. **Potentially Contaminated Material:** Soil and/or groundwater that exhibits visual (e.g., discoloration, staining, free product, etc.) or olfactory (e.g. chemical, solvent or petroleum odors) indicators of contamination.
- H. **Chemicals of Concern:** Chemical(s) that is/are suspected to be present in soil and/or groundwater at the site as a result of historical use.
- I. **Licensed Disposal Facility:** A facility that has obtained the necessary permits or licenses that this or another state may require to accept materials for permanent burial, destruction, or treatment. Facilities are licensed based on the materials to be accepted such as solid waste, hazardous waste, non-hazardous waste, and petroleum contaminated soil.
- J. **Solid Waste:** Discarded material defined as “solid waste” under federal regulations 40 CFR 261.2 and Michigan PA 451 Part 115.
- K. **Storage:** To accumulate, collect, or stockpile excavated soil or groundwater on site or off site.
- L. **Treatment:** Use of any method, process, or technique other than storage or disposal designed to change the physical, chemical, or biological character or composition of one or more COCs in contaminated material to render it non-hazardous or less hazardous; safer to transport, store, or dispose of; or amenable for recovery or reduced in volume.

1.3 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

- A. **Federal Requirements** that govern hazardous material management or transportation, and disposal of hazardous waste material.
- B. **U.S. Department of Labor, Occupational Safety and Health Administration (OSHA):**
 - 1. **Respiratory Protection:** 29 Code of Federal Regulations (CFR) 1910.134.
 - 2. **Construction Industry:** 29 CFR 1926.
 - 3. **Hazard Communication:** 29 CFR 1910.
 - 4. **Specifications for Accident Prevention Signs and Tags:** 29 CFR 1910.14.
 - 5. **Lead in Construction:** 29 CFR 1926.62.



C. U.S. Environmental Protection Agency (EPA):

1. Guidance on Field Methods for the Analysis of Petroleum Hydrocarbons: EPA 510-B-97-001.
2. Identification and Listing of Hazardous Waste: 40 CFR 261.
3. Standards applicable to Generators of Hazardous Waste: 40 CFR 262.
4. Standards applicable to Transporters of Hazardous Waste: 40 CFR 263.
5. Standards for Universal Waste Management: 40 CFR 273.
6. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions: 40 CFR 731.

D. State Requirements:

1. Petroleum Contaminated Soils: NREPA 451 R299.9204(2)(l).
2. Solid Waste: NREPA 451 Part 115.
3. Hazardous Waste Management Standards: NREPA 451 Part 111.
4. Liquid Industrial By-Products: NREPA 451 Part 121.

E. U.S. Department of Transportation (DOT):

1. Hazardous materials table, special provisions, hazardous materials communication, emergency response information, training requirements and security plans: 40 CFR 172.
2. Shippers- General requirements for shipments and packaging: 40 CFR 173.
3. Hazardous Materials Transportation Regulations: 40 CFR Parts 174 through 176.

F. American National Standards Institute (ANSI):

1. Z88.2-80, Practices for Respiratory Protection.

G. National Institute of Occupational Safety and Health (NIOSH):

1. Respiratory Protection – An Employer’s Manual & Respiratory Protection – A Guide for the Employee.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittals Procedures.
- B. Comply with Section 01 35 29 – Safety Program.



- C. In addition to all other requirements of the Section 01 35 29 – Safety Program, identify the health and safety concerns pertaining to encountering potentially contaminated soils and groundwater, and include provisions for air monitoring and equipment to monitor VOC's (combustible gases), oxygen level, hydrogen sulfide level, and lower explosive limit (LEL) within the excavation. If any of the levels are exceeded, the Engineer shall be notified immediately. The plan shall identify the appropriate measures to be taken for both non-hazardous and hazardous soil and groundwater.
- D. Submit an Emergency Response Cleanup Plan which details response procedures in the event of any spill or release of regulated material.
- E. Submit the Site Safety and Health Officer qualifications, which shall include a minimum of five (5) years of experience with safety assessments and oversight associated with excavating contaminated soil and/or groundwater.
- F. Submit the following items:
 - 1. Soil and Groundwater Management Plans in accordance with this section, including descriptions of proposed methods and equipment to be used for handling, sampling, and transportation and disposal of contaminated soil and groundwater. Separate plans shall be submitted for the following:
 - a. PCS.
 - b. Hazardous material.
 - c. Non-hazardous waste material.
 - d. Groundwater with chemicals of concern.
 - 2. Qualifications of the Contractor's analytical testing laboratory for all testing necessary for disposal, and the laboratory's anticipated turn-around time for results.
 - 3. The name and address of the proposed licensed disposal and/or recycling facility(s) and waste hauler(s). Include copies of applicable permits and licenses.
 - 4. Description of proposed disposal site(s) and/or recycling facility(s) including a pre-approval letter from each disposal/recycling site operator indicating the allowable range of contaminants that are acceptable at each site.
 - 5. Analytical results and laboratory chain-of-custody records for all samples.
 - 6. Records of transportation and disposal including weight tickets; manifests and/or non-hazardous certificates, as applicable; disposal receipts, etc.

1.5 QUALITY ASSURANCE

- A. Maintain a safe worksite.
- B. Furnish a Site Safety and Health Officer responsible for evaluating the safety conditions during excavation of contaminated soil and/or groundwater. The Health and Safety Officer shall have a minimum of 5 years of experience with safety assessments and oversight associated with excavating potentially contaminated soil and/or groundwater. Personnel shall be trained in accordance with 29 CFR 1926.65, Safety and Health Regulations for Construction for Hazardous



Waste Operations and Emergency Response. These requirements are in addition to all requirements included in Specification Section 01 35 29 – Safety Program.

- C. Establish and maintain an Emergency Response Cleanup Plan which details the response plan in the event of any spill or release of regulated materials such as hazardous substances or petroleum products.
- D. Pay for any violations and/or fines, etc. that arise from the mishandling, improper disposal or use of faulty equipment associated with the removal of contaminated soil and/or groundwater.
- E. Maintain current licenses, permits and certifications as required by the applicable federal, state, or local jurisdictions for the removal, transporting disposal, or other regulated activity relative to work conducted under this contract.
- F. The Owner, at his sole discretion, may provide a third-party inspector experienced in the identification and field screening of soil and/or groundwater to confirm the Contractor's observations. At any time, the Owner may perform duplicate sampling and testing to verify results for disposal or recycling activities. Properly handle, test, transport, and dispose of all excavated soil and groundwater regardless of any testing or inspection performed or not performed by the Owner directly or through a third party.
- G. Perform all testing, transportation, disposal, and recycling activities in accordance with local, state and federal regulations.
- H. Disposal and recycling facilities shall be licensed by the local, State, or federal agencies as applicable for the management of liquid, solid and/or hazardous waste.
- I. Obtain all necessary permits and approvals for transporting material to a licensed disposal or recycling facility.
- J. Groundwater discharge to any sanitary sewer shall be below the GLWA Local Limits. The GLWA Industrial Pretreatment Program is intended to prevent the introduction of pollutants to the GLWA wastewater treatment plant that could interfere with treatment operations, that may not receive adequate treatment in the process, and which may pass through the system into the receiving waters or the atmosphere or otherwise be incompatible with the system. In addition, the Pretreatment Program is intended to protect the general health and safety of the wastewater treatment plant, employees, and the environment.

PART 2 – PRODUCTS – Not Used



PART 3 - EXECUTION

3.1 GENERAL

- A. Excavation and handling of contaminated soil and groundwater shall be conducted in such a manner that prevents any runoff or further contamination.
- B. Locations of soil stockpiles and/or containers shall be submitted for pre-approval by the Owner. This information shall be included in the Soil and Groundwater Management Plan.
- C. The Contractor shall be considered the transporter of all material removed from the Work site. The transporter shall be licensed in accordance with applicable federal, state, and local regulations.
- D. The Owner shall be considered the generator of all material removed from the Work site.
- E. Maintain daily logs, landfill tickets, and manifests that document the source, movement, and destination of each truckload of excavated soil.
 - 1. Contaminated materials shall be transported in leak-proof vehicles or containers.
 - 2. During the transport of excavated soil, open-top vehicles or containers shall be covered or tarped.
 - 3. All waste material transported off-site shall be shipped under a bill of lading and, as applicable, waste manifests, waste profiles, land disposal restriction forms, and all other documentation required by federal, state, and local regulations.
 - 4. The disposal/recycling facility shall determine the weight of the material and report the weight on the returned bill of lading and all other required documents.
 - 5. Provide an initialed and dated copy of the weight ticket receipt to the Owner within 2 working days of the delivery. The weight ticket shall clearly identify the bill of lading.
 - 6. Submit to the Owner final copies of all waste manifests and bills of lading for tracking material through transportation and treatment or disposal.

3.2 SOIL HANDLING, SAMPLING, TESTING, AND DISPOSAL

- A. The Contractor's Site Safety and Health Officer shall evaluate the air quality conditions within any trenching or open cut excavation operation within suspected contaminated areas, develop a baseline analysis of the air quality, and incorporate appropriate engineering controls and appropriate personal protective equipment (PPE) to allow for safe working conditions.
 - 1. Before any workers enter the excavation, a multi-gas detector shall be used to determine, at a minimum, the oxygen level, hydrogen sulfide level, and lower explosive limit (LEL). If any of the levels exceed OSHA acceptable levels or indicate unsafe working conditions, workers will not be allowed to enter the excavation, and all workers shall evacuate the area to 150 feet upwind of the excavation.



2. A photoionization detector (PID) shall be used to monitor for volatile organic compounds (VOC's) within the excavation. If VOC levels exceed 20.0 parts per million (ppm), the site workers shall immediately exit the excavation and engineering control shall be re-evaluated.
3. Air quality shall be monitored continuously.

B. Adhere to the following procedures for PCS excavated from the areas identified in Part 1.1.B:

1. Notify the Owner prior to the start of excavation.
2. PCS material shall be handled, transported, and disposed in accordance with local, state and federal regulations.
3. The Owner will be considered the generator of all PCS.
4. The Site-Specific Health and Safety Officer shall require the use of appropriate PPE to allow for safe working conditions during excavation.
5. The PCS shall be segregated from other excavated materials on stockpiles on impermeable membranes or in approved leak-proof containers. During wet weather, stockpiles or containers shall be covered or tarped with impermeable membranes to prevent contact with precipitation and/or surface runoff. Caution shall be exercised to prevent spillage of PCS during transport to containers or stockpiles.
6. Excavation, transportation, and placement operations shall result in no visible dust.
7. Perform all field and analytical testing required by the licensed disposal and recycling facility or beneficial use criteria.
 - a. Collect samples after the soil has been properly stockpiled or loaded into roll-off containers/trucks. Samples shall be representative of the stockpiled soil. No surface soil from the stockpiled or containerized soil shall be used.
 - b. An appropriate number of samples shall be obtained to fully characterize the material, as required by the disposal or recycling facility.
 - c. Field notes shall be completed and shall include sample location, sample number, date and time collected and other pertinent information.
 - d. Chain-of-Custody documents shall be prepared and sample containers shall be labeled with the project name, sample number, date and time collected, and analyses required.
8. If analytical results confirm that the material is PCS, handle, transport, and dispose of the material in accordance with state and federal requirements.
9. If visual or olfactory indicators, field screening, field testing, or analytical testing indicate that the material is potentially hazardous or is any type of contamination other than PCS, immediately notify the Owner and segregate the excavated material from other excavated materials in approved leak-proof containers or stockpile the material on impermeable membranes.
10. Decontaminate equipment used during the handling, sampling, storage and disposal of PCS Material prior to beginning the excavation of Unclassified Material. Any Potentially Contaminated Material generated by decontamination activities shall be characterized and disposed in accordance with state and federal regulations.



11. No additional compensation will be allowed for delays in accepting waste or waste rejected by the facility due to incomplete characterization, or due to invalid or expired transporter permits.
 12. The waste profile must be signed by the Owner.
 13. The waste manifest must be signed by the Owner.
- C. Adhere to the following procedures for hazardous material excavated from the areas identified in Part 1.1.B:
1. Notify the Owner prior to the start of excavation.
 2. Handle, transport and dispose of hazardous waste in accordance with state and federal regulations. Hazardous waste must be transported by an appropriately permitted hauler to a properly licensed disposal facility.
 3. The Owner will obtain the necessary hazardous waste facility identification number from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and provide it to the Contractor. The Owner will be considered the generator of all hazardous waste.
 4. The Site-Specific Health and Safety Officer shall require the use of appropriate PPE to allow for safe working conditions during excavation.
- D. Hazardous material shall be segregated from other excavated materials on stockpiles on impermeable membranes or in approved leak-proof containers. During wet weather, stockpiles or containers shall be covered or tarped with impermeable membranes to prevent contact with precipitation and/or surface runoff. Caution shall be exercised to prevent spillage of hazardous material during transport to containers or stockpiles.
1. Excavation, transportation, and placement operations shall result in no visible dust.
 2. Perform all field and analytical testing required by the licensed disposal and/or recycling facility or beneficial use criteria.
 - a. Collect the appropriate number of samples. Samples shall be representative of the stockpiled soil. No surface soil from the stockpiled or containerized soil shall be used.
 - b. An appropriate number of samples shall be obtained to fully characterize the material, as required by the disposal facility.
 - c. Field notes shall be completed and shall include sample location, sample number, date and time collected and other pertinent information.
 - d. Chain-of-Custody documents shall be prepared and sample containers shall be labeled with the project name, sample number, date and time collected, and analyses required.
 3. If analytical results confirm that the material is hazardous waste, handle, transport, and dispose of the material as specified in the Contractor's Soil Management Plan and in accordance with state and federal regulations.
 4. Decontaminate equipment used during the handling, sampling, storage and disposal of Hazardous Material prior to beginning the excavation of Unclassified Material. Any Potentially Contaminated Material generated by decontamination activities shall be characterized and disposed in accordance with state and federal regulations.



5. No additional compensation will be allowed for delays in accepting waste or waste rejected by the facility due to incomplete characterization, or due to invalid or expired transporter permits.
 6. The waste profile must be signed by the Owner.
 7. The waste manifest must be signed by the Owner.
- E. Adhere to the following procedures for non-hazardous waste excavated from the areas identified in Part 1.1.B:
1. Notify the Owner prior to the start of excavation.
 2. Non-hazardous waste material shall be handled, transported, and disposed in accordance with state and federal regulations.
 3. The Owner will be considered the generator of all non-hazardous waste.
 4. The Site-Specific Health and Safety Officer shall require the use of appropriate PPE to allow for safe working conditions during excavation.
 5. The non-hazardous waste shall be segregated from other excavated materials on stockpiles on impermeable membranes or in approved leak-proof containers. During wet weather, stockpiles or containers shall be covered or tarped with impermeable membranes to prevent contact with precipitation and/or surface runoff. Caution shall be exercised to prevent spillage of non-hazardous during transport to containers or stockpiles.
 6. Excavation, transportation, and placement operations shall result in no visible dust.
 7. Perform all field and analytical testing required by the licensed disposal and/or recycling facility or beneficial use criteria.
 - a. Collect samples after the soil has been properly stockpiled or loaded into roll-off containers/trucks. Samples shall be representative of the stockpiled soil. No surface soil from the stockpiled or containerized soil shall be used.
 - b. An appropriate number of samples shall be obtained to fully characterize the material, as required by the disposal or recycling facility.
 - c. Field notes shall be completed and shall include sample location, sample number, date and time collected and other pertinent information.
 - d. Chain-of-Custody documents shall be prepared and sample containers shall be labeled with the project name, sample number, date and time collected, and analyses required.
 8. If analytical results confirm that the material is non-hazardous waste, handle, transport, and dispose of the material in accordance with state and federal regulations.
 9. If visual or olfactory indicators, field screening, field testing, or analytical testing indicate that the material is potentially PCS, hazardous waste, or any type of contamination other than non-hazardous waste, immediately notify the Owner and segregate the excavated material from other excavated materials in approved leak-proof containers or stockpile the material on impermeable membranes.
 10. Decontaminate equipment used during the handling, sampling, storage and disposal of Non-hazardous waste material prior to beginning the excavation of Unclassified Material. Any Potentially Contaminated Material generated by decontamination activities shall be characterized and disposed in accordance with state and federal regulations.



11. No additional compensation will be allowed for delays in accepting waste or waste rejected by the facility due to incomplete characterization, or due to invalid or expired transporter permits.
 12. The waste profile must be signed by the Owner.
 13. The waste manifest must be signed by the Owner.
- F. Testing shall be performed by an independent, certified analytical laboratory.
- G. If any type of contaminated material is detected at any location other than those listed in Part 1.1.B, immediately take all necessary precautions to protect worker health and safety, secure the area, notify the Owner, and segregate any materials already excavated.
- H. The link to the EGLE website listing Hazardous Waste Facilities licensed in Michigan is as follows https://www.michigan.gov/deq/0,4561,7-135-3312_4118_4240-8987--,00.html. In general, a landfill classified as a Hazardous Waste Facility will accept different types of hazardous waste, except some may not accept wastes with high concentrations of PCB's. However, note that certain facilities may only accept certain types of hazardous waste (i.e., solids, liquids, battery recycling, mercury, electrical equipment, PCBs, etc.). Therefore, the Contractor will need to contact the facility to ensure that they accept soil classified as hazardous waste. The Contractor, for bidding purposes, shall assume that the soil will not contain high PCB concentrations that would preclude disposal at a hazardous waste landfill.

3.3 GROUNDWATER HANDLING, SAMPLING, TESTING, AND DISPOSAL

- A. Test all groundwater prior to discharging it to the sewer system if approved by DWSD and GLWA. Testing shall be performed by an independent, certified analytical laboratory provided by the Contractor.
- B. Provide proper equipment capable of removing and treating potentially contaminated groundwater without causing unsafe work conditions.
- C. Remove groundwater from excavation by pumping, bailing, or other methods acceptable to the Owner and in accordance with other specification sections and applicable requirements of the U.S. EPA, EGLE, State Fire Marshal, and local regulatory agencies. Sample and provide necessary testing of groundwater encountered during excavation and dewatering activities for waste characterization and as required by disposal facilities.
- D. Characterize the groundwater as petroleum contaminated media similar to PCS, hazardous waste, or non-hazardous liquid industrial by-products based on analytical testing and site information.
- E. The liquid waste shall be handled, transported, and disposed of in accordance with state and federal regulations.
 1. Notify the Owner immediately.
 2. The Owner will be considered the generator of all waste.
 3. The Owner will obtain the necessary waste facility identification number from EGLE.



4. The waste profile must be signed by the Owner.
5. The waste manifest must be signed by the Owner.
6. Liquid waste must be transported by an appropriately permitted hauler to a properly licensed disposal facility.
7. No additional compensation will be allowed for delays in accepting waste or waste rejected by the facility due to incomplete characterization, or due to invalid or expired transporter permits.

END OF SECTION 02 61 13



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EXCAVATION AND HANDLING OF
CONTAMINATED MATERIALS
DWSD Standard Specification
March 2025

SECTION 03 10 00 - CONCRETE FORMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Design, furnish and install materials for fabricating, erecting and removing formwork, falsework and shoring for cast-in-place concrete as shown on the Contract Drawings and specified herein for a complete installation.
2. Use formwork to cast all cast-in-place concrete structures.

B. Related Requirements:

1. Section 03 20 00 – Concrete Reinforcing.
2. Section 03 30 00 – Cast-in-Place Concrete.
3. Section 03 31 00 – Construction and Expansion Joints.
4. Section 31 23 33 – Trenching and Backfill.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. American Concrete Institute (ACI):

1. ACI 117/117R - Standard Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 309.2R - Identification and Control of Visible Effects of Consolidation on Formed Concrete Surfaces.
4. ACI 318/318R - Building Code Requirements for Structural Concrete and Commentary.
5. ACI 347R - Guide to Formwork for Concrete.
6. ACI 350.5 - Specifications for Environmental Concrete Structures.

B. APA – The Engineered Wood Association (formerly American Plywood Association).

C. National Institute of Product Standards and Technology:

1. Voluntary Product Standard PS 1 Structural Plywood.

D. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 CFR 1926, current edition.



1.3 DESIGN REQUIREMENTS

- A. Design formwork in conformance with methodology of ACI 347R for anticipated loads, lateral pressures, depth of concrete placement and rate of concrete placement. Design shall consider any special requirements due to the use of self-consolidating, plasticized and/or retarded set concrete. All forms and shoring shall be designed at the Contractor's expense.
- B. Provide and design forms with openings to allow placement and consolidation of concrete without segregation. Provide drop chutes or drop pipes to prevent accumulation of hardened concrete on forms and reinforcement above fresh concrete and to prevent concrete segregation.

1.4 QUALIFICATIONS

- A. Formwork Designer: Formwork, falsework, and shoring design shall be by the Contractor's Professional Engineer registered in the State of Michigan.

1.5 SUBMITTALS

- A. Submit product data for form ties, spreaders, chamfer strips, form coatings, and bond breakers at least fourteen (14) days prior to any field activity.
- B. Submit the following shop drawings:
 - 1. Form Ties-Tapered Through-Bolts.
 - 2. Proposed method of sealing form tie holes.
- C. For cast-in-place concrete structures only, submit formwork design calculations signed and sealed by a Professional Engineer registered in the State of Michigan.

1.6 QUALITY ASSURANCE

- A. Design of Formwork:
 - 1. Design, engineer, and construct formwork. Forms shall be designed to produce concrete members identical in shape, to the lines and dimensions shown in the Contract Documents.
 - 2. When high range water reducer (superplasticizer) is used in concrete mix or when self-consolidated concrete is specified, forms shall be designed for full hydrostatic pressure per ACI 347.
 - 3. The formwork shall be designed for the loads and lateral pressures in accordance with ACI 347 and wind and other loads as specified by Michigan Building Code.



4. Construction and contraction joints, openings, offsets, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, waterstops, anchorages, inserts, and other features shall be provided.
 5. Formwork shall be designed to be readily removable without impact, shock, or damage to 'green' concrete surfaces and adjacent materials.
 6. The maximum panel deflection shall be $1/360$ of the span between structural members.
- B. Unless otherwise specified herein, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits as given in ACI 117 and as indicated in Table 03 10 00-1.
- C. Materials, fabrications, and workmanship found defective shall be promptly removed and replaced and new acceptable work shall be provided in accordance with Contract requirements at no additional cost to the Owner.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered to the site in an undamaged condition and at such intervals as will avoid delay in the work.
- B. Material shall be stored and protected in a clean, properly drained location. Material shall be kept off the ground under a weather-tight covering permitting good air circulation. Formwork materials shall be stored on dry wood sleepers, pallets, platforms or other appropriate supports which have slope for positive drainage. Materials shall be protected from distortion, excessive stresses, corrosion and other damage. Materials shall not be stored on the structure in a manner that might cause distortion or damage to the supporting structure.

PART 2 - PRODUCTS

2.1 LUMBER

- A. Boards shall be 6 inches or more in width.

2.2 PLYWOOD

- A. Only grade-marked plywood conforming to APA shall be provided.
- B. Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS 1 Structural Plywood.
- C. Thickness shall be sized to maintain alignment and surface smoothness, but not less than 5/8-inch thick.



2.3 STEEL FORMS

- A. Commercial grade sheets not less than 16-gage shall be provided.
- B. Stock material that is free from warps, bends, kinks, cracks, and rust or other matter that could stain the concrete shall be provided.
- C. Steel forms shall be used for the inside face of circular arcs. Forms shall provide a continuous, smooth surface, truly cylindrical, and of the correct diameter throughout. Timber may be used to form transitions and short sections.
- D. Provide forms with strength to restrain forms from deflecting beyond finish tolerances specified.
- E. Provide forms having sheet steel lining with steel back-up framing. Do not use sheet steel lining with wood back-up framing.

2.4 FORM MATERIAL LOCATIONS

- A. Wall Forms and Underside of Slabs and Beams:
 - 1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particleboard, or steel in new and undamaged condition, of sufficient strength and surface smoothness to produce specified finish.
- B. Column Forms:
 - 1. Rectangular Columns: As specified for walls.
 - 2. Circular Columns: Fabricated steel or fiber reinforced plastic with bolted together sections or spirally wound laminated fiber form internally treated with release agent for height of column.
- C. All Other Forms: Materials as specified for wall forms.
- D. Rustication Grooves and Chamfer Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

2.5 FORM TIES

- A. Locate form ties on exposed surfaces in a uniform pattern. Place form ties so that they remain embedded in the concrete except for a removable portion at each end. Form ties shall have conical or spherical type inserts with a maximum diameter of one inch. Construct form ties so that no metal is within 1-1/2 inches of the concrete surface when the forms, inserts, and tie ends are removed. Do not use wire ties. Ties shall withstand all pressures and maintain forms within acceptable deflection limits.



- B. Tapered form ties shall be tapered through-bolts or through-bolts that utilize a removable tapered sleeve. Tapered form ties shall not be used on portions of structures required to be watertight.
- C. Wire ties will not be permitted.
- D. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
 - 1. Integral steel water stop 0.103-inch thick and 0.625-inch in diameter tightly and continuously welded to tie.
 - 2. Neoprene water stop 3/16-inch thick and 15/16-inch diameter whose center hole is one-half diameter of tie, or molded plastic water stop of comparable size.
- E. Elastic Vinyl Plug:
 - 1. Design and size of plug shall allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal forming watertight seal.
 - 2. Manufacturer:
 - a. Dayton Superior, Miamisburg, OH; A58 Sure Plug.
 - b. Or approved equal.
- F. Mechanical EPDM Rubber Plug:
 - 1. Mechanical plug for taper tie.
 - 2. Manufacturers:
 - a. Greenstreak Group Inc., St. Louis, MO; X-Plug.
 - b. Or approved equal.
 - 3. Friction fit plugs will not be allowed.

2.6 BOND BREAKER

- A. Bond breaker shall be a V.O.C.-compliant nonstaining type that will provide a positive bond prevention.
- B. Manufacturers:
 - 1. Edoco Burke; Clean Lift 90 W.B.
 - 2. Nox-Crete, Inc.; Silcoseal 97EC.
 - 3. Dayton Superior, Miamisburg, OH; J6 WB.
 - 4. Or approved equal.



2.7 FORM CAULKING

- A. Form caulking shall be a one-component, gun-grade silicone sealant that is capable of producing flush, watertight and non-absorbent surfaces and joints. Sealant shall be compatible with the type of forming material and concrete ingredients used.
- B. Products:
 - 1. Series 1200 Construction Caulking; GE Silicones, Waterford, NY.
 - 2. Dow Corning 999-A; Dow Corning Co., Midland, MI.
 - 3. Sikasil-GP; Sika Corporation Industry Products, Madison Heights, MI.
 - 4. Or approved equal.

2.8 CHAMFER STRIPS

- A. Provide 3/4-inch x 3/4-inch chamfer strips milled from clear, straight-grain pine, surfaced each side, or having extruded vinyl type with or without nailing flange unless otherwise shown in the Contract Documents.

2.9 INSERTS

- A. Provide galvanized cast steel or galvanized welded steel inserts, complete with anchors to concrete and fittings such as bolts, wedges and straps.

2.10 FORM RELEASE AGENT

- A. Form release agent shall not bond with, stain, or adversely affect concrete surfaces and shall not impair subsequent treatments of concrete surfaces when applied to forms. A ready-to-use water-based material formulated to reduce or eliminate surface imperfections and containing no mineral oil or organic solvents.
- B. Manufacturers and Products:
 - 1. BASF, Shakopee, MN; MBT, Rheofinish 211.
 - 2. Cresset Chemical Company; Crete-Lease 20-VOC.
 - 3. Unitex Chemicals; Farm Fresh.
 - 4. Magic Kote: Symons Corporation, Des Plaines, IL.
 - 5. Or approved equal.



PART 3 - EXECUTION

3.1 FORM TOLERANCES

- A. Comply with the requirements of ACI 117 for tolerances for formed surfaces except as specified in Table 03 10 00-1.

Table 03 10 00-1	
Item	Tolerance
Vertical alignment (plumbness)	1/4 inch in any 10 feet and 1 inch maximum for entire length
Variation in the lines and surfaces of foundation mats, base slabs and walls	1/4 inch in any 10 feet and 1-inch max. for entire length
Variation from the level or from the grades indicated on the drawings	1/4 inch in any 10 feet
Variation of the linear building lines from established position in plan	1/2 inch in any 20 feet and 1 inch maximum for entire length
Variation of distance between walls	1/4 inch in any 10 feet and 1 inch maximum for entire length and height
Variation in the sizes and locations of sleeves, floor openings and wall openings	Minus 1/4 inch. Plus 1/2 inch.
Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus 1/4 inch. Plus 1/2 inch.
Offset between adjacent panels of formwork facing material	1/2 inch (ACI 117 Class C finish).
Offset between adjacent panels of formwork facing material for exposed surfaces where appearance is of importance	1/8 inch (ACI 117 Class A finish).

- B. Tolerances are not cumulative.
- C. Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.
- D. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.



3.2 PREPARATION

- A. Clean form surfaces to be in contact with concrete or foreign material prior to installation. Tape, gasket, plug, and/or caulk joints, gaps, and apertures in forms so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.
- B. Coat form surfaces in contact with concrete with a form release agent prior to form installation.
- C. Keep form coatings off steel reinforcement, items to be embedded, and previously placed concrete.
- D. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.
- E. Form liners to be installed for architectural concrete finish shall be in accordance with the manufacturer recommendations.

3.3 ERECTION AND INSTALLATION

- A. Forms shall be constructed in accordance with ACI 347 to required dimensions, plumb, and straight. All joints and seams shall be made mortar-tight. Forms shall be substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subjected to. Unless otherwise indicated on the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits in ACI 117 and herein specified.
- B. Provide means for holding adjacent edges and ends of form panels tight and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Forms shall be tight and shall prevent the loss of mortar and fines during placing and vibration of concrete.
- C. Provide exterior exposed corners in concrete members with chamfers as specified, unless otherwise noted.
- D. Provide means for removing forms without injury to the surface of finished concrete.
- E. Do not embed any form-tying device or part thereof other than metal in the concrete.
- F. Locate large end of taper tie on the "wet" side of the wall.
- G. Use only form or form-tying methods that do not cause spalling of the concrete upon form stripping or tie removal.
- H. Form surfaces of concrete members except where placement of the concrete against the ground is shown in the Contract Drawings.



- I. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure water tightness. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with additional reinforcement as shown in the Contract Drawings. Reinforcing shall be at least two inches clear from the opening surfaces and encased items.
- J. Set anchor bolts and other embedded items accurately before placing concrete and hold securely in position until the concrete is placed and set. Check special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after placing concrete. Check nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to placing concrete.
- K. Maintain steel form temperature between 50-degree F and 95-degree F before, during, and after concrete placement until the forms are removed.
- L. If the ambient temperature is below 40-degree F, forms shall be removed only after review by the Engineer or if the strength of each of two adjacent field cured test cylinders representing the concrete to be stripped exceeds the minimum strengths indicated. Field cylinders selected to determine minimum strength for stripping purposes shall be field cylinders taken from the concrete at the end (i.e., during the last hour) of the placement.

3.4 PROTECTION

- A. During installation, the forms shall not be used as a storage platform nor as a working platform until the forms have been permanently fastened in position.

3.5 PIPES AND WALL CASTINGS CAST IN CONCRETE

- A. Comply with requirements in Section 03 30 00 – Cast-in-Place Concrete.

3.6 REMOVAL OF FORMS

- A. Forms shall be removed in accordance with ACI 347 recommendations without damage to concrete and in a manner to ensure complete safety to the structure. Forms, form ties and bracing shall not be removed without specific permission of the Contractor's Professional Engineer registered in the State of Michigan.
- B. Table 03 10 00-2 indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed; during which the air surrounding the concrete is above 50 degrees F.



Table 03 10 00-2	
Sides of footings and encasements.	24 hours.
Walls, vertical sides of beams, girders, columns, and similar members not supporting loads.	48 hours.
Slabs, beams, and girders.	10 days (forms only).
Shoring for slabs, beams, and girders.	Until concrete strength reaches 70 percent specified 28-day strength.
Wall bracing.	Until top or roof slab concrete reaches 70 percent specified 28-day strength.

- C. Removal times will be increased if the concrete temperature following placement is permitted to drop below 50 degrees F.
- D. Do not remove supports and reshore unless otherwise accepted by Engineer.

3.7 PATCHING OF TAPERED TIE HOLES

- A. Choose one of the following systems for patching of tapered tie holes:
 - 1. Elastic Vinyl Plug:
 - a. Clear tie hole of all loose debris with a taper tie void brush and flush debris from tie hole with air or water.
 - b. Install elastic vinyl plug from larger tie hole end in accordance with manufacturer's instructions using an insertion tool as recommended by the manufacturer.
 - c. Coat entire annular surface of the hole with epoxy bonding compound prior to filling with non-shrink, non-metallic patching mortar. Apply epoxy in accordance with manufacturer's instructions.
 - d. Fill each side of hole with mortar. Apply mortar to the "wet" side of the wall first. Consolidate mortar solidly into the hole.
 - 2. Mechanical Plug:
 - a. Clear tie hole of all loose debris with a taper tie void brush and flush debris from tie hole with air or water.
 - b. Install mechanical plug in accordance with manufacturer's instructions.
 - c. Coat entire annular surface of the hole with epoxy bonding compound prior to filling with non-shrink, non-metallic patching mortar. Apply epoxy in accordance with manufacturer's instructions.
 - d. Fill each side of hole with mortar. Apply mortar to the "wet" side of the wall first. Consolidate mortar solidly into the hole.



3.8 ALUMINUM SURFACES IN CONTACT WITH CONCRETE

- A. Coat aluminum surfaces that will be in contact with concrete with bituminous coating to avoid chemical reaction. Under no circumstances shall aluminum contact dissimilar metal or concrete.

END OF SECTION 03 10 00



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SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Requirements:

1. Section 03 10 00 – Concrete Forming.
2. Section 03 25 00 – Concrete Accessories.
3. Section 03 30 00 – Cast-in-Place Concrete.
4. Section 03 31 00 – Construction and Expansion Joints.
5. Section 03 37 13 – Shotcrete: Reinforcement for shotcrete.
6. Section 03 39 00 – Concrete Curing.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures
4. ACI SP-66 - ACI Detailing Manual.

B. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

C. ASTM International:

1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
3. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
4. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.



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5. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
6. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

D. Concrete Reinforcing Steel Institute:

1. CRSI 10-MSP - Manual of Standard Practice.
2. CRSI 10-PLACE - Placing Reinforcing Bars.

1.3 COORDINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Coordinate Work of this Section with placement of formwork, formed openings, and other Work.

1.4 PRE-INSTALLATION MEETINGS

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings:
 1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel, bar supporters and welded wire fabric.
 2. Indicate bending and cutting schedules.
 3. Indicate supporting and spacing devices.
 4. Indicate bend details of bars with mechanical couplers.
 5. Include manufacturer's certification and cut-sheets for mechanical couplers.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Submit certified copies of mill test report of reinforcement materials analysis.
- E. Welder Certificates:
 1. Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.
 2. Welders: Qualify procedures and personnel according to AWS D1.4.



- F. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, submit Manufacturer's literature that contains instructions and recommendations for installation for each type of coupler used; certified test reports that verify the load capacity of each type and size of coupler used; and Shop Drawings that show the location of each coupler with details of how they are to be installed in the formwork.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI 315.
- B. Prepare Shop Drawings according to ACI SP-66.

1.7 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months for employed weld types.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
 - 1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel:



1. Comply with ASTM A615.
2. Yield Strength: 60 ksi.
3. Billet Bars: Deformed.
4. Finish: Uncoated.

B. Reinforcement:

1. Material: Steel bars.
2. Comply with ASTM A706.
3. Yield Strength: 60 ksi.
4. Finish: Uncoated.
5. These bars shall be used only where welding is indicated or approved by the Engineer.

C. Deformed Wire:

1. Comply with ASTM A1064.
2. Finish: Uncoated.

D. Plain Wire:

1. Comply with ASTM A1064.
2. Finish: Uncoated.

E. Welded Deformed Wire Fabric:

1. Comply with ASTM A1064.
2. Configuration: Flat sheets.
3. Finish: Uncoated.

F. Welded Plain Wire Fabric:

1. Comply with ASTM A1064.
2. Configuration: Flat sheets
3. Finish: Uncoated.

2.2 SHOP FINISHING

- A. Epoxy-Coated Finish for Steel Bars: Comply with ASTM A775. For coating applied after fabrication, comply with ASTM A934.
- B. Epoxy-Coated Finish for Steel Wire: Comply with ASTM A884, Class A.

2.3 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage, annealed type, epoxy coated.



- B. Chairs, Bolsters, Bar Supports, and Spacers Size and Shape: To strengthen and support reinforcement during concrete placement conditions.
- C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather-Exposed Concrete Surfaces:
 - 1. Material: Stainless steel.
 - 2. Size and Shape: To meet Project conditions.
- D. Reinforcing Splicing Devices:
 - 1. Type: Mechanical threaded; full tension and compression.
 - 2. Size: To fit joined reinforcing.
 - 3. Mechanical couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcing bars being spliced at each splice.
 - 4. Coupler system shall possess a current and valid International Code Council Evaluation Service Report.
 - 5. Where the type of coupler used is composed of more than one component, all components required for the complete splice shall be supplied.
 - 6. Manufacturers:
 - a. Erico (Pentair) – Lenton Form Saver.
 - b. Dayton Superior – DBDI Splice System.
 - c. Approved equal.
- E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.4 SOURCE QUALITY CONTROL

- A. Certificate of Compliance:
 - 1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Fabricate concrete reinforcement according to ACI SP-66.
- B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks as indicated on Drawings.
- C. Form reinforcement bends with minimum diameters according to ACI 318 or ACI 350.



- D. Weld reinforcement according to AWS D1.4.
- E. Epoxy-Coated Reinforcement: Clean surfaces, weld, and re-protect welded joint according to CRSI 10-PLACE.
- F. Splicing: If not indicated on Drawings, locate reinforcement splices at point of minimum stress. However, such locations shall be subject to approval by the Engineer.

3.2 INSTALLATION

- A. Place, support, and secure reinforcement against displacement.
- B. Do not deviate from required position beyond specified tolerance.
- C. Do not weld crossing reinforcement bars for assembly except as permitted by Engineer.
- D. Accommodate placement of formed openings.
- E. Spacing and Concrete Cover:
 - 1. Space reinforcement bars at spacing indicated on the Drawings within the specified tolerances.
 - 2. Place reinforcement bars with minimum clear concrete cover according to ACI 350 unless shown otherwise on the Drawings.
 - 3. If bars are indicated in multiple layers, place upper bars directly above lower bars.
- F. Comply with tolerance requirements in Section 01 40 00 - Quality Requirements.
- G. Install reinforcement to tolerances given in ACI 350 unless otherwise indicated or specified.

3.3 FIELD QUALITY CONTROL

- A. Comply with Contractor procured inspecting and testing requirements in Section 01 40 00 - Quality Requirements.
- B. Field quality control inspection and testing may also be performed by an independent firm retained by the Owner according to ACI 315. This shall be independent from the inspection and testing conducted by the Contractor.
- C. Provide unrestricted access to Work and cooperate with Owner-appointed inspection and testing firm.
- D. Reinforcement Inspection:



1. Placement Acceptance: Inspect specified material requirements and specified placement tolerances.
2. Welding: Inspect welds according to AWS D1.4.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Continuous Weld Inspection: Inspect reinforcement according to ACI 350.
5. Periodic Weld Inspection: Inspect other welded connections.
6. Post-installed reinforcement dowels shall be tension tested in accordance with grout manufacturer's requirements. Should any tension test fail, all dowels installed that day shall be tested.

END OF SECTION 03 20 00



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SECTION 03 25 00 – CONCRETE ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joint Fillers.
2. Joint Sealants.
3. Waterstops.
4. Miscellaneous Embedded Items in Concrete.

B. Related Requirements:

1. Section 03 10 00 – Concrete Forming.
2. Section 03 20 00 – Concrete Reinforcement.
3. Section 03 30 00 – Cast-in-Place Concrete.
4. Section 03 31 00 – Construction and Expansion Joints.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. ASTM National:

1. ASTM A193 – Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications.
2. ASTM A194 – Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.
4. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
5. ASTM F436 – Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
6. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

B. Submit certified manufacturer's literature, catalog data, and statement of compliance with referenced standards and specifications for materials specified herein.



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- C. Provide technical data sheets for the Contractor's personnel and the Owner covering joint preparation, priming, and sealant materials application.
- D. Submit a schedule of concrete pouring and indicate locations of proposed construction and expansion joints.

1.4 SEQUENCING

- A. Sequence installation of miscellaneous embedded items with the Work of Section 03 10 00 - Concrete Formwork, Section 03 20 00 - Concrete Reinforcement, and Section 03 30 00 - Cast-in-Place Concrete.

1.5 MANUFACTURER'S SERVICES

- A. Prior to joint preparation for joints receiving sealant materials, the Contractor shall require joint manufacturer's technical representative to demonstrate at the site joint preparation, priming, and sealant materials application for the Contractor's personnel performing joint work. Manufacturer's technical representative shall complete this demonstration no later than 5 days prior to start of this work by the Contractor's personnel. The manufacturer's representative or the inspector shall observe as many instances of the Contractor's personnel performing this work as possible.

PART 2 - PRODUCTS

2.1 JOINT FILLER

- A. Comply with Section 03 31 00 – Construction and Expansion Joints.

2.2 WATERSTOPS

- A. Comply with Section 03 31 00 – Construction and Expansion Joints.

2.3 CONCRETE ANCHORS

- A. General:
 - 1. Unless otherwise specified, select type and size to achieve required loading capacity using information provided by manufacturer. If the required type is not indicated, select types appropriate to conditions and items being fastened.
 - 2. Maintain critical edge distance and spacing per manufacturer's recommendations for all anchors. Provide tamper proof hardware where specified on Drawings.



3. Provide cast-in-place headed anchor bolts where indicated on Drawings, for high temperature applications, for vibratory applications / situations, and where recommended by the equipment manufacturer.

B. Adhesive Anchors:

1. Injectable adhesive shall be used for installation of all reinforcing steel dowels or threaded anchor rods and inserts into new or existing concrete.
2. Combination injectable adhesive and insert system; chisel pointed threaded rod with hex nut/washer, reinforcing bar, or internally threaded insert, installed into a pre-drilled anchor hole using rotary hammer drill. Adhesive shall be a hybrid adhesive consisting of a methacrylate resin, hardener, cement, and water formulated for fast curing and high strength and stiffness.
3. Adhesive shall be furnished in containers which keep components A and B separate.
4. Adhesive anchors shall be as defined on the Drawings or approved equal.
5. Threaded rod: ASTM A193 Grade B7 Type 2, ASTM A194 Grade 2H or ASTM A563 Grade DH nuts, and ASTM F436 washers; plated in accordance with ASTM B633, SC1, with Type II yellow chromate treatment,.
6. Threaded Insert: Stainless steel tubular insert, internally threaded.

C. Wedge Type Anchors:

1. One-piece body with expansion mechanism installed in pre-drilled hole using matching tolerance bit.
2. Wedge type anchors, if indicated or permitted, shall be galvanized steel unless otherwise noted, shall be of the expansion type, and shall be Simpson String-Tie Strong-Bolt 2 anchor, Hilti Kwik-Bolt TZ anchor, or an approved equal.

2.4 CAST-IN-PLACE HEADED ANCHOR BOLTS

- A. Where indicated on the Drawings, the anchors bolts shall be cast-in-place headed anchor bolts.
- B. Carbon steel anchor bolts shall conform to ASTM F1554 Grade 36 or Grade 55 as indicated on the Drawings. Finish shall be plain or hot-dipped galvanized as indicated on the Drawings. Nuts shall conform to ASTM A563 (hex or heavy hex depending upon the diameter) and washers shall conform to ASTM F436.
- C. Stainless steel anchor bolts shall conform to ASTM A193 Grade B8 Class 2 (AISI 304) as indicated on the Drawings. Nut shall conform to ASTM A194 Grade 8 and washer shall conform to SS304 for Grade B8 Class 2 bolt.

PART 3 - EXECUTION CONTRACTOR'S VERIFICATION

- A. Inspect the locations and surfaces to receive joint filler, joint sealer, waterstops, or miscellaneous embedded items and correct defects or conflicts which will affect the proper performance of the item to be placed.



3.2 PREPARATION

- A. All accessories to be embedded into concrete shall have contact surfaces free of dirt, curing compound, protrusions of hardened concrete or any other foreign material which would affect bond with concrete.
- B. Prime surfaces in accordance with manufacturer's recommendations.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Joints shall not be sealed when the sealant, air, or concrete temperature is less than 40°F. Bond breaker and backup material shall be installed where required as indicated on the Plans or per manufacturer's recommendations.

3.4 CONCRETE ANCHORS

- A. Do not begin installation until substrates have been properly prepared. Do not proceed with installation if substrate preparation is unsatisfactory.
- B. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install in accordance with manufacturer's instructions and recommendations and as required by applicable code. Anchor applied items neatly, with item mounted plumb and level unless otherwise indicated.
- D. The anchor manufacturer's representative shall demonstrate proper installation procedures for post-installed anchors and shall observe Contractor's installation procedures. Conduct at least two pullout or shear tests to determine adequacy of anchors.
- E. The minimum embedment length for anchors shall be as noted in Drawings. If embedment length is not specified, provide embedment to develop full strength of the anchor.
- F. Cast-in-place headed anchor bolts shall be set with a template.

3.5 PVC WATER STOPS

- A. Water stops shall be heat spliced at ends and intersections to ensure continuity. Bent water stops up from footing and slab joint and splice to wall water stop to result in a watertight structure. Construct forms for construction joints in such a manner as to prevent injury to water stops. Hold water stops securely in position in the construction joints by wire ties, continuous bars, and rings as indicated. Install water stops in construction and expansion joints in hydraulic structures or where shown in the drawings.



- B. Make field splices with a thermostatically controlled heating iron in conformance with the manufacturer's current recommendations. Allow at least 10 minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80% of the un-spliced materials.

3.6 INSTALLATION OF JOINT SEALANTS

- A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.
- B. Apply masking tape along the edges of the exposed surface of the exposed joints.
- C. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.
- D. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer.
- E. Trowel the joints smooth with a tuck-pointing tool wiped with a solvent recommended by the sealant manufacturer.
- F. After applying the sealant, remove the masking tape and any sealant spillage.

3.7 MISCELLANEOUS EMBEDDED ITEMS

- A. All sleeves, inserts, anchor bolts, and other embedded items required for adjoining Work or for its support shall be placed prior to concreting.
- B. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into voids.

END OF SECTION 03 25 00



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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Class A Concrete: Normal-weight concrete shall be used in all cast-in-place structures except where Class B concrete is permitted.
2. Class B Concrete: Normal-weight concrete shall be used where specified in the Plans.
3. Class D Concrete: Normal-weight unreinforced concrete to be used as a concrete fill below foundation and where noted in Plans or permitted by the Engineer.

B. Related Requirements:

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 31 00 - Construction and Expansion Joints.
4. Section 03 39 00 - Concrete Curing.

C. Provide labor, materials, equipment and incidentals necessary to furnish, install and test cast-in-place concrete as specified and as shown on Contract Drawings.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. American Concrete Institute (ACI):

1. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
4. ACI 305R - Guide to Hot Weather Concreting.
5. ACI 306.1 - Standard Specification for Cold Weather Concreting.
6. ACI 309 - Recommended Practice for Consolidation of Concrete.
7. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures.

B. ASTM International:

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.



4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C295 - Standard Guide for Petrographic Examination of Aggregates for Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
18. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
19. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
20. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
21. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
22. ASTM C1260 - Standard Test Method for Potential Alkali Activity of Aggregates (Mortar-Bar Method).
23. ASTM D75 - Standard Practice for Sampling Aggregates.
24. ASTM E329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.

- C. Michigan Department of Transportation (MDOT) Latest Edition of Standard Specifications for Construction.
- D. American Association of State Highway and Transportation Officials (AASHTO) T26 Quality of Water to be Used in Concrete.

1.3 DEFINITIONS

- A. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16-inch, cracks 0.005-inch or wider as well as any crack or joints that leaks in liquid containment structures and below-grade habitable or watertight spaces, cracks 0.010-inch wide and larger in non-liquid holding structures, spalls, chips, air bubbles greater than 3/4-inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, texture irregularities, and stains and other color variations that cannot be removed by cleaning.



1.4 COORDINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.

1.5 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer's specifications and instructions including for attachment accessories, admixtures and Material Data Sheets (MDS) for admixtures. Manufacturer's certification of compatibility of all admixtures.
- C. Design Data: Submit the following:
 - 1. Name and address of Contractor's proposed testing laboratory firm and a brief description and references for prior work which is similar to that proposed for this project. ASTM E329 shall also be used for evaluating the testing laboratory firm.
 - 2. Manufacturer's Certificate of Compliance for Portland Cement, Fly Ash, Aggregates, and Admixtures. Identify chloride content of admixtures and whether or not chlorides were added during manufacture.
 - 3. State of Qualifications for the Mix Designer and Batch Plant.
 - 4. Submit concrete mix design for each concrete strength. This shall include total gallons of water per cubic yard, brand / type / quantity of Portland Cement and Fly Ash, Specific gravity of all constituents, surface-dry weight and gradation of aggregates, ratio of fine to total aggregates, brand / type / ASTM Designation / quantity of each admixture, slump, air content, and unit weight. Concrete mix design shall be accompanied with matching trial batch and/or field-test data. Shrinkage Test data shall also be submitted for Class A Concrete designs. All strength data shall be for the proposed mix design or sufficiently close to it and shall not be any older than 12 months from the date of the submittal.
 - 5. Concrete mix designs different in admixture type and quantity shall be deemed as different mix designs and shall be submitted individually with their own respective strength data.
- D. Manufacturer Instructions: Submit installation procedures and interfacing required with adjacent Work.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.



1.7 QUALITY ASSURANCE

- A. Perform Work according to ACI 301 unless otherwise indicated or specified.
- B. Comply with ACI 305R when placing concrete during hot weather.
- C. Comply with ACI 306.1 when placing concrete during cold weather.
- D. Acquire cement from one source for Work.
- E. Acquire aggregate from one source for Work.
- F. Qualifications: Batch Plant currently certified by the National Ready Mixed Concrete Association.
- G. Project Concrete Conference:
 - 1. Required attendees:
 - a. Owner or Engineer.
 - b. Contractor, including pumping, placing and finishing, and curing sub-contractor(s).
 - c. Ready-Mixed concrete producer.
 - d. Admixture representative, if requested by Owner.
 - e. Testing and sampling personnel / technician.
 - 2. Schedule and conduct prior to start of any concrete work and in a timely manner to facilitate the project schedule. Schedule the conference in coordination with all the attendees.
 - 3. Agenda shall include:
 - a. Mix designs, test of mixes, and submittals.
 - b. Admixture types, dosage, and performance.
 - c. Placement methods, techniques, equipment, consolidation, and form pressures.
 - d. Slump and placement time to maintain slump.
 - e. Finishing, curing, and water retention.
 - f. Protection procedures for weather conditions.
 - g. Other specified requirements requiring coordination.
- H. Trial Mix:
 - 1. When field experience records are inadequate or out-of-date to confirm the quality of a proposed concrete mix, or when required by the Engineer, an independent testing laboratory designated by the Contractor and acceptable to the Engineer shall test a trial batch of each of the preliminary concrete mixes submitted by the Contractor. The trial batch shall be prepared using the aggregates, cement, and admixtures proposed for the Project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain enough samples to satisfy requirements stated below. Tests on individual materials shall already be performed before any trial mix is developed and tested. The cost of the



laboratory trial batch tests for each specified concrete mix shall be at no additional cost to the Owner.

2. The independent testing laboratory shall observe the preparation of the trial batch, and they shall prepare a minimum of fifteen (15) standard test cylinders in accordance with ASTM C31 in addition to conducting slump (ASTM C143), air content (ASTM C231), and unit weight (ASTM C138) tests. Compressive strength test on the cylinders shall subsequently be performed by the same laboratory in accordance with ASTM C39 as follows: Test 3 cylinders at age 7 days; test 3 cylinders at age 21 days; test 3 cylinders at age 28 days and test 3 cylinders at 56 days. The cylinders shall be carefully labelled. If the average 28-days compressive strength of the trial mix is less than that specified, or if any single cylinder falls below the required strength by more than 500 psi, the mix shall be corrected, another trial batch prepared, test cylinders taken, and new tests performed as before. Any such additional trial batch testing required shall be performed at no additional cost to the Owner. Adjustments to the mix shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor.

I. Shrinkage Test:

1. The testing laboratory shall perform drying shrinkage tests for the trial batches as specified herein.
2. Fabricate, cure, dry, and measure specimens in accordance with ASTM C157 modified as follows:
 - a. Remove specimens from molds at an age of 23 hours +/- 1 hour after trial batching, place immediately in water at 70°F +/- 3° degrees F for at least 30 minutes, measure within 30 minutes thereafter to determine original length, and then submerge in saturated lime water at 73°F +/- 3 degrees. At age seven days, make measurement to determine expansion, expressed as a percentage of original length. This length at age seven days shall be the base length for drying shrinkage calculations (zero days' drying age).
 - b. Then, store specimens immediately in a humidity-controlled room maintained at 73°F +/- 3°F and 50 percent +/- 4 percent relative humidity for the remainder of the test. Make and report measurements to determine shrinkage expressed as percentage of base length separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
3. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at zero days' drying age) and the length after drying at each test age. Compute the average drying shrinkage deformation of the specimens to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen. Report results of the shrinkage test to the nearest 0.001 percent of shrinkage. Take compression test specimens in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project.



4. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.036 or 0.042 percent, respectively. Use a mix design for construction that has first met the trial batch shrinkage requirements.
 5. If the trial batch specimens do not meet the shrinkage requirements, revise the mix design and/or materials and retest.
 6. Shrinkage test requirement applies only to Class A concrete designs.
- J. Do not place concrete until design mix, material tests, and trial concrete batch mix compression test results are approved by the Engineer.
- K. Concrete delivered to the job site with a temperature outside the specified concrete temperature limitations shall be rejected.
- L. Do not place concrete in water, or on frozen or disturbed ground.
- M. Acceptance of Structure: Acceptance of completed concrete work requires conformance with dimensional tolerances, appearance, and strength as indicated or specified.

1.8 AMBIENT CONDITIONS

- A. Comply with Section 01 52 00 - Temporary Facilities.
- B. Do not place concrete until conditions and facilities for making and curing control test specimens are in compliance with ASTM C31 and as specified herein.
- C. Maintain concrete temperature after installation at minimum 50°F for minimum seven days.
- D. Maintain high-early strength concrete temperature after installation at minimum 50°F for minimum three days.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete:
 1. Portland Cement:
 - a. Portland Cement shall be Type I/II or Type II in accordance with ASTM C150. Type I cement may be used with Class B and Class D concrete.
 - b. For concrete mixed with only Portland Cement, the total alkalis in the cement (calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O) shall



- not exceed 0.40% unless aggregates to be used meet the requirements for non-reactivity with alkalis as stated in paragraph 2.1.A.5.h.1.
 - c. For concrete mixed with Portland Cement and an appropriate amount of fly ash, the total alkalis in the Portland Cement (calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O) shall not exceed 0.85% unless aggregates to be used meet the requirements for non-reactivity as stated in article 2.1.A.5.h.1.
 - d. Reject the entire Portland Cement shipment when cement is lumpy, wetted, partially or wholly set, or otherwise damaged.
 - e. Portland cement shall be from one approved manufacturer unless otherwise approved by the Engineer. Use cement of uniform color.
 - f. Cement shall be stored in a suitable weather-tight building to prevent deterioration or contamination.
2. Fly Ash:
 - a. Class F fly ash conforming to ASTM C618 for chemical and physical properties.
 - b. Supplemental requirements:
 - 1) Maximum carbon content; 3%.
 - 2) Maximum sulfur trioxide (SO_3) content; 4%.
 - 3) Maximum loss on ignition; 3%.
 - 4) Maximum water requirement (as a % of control); 100%.
 - 5) Fineness, maximum retained on No. 325 sieve; 25%.
 - c. Maximum available alkalis; 1.5%.
 - d. Fly ash shall also meet the optional physical requirements for uniformity as per ASTM C618.
 - e. Where fly ash is included in the concrete mix to waive the 0.4% alkali requirement of the Portland Cement, the fly ash constituent shall be between 15% and 25% of the total weight of the combined Portland Cement and fly ash. The percentage of fly ash shall be set so that the mean mortar bar expansion of the cement-fly ash mix shall be 0.08% or less when tested at 16 days in accordance with ASTM C1260. The Portland Cement and aggregates used in the mix for this test shall be the same as proposed for use on the Project.
3. Ground Granulated Blast Furnace Slag (GGBF): GGBF, when used, shall meet the requirements of ASTM C989, Grade 100 or better.
4. Silica Fume: Comply with ASTM C1240. Use silica fume only where indicated on the Drawings. Silica fume shall not exceed 10 percent of the total weight of the silica fume plus the cement.
5. Normal Weight Aggregates:
 - a. All aggregate used shall comply with ASTM C33.
 - b. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 - c. Wash all aggregate to remove dust, clay, or silt coating.
 - d. Aggregates that have been washed shall not be used sooner than 24 hours after washing, unless approved by the Engineer.



- e. Fine aggregate (sand) shall consist of natural siliceous sand, clean and free from deleterious substances and shall conform to the requirements of ASTM C33 with a finest modulus between 2.50 and 3.00.
- f. Coarse aggregate shall be gravel or crushed rock conforming to ASTM C33.
- g. Aggregates shall be tested for soundness in accordance with ASTM C88. The loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using magnesium sulfate.
- h. When aggregates, which are non-reactive with alkalis, are desired in order to waive the alkali content requirement of cement as stated herein, the following tests shall be performed:
 - 1) A petrographic analysis in accordance with ASTM C295 shall be performed to identify the constituents of the fine and coarse aggregate. Aggregates containing more than the following quantities of constituents shall be considered potentially reactive:
 - a) Optically strained, microfractures, or microcrystalline quartz exceeding 5.0%.
 - b) Chert or Chalcedony exceeding 3.0%.
 - c) Tridymite or cristobalite exceeding 1.0%.
 - d) Opal exceeding 0.5%.
 - e) Natural volcanic glass in volcanic rocks exceeding 3.0%.
 - 2) Aggregates shall be evaluated by ASTM C1260. Aggregates sources that exhibit mean mortar bar expansions at 16 days greater than 0.8% shall be considered potentially reactive. Tests shall be made with cement proposed for use on the Project.
- i. Contractor shall submit a new trial mix to the Engineer for approval whenever a different aggregate or gradation is proposed.
- j. No aggregates that have become intermixed prior to proportioning shall be used. Sufficient aggregate shall be available to preclude the possibility of delays while placing the concrete.

6. Water:

- a. Potable water approved by the State Department of Public Health may be used without testing.
- b. For water requiring testing, the tests shall be conducted in accordance with AASHTO T26 and meet the following requirements:
 - 1) Total solid matter; 0.30% maximum.
 - 2) Organic matter; 0.05% maximum.
 - 3) Alkalinity-acidity; neutral to litmus.
 - 4) Water-soluble chloride ions by weight of cement 0.06 % maximum.

B. Concrete Admixtures:

- 1. Provide admixtures produced by established, reputable manufacturers, and used in compliance with the manufacturer's printed instructions.



2. All admixtures shall be obtained from one manufacturer. The manufacturer shall be capable of providing a qualified field service representative.
3. The admixture manufacturer shall certify the compatibility of multiple admixtures used in the same concrete mix.
4. Maintain required compressive strength and maximum water-cement ratio indicated in this section when using admixtures. Include all admixtures in solution form in the water-cement ratio calculations.
5. Do not use calcium chloride, admixtures containing chloride ions or other admixtures causing accelerated setting of cement. Do not use combinations of admixtures and cements producing erratic or otherwise undesirable results with aggregates.
6. Reject admixtures that have been in storage for longer than manufacturer's recommendations or which have been subjected to freezing.
7. Do not use admixtures in greater dosages than recommended by the manufacturer.
8. The quantity of the admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.
9. The strength of concrete with proposed admixtures after 48 hours shall not be less than the strength of similar concrete without admixtures.
10. Air Entrainment:
 - a. Air entrain all concrete, unless specified otherwise.
 - b. Use air-entraining admixture complying with ASTM C260.
 - c. Measure air content in accordance with ASTM C231.
 - d. Adjust the dosage rate to accommodate fly ash or pozzolan requirements, and other admixtures when used, in order to obtain the specified air content.
 - e. Products:
 - 1) SIKA AER by Sika Corporation.
 - 2) MB-VR by Master Builders.
 - 3) Daravair by W.R. Grace & Co.
 - 4) Or approved equal.
11. Mid- Range Water Reducer:
 - a. Comply with ASTM C494.
 - b. Use admixture Type A.
 - c. Products:
 - 1) Use Daracem by W.R. Grace.
 - 2) Polyheed by BASF.
 - 3) Sikament by Sika Corporation.
 - 4) Or an approved equal.
12. High -Range Water Reducer (Super plasticizer):
 - a. Use admixture Type F or G with extended slump life.
 - b. High-range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.
 - c. No more than 14 ounces of water reducer per sack of cement shall be used.
 - d. Concrete shall be mixed at mixing speed for a minimum of 70 mixer revolutions or 5 minutes after the addition of high-range water reducer, unless otherwise recommended by the manufacturer.
 - e. Products:
 - 1) Use ADVA by W.R. Grace.



- 2) ViscoCrete by Sika Corporation.
 - 3) Glenium by BASF.
 - 4) Or an approved equal.
13. Retarder:
- a. Use admixture Type B.
 - b. When the air temperature at the time of concrete placement is expected to be consistently greater than 80°F, a concrete retarder shall be used.
 - c. Products:
 - 1) Plastocrete 161MR by Sika Corporation.
 - 2) Pozzolith or Delvo by BASF.
 - 3) Daratard by W.R. Grace.
 - 4) Or an approved equal.
14. Water Reducer and Retarder: Use admixture Type D.
15. Water Reducer and Accelerator:
- a. Use admixture conforming to Type E.
 - b. When the air temperature at the time of concrete placement is expected to be consistently less than 40°F, a non-corrosive accelerating admixture shall be used.
 - c. Use of accelerator shall not relax cold-weather placement requirements.
 - d. Products:
 - 1) Plastocrete 161FL by Sika Corporation.
 - 2) Pozzutec 20 by BASF.
 - 3) Daraset by W.R. Grace.
 - 4) Or an approved equal.
16. Plasticizer and Retarder: Use admixture compliant to ASTM C1017, Type II.
17. Color Pigment:
- a. Compliant to ASTM C979, synthetic mineral-oxide pigment or colored water-reducing admixtures; color stable, free of carbon black, non-fading, and resistant to lime and other alkalies.
 - b. Color: concrete for electrical duct bank and other appurtenant work shall have an integral red oxide pigment. Surface paint, spraying, or coating of concrete shall not be acceptable.

2.2 CONCRETE MIX

- A. Select proportions for concrete according to ACI 350 trial mixes or field test data. When trial mixes are used, they shall also confirm to paragraph 3.1.
- B. Use ready-mixed concrete, secured from a batching or mixing plant conforming to ASTM C94, capable of developing specified characteristics and being placed without segregation.
- C. Limit maximum size of coarse aggregate to 1-1/2 inch for walls greater than 8 inches in thickness, grade beams, footings, foundations, and base slabs. Limit maximum size of coarse aggregate to 3/4 inch for all other concrete.
- D. Produce concrete mix of homogeneous consistency, capable of being worked into constricted areas of forms, corners, and around embedded items, without segregation or bleeding of water.



E. Performance and Design Criteria:

1. Class A Concrete:
 - a. 28-Day Compressive Strength: 5,000 psi.
 - b. Maximum water / cementitious material ratio: 0.42 by weight.
 - c. Minimum Cement Content: 564 lb./cu. yd.
 - d. Slump: 4-inch nominal unless high-range water reducing admixture is used. 3-inch maximum before addition of high-range water reducing admixture. 8-inch maximum after addition of high-range water reducing admixture.
 - e. Total Air Content by volume:
 1. 4 to 6 percent for concrete with 1-1/2-inch maximum aggregate size.
 2. 5 to 7 percent for concrete with 3/4-inch maximum aggregate size.
 3. Air content in concrete to receive trowel finish shall be limited to 3 percent maximum.
 - f. Uniformly disperse fiber reinforcement in concrete mixture used for topping at a rate of 1.5 lb./cu. yd.
2. Class B Concrete:
 - a. 28-Day Compressive Strength: 4,000 psi.
 - b. Maximum water / cementitious material ratio: 0.48 by weight.
 - c. Minimum Cement Content: 517 lb./cu. yd.
 - d. Slump: 4-inch nominal unless high-range water reducing admixture is used. 3-inch maximum before addition of high-range water reducing admixture. 8-inch maximum after addition of high-range water reducing admixture.
 - e. Total Air Content by volume:
 1. No air entrainment is required unless exposed to freeze / thaw cycles.
 2. 4 to 6 percent for concrete with 1-1/2-inch maximum aggregate size.
 3. 5 to 7 percent for concrete with 3/4-inch maximum aggregate size.
 4. Air content in concrete to receive trowel finish shall be limited to 3 percent maximum.
 - f. An integral red oxide color pigment, batched at a rate of 8 pounds per cubic yard, shall be provided for duct bank encasement and other concrete appurtenant to electrical work.
3. Class D Concrete:
 - a. 28-Day Compressive Strength: 2,000 psi.
 - b. Maximum water / cementitious material ratio: 0.60 by weight.
4. Admixtures:
 - a. Include admixture types and quantities indicated in concrete mix designs only if approved by Engineer.
 - b. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, and silica fumes content as required by applicable code.

2.3 ACCESSORIES

A. Bonding Agent:

1. The bonding agent shall be epoxy adhesives, unless approved otherwise by the Engineer.



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2. Bonding agent for bonding freshly-mixed, plastic concrete to hardened concrete shall be:
 - a. Sikadur 32 Hi-Mod epoxy adhesive by Sika Corporation.
 - b. Concessive Liquid (LPL) by MBT/Degussa Building Systems.
 - c. BurkEpoxy MV by Edoco.
 - d. Or an approved equal.
3. Bonding agent for bonding hardened concrete to steel shall be:
 - a. Sikadur 31 Hi-Mod Gel by Sika Corporation.
 - b. BurkEpoxy NS by Edoco.
 - c. Concessive Paste (LPL) by MBT/Degussa Building Systems.
 - d. Or an approved equal.
4. Non-Epoxy bonding agent shall be used where specified on the Drawings or approved by the Engineer and shall be one of the following:
 - a. Weld-Crete by Larsen Products Corporation.
 - b. Euroweld by Euclid Chemical Co.
 - c. Or approved equal.

B. Non-shrink, non-metallic Grout:

1. Premixed compound consisting of non-metallic aggregate, cement, and water-reducer, plasticizing agents and only requiring addition of water.
2. Minimum 28-day compressive strength of 5,000 psi.
3. Comply with ASTM C1107, Grade A, B, or C.
4. Products:
 - a. Five Star Grout by U.S. Grout Corp.
 - b. SikaGrout 212 by Sika Corporation.
 - c. MasterFlow 928 Grout by Master Builders.
 - d. Or approved equal.

C. Concrete Reinforcing Fibers:

1. High-strength industrial-grade synthetic macro fibers specifically engineered for secondary reinforcement of concrete.
2. Fibers shall be 100 percent virgin homopolymer polypropylene-fibrillated fibers, containing no reprocessed olefin materials.
3. Comply with ASTM C1116.
4. Tensile Strength: 70 to 110 ksi in accordance with ASTM D2256.
5. Fiber Length: 1 ½ inches.
6. Dosage rate: Per manufacturer's recommendations or as specified on the drawings.
7. Concrete topping shall be provided with reinforcing fibers unless specified otherwise on the Drawings.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Previously Placed Concrete:
 - 1. Prepare previously placed concrete by bush hammer, sand blasting or cleaning with steel brush, as applicable, and applying bonding agent.
 - 2. Remove laitance, coatings, and unsound materials.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete and install steel dowels with epoxy adhesive per manufacturer's written instructions.
- D. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- E. Remove water from areas receiving concrete before concrete is placed.

3.3 PIPES AND WALL CASTINGS CAST IN CONCRETE

- A. Install wall spools, wall flanges, hydrophilic waterstops and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall castings or anchors to the reinforcing steel.
- B. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement occurs during construction.
- C. Pipes or wall castings located below operating water level shall have water stop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast unless approved, authorized or directed by the Engineer. Pipes fitted with thrust rings shall be cast-in-place.



3.4 INSTALLATION

- A. Production of Concrete: Batch, mix, and deliver concrete in conformance with ASTM C94. Batch all constituents at central batching or mixing plant. Produce concrete in conformance with ACI 301 and as specified herein.
- B. Transporting and Mixing:
 - 1. Conform to concreting procedures set forth in ACI 304R and as specified herein.
 - 2. Transport concrete to discharge locations without altering the specified properties of water-cement ratio, slump, air entrainment, temperature, and homogeneity.
 - 3. Discharge concrete into forms within 1-1/2 hours, with the addition of a retarding admixture conforming to ASTM C494 Type B, D or G, after cement has entered mixing drum or before the drum has revolved 300 revolutions after the addition of water, whichever occurs first. Do not add re-tempering water at jobsite, nor exceed the maximum water content in the approved concrete design mix.
- C. Conveying: Convey concrete from agitator or mixer truck to place of final deposit in forms by one of the following methods:
 - 1. Buckets or hoppers with discharge gates having a clear opening equal to not less than one-third the maximum interior horizontal area or five times the maximum aggregate size being used, whichever is greater, and side slopes of not less than 60 degrees to the horizontal.
 - 2. Buggies or wheelbarrows equipped with pneumatic tires.
 - 3. Round bottom, metal or metal-lined chutes with inclined slope of between two to three feet horizontally to one foot vertically and sufficient capacity to avoid overflow.
 - 4. Circular drop pipes with a top diameter of at least eight times the maximum aggregate size, but not less than 4-inch, or tapered to not less than six times maximum aggregate size. Do not drop concrete more than 5 feet without drop pipes.
- D. Pumping:
 - 1. Use equipment procedures with backup to maintain steady flow of concrete at discharge end of pipe.
 - 2. Maintain concrete properties of unit weight, slump, air content, and temperature. Adjust concrete proportions as necessary to provide concrete properties in accordance with the approved concrete design mix and as specified herein.
 - 3. Do not pump concrete through aluminum piping.
 - 4. Use pipe having a diameter of at least 4 times the maximum coarse aggregate size, but not less than 4-inch.
 - 5. Take samples at the point of discharge. Adjust slump and air content to maintain the specified requirements at the discharge end of the pipe.
 - 6. Furnish labor and assistance as required by the testing laboratory in obtaining and handling test specimens.
- E. Placing Concrete:
 - 1. Place concrete according to ACI 301.



2. Notify testing laboratory and Owner minimum 24 hours prior to commencement of operations.
3. Conform to ACI 305R and as specified herein for hot weather concreting. Do not add retarder to concrete unless approved by the Engineer.
4. Conform to ACI 306R and as specified herein for cold weather concreting. Do not add accelerator to concrete unless approved by the Engineer.
5. Do not place concrete containing pozzolan during cold weather concreting as defined in ACI 306R.
6. Ensure that reinforcement, inserts, embedded parts, waterstops, formed expansion and contraction joints, and are not disturbed during concrete placement.
7. Deposit concrete at final position, preventing segregation of mix.
8. Place concrete in continuous operation for each panel or section as determined by predetermined joints.
9. Place concrete in continuous units between predetermined expansion, control, and construction joints as specified and approved by the Engineer. Where required on the Drawings and wherever practical, the placement of concrete in such unit shall be done in an alternating or checkerboard pattern.
10. Do not interrupt successive placement and do not permit cold joints to occur.
11. Consolidate concrete.
12. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
13. Screeding:
 - a. Screed floors and slabs on grade level.
 - b. Surface Flatness: maximum 1/4 inch in 10 feet, unless specified otherwise on the Drawings.

F. Consolidation:

1. Consolidate concrete using mechanical vibrators operated within the mass of concrete conforming to procedures set forth in ACI 309R and as specified herein.
2. Conduct vibrations in a systematic manner with regularly maintained vibrators. Furnish sufficient backup units at job site. Use vibrators having minimum frequency of 8,000 vibrations per minute and of amplitude to consolidate concrete. Use not less than one vibrator with crew for each 35 to 40 cubic yards of concrete placed per hour.
3. Insert and withdraw vibrator vertically at a uniform spacing over the entire area of placement. Space distances between insertion points such that spheres of influence of each insertion overlap.
4. Place concrete in horizontal lifts. Insert vibrator rapidly to bottom of layer, and at least six inches into underlying layer. Hold stationary for several seconds, and then withdraw slowly at a rate of about 3 inches per second. Conduct vibration to produce concrete of uniform texture and appearance, free of honeycombing, streaking, cold joints, or visible lift lines.
5. Use additional vibration with pencil vibrators on vertical surfaces and on all exposed concrete to bring full surface of mortar against the forms so as to eliminate air voids, bug holes, and other surface defects. Employ the following additional procedures for vibrating concrete:



- a. Reduce distance between internal vibration insertions and increase time for each insertion.
- b. Insert vibrator as close to face of form as possible without contacting the form or reinforcement.
- c. Thoroughly vibrate area immediately adjacent to waterstops without damaging the waterstop.
- d. Use spading as a supplement to vibration where particularly difficult conditions exist.

G. Concrete Acceptance:

1. Accept or reject each batch of concrete delivered to the point of agitator or mixer truck discharge. The signature of Contractor's authorized representative on the delivery ticket batch ticket shall indicate concrete acceptance.
2. Reject concrete delivered without a complete concrete delivery batch ticket as specified herein. The concrete supplier shall furnish copies of the signed batch ticket to the Contractor and the Engineer. The batch tickets shall have following information as a minimum:
 - a. Date and truck number.
 - b. Ticket number.
 - c. Mix designation of concrete.
 - d. Cubic yards of concrete.
 - e. Cement brand, type, and weight in pounds.
 - f. Weight in pounds of fly ash and silica fume.
 - g. Weight in pounds of fine aggregate and coarse aggregates.
 - h. Air entraining agent brand and weight in pounds / ounces.
 - i. Other admixtures – brands and weights in pounds/ounces.
 - j. Water in gallons added at the batch plant.
 - k. Water in gallons – maximum that can be added onsite without exceeding design w/c_m ratio, when approved by the Engineer.
 - l. Time of loading.
 - m. Time of delivery to the job site.
 - n. Detailed placement location of concrete.
 - o. Any truck delivering concrete to the job site, which is not accompanied by a delivery ticket showing the above information shall be rejected and such truck shall immediately depart from the job site.
3. The testing agency shall perform field tests at the point of discharge. Accept or reject concrete on the basis of conformity with slump, air content, and temperature specified.
4. The testing agency shall inspect concrete transit truck's barrel revolution counter and gauge for measuring water added to the concrete. Reject concrete which exceeds the maximum barrel revolution of 300 or which has water content exceeding the specified water-cement ratio.
5. Reject concrete exceeding time or temperature limitations specified.
6. Reject concrete not conforming to specification before discharging into the forms.



7. The Engineer reserves the right to reject concrete. Engineer's right to reject concrete shall supersede Contractor's right to reject concrete.

H. Joints and Embedded Items:

1. Provide construction joints and expansion joints as specified in Section 03 31 00 – Construction and Expansion Joints. Bush hammer or lightly sandblast all construction joints to expose coarse aggregate and to remove loose concrete and laitance before placing adjoining concrete. Do not damage exposed concrete edges, key grooves, waterstops, or reinforcement.
2. Embedded Items:
 - a. Clean embedded items of oil and all foreign matter.
 - b. Install inserts, anchors, sleeves, and other items indicated or specified under other sections of these specifications.
 - c. Check location and support of piping and other embedded items before depositing concrete.

I. Separate Floor Toppings:

1. Prior to placing floor topping, remove deleterious material, roughen substrate concrete surface, broom, and vacuum clean.
2. Place required edge strip, reinforcement and other embedded items to be cast in concrete.
3. Apply bonding agent to substrate unless specified otherwise.
4. Place concrete floor toppings to required lines, levels, and slopes.

3.5 CONCRETE FINISHING

- A. General: Dusting with dry cement or other mixtures or water addition during finishing shall not be permitted.

B. Locations:

1. Steel-trowel finish all top, horizontal, and inclined surfaces not otherwise specified or indicated. This includes concrete fills and toppings, top of walls, floors, and roof surfaces to which roof insulation or roofing is to be applied.
2. Hand steel-trowel finish all surfaces shaped with or without forms and over which liquids will flow.
3. Float finish floors scheduled to receive concrete fills and toppings.
4. Broom finish exterior walkways, exterior stairs, entrance platforms, and loading docks.
5. Use smooth forms for all structures in conformance with Section 03 10 00 – Concrete Forming, and as specified.

C. Descriptions:

1. Steel-Trowel Finish: Remove excess laitance from surfaces by tamping, screeding, and magnesium bull floating. Compact surface with motor-driven floats, if feasible, when slab



has hardened so that water and fine material will not work to top and trowel smooth. Leave surfaces with smooth hard finish free of blemishes.

2. Float Finish: Prepare surfaces by tamping with special tools to force coarse aggregate away from surface, screeding with straight edges to bring surfaces to required line and then magnesium bull float.
3. Broom Finish: Steel-trowel surface then broom normal to direction of travel with fine hair stable broom to produce non-slip surface of uniform appearance.
4. Smooth Form Finish: Remove fins, finish flush with parent concrete and make necessary repairs. Wet and rub finned and repaired surfaces with carborundum stone or other abrasive until uniform color and texture are produced. Complete rubbing not later than 24 hours after the curing period.

3.6 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Protect concrete footings from freezing for minimum of seven days.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.
- D. Cure concrete floor surfaces as specified in Section 03 39 00 - Concrete Curing.

3.7 CONCRETE WORK IN COLD WEATHER

- A. Cold weather concreting procedures shall conform to the requirements of ACI 306.
- B. Do not place concrete at any time when air temperature is 40°F or lower unless cold weather concreting requirements are met. If concrete work is permitted, the concrete shall have a minimum temperature, as placed, of 55°F for placement of concrete section less than 12-inches thick, 50°F for concrete section 12-inches to 36-inches thick, and 45°F for concrete sections more than 36-inches thick. The temperature of the concrete as placed shall not exceed the aforementioned minimum values by more than 20°F.
- C. All aggregate and water shall be pre-heated. Precautions shall be taken to avoid the possibility of flash set when aggregate or water are heated to a temperature exceeding 100°F in order to meet concrete temperature requirements. The addition of admixtures to the concrete to prevent freezing shall not be permitted.
- D. All reinforcement, forms, and ground with which the concrete is to come in contact shall be defrosted by an approved method. No concrete shall be placed on frozen ground.



3.8 CONCRETE WORK IN HOT WEATHER

- A. Hot weather concreting procedures shall conform to the requirements of ACI 305.
- B. When air temperature exceeds 85°F or when extremely dry conditions (relative humidity below 20 percent) exist even at lower temperatures, particularly if accompanied by high winds exceeding 30 mph, exercise special and precautionary measures in preparing, delivering, placing, finishing, curing, and protecting the concrete. All necessary materials and equipment shall be on hand and in position prior to each placing operation.
- C. Preparatory work at the job site shall include thorough wetting of all forms, reinforcing steel, and in the case of slab pours on ground or subgrade, spraying the ground surface on the preceding evening and again just prior to placing concrete. No standing puddles of water shall be permitted in those areas which are to receive the concrete.
- D. The temperature of the concrete mix when placed shall not exceed 90°F.
- E. Temperature of mixing water and aggregates shall be carefully controlled and monitored at the supplier's plant, with haul distance to the job site being taken into account. Stockpiled aggregates shall, if necessary, be shaded from the sun and sprinkled intermittently with water. If ice is used in the mixing water for cooling purposes, it must be entirely melted prior to addition of the water to the mix.
- F. Delivery schedules shall be carefully planned in advance so that concrete is placed as soon as practical after it is properly mixed. For hot weather concrete work, discharge of the concrete to its point of deposit shall be completed within 60 minutes from the time the concrete is batched when concrete temperature at time of placement is between 85 and 90°F. Concrete with a temperature of more than 90°F at time of placement shall be rejected.
- G. Arrange for an ample work force to be on hand to accomplish transporting, consolidating, finishing, and covering of fresh concrete as rapidly as possible.

3.9 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- C. Additional Inspection and Testing: May be performed by Owner's testing laboratory according to ACI 350.
- D. Coordinate with the Engineer for the on-site scheduling of the testing firm's personnel for required concrete testing.
- E. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.



- F. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- G. Concrete Inspections:
1. Continuous Placement Inspection: inspect for proper installation procedures.
 2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- H. Tests shall be made for each concrete class of each batch of concrete delivered, each 50 cubic yards, or whenever consistency appears to vary.
- I. Test for Consistency:
1. The consistency of the concrete shall be checked by standard slump cone tests. Make any necessary adjustments in the mix as the Engineer may direct and upon written order suspend all placing operations in the event the consistency does not meet the intent of the specifications.
 2. Slump test shall be made in accordance with ASTM C143. Slump tests shall be performed as deemed necessary by the Engineer and each time the compressive strength test samples are taken.
 3. Concrete with a specified nominal slump shall be placed having a slump of +/- 1 inch of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than or equal the specified slump.
- J. Test for Air Content:
1. Samples of freshly mixed concrete shall be tested for entrained air content in accordance with ASTM C231.
 2. Air content tests shall be performed as deemed necessary by the Engineer and each time compressive strength test samples are taken.
 3. If test results are outside the limits specified, additional tests shall be made. Admixture quantity adjustments shall be made immediately upon discovery of an incorrect air entrainment.
 4. If concrete placed by the Contractor is suspected of not having proper air content, an independent test laboratory will obtain and test samples for air content in accordance with ASTM C457.
- K. Test for Compressive Strength:
1. Samples of freshly mixed concrete shall be taken by the independent test laboratory and tested for compressive strength in accordance with ASTM C172, C31, and C39, except as modified herein. Any proposed deviations from the requirements specified shall require Engineer's prior approval and, thereupon, recorded in the test report.
 2. In general, one sampling shall be taken for each placement in excess of five (5) cubic yards, with a minimum of one (1) sampling for each day of concrete placement operations, for each fifty (50) cubic yards of concrete of each type (class), whichever is greater.



3. All compressive strength test cylinders shall be 6-inch diameter x 12 inch high. The Engineer may approve 4-inch diameter x 8-inch-high cylinders at Contractor's request; however, such approval shall be subject to limitation on maximum aggregate size and required increase in number of test cylinders for each sampling.
4. Each sampling shall consist of at least four (4) cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the cylinder.
5. Furnish labor to the independent test laboratory for preparing test cylinders. Provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the specimens made in any four consecutive working days and to protect the specimens. The box shall be erected, furnished, and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C31. Such box shall be located in an area free from the vibrations such as pile driving and traffic of all kinds. No concrete requiring testing shall be delivered to the site until such storage curing box has been provided. Specimens shall remain undisturbed in the curing box until ready for delivery to the testing laboratory but not less than sixteen hours.
6. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.
7. Compression tests shall be performed in accordance with ASTM C39. One test cylinder shall be tested at seven days and two at 28 days. The remaining cylinder shall be held to verify test results, if necessary.
8. The acceptance test results shall be the average of the strength of the two (2) specimens tested at 28 days. If one (1) specimen in a test manifests evidence of improper sampling, molding, or testing, it shall be discarded and the strength of the remaining cylinder shall be considered the test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.
9. Acceptance of Concrete: The strength level of the concrete will be considered satisfactory so long as the following conditions are met:
 - a. The averages of all sets of three (3) consecutive strength test results equal or exceed the specified 28-day strength.
 - b. No more than 20 percent of the compressive tests have strength less than that specified.
 - c. No individual strength test result falls below the 28-day strength by more than 500 psi.
 - d. In the even that any of the conditions listed above are not met, the mix proportions shall be corrected for the next concrete placing operation and additional testing (per paragraph 3.9.M below) shall be performed to qualify the concrete already placed.
 - e. When a ratio of 7-day and 28-day strengths has been established by these tests, the 7-day strengths shall subsequently be taken as a preliminary indication of the 28-day strengths. Should the 7-day strength form any sampling be more than 10 percent below the established strength, the Contractor shall:
 - 1) Immediately provide additional periods of curing in the affected area form which the deficient test cylinders were taken.
 - 2) Maintain or add temporary structural support as required.



- 3) Correct the mix for the next concrete placement operation, if required to remedy the situation.
-
10. All concrete which fails to meet the ACI requirements and these specifications shall be subject to removal and replacement at no additional cost to the Owner.
-
- L. Test for Concrete Temperature: Determine the temperature of concrete sample for each strength test.
-
- M. Additional Test for Compressive Strength:
1. Additional tests on in-place, when and if ordered by the Engineer, shall also be provided and paid for by the Contractor.
 2. In the event that the 28-day test cylinders fail to meet the strength requirements (as outlined in paragraph 3.9.K.9 above), the Contractor shall have concrete core specimens obtained and tested from the affected area immediately.
 3. Three cores shall be taken for each sample in which the strength requirements were not met. Core holes shall be filled with non-shrink grout or repair mortar.
 4. The drilled cores shall be obtained and tested in conformance with ASTM C42. The tests shall be conducted by an independent testing laboratory.
 5. The location from which each core is taken shall be approved by the Engineer. Each core specimen shall be located, when possible, so that its axis is perpendicular to the concrete surface and not near formed joints or obvious edges of a unit of concrete placement.
 6. The core specimens shall be taken, if possible, so that no reinforcing steel is within the confines of the core.
 7. The diameter of the core specimens should be at least 3 times the maximum nominal size of course aggregate used in the concrete, but not less than 2-inches in diameter.
 8. The length of the specimen, when capped, shall be at least twice the diameter of the specimen.
 9. The core specimens shall be taken to the laboratory and when transported, shall not be thrown, dropped, allowed to roll, or damaged in any way.
 10. These test results shall be transmitted to the Engineer and the Contractor at the earliest possible opportunity. The concrete in question will be considered acceptable if the average of the test results on core specimens taken from a given area equal or exceed 85 percent of the specified 28-day strength and if the lowest core strength is greater than 75 percent of the specified 28-day strength.

3.10 REPAIR

- A. Repair all surface defects immediately after form removal. Surface defects include tie holes, air voids and bug holes with a nominal diameter or depth greater than 1/4-inch, honeycombed areas, visible construction joints, fins, burrs, color and texture variations and other defects as determined by the Engineer. Make concrete repairs in concrete surfaces to produce a uniform color and texture and free of all irregularities.
- B. Surface defects in all concrete surfaces that adversely affect the durability of the concrete shall be repaired per the requirements of this section. Such surface defects that require repair include



all visible cracks in tank floors and walls and the exterior envelope of structures below grade, regardless of width, cracks in all other areas in excess of 0.02-inch width, honeycombs, rock pockets, holes left by tie rods and bolts, and spalls.

C. Repair of Cracks:

1. Cracks that are structural in nature shall be pressure grouted using an injectable epoxy.
2. Cracks in water retaining or below grade members that show sign of leakage, or are positioned such that leakage cannot be observed, shall be pressure grouted using hydrophilic resin.
3. Cracks in other members that exceed 0.020 inch in width shall be pressure grouted using hydrophilic resin.
4. Apply crack repair materials in accordance with the manufacturer's directions and recommendations.

D. Repair of Defective Areas:

1. Remove rock pockets, honeycombed and other defective concrete down to sound concrete. Chisel edges a minimum of 1-inch deep perpendicular to the surface or slightly undercut. No featheredges permitted.
2. Dampen the area to be patched and area at least 6-inches wide surrounding it for at least 24 hours to prevent absorption of water from patching mortar.
3. Concrete repair material shall be prepackaged polymer-modified cementitious repair mortar with the following minimum properties:
 - a. Compressive strength at 1-day: 2,000 psi (ASTM C109).
 - b. Compressive strength at 28-day: 6,000 psi (ASTM C109).
 - c. Bond strength at 28-day: 1,800 psi (ASTM C882 modified).
 - d. NSF Standard 61: potable water approved when used in water treatment and related facilities.
4. Use no more mixing water than necessary for handling and placing. Mix patching mortar and allow it to stand with frequent manipulation with a trowel, without addition of water, until it has reached stiffest consistency that will permit placing.
5. Brush bond coat of neat cement well into surface after surface water has evaporated from area to be patched. Consolidate mortar into place and strike off so as to leave patch slightly higher than surrounding surface to permit initial shrinkage. Leave patch undisturbed for at least 1 hour before final finish. Keep patched area damp for a minimum of 7 days.

E. Tie Holes: Fill tie holes solid with patching mortar after cleaning and dampening. Fill tie holes in liquid containing structures with specified non-shrink, non-metallic grout.

F. Core Holes: Roughen concrete surface, clean and dampen for at least 24 hours. Fill core holes with the specified repair mortar. Wet cure concrete for 7 days after placement. Fill anchor holes completely with specified non-shrink, non-metallic grout after cleaning and dampening.

G. Final determination as to acceptability of concrete repairs of surface defects and associated finishes will be made by the Engineer.



END OF SECTION 03 30 00



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SECTION 03 31 00 - CONSTRUCTION AND EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Concrete construction and expansion joints.

1.2 STANDARDS

Except as modified herein, comply with the latest version of the following Standards:

- A. ASTM International:

1. ASTM C 920: Specification for Elastomeric Joint Sealants.
2. ASTM D 1752: Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
3. ASTM D 2628: Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
4. ASTM D 2835: Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.

- B. US Army Corps of Engineers Spec. CRD-C572: Specification for Polyvinylchloride Waterstop.

1.3 SUBMITTALS

- A. Shop Drawings:

1. Product data for materials, including location where product is to be used.
2. Certification that materials meet the specifications.
3. Testing laboratory data substantiating results of waterstop zero water leakage tests conforming to test arrangement in the 1959 Journal of the ACI.
4. Manufacturer's application and installation instructions.
5. Samples of waterstops and joint fillers.
6. Color samples or charts for joint compounds.
7. Record documents and shop drawings marked to record actual construction.

PART 2 - PRODUCTS

2.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site in the manufacturer's sealed bags, unopened containers and banded pallets.



- B. Store materials off ground on platform or skid supports, and protect with covers from snow, rain and ground splatter.
- C. Store plastic products under cover in a dry, cool location out of direct sunlight.

2.2 JOINT COMPOUNDS

- A. In surface facilities, provide joint compound for joints in horizontal and inclined surfaces less than 30 degrees from the horizontal conforming to ASTM C920, Type S or M, Grade P, Class 25. Provide Type T compound in pedestrian and vehicular traffic areas, and Type NT in non-vehicular areas. Provide preformed joint seals where indicated.
- B. In surface facilities, provide joint compound for joints in walls inclined surfaces greater than 30 degrees from the horizontal conforming to ASTM C920, Type S or M, Grade NS, Class 25.
- C. Provide compatible joint compounds as recommended by manufacturer when they abut each other.
- D. Provide compound made for continuous submergence in liquid containing structures.
- E. Provide preformed polychloroprene elastomeric joint seal (compression seal) made of vulcanized elastomeric compound using polychloroprene as the only base polymer. Provide in expansion joints where indicated and conform to ASTM D2628.
- F. Provide one-component polychloroprene compound conforming to ASTM D2835 as lubricant for installation of elastomeric joint seal.

2.3 BOND BREAKER FOR JOINT COMPOUNDS

- A. Provide polyethylene tape, coated paper, metal foil, or similar type material.
- B. Provide 100 percent closed-cell material, compressible, non-shrink, nonreactive with joint compound, and nonabsorbent.

2.4 BACK-UP MATERIAL FOR JOINT COMPOUNDS

- A. Provide 100 percent closed-cell material, compressible, non-shrink, nonreactive with joint compound, and nonabsorbent.
- B. Extruded butyl or polychloroprene foam rubber is acceptable.
- C. Material impregnated with oil, bitumen, or similar substances is not acceptable.
- D. Provide back-up material which is compatible with joint compound and as recommended by manufacturer and has same expansion and contraction capability as compound.



2.5 PREMOLDED-JOINT FILLER

- A. Provide pre-molded joint filler complying with ASTM D1752, Type I or Type II.
- B. Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types) ASTM D1751.
- C. Provide joint filler having same thickness as expansion joint width indicated.
- D. Provide maximum length filler manufactured to minimize field cutting.

2.6 POLYVINYL CHLORIDE (PVC) WATERSTOP

- A. Provide in accordance with US Army Corps of Engineers Specification CRD-C572.
- B. Provide waterstops of type and size indicated with looped galvanized steel wire along both edges. Manufacture from virgin polyvinyl chloride plastic compound that has a minimum tensile strength of 1750 psi.
- C. Provide waterstops having zero water leakage when tested to 50 psi minimum water pressure conforming to test arrangement in the 1959 Journal of the ACI.
- D. Provide factory-made and tested crosses, tees, and ells, manufactured using thermostatically controlled electric heat source.
- E. PVC waterstops shall be manufactured by:
 - 1. Catalog No. R638 (6-inch wide ribbed flat-strip) at construction joint and Catalog No. RB912 (9-inch wide ribbed center-bulb) at expansion joint - as manufactured by Vinylex Corporation, Knoxville, TN.
 - 2. Wirestop Waterstop Part # FR-6380 (6-inch wide ribbed flat-strip) at construction joint and CR-9380 (9-inch wide ribbed center-bulb) at expansion joint - as manufactured by Paul Murphy Plastics, Roseville, MI.
 - 3. Style No. 679 (6-inch wide ribbed flat-strip) at construction joint and Style No. 735 (9-inch wide ribbed center-bulb) at expansion joints - as manufactured by (Sika) Greenstreak Plastic Products Company, St. Louis, MO.
 - 4. Or approved equal.

2.7 RETROFIT WATERSTOPS

- A. Seal joints where new construction interfaces with an existing concrete and can be suitable for moving joints. Systems shall include stainless steel batten bars and fasteners for anchoring to the existing structure with the aid of an epoxy gel.
- B. Provide retrofit waterstop systems as specified in Plans and manufactured by:



1. Style No. 667 as manufactured by (Sika) Greenstreak Plastic Products Company, St. Louis, MO.
2. Style No. 609 as manufactured by (Sika) Greenstreak Plastic Products Company, St. Louis, MO.
3. Or approved Equal.

2.8 HYDROPHILIC RUBBER WATERSTOPS

- A. Provide flexible, hydrophilic synthetic rubber, strip waterstop (1"x3/4" min.) with manufacturer recommended adhesive, shall be used in joints in wall and slabs where indicated on the plans.
- B. Provide hydrophilic rubber gasket waterstops as manufactured by:
 1. Duroseal Gasket Waterstop manufactured by BBZ USA, Southington, CT.
 2. Adeka Ultraseal MC-2010M manufactured by Adeka North America, Spearfish, SD.
 3. Swellseal 8 manufactured by De Neef Construction Chemicals, Inc., Waller, TX.
 4. Or approved equal.

2.9 HYDROPHILIC PASTE WATERSTOPS

- A. Provide hydrophilic rubber paste waterstops of urethane paster, thixotropic vinyl monomer or similar materials.
- B. Hydrophilic rubber paste shall be compatible with waterstop material.
- C. Hydrophilic paste shall be 100% solids.
- D. Provide hydrophilic paste waterstops which meet or exceed the criteria in the following table:

Table 03 31 00-1: Waterstop Criteria

Property	Test Methods	Limit
Ultimate Elongation	ASTM D 638	50% minimum
Tensile Strength	ASTM D 638	25 psi
Ozone Resistance	ASTM D 1149	No Failure
Volatile Loss	ASTM D 1203	0.50% maximum
Hardness, Shore A	ASTM D 2240	20 to 60

- E. Provide hydrophilic rubber paste as manufactured by:
 1. Duroseal Paste manufactured by BBZ USA, Southington, CT.



2. Adeka Ultraseal P-201 manufactured by Adeka North America, Spearfish, SD.
3. Swellseal Cartridge manufactured by De Neef Construction Chemicals, Inc., Waller, TX.
4. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Do not omit, add, or relocate construction and expansion joints without Engineer's prior written approval.
- B. Cast slabs and beams monolithically without horizontal joints.
- C. Allow 48 hours minimum elapsed time between pours of adjacent slab or wall at construction joints.
- D. Do not use horizontal joints within footings, foundation mats, pile caps, slabs, and other similar structural elements.
- E. Provide concrete construction and expansion joints in fills and toppings at the same location as the construction and expansion joints in the supporting concrete.
- F. Place waterstops in joints, in location indicated, before concrete placement.
- G. Use factory-made and tested crosses, tees and ells at all corners and intersections where radius is less than 6 inches.
- H. Reject before placing concrete, all waterstops bent around corners and remove from the construction or expansion joint and replace with factory-made pieces at no additional cost to the Owner.
- I. Spark test all waterstop splices before installation in accordance with manufacturer's instructions.
- J. Clean all expansion joint sidewalls before installing joint compound and compression seals.

3.2 JOINT PREPARATION

- A. General:
 1. The joints shall be accurately located and constructed to produce straight joints; and shall be vertical or horizontal, except where walls intersect sloping floors.
 2. The concrete pour shall not commence until after the joint preparation has been inspected by the Engineer.
- B. Preparation of Construction Joints:



1. Terminate each day's pour with a construction joint, as shown on the Drawings or as approved by the Engineer, and a suitable bulkhead.
2. Maintain on hand, at all times, sufficient keyway material, waterstops, and dowels for emergency use if a construction joint is required due to stoppage of concrete pour because of an emergency shutdown.
3. Temporary stoppage of pouring concrete may result in a cold joint; however, such instances shall be eliminated to the greatest extent by proper and contingent planning. Prior to resuming concrete placement on this plane, the surface shall be thoroughly cleaned of all laitance, loose or defective concrete, coatings, sand and other foreign material. The surface shall be prepared to a sufficient depth to expose sound concrete. Immediately prior to covering with fresh concrete, the joint shall be wet sandblasted, washed with air-water jet, and surface dried.

3.3 CONSTRUCTION JOINTS

- A. Provide construction joints as indicated or approved or directed by the Engineer.
- B. Prior to placing the abutting concrete, the contact surface shall be prepared as specified herein. The exposed portion of the reinforcing steel shall be cleaned of all concrete.
- C. Roughen the surface of the hardened concrete by one of the following methods:
 1. Sandblasting the previously placed concrete and reinforcing dowels after such concrete has fully cured to remove all laitance and spillage, and to expose sound aggregate.
 2. Water blasting the previously placed concrete and reinforcing dowels after such concrete has partially cured to remove all laitance and spillage, and to expose sound aggregate.
 3. In no case shall the roughening process cause microfractures on the treated surface.
- D. At least 2 hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor or roof system and shall be placed monolithically therewith.
- E. Furnish key groove with key width one-third the thickness of the member in which the key is placed and a key depth of 1-1/2 inch, unless otherwise indicated.
- F. Use tapered key groove forms, with taper being no greater than 2 inches per foot, to permit form removal without damage to groove after concrete has cured.
- G. Center waterstops in construction joints unless otherwise indicated.
- H. The PVC strip shall be embedded one-half its width in the poured concrete at the construction joint. The exposed half width of strip shall be adequately protected against damage and shall be cleaned and repaired, if needed, prior to being embedded in the next adjacent pour.
- I. Secure waterstops in position by tie wire from loops to adjacent reinforcement every 12 inches along each edge both sides.



- J. Continue reinforcement across and perpendicular to the construction joint unless specifically indicated otherwise.
- K. Consolidate concrete during placement adjacent to key groove and around waterstop.
- L. Do not remove key groove forms until after concrete has been cured for 24 hours.
- M. Key groove forms left in place shall not be acceptable.
- N. Clean key groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, roughen, and blow out debris and dust with oil-free compressed air.
- O. Protect exposed key groove from damage.

3.4 EXPANSION JOINTS

- A. Provide expansion joints as indicated.
- B. Center waterstops in expansion joints unless otherwise indicated.
- C. Secure waterstops in position by tie wire from loops to adjacent reinforcement every 12 inches along each edge both sides.
- D. Terminate reinforcement across the expansion joint.
- E. Consolidate concrete during placement adjacent to expansion joint and around waterstop.

3.5 POLYVINYL CHLORIDE WATERSTOPS

- A. Provide waterstops in longest continuous lengths to minimize field splices.
- B. Bending waterstops in forms is not permitted. Use factory-made and tested crosses, tees and ells at all corners and intersections where radius is less than 6 inches.
- C. Split waterstops are not permitted.
- D. Make all splices on a bench following manufacturer's splicing procedures and instructions. Use miter guide and portable power saw to cut spliced ends.
- E. Maintain continuity through splice of characteristic features of waterstop cross-section, including ribs and center bulb.
- F. Remove looped steel wire along both edges of waterstop adjacent to saw-cut ends prior to splicing.



- G. Make splices by heat sealing adjacent surfaces using a thermostatically controlled electric heat source in accordance with manufacturer's printed instructions.
- H. Reform waterstop at splices using a remolding iron having pattern matching waterstop.
- I. After splice has cooled, spark test all splices in accordance with manufacturer's printed instructions. If splice shows any separation or lack of fusion, reject the splice, recut back at least one inch from rejected splice each side, re-weld, and retest.
- J. Position and tie waterstop to form a continuous, watertight diaphragm in joint, to prevent leakage.
- K. Support and protect waterstop.
- L. Replace or repair, in accordance with manufacturer's printed instructions, damaged or punctured waterstop.
- M. Clean waterstop of curing compound, foreign materials, and protrusions of hardened concrete.
- N. Consolidate concrete during placement adjacent to waterstop.
- O. Maintain 2 inches minimum clearance between waterstop and reinforcement, and all embedded items, unless otherwise shown on Drawings.

3.6 PREMOLDED-JOINT FILLER

- A. Treat cut surface as recommended by manufacturer, when strips are cut. Clean groove of laitance, curing compound, foreign materials, protrusions of hardened concrete; blow out dust with oil-free compressed air.
- B. Place against the bulkhead form and fasten to the inside of the form with non-corrodible fasteners.
- C. Fill expansion joint completely.
- D. Use tapered wood strips with the smaller width being the same width as the expansion joint and of depth to install the joint compound and back-up materials as recommended by manufacturer. Secure wood strips to surfaces which are to receive joint compound. Use materials to secure joint filler and wood strips which will not harm concrete or affect the joint compound's bond to concrete. Do not remove wood strips until after the concrete curing period.
- E. Prevent disturbance of or damage to joint filler.

3.7 JOINT COMPOUND

- A. Seal, clean, and dry concrete in accordance with manufacturer's printed instructions.
- B. Install back-up and bond breaker materials to prevent 3-sided bending.



- C. Prime concrete, fill flush with joint compound of required thickness, tool to concave joint and seal, all in accordance with the manufacturer's instructions, and ASTM C962.
- D. Prevent spilling compound over adjoining surfaces. Use tape adjacent to joint if required. Remove all tape completely from concrete surface.
- E. Do not seal when compound, air, or concrete temperature is less than 40 degrees F.

3.8 PREFORMED ELASTOMERIC JOINT SEAL

- A. Remove all joint fillers as recommended by manufacturer for installation of compression seal.
- B. Prior to installation, correct irregularities in the expansion joint face that would prevent contact between the joint seal and the joint face.
- C. Sandblast without damaging, the exposed joint faces until the surfaces are free of dust, dirt, curing compound, joint filler, and any other material that might prevent readily inserting and bonding of the joint seal to the concrete or stainless steel.
- D. Clean and dry expansion joints. The atmospheric and concrete temperatures shall be above 40 degrees F at the time of joint seal installation.
- E. After final cleaning and immediately prior to joint seal installation, blow-out the expansion joints with oil-free compressed air and leave completely free of sand and water.
- F. Lubricate and install the joint seal in accordance with the manufacturer's printed instructions.
- G. Install the joint seal in the upright position and free form twisting, distortion and stretching that exceeds 5 percent. Install the joint seal to a depth of 3/16-inch, $\pm$ 1/16-inch, from the finished surface.
- H. Make butt joints and intersecting splices with full contact. Use adhesive recommended by the seal manufacturer. Remove all dust, grease, or substances impeding the formation of the seal.
- I. When rain interrupts sealing operations, re-clean and re-dry expansion joints prior to installing the joint seal.
- J. If joint seals in place fail to meet specified requirements, remove them and install new seals at no additional cost to the Owner.

3.9 RETROFIT WATERSTOP

- A. Use only where specifically shown in the Drawings or approved by the Engineer.
- B. Install in full conformance with the manufacturer's printed recommendations including that for surface preparation.



- C. A waterstop system comprising of multiple components, shall be installed with all the components as supplied by the same approved manufacturer. No inter-mixing of components from different manufacturers shall be permitted.
- D. Epoxy required for the installation shall be as manufactured and/or recommended by the waterstop manufacturer.

3.10 HYDROPHILIC WATERSTOP

- A. Use only where specifically shown in the Drawings or approved by the Engineer. Install in accordance with the manufacturer's written instructions.
- B. Locate the waterstop within the two curtains of vertical wall reinforcing bars as shown or provide a minimum of 2-1/2 inches of concrete cover over the waterstop.
- C. Apply adhesive to concrete surface and allow drying for specified time before applying waterstop strip.
- D. Butt ends of waterstop strip together at splices and corners and joins with sealant.
- E. For vertical and overhead applications, apply adhesive and secure waterstop with concrete nails as 12-inch maximum spacing.
- F. Verify that waterstop is anchored firmly in place before placing concrete. Do not allow vibrator to come in contact with waterstop.

END OF SECTION 03 31 00



SECTION 03 39 00 - CONCRETE CURING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Initial and final curing of horizontal and vertical concrete surfaces.
- B. Related Requirements:
 - 1. Section 03 10 00 – Concrete Forming.
 - 2. Section 03 20 00 – Concrete Reinforcing.
 - 3. Section 03 30 00 – Cast-in-Place Concrete.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

- A. American Concrete Institute (ACI):
 - 1. ACI 301 – Specifications for Structural Concrete.
 - 2. ACI 302.1 – Guide to Concrete Floor and Slab Construction.
 - 3. ACI 308.1 – Specification for Curing Concrete.
 - 4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
 - 5. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary.
- B. ASTM International:
 - 1. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM D2103 – Standard Specification for Polyethylene Film and Sheeting.
- C. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. M182 – Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.



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1.3 SUBMITTALS

- A. Comply with requirements in Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer's information on curing compounds, mats, paper, and film, including compatibilities and limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

1.4 QUALITY ASSURANCE

- A. Comply with ACI 301 and ACI 302.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.
- C. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Membrane-Curing Compound – Dissipating Type. Type 1, Class A & B:
 - 1. Comply with ASTM C309, Type 1, Class A & B.



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2. Use non-yellowing formulation where subject to ultraviolet light.
3. Cured film must start to chemically break down in four to six weeks after application.
4. Manufacturers: Clear Resin Cure J11W by Dayton Superior, Kurez DR VOX by Euclid Chemicals, or approved equal.

B. Membrane-Curing Compound and Floor Sealer:

1. Comply with ASTM C1315, Type I, Class A.
2. Minimum 25 percent solids, acrylic, non-yellowing.
3. When using curing and sealing compound and where indicated, provide curing and sealing formulation with long-lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.
4. Manufacturers: Dress & Seal 30 by L&M Chemical, Masterkure-N-Seal HS by Master Builders, MasterKure CC 250SB by BASF, Cure & Seal 30 by Dayton Superior, or approved equal.

C. Absorptive Mats:

1. Material: Burlap-polyethylene (PE).
2. Bonded to prevent separation during handling and placing.
3. Comply with ASTM C171 and AASHTO M182.

D. Waterproof Paper:

1. Description: Curing paper treated to prevent separation during handling and placing.
2. Comply with ASTM C171.

E. Polyethylene (PE) Film:

1. Comply with ASTM C171 and D2103.
2. Thickness: 6 mils.

F. Water: Potable and not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with examination requirements in Section 01 70 00 - Execution and Closeout Requirements.
- B. Verify that substrate surfaces are ready to be cured.



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3.2 APPLICATION

A. General:

1. Protect concrete from premature drying, hot or cold temperatures, and mechanical injury, beginning immediately after placement and maintain concrete with minimal moisture loss at relatively constant temperature.
2. All concrete shall be water cured, unless specified otherwise.
3. Comply with curing procedures set forth in ACI 301, applicable portion of ACI 308 and as specified herein.
4. Perform hot weather concreting in conformance with ACI 305R and as specified herein when the ambient atmospheric temperature is 80°F or higher.
5. Perform cold weather concreting in conformance with ACI 306R and as specified herein when the ambient atmospheric temperature is 40°F or lower.

B. Duration:

1. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from unformed concrete surfaces. Initial curing starts as soon as formed concrete achieves final set. Forms left tightly in place are considered as part of the curing system, provided that the wooden forms are kept continuously moist for not less than 3 days.
2. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures for a total curing period, initial plus final, of at least 10 days.
3. For concrete sections over 30 inches thick, continue final curing for an additional 7 days, minimum where specified in Plans.
4. Avoid rapid drying at the end of the final curing period by slowly reducing the wetting of concrete surface over an additional 3 days where specified in Plans.

C. Curing Requirements:

1. Unformed Surfaces: Cover and cure entire surface of newly placed concrete immediately after completing finishing operations and water film has evaporated from surfaces or as soon as marring of concrete will not occur. Protect finished slabs from direct rays of the Sun to prevent checking, crazing, and plastic shrinkage.
2. Formed Surfaces: Minimize moisture loss from formed surfaces exposed to heating by the Sun by keeping forms wet until safely removed. Keep surfaces continuously wet by warm water spray or warm water saturated fabric immediately following form removal.
3. Water Retaining and Below-Grade Structures: Moist cure by the addition of water to maintain the surface in a continually wet condition. Use water that is free of impurities that could etch or discolor exposed concrete surfaces. Other concrete shall be cured by moist curing, by moisture-retaining cover curing, or using curing compound. Use curing compound at water retaining and below-grade structures only in cold weather after initial curing period and only when approved by the Engineer, in writing.



D. Curing Methods:

1. Water Curing: Use warm water curing for unformed surfaces. Continuously water cure all exposed concrete for the entire curing period. Provide moisture curing by any of the following methods:
 - a. Keeping the surface of the concrete continuously wet by ponding or immersion.
 - b. Continuous water-fog spray or sprinkling.
 - c. Covering the concrete surface with curing mats, thoroughly saturating the mats with water, and keeping the mats continuously wet with sprinklers or porous hoses. Place curing mats so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent mats. Weight down the curing cover to maintain contact with the concrete surface, as necessary.
2. Sealing Materials:
 - a. Use common sealing materials such as plastic film or waterproofing (kraft) paper when approved by the Engineer.
 - b. Lap adjacent sheets a minimum of 12 inches. Seal edges with waterproof tape or adhesive. Use sheets of sufficient length to cover sides of concrete member.
 - c. Place sheet materials only on moist concrete surfaces. Wet concrete surface with fine warm water spray if the surface appears dry.
 - d. The presence of moisture on concrete surfaces at all times during prescribed curing period is proof of acceptable curing using sheet material.
3. Membrane Curing Compound:
 - a. Apply membrane-curing compound uniformly over concrete surface by means of roller or mechanical spray machine at a rate recommended by the curing compound manufacturer, but not less than 1 gallon per 150 sq. ft. of surface area. Agitate curing material in supply container immediately before transfer to distributor and thoroughly agitate it during application for uniform consistency and dispersion of pigment.
 - b. Do not use curing compounds on construction joints or on surfaces to receive concrete fills and toppings or other applications requiring positive bond.
 - c. Reapply membrane-curing compound to concrete surfaces that have been subjected to rainfall within 3 hours after curing compound has been applied by method for initial application.
 - d. Maintain the continuity of the coating and repair damage to the coating during the entire curing period.
 - e. Provide a copy of manufacturer's certification that the curing compound meets the requirements of ANSI/NSF 61 for concrete surfaces that will be in contact with potable water.
 - f. When curing compound is authorized for application to water retaining or below-grade structures, it shall be applied at the manufacturer's recommended coverage rate and then applied again at the same rate to provide twice the recommended coverage.



4. Membrane Curing and Sealing Compound:
 - a. Where indicated, provide curing and sealing formulation with long lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.
 - b. Apply at a rate stated by the manufacturer to conform to moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain. Apply additional coat near substantial completion to act as sealer.

3.3 PROTECTION

- A. Comply with protecting finished Work requirements in Section 01 70 00 - Execution and Closeout Requirements.
- B. Protection from environmental conditions: Maintain the concrete temperature above 50°F continuously throughout the curing period. Make arrangements before concrete placing for heating, covering, insulation, or housing as required to maintain the specified temperature and moisture conditions continuously for the curing period.
 1. When the atmospheric temperature is 80°F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering.
 2. Protect the concrete continuously for the concrete curing period.
 3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes.
 4. Avoid temperature changes in concrete that exceed 5°F in any one hour and 50°F in any 24-hour period.
- C. Protection from physical injury: Protect concrete from physical disturbances such as shock and vibration during curing period. Protect finished concrete surfaces from damage by construction equipment, materials, application of curing procedures and rain or running water. Do not load concrete in such a manner as to overstress concrete. Do not permit traffic over unprotected floor surfaces. Any traffic imposed shall be light enough as not to overstress, damage, or mar the concrete.
- D. Protection from deicing agents: Do not apply de-icing chemicals to unsealed concrete surfaces.

END OF SECTION 03 39 00



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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing surface debris.
2. Removing designated paving, curbs, and sidewalks.
3. Removing designated trees, stumps, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Removing fence materials and gates.
6. Excavating topsoil.

B. Related Requirements:

1. Section 02 31 13.23 – Utility Line Removal.
2. Section 02 61 13 – Excavation and Handling of Contaminated Materials.

1.2 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.
- C. Location of final disposal of cleared materials and written permission from property owner.

1.3 QUALITY ASSURANCE

- A. Conform to state, county, and local laws and code requirements for the trimming, removal, hauling and disposing of trees, shrubs, stumps, roots, rubbish, debris and other matter. Pay for all disposal permits and fees. Disposal will not be permitted in a wetland or floodplain unless permits are obtained from the appropriate regulatory agencies.
- B. Perform Work in accordance with Environmental Protection Agency (EPA), Michigan Department of Transportation (MDOT), Wayne County, and Detroit Water and Sewerage Department (DWSD) standards. Perform Work in adherence to the City of Detroit Fugitive Dust Ordinance (Ordinance No. 32-17).
- C. Maintain on-site two (2) copies of any disposal permit obtained.



- D. Comply with all federal and state Emerald Ash Borer quarantines, if applicable. Comply with Michigan Department of Agriculture requirements.
- E. Comply with all Federal and State regulations for the protection of the Indiana Bat. The clearing of plant life within Indiana Bat habitat is prohibited during the dates of April 1 through September 30.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Herbicide: Submitted to and approved by the Engineer on a case by case basis.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Verify that existing plant life designated to remain is tagged or properly identified.
- C. Identify waste area for placing removed materials and soil stockpile location.

3.2 PREPARATION

- A. Call Local Utility Line Information service MISS DIG (811) at 1-800-482-7171 no less than three full working days, excluding Saturdays, Sundays, and holidays, but no more than 14 calendar days before digging operations are scheduled to begin.
- B. Request underground utilities to be located and marked within surrounding construction areas. Do not dig until all utilities have been marked by MISS DIG (811).

3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Protect benchmarks, survey control points, and existing structures from damage or displacement.



3.4 CLEARING

- A. Clear and grub areas to a depth necessary for access to site and execution of the Work.
- B. Remove trees and shrubs as required for access within water and sewer easements and marked areas. Remove stumps and root systems within marked areas to a minimum depth of 6 inches. Remove surface rock to 6 inches below subgrade. Trees and tree branches which encroach the access areas shall be trimmed and pruned to the satisfaction of the Engineer or jurisdictional authority.
- C. Clear undergrowth and deadwood without disturbing subsoil.
- D. Apply herbicide to remaining stumps within marked areas to inhibit growth.

3.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Partially remove paving, driveways, curbs, ADA ramps, and sidewalks as indicated on Drawings. Neatly sawcut edges at right angle to surface.
- C. Remove abandoned utilities in accordance with Section 02 31 13.23 – Utility Line Removal. Indicate removal termination points for underground utilities on Record Documents.
- D. Remove fences, gates, traffic signs, mailboxes, etc., as indicated on the Drawings.
- E. Continuously clean up and remove waste materials from site. Do not allow materials to accumulate on site.
- F. Do not burn or bury materials on-site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from entire site without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 6 feet and protect from erosion. Stockpile material on impervious material and cover with same material until disposal.
- D. Remove excess topsoil not intended for reuse from site to a location approved by the Engineer.
- E. Contaminated materials management in accordance with Section 02 61 13 – Excavation and Handling of Contaminated Materials.



3.7 SCHEDULES

A. Protect the following materials:

1. Protect streets, roads, adjacent property, and all other facilities and structures from damage caused by the Contractor's operations.
2. Return to original condition, satisfactory to the Engineer, facilities damaged by the Contractor's operation at the Contractor's expense.
3. Protect trees, shrubs, and grassed areas by using fences, barricades, wrapping, or other methods as shown, specified or approved by the Engineer.

END OF SECTION 31 10 00



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SECTION 31 23 16.26 - ROCK REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Excavating and removing identified and discovered rock during excavation.
- B. Related Requirements:
 - 1. Section 31 23 33 – Trenching and Backfilling

1.2 DEFINITIONS

- A. Rock: Solid mineral material with volume in excess of 1/2 cu. yd. or solid material that cannot be removed with 3/4 cu. yd. capacity excavator without drilling or blasting, or continuous use of a ripper or other special equipment.

1.3 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 495 – Explosive Materials Code.
 - 2. MIOSHA Part 27 – Blasting and Use of Explosives.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

1.5 PROJECT CONDITIONS

- A. Conduct survey and document conditions of buildings near locations of rock removal, and photograph existing conditions identifying existing irregularities.
- B. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey.



- C. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

1.6 SCHEDULING

- A. Coordination and Project Conditions: Comply with Section 01 30 00 - Administrative Requirements.
- B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by mechanical method. Alternatively, drill holes and use expansive tools and wedges to fracture rock.
- B. Cut away rock at bottom of excavation to form level subgrade.
- C. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- D. Remove excavated materials from site.
- E. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 23 33 – Trenching and Backfill, unless directed otherwise by the Engineer.

3.4 FIELD QUALITY CONTROL

- A. Comply with field inspecting, testing, adjusting, and balancing requirements in Section 01 40 00 - Quality Requirements.
- B. Request visual inspection of bearing surfaces by Engineer before installing subsequent work.



END OF SECTION 31 23 16.26



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SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dewatering system.
2. Surface water control system.
3. Monitoring wells.
4. System operation and maintenance.
5. Water disposal.

B. Related Requirements:

1. Section 01 57 13 – Temporary Erosion and Sediment Control
2. Section 02 61 13 – Excavation and Handling of Contaminated Materials
3. Section 31 23 33 – Trenching and Backfill

1.2 DEFINITIONS

A. Dewatering:

1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations, trenches, tunnels, and shafts.
2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations, trenches, tunnels, and shafts.
3. Legally disposing of removed water.

B. Piezometer: A tube inserted into a vessel or pipe to indicate the height (pressure) that a liquid can rise in the tube.

C. Pitometer: A measuring device that transforms a differential pressure into an electrical output current proportional to the flow rate.

D. Surface Water Control: The removal of surface water within open excavations.

E. Dewatering System: The system of wells, well points, sumps, ejectors, pumps, power supply, effluent treatment equipment, and other applicable equipment designed by the Contractor to effectively dewater the site as required herein and as specified.



1.3 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. ASTM International:

1. ASTM C33 – Standard Specification for Concrete Aggregates.
2. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
4. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe Systems.

B. Michigan Department of Environmental Quality (MDEQ) – Part 127, Act 368 PA 1978 “Michigan Well Code.”

C. Soil Erosion and Sedimentation Control Act of the State of Michigan, Part 91 of Act 451; PA of Michigan.

D. National Pollutant Discharge Elimination System (NPDES) Permit.

1.4 COORDINATION

A. Comply with Section 01 30 00 - Administrative Requirements.

B. Coordinate Work of this Section to permit the following construction operations to be completed on dry and stable substrate: Trenching for utilities as specified in Section 31 23 33 – Trenching and Backfill.

1.5 PREINSTALLATION MEETINGS

A. Comply with Section 01 30 00 - Administrative Requirements.

B. Convene a pre-installation meeting a minimum two weeks prior to commencing Work of this Section.

1.6 SEQUENCING

A. Comply with Section 01 11 00 – Summary of Work.

B. Obtain required permits before start of dewatering operations.



- C. Install and test monitoring systems a minimum seven (7) days before testing and operating dewatering systems.
- D. Install and test dewatering and surface water control systems a minimum seven (7) days before starting excavation, trenching, tunneling, and shaft drilling.

1.7 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Dewatering System/Plan: Submit plan of dewatering system as indicated in Shop Drawings Section below.
- C. Product Data:
 - 1. Submit catalog cuts and product data sheets for major equipment items including pumps, motors, valves, pressure gauges, flow meters, piping, electrical power supply, and standby generators.
 - 2. Submit pumping equipment for control of surface water within excavation.
- D. Shop Drawings:
 - 1. Indicate that the water to be extracted from subsurface does not contain hazardous materials. Comply with Section 02 61 13 – Excavation and Handling of Contaminated Materials.
 - 2. Indicate dewatering system layout, well depths, well screen lengths, dewatering pump locations, pipe sizes and capacities, grades, filter sand gradations, surface water control devices, valves, and water disposal method and location.
 - 3. Indicate primary and standby power system location and capacity.
 - 4. Indicate layout and depth of monitoring wells, piezometers, and flow measuring devices for system performance measurement.
 - 5. Include detailed description of dewatering and monitoring system installation procedures and maintenance of equipment.
 - 6. Include description of emergency procedures to follow when problems arise. Provide a designated dewatering responsible person who will be the point of contact in the event of system failure or loss of power.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Design Submittals:
 - 1. Submit a preliminary dewatering plan including:
 - a. Proposed locations and number of wells, well points and monitoring wells.
 - b. Anticipated groundwater drawdown range and depth.
 - c. Schedule for installation, development, and testing of all dewatering system components, as well as the excavation activities at each dewatering site.



- d. Proposed casing diameters, depths, and screen lengths.
 - e. Proposed location and size of the discharge header.
 - f. Performance curves for proposed pumps.
 - g. Proposed estimated total pumping horsepower and standby power generator(s) capacity.
 - h. Proposed locations and types of flow meters.
 - i. Suspended solids monitoring procedures.
 - j. Proposed monitoring frequency and reporting format for various construction stages and situations.
 - k. Designated dewatering responsible person who will be contacted in the event of system failure or loss of power.
 2. Submit signed and sealed design and Shop Drawings of approved Dewatering Plan.
 3. Indicate design values, analyses, assumptions, and calculations to support design.
 4. Include description and profile of geology, soil, and ground water conditions.
 5. Submit signed and sealed survey of existing adjacent buildings, structures, and improvements for position and elevation of principal elements before and after completion of dewatering operations.
 - G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, and testing and monitoring reports.
 - H. Reports:
 1. Initial Installation Report: General
 - a. Installation and development reports for well points and pumps including well performance data based on tests conducted at the time of installation including pumping rate, static level, pumping levels, drawdown, and pumping duration shall all be included on well log.
 - b. Installation and baseline reports for monitoring of wells and piezometers.
 - c. Test reports of well water analysis.
 - d. Initial dewatering flow rates.
 2. Weekly Monitoring Reports:
 - a. Dewatering flow rates.
 - b. Piezometer readings.
 - c. Test reports of discharge water analysis.
 - d. Maintenance records for dewatering and surface water control systems.
 - I. Qualifications Statements: Submit qualifications for manufacturer, installer, licensed professional, and representative that will oversee the dewatering system daily.
- 1.8 CLOSEOUT SUBMITTALS
- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.



- B. Project Record Documents: Record actual locations and depths of capped wells and piping abandoned in place.

1.9 QUALITY ASSURANCE

- A. Comply with the applicable codes, ordinances, statutes, rules, and regulations of the City of Detroit, the State of Michigan, and Federal Government for the following:
 - 1. Drilling and abandonment of wells used for dewatering systems (MDEQ “Well Construction Code”).
 - 2. Water discharge and disposal from pumping operations (NPDES, as administered by MDEQ, Natural Resources and Environmental Protection Act, 1994 PA 451).
- B. If noted on the drawings or in the specifications, obtain a permit from the MDEQ under the National Pollutant Discharge Elimination System (NPDES) for discharge from the Site. The quality of the discharge from dewatering operations determines whether a NPDES permit is required. In general, the discharge of clean water will not require an NPDES permit.
- C. Small portions of the City of Detroit have regulated municipal separate storm sewer systems (MS4). Discharge from dewatering operations to a MS4 shall comply with the illicit discharge definition (i.e., the discharge cannot be contaminated). Obtain approval from DWSD prior to discharging to their system from any dewatering operation.
- D. Complete submittals required by MDEQ well abandonment procedures. Submittals shall be made directly to MDEQ, copying the Owner, within 15 days of completion.
- E. Perform Work according to Detroit Water and Sewerage Department standards.
- F. Maintain two copies of each standard affecting Work of this Section on-site.

1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum five (5) years documented experience and approved by the manufacturer and Owner.
- C. Licensed Professionals:
 - 1. Professional engineer experienced in design of specified Work and licensed in the State of Michigan.
 - 2. Surveyor experienced in specified Work and licensed in the State of Michigan.
 - 3. Water Well Driller experienced in specified work and licensed in the State of Michigan.



PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Lower the ground water level in excavations to provide a stable, dry subgrade for the execution of subsequent Work.
- B. Furnish, install, and maintain dewatering and surface water control systems to permit the work to be completed on dry and stable subgrade.
- C. Furnish, install and maintain well points/wells to dewater and relieve hydrostatic pressure within the strata as identified in the Contract Documents.
- D. Furnish, install and maintain monitoring wells and monitoring equipment to obtain meaningful observations of conditions affecting the excavation. The ground water table shall be maintained a minimum of 3 feet below the excavation at all times.
- E. Furnish, install and maintain monitoring wells to observe ground water conditions as designed in dewatering plan.
- F. Standby Equipment:
 - 1. Provide standby pumping and power equipment of sufficient capacity to maintain the dewatering system in an operable condition in the event of failure of any of the original equipment or power.
 - 2. Store at Site and ready for immediate use upon failure of dewatering equipment.
 - 3. Standby equipment shall include power generator(s) installed and available, and additional pumps of a quantity of at least 10% of the total number and sized pumps.

2.2 PERFORMANCE AND DESIGN CRITERIA

- A. Design:
 - 1. Lower water table within areas of excavation to minimum 3 feet below bottom of excavation to permit the work to be completed on dry and stable subgrade.
 - 2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
 - 3. Prevent damage to adjacent properties, buildings, structures, utilities, and other facilities from construction operations.
 - 4. Prevent loss of fines, quick condition, or softening of foundation subgrade.
 - 5. Maintain stability of all sides/faces/walls/bottoms of excavations, trenches, tunnels, and shafts.
 - 6. Surface Water Control System: Collect and remove surface water and seepage entering excavation.



2.3 DEWATERING EQUIPMENT

- A. Prepare a complete plan and design of the dewatering system. Submit to the Owner for review and approval. Design dewatering equipment to meet the specified performance requirements.
- B. The dewatering system shall be of sufficient size and capacity to maintain a dry condition for construction of each part of the work without delaying construction operations. Control all water regardless of source. Comply with applicable environmental protection laws and requirements in operation of the dewatering system.

2.4 MONITORING EQUIPMENT

- A. Piezometers:
 - 1. Description: Sand filter or Push-in installation to monitor water elevation.
 - 2. Type: Standpipe, strain gage, or vibrating wire.
 - 3. Accessories: Signal cable and data recorder or logger.
- B. Flow Measurement Devices:
 - 1. Pitometer installed on discharge of pipe from each well.
 - 2. Pitometer installed to measure flow from entire dewatering system.

2.5 ACCESSORIES

- A. Valves and Fittings: Furnish valves and fittings as required to isolate each well from header pipe and to prevent loss of pump prime.
- B. Filter Sand:
 - 1. Description: Natural river or bank sand, washed, and free of silt, clay, loam, friable, or soluble materials.
 - 2. Comply with ASTM C33/C33M.
 - 3. Grading: To suit well screen.
- C. Grout: Mixture of Portland cement and bentonite clay for sealing abandoned wells and piping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.



- B. Review and evaluate the available subsurface data for the project site with respect to required dewatering facilities, including any additional groundwater monitoring data required. The subsurface conditions from the test borings and excavations apply only to the locations of the borings and at the times of the explorations. The subsurface conditions elsewhere at the site and at the time of construction may be different.
- C. Conduct additional borings and investigations to supplement subsurface investigations as necessary to complete dewatering system design. Contractor may use monitoring wells left by the Owner's geotechnical engineer.
- D. Utility Service Locator:
 - 1. Call local utility service-line information MISS DIG at 811 between 3 days and 14 calendar days, excluding Saturdays, Sundays, and holidays, before beginning Work.
 - 2. Request that underground utilities be located and marked within and immediately surrounding construction areas.
 - 3. Identify required lines, levels, contours, and data.

3.2 PREPARATION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Protect existing adjacent buildings, structures, and improvements from damage that may be caused by dewatering operations.

3.3 MONITORING WELLS

- A. Install monitoring wells at locations as indicated on Contract Documents and Shop Drawings.
- B. Test each monitoring well point to verify that installation is performing properly.
- C. Install, calibrate, and test piezometers for proper operation.
- D. Maintain accessibility to monitoring wells continuously during construction operations.
- E. Maintain monitoring wells until groundwater can return to normal level.

3.4 DEWATERING SYSTEM

- A. Install dewatering system according to Contractor's approved signed and sealed Dewatering Plan and Shop Drawings. Provide means and devices to remove promptly and dispose of water entering excavations and keep the bottoms of the excavations firm and free of standing water and side slopes stable until the structures to be constructed are completed or the backfill to be placed therein has been placed.



- B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way, sidewalks, and adjacent buildings, structures, and improvements.
- C. Drilling:
 - 1. Drill wells in sizes and to depths as indicated in Dewatering Plan.
 - 2. Provide temporary surface casing if required to stabilize soil while advancing well.
- D. Installation Standards: Install Work according to Detroit Water and Sewerage Department standards.
- E. Perform the pumping and dewatering operations such that no disturbance to the bearing soil or to soil supporting any other work will result from the dewatering operations. The dewatering discharge shall not cause siltation or other negative environmental impact on natural waterways or other property; such discharge shall be in accordance with applicable federal, state, and local regulations. At dewatering discharge locations, install erosion-bales, silt barriers, or other erosion control measures to control and prevent siltation.
- F. Operate the dewatering system continuously to prevent flotation of partially completed structures or other work and flooding/excess wetting of work areas.

3.5 SURFACE WATER CONTROL SYSTEM

- A. Furnish, install, and maintain a surface water control system according to Contractor's approved signed and sealed Dewatering Plan. The location of every element of the dewatering system shall be such that interference with excavation and construction activity is minimized.
- B. Construct and maintain ditches, berms, and other devices to divert and drain surface water from excavation area, as designed in Dewatering Plan and specified in Contract Documents, Section 01 57 13 – Erosion Control Sedimentation and Containment of Construction Materials.
- C. Divert surface water and seepage water within excavation areas into sumps and pump water according to Contractor's Dewatering Plan and per the requirements of authorities having jurisdiction.
- D. Control and remove unanticipated water seepage into excavation.

3.6 SYSTEM OPERATION AND MAINTENANCE

- A. Operate dewatering system according to Contractor's approved signed and sealed Dewatering Plan.
- B. Operate dewatering system continuously until backfill is complete.



- C. Provide 24-hour supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.
- D. When the dewatering system does not meet the specified requirements and, as a consequence, loosening or disturbance of the foundations strata, instability of the slopes, or damage to the foundations or structures occurs, provide materials, labor, and work for restoration of foundations soil, fill soils, slopes, foundations, or structures at no cost to the Owner.
- E. When the dewatering system does not meet the specified requirements and consequently fill surfaces become too wet or the fill exceeds the specified moisture content, remove and replace the upper materials with materials placed and compacted to the specifications. Do not dry out overly wet fills resulting from failed or inadequate dewatering systems or mix with dry material and rework in-place to meet applicable fill specifications.
- F. Monitoring:
 - 1. Conduct daily observation of dewatering system and monitoring system.
 - 2. Make required repairs and perform scheduled maintenance.
- G. Fill fuel tanks before tanks drop to 25 percent capacity.
- H. Start emergency generators at least twice each week to check operating condition.
- I. System Failure:
 - 1. If dewatering system cannot control water within excavation, notify Engineer and stop excavation Work.
 - 2. Supplement or modify dewatering plan and provide other remedial measures to control water within excavation.
 - 3. Demonstrate that revised dewatering plan complies with performance requirements before resuming excavation operations.
- J. Modify dewatering and surface water control plan if operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.
- K. Correct unanticipated pressure conditions affecting dewatering system performance.
- L. Do not discontinue dewatering operations without approval of Engineer.

3.7 WATER DISPOSAL

- A. Discharge water according to Contractor's approved signed and sealed Dewatering Plan.



3.8 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Testing:
 - 1. After dewatering system is installed, perform pumping test to determine at what point selected pumping rate lowers water level in well below pump intake.
 - 2. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.
- C. Monitoring and Recording:
 - 1. Daily:
 - a. Note average discharge flow rate for each deep well, eductor header, well point, and ground water elevation.
 - b. Continue monitoring daily until steady state conditions occur, then monitor twice each week.
 - 2. Sand Content:
 - a. Monitor ground water discharge for sand content.
 - b. Sample and test water from each well weekly for sand content.
 - c. Maximum Permitted Sand Content: 5 ppm.
 - 3. Contaminants:
 - a. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.
 - b. Sample and test water weekly for contaminants.
 - 4. Existing Adjacent Buildings, Structures, and Improvements:
 - a. Survey weekly during dewatering to detect movement in comparison to original elevations.
 - b. Notify Engineer immediately of measured movement.

3.9 PROTECTION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Repair without cost to the Owner any damage to work in place, other contractors' equipment, and the excavation, including damage to the bottom of the excavation due to heave and removal of material and pumping out of the excavated area that may result from the Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
- C. Protect monitoring well standpipes from damage by construction operations.



3.10 SYSTEM REMOVAL

- A. Remove dewatering and surface water control systems after dewatering operations are discontinued.
- B. Remove piezometers and monitoring wells unless directed otherwise by the Owner.
- C. Abandoned Wells: Per MDEQ Part 127, Act 368 PA 1978

END OF SECTION 31 23 19



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SECTION 31 23 23.33 - FLOWABLE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flowable fill for:
 - a. Structure backfill.
 - b. Utility bedding.
 - c. Utility backfill.
 - d. Filling abandoned utilities.

B. Related Requirements:

1. Section 31 23 33 – Trenching and Backfilling.
2. Section 33 14 13 – Public Water Utility Distribution Piping.
3. Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.

1.2 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.
- B. Flowable Fill: Lean Portland cement concrete fill for utility trenches, culverts, and filling abandoned utilities.

1.3 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
5. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
6. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
8. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.



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9. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Field Quality-Control Submittals:
 1. Mix Design:
 - a. Furnish flowable fill mix design for each specified strength.
 - b. Furnish separate mix designs when admixtures are required for the following:
 - 1) Flowable fill during hot and cold weather.
 - 2) Air entrained flowable fill.
 - c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
 2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements minimum of fifteen (15) days prior to placement.
- C. Method of Placement.
- D. Delivery Tickets: Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40° F.

PART 2 - PRODUCTS

2.1 FLOWABLE FILL

- A. Furnish materials according to State of Michigan Department of Transportation standards.
- B. Flowable Fill:
 1. Filling abandoned utilities.
 2. Utility Trenches.
 3. Roadway Subgrade.
 4. Any areas specified.



2.2 MATERIALS

- A. Portland Cement: ASTM C150; Type I - Normal or Type IA - Air Entraining; for Excavatable Flowable Fill.
- B. Granular Materials:
 - 1. MDOT Standard Specifications for Construction for Class II requirements except that 100% shall pass the ½ inch sieve (Table 902-3).
 - 2. Fine Aggregates: MDOT Standard Specifications for Construction for 2NS requirements (Table 902-4).
- C. Fly Ash: ASTM C618 Class F with no limit on the loss of ignition.
- D. Water: Potable, clean and not detrimental to concrete.

2.3 OPTIONAL MATERIALS

- A. Ground Granulated Blast Furnace Slag: Ground blast furnace slag shall conform to ASTM C989, Grad 100. It shall be used only as a blending material with Type I or Type IA Portland Cement.

2.4 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical Admixtures: ASTM C494:
 - 1. Type A - Water Reducing.
 - 2. Type B - Retarding.
 - 3. Type C – Accelerating.
 - 4. Type D - Water Reducing and Retarding.
 - 5. Type E - Water Reducing and Accelerating.

2.5 MIXES

- A. Mix and deliver flowable fill according to ASTM C94, Option C.
- B. Flowable Fill Design Mix:
 - 1. Cement Content (Type I): 50 lb./cu. yd.
 - 2. Fly Ash Content (Class F): 200 lb./cu. yd.
 - 3. Water Content: Sufficient water to provide the desired flowability (approximately 40 gal/cu. yd.).
 - 4. Air Entrainment: 5 to 35 percent.
 - 5. 28-Day Compressive Strength:



- a. 50 psi at 3 days.
 - b. Maximum 150 psi at 28 days.
 6. Unit Mass (Wet): 80 to 110 pcf.
 7. Temperature, Minimum, at Point of Delivery: 50° F.
- C. Provide water content in the design mix to produce self-leveling, flowable fill material at time of placement.

2.6 SOURCE QUALITY CONTROL

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Test and analyze properties of flowable fill design mix and certify results for the following:
1. Design mix proportions by weight of each material.
 2. Aggregate: ASTM C33 for material properties and gradation.
 3. Properties of plastic flowable fill design mix including:
 - a. Temperature.
 - b. Slump.
 - c. Air entrainment.
 - d. Wet unit mass.
 - e. Yield.
 - f. Cement factor.
 4. Properties of hardened flowable fill design mix including:
 - a. Compressive strength at 3 days and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
 - b. Unit mass for each specimen.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Verify excavation is dry and dewatering system is operating.

3.2 PREPARATION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.



- C. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.
- D. Protect utilities to prevent intrusion of flowable fill.
- E. The temperature of the flowable fill mix, as it is manufactured and delivered, shall be at least 50° F.
- F. The flowable fill mix shall be transported to the point of placement in a revolving drum mixer or agitator.

3.3 INSTALLATION

- A. Place flowable fill in a manner similar to that for concrete but that adheres to the requirements for backfilling, according to Section 31 23 33 – Trenching and Backfilling.
- B. No placement of flowable fill will be allowed if the anticipated air temperature will be 35° F or less in the 24-hour period following the proposed placement.
- C. No water shall be added to the flowable fill after batching.
- D. Any pipes within the backfill area shall be secured in order to avoid buoyant effect of flowable fill.

3.4 INSTALLATION - FILL, BEDDING, AND BACKFILL

- A. Place flowable fill by chute, pumping or other methods approved by Engineer.
- B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.
- C. Place flowable fill evenly on both sides of utilities to maintain alignment.
- D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.
- E. When flowable fill is used in pavement cuts, the fill shall be placed to the top of pavement. After setting, the flowable fill shall be removed to the bottom of a concrete pavement patch or the bituminous base course.

3.5 INSTALLATION - FILLING ABANDONED UTILITIES

- A. Use excavatable flowable fill only.



- B. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation or pumping of flowable fill for entire length indicated to be filled.
- C. Place flowable fill under pressure into properly vented open system until flowable fill emerges indicating pipe is completely filled. Pumping flowable fill must be completed under sufficient pressure to overcome friction and to fill water main from downstream to upstream end.
- D. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations during gravity installation.
- E. Seal both ends of pipes and conduits with approved bulkheads suitable to contain flowable fill during pumping of flowable fill under pressure.
- F. Provide batch and delivery tickets to the Engineer for all flowable fill material.
- G. Place flowable fill using method to ensure there are no voids.
 - 1. Fill pipes and conduits from high end.
 - 2. Fill manholes, tanks, and other structures from grade level access points.

3.6 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Perform in place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403. Perform tests at locations as directed by Engineer.
- C. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
 - 1. Test Requirements:
 - a. Minimum temperature at point of delivery.
 - b. Compressive strength requirements for each type of fill.

3.7 CLEANING

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Remove spilled and excess flowable fill from Project Site.
- C. Restore facilities and site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION 31 23 23.33



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SECTION 31 23 33 - TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trench excavation width and safety.
2. Backfill materials and placement.
3. Utility identification using marking tape and trace wire.
4. Soil and aggregate materials.
5. Compaction and testing.

B. Related Requirements:

1. Section 02 22 30 – Pre-Construction Video and Photographic Record.
2. Section 31 23 16.26 – Rock Removal.
3. Section 31 23 23.33 – Flowable Fill.
4. Section 31 50 00 – Excavation Support Systems.
5. Section 32 11 23 – Aggregate Base Courses.
6. Section 33 14 13 – Public Water Utility Distribution Piping.
7. Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.

1.2 DEFINITIONS

- A. Percent Compaction or Compaction Density: The field dry density of compacted material, expressed as a percentage of the maximum dry density.
- B. Field Dry Density or Field Density: In-place density as determined by ASTM D6938 (Nuclear Method).
- C. Maximum Dry Density: Laboratory density as determined by ASTM D1557 (Modified Proctor) and occurring at the optimum moisture content of the soil being tested.
- D. Pipe Embedment: Comprised of the following or combination thereof:
1. Foundation: Required when the native trench bottom does not provide a firm working platform or the necessary uniform and stable support for the install pipe.
 2. Bedding: Placed directly underneath the pipe and brings the trench bottom to grade. Provides a firm, stable, and uniform support of the pipe.
 3. Haunching: The same material as the bedding, placed from bottom of pipe to springline.



4. Initial Backfill: The same material as the bedding, placed from top of haunching to 6 to 12 inches above top of pipe, as shown on the Drawings.
5. Final Backfill: Placed above the initial backfill to a level below that required for the trench restoration area.
6. Backfill: Includes initial and final backfill.

1.3 STANDARDS

Except as modified herein, comply with the latest version of the following standards:

- A. American Association of State and Highway Transportation Officials (AASHTO):
 1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.
- B. ASTM International:
 1. ASTM C33 - Specification for Concrete Aggregates.
 2. ASTM C150 - Standard Specification for Portland Cement.
 3. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 4. ASTM D75 - Standard Practice for Sampling Aggregates.
 5. ASTM D421 - Practice for Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants.
 6. ASTM D422 - Test Method for Particle-Size Analysis of Soils.
 7. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (600 kN-m/m³)).
 8. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 9. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 10. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
 11. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 12. ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
 13. ASTM D2940/D2940M - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
 14. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 15. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
 16. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).



- C. Michigan Department of Transportation (MDOT):
 - 1. MDOT Specifications: Michigan Department of Transportation, Standard Specifications for Construction, 2012 edition.
 - 2. MDOT Density Testing and Inspection Manual (rev. 2017).
- D. City of Detroit, Department of Public Works, City Engineering Division:
 - 1. Standard Specifications for Paving and Related Construction.
 - 2. Street and Alley Standard Plans.
- E. Occupational Safety and Health Administration (OSHA):
 - 1. OSHA 29 CFR 1926, Subpart P: Safety and Health Regulations for Construction, Excavations.
- F. MISS DIG
 - 1. Public Act 174: MISS DIG Underground Facility Damage Prevention and Safety Act

1.4 CLASSIFICATION OF EXCAVATION

- A. Excavation is part of the unit prices of the contract. Excavation is not classified, except where rock excavation is authorized outside specified or indicated limits of excavation.

1.5 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittal Requirements:
 - 1. Temporary excavation and shoring drawings for worker protection in accordance with the General Conditions.
 - 2. Gradation analysis for each material including a separate submittal for the same material if from a different supplier.
 - 3. Dewatering plan including disposition of groundwater, if required.
 - 4. Manufacturer's catalog data and a sample of prefabricated drainage panel and filter fabric with manufacturer's installation instructions and details.
 - 5. Materials Sources: Name of source, location, date of sample, sieve analysis, and laboratory compaction characteristics (proctor).
 - 6. Test and Evaluation Reports:
 - a. Field density testing reports: Provide results from field density testing of prepared subgrade and compacted fill.
 - b. Grain-size analysis.
 - c. Laboratory compaction characteristics of soils.
 - d. Water content.



7. Geotextile:

- a. At least two (2) weeks prior to shipment, submit manufacturer's certificate of compliance and physical property data sheet indicating that requirements for materials and manufacture are in conformance as specified.
 - b. For informational purposes only, submit manufacturer's printed installation instructions.
8. Compaction method and removal sequence of shoring.
 9. Mix design and test results for flowable fill as specified in Section 31 23 23.33 – Flowable Fill.
 10. MISS DIG training certification for all Contractor personnel.
 11. MISS DIG ticket documentation prior to commencing excavations.

1.6 QUALITY ASSURANCE

- A. Comply with the requirements specified in Section 01 40 00 – Quality Requirements.
- B. Sample backfill materials in accordance with ASTM D75.
- C. Testing will be provided by the Contractor. Payment for the cost of testing and inspection shall be in accordance with Section 01 20 00 – Price and Payment Procedures.
- D. Protect workers in and near excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in of loose soil. Protection shall be in accordance with OSHA 29 CFR 1926, Subpart P.

1.7 DELIVERY STORAGE AND HANDLING

- A. Provide geotextile fabric in rolls wrapped with protective covering to protect geotextile fabric from mud, dirt, dust, and debris. Label each roll of geotextile fabric with number or symbol to identify production run.
- B. Protect geotextile fabric from sunlight during transportation and storage. Do not leave geotextile fabric exposed to sunlight for more than two (2) weeks during installation operations.

1.8 EXISTING CONDITIONS

- A. Geotechnical Report: If a report is made available, the documentation is for information only and is not part of the contract documents. Logs of borings are included in the report and indicate conditions encountered only at test boring locations. Nothing in the contract documents shall be construed as guarantee that other materials will not be encountered or that proportion of materials will not vary from proportions shown on the logs of test borings.



PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

- A. Suitable Material: Material from on-site excavation and permitted off-site sources that meets all specified requirements for its intended use and is not unsuitable. Wet subgrade material which meets other requirements for suitable material is suitable.
- B. Unsuitable Material: Material that fails to meet requirements for suitable materials; or contains any of the following:
 - 1. Organic clay, organic silt, or peat; as defined in ASTM D2487.
 - 2. Vegetation, wood, roots, leaves, and organic, degradable material.
 - 3. Stones or rock fragments over 6 inches in any dimension.
 - 4. Porous biodegradable matter, excavated pavement, construction debris, rubbish, or refuse.
 - 5. Ice, snow, frost, or frozen soil particles.
- C. Bedding, Haunching, and Initial Backfill: Granular Fill, Open Graded; depth of 1/8 of diameter, 4 inches minimum, 6 inches maximum, or as illustrated in the standard details. MDOT Class II or City Engineering Grade "A".
- D. Final Backfill Not Under Pavement: Suitable, unclassified material excavated from trench; free of rocks with dimensions greater than 1/2 the compacted lift; and rocks provide less than 50 percent of the final backfill volume.
- E. Granular Fill:
 - 1. Densely Graded: MDOT Specifications, Section 902, No. 21AA, 21A or 22A.
 - 2. Open Graded: ASTM C33, coarse aggregate, No. 57. MDOT Specifications, Section 902, 6A.
- F. Sand: MDOT Specifications, Section 902; granular materials meeting the gradation limits of Class II or Class IIA.
- G. Base Aggregate for Pavement: MDOT Specifications, Section 902; 21AA, 21A or 22A.

2.2 FLOWABLE FILL

- A. Flowable Fill shall consist of a mixture of Portland cement, aggregate, fly ash, water, and admixtures conforming to Section 31 23 23.33 – Flowable Fill.



2.3 EQUIPMENT

- A. Compaction equipment shall be capable of consistently achieving the specified compaction requirements.

2.4 UTILITY IDENTIFICATION

- A. Trace Wire: Continuous, single-strand copper wire, insulated, maximum 10 AWG. Clear plastic covering imprinted with inscription describing specific utility in large letters.
- B. Marking Tape: Use type specifically manufactured for marking and locating underground utilities. Acid- and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch, minimum strength of 1,750 psi lengthwise and 1,500 psi crosswise. Furnish and install tape manufactured with foil core at least 0.35-mil thick to enable detection by metal detection when tape is buried up to 3 feet deep. Tape shall bear continuous printed inscription describing specific utility. Tape color shall be as follows:
 - 1. Electric conduits, duct banks, and cable: Red.
 - 2. Potable water systems: Blue.
 - 3. Gas, oil, dangerous materials: Yellow.
 - 4. Telephone, CCTW, fire communications: Orange.
 - 5. Sanitary sewer systems: Green.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Notify MISS DIG (811) at least three (3) days in advance of proposed start of Work, but not more than 14 calendar days before digging operations are scheduled to begin. Do not dig unless all utilities have been marked by MISS DIG (811).
 - 1. Contractor shall be required to enter MISS DIG tickets for all work requiring excavation. When entering the ticket, the following information must be added to the "Locate Info" field. Contractor shall enter "*ENG*" followed by "Contract Number*". Example of entry for a Contract with Contract Number 917: *ENG*:917*, followed by a description requesting utility location markings that encompasses the entire work area..
- B. Verify that dewatering support systems are in place before commencing with excavation.
- C. Verify that excavation safety and support systems meeting the requirements of OSHA 29 CFR 1926, Subpart P are in place before commencing with excavation.
 - 1. Minimum slopes for laying back excavations or materials are contained in OSHA 29 CFR 1926, Subpart P; Appendices A and B.



2. Minimum requirements for shoring and bracing are contained in OSHA 29 CFR 1926, Subpart P; Appendix C.
- D. Verify that fill materials submittals have been accepted by Engineer before commencing with work requiring the use of these materials.
- E. Verify that erosion and sediment control measures are in place and functioning properly.
- F. Immediately notify the Engineer if unexpected subsurface facilities or suspected hazardous materials are encountered during excavation.
- G. Test Pits: Excavate test pits to field verify the locations of existing underground utilities at crossings and at tie-in points before ordering materials or commencing excavation. Immediately notify the Engineer if conflicts are encountered.

3.2 PREPARATION

- A. Underpin or otherwise support adjacent structures that could be damaged by excavation work.
- B. Cut pavement with saw or pneumatic tools to prevent damage to remaining pavement. Dispose of large pieces of demolished pavement before proceeding with excavation.

3.3 PROTECTION OF IN-PLACE CONDITIONS

- A. Comply with requirements specified in Section 02 01 20 – Protecting Existing Underground Utilities.
- B. Support and protect from damage: existing pipes, poles, wires, fences, curbs, property line markers, and other features or structures which must be preserved in place to avoid being temporarily or permanently relocated.
- C. Excavation Near Existing Structures:
 1. Discontinue digging by machinery when excavation approaches pipes, conduits, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in work to be done when incidental to normal excavation and under items involving normal excavation.
 2. Excavate test pits near, or at intersection with, existing utilities or underground structures to determine the exact location of existing features.



D. Excavation Near Private Property:

1. Record existing condition of features on adjacent property by means of dated photographs or cameras. Provide construction photographs according to Section 02 22 30 – Pre-Construction Video and Photographic Record.
2. Enclose uncut tree trunks adjacent to work in wooden boxes of such height necessary to protect tree from injury due to piled material, equipment, or operations. Operate excavating machinery and cranes to prevent injury to overhanging branches and limbs.
3. Protect cultivated hedges, shrubs, and plants which would otherwise be damaged by the work.
4. Where protection of vegetation is not possible, dig up, temporarily transplant, and maintain. After active construction operations in the area have ceased, transplant vegetation to the original positions and provide water and nursery care until growth is re-established.
5. Do not use or operate tractors, bulldozers, or other power-operated equipment on paved surfaces. Provide protection on pavement or tracks if construction traffic is unavoidable.

E. Maintain Public Access

1. Provide suitable and safe crossings at all times during the Work for pedestrians and homeowners, including bridges, ramps, temporary stone, and temporary cold patch.
2. The Contractor shall lay and maintain temporary ramps, bridges, and trench crossings, such as in the opinion of the Engineer are necessary to accommodate through traffic and the general public.
3. The Contractor shall provide free access to all municipal, commercial, residential entrances, fire hydrants, and water and gas valves located in the work vicinity. The Contractor shall lay and maintain temporary driveways, bridges, and trench crossings, which the Engineer deems necessary to maintain access to driveways and to reasonably accommodate the public at no additional cost.

3.4 RESTORATION

- A. Restore private property and structures promptly. Begin restoration work within 24 hours of when damage occurred.
- B. Existing surfaces, features, or utilities that are to remain but are damaged during construction shall be repaired or replaced to at least the condition in which they were found immediately before work began, unless noted otherwise.
- C. Damaged Trees to Remain: Cut all damaged branches, limbs, and roots smoothly and neatly without splitting or crushing. Neatly trim, cut the injured portions and cover with an application



of grafting wax or tree healing paint. Replace damaged trees which subsequently die or continue to show lack of growth due to damage, one (1) year after substantial completion.

- D. Cultivated Vegetation: Includes, but is not limited to: hedges, shrubs, and plants. Vegetation that is damaged shall be replaced with equal kind and of at least the quality before work began.

3.5 TRENCH EXCAVATION

- A. Comply with all requirements of MISS DIG Public Act 174 including contacting MISS DIG, hand excavation near utilities, and contacting 911 in case of emergency.
 - 1. If a utility is damaged resulting in the escape of any flammable, toxic, or corrosive gas or liquid, or endangering life, health, or property, the Contractor shall call 9-1-1 and provide immediate notice to the utility owner or utility operator. The Contractor shall also take reasonable measures to protect the excavator, those in immediate danger, the general public, and the environment until the utility owner or utility operator, or emergency first responders, have arrived and taken control of the site.
- B. Furnish, install, and maintain dewatering system to allow for working conditions in dry, stable soil. Properly dispose of water to avoid damage to property and in accordance with laws and regulations. Lower groundwater table prior to excavation and keep a minimum of 24 inches below lowest excavation subgrade until structure has sufficient strength to withstand soil and water pressures.
- C. Sheet and brace trenches, excavations, and adjacent structures to comply with laws and regulations and to provide protection of life, property, and the Work. Where close sheeting is necessary, drive to prevent adjacent soil from entering excavation. Remove close sheeting only when removal will not damage property or the Work. Sheeting left in place shall be cut off 5 feet below ground surface.
- D. Preserve material below and beyond the lines of excavations.
- E. Locate stockpiled excavated material at least 3 feet from edge of excavations to prevent cave-ins or bank slides.

3.6 AUTHORIZED OVER-EXCAVATION

- A. Remove rock to a depth of 6 inches below the proposed excavation depth and backfill with bedding material.

3.7 UNAUTHORIZED EXCAVATION

- A. Backfill unauthorized excavations with bedding material.



3.8 BACKFILL

- A. Fill to lines and grades necessary to provide finish grades.
- B. Use a placement method that does not disturb or damage other work or existing features.
- C. Maintain fill materials within 3 percent of optimum moisture to attain required compaction density.
- D. Place and compact material in equal continuous layers.
- E. Maximum compacted depth shall be 12 inches for aggregate materials and soil materials, unless noted otherwise on the Drawings.

3.9 FLOWABLE FILL PLACEMENT

- A. Provide batching equipment to obtain the proper weights of soil, cement, water, and admixtures. Measuring devices shall be sensitive to a 2 percent variation above or below the actual weights required. Volumetric batching may be used, provided the same accuracy required for weight batching is maintained.
- B. Design and operate the mixers used for mixing the flowable fill so that the flowable fill, as discharged from the mixer, is uniform in composition and consistency throughout each batch.
- C. Place the flowable fill so that it flows easily into all openings between the pipe and the excavated trench. In some cases, such as trenches on a slope, a stiffer mix may be required to prevent it from flowing down the trench. In this case, use vibration to ensure that the flowable fill completely fills all spaces.
- D. Lay the pipe on the soil pads and place the flowable fill bedding as shown in the drawings. Place bedding under pipe from one (1) side and vibrate so that it flows under the pipe until it appears on the other side. Then add flowable fill to both sides of the pipe and vibrate until it completely fills the space between the pipe and the excavated trench bottom. This operation shall follow as closely behind pipe laying operations as possible. Place flowable fill in such a way as to prevent uplift or buckling of the pipe. Deposit flowable fill as nearly as practicable in its final position. Do not disturb the pipe trench or cause foreign material to become mixed with the cement slurry.
- E. Do not place backfill above the pipe until the flowable fill has reached the initial set. Place and maintain a 6-inch cover of moist backfill cover until additional backfill is placed. If the ambient temperature is 50 degrees F or less, place an additional 6-inch cover of backfill over the moist backfill cover prior to the end of the working day.
- F. Whenever freezing temperatures are imminent, maintain the flowable fill at a temperature of not less than 50 degrees F for 24 hours after placement. The temperature of the mix shall be 50 degrees



F or greater at the time of placement. Monitor the temperature by placing a thermometer in the flowable fill immediately after sampling at the placement site. When freezing weather appears imminent, make ready at the placement site materials that may be required for protection of the flowable fill. Delay placement of flowable fill until adequate provisions for protection against weather are made. Do not place flowable fill bedding in pipe trenches when the trench bottom or walls are frozen or contain frozen material. Backfill placed as cover over the flowable fill is prohibited from containing any frozen material.

3.10 COMPACTION

- A. Compact to density specified for various types of material. Control moisture content of material being placed as specified, or if not specified, at a level slightly lower than optimum.
- B. Compaction Density: Provide trench backfill densities according to Table 31 23 33-3. The values listed are minimum percentages, unless noted otherwise.

Table 31 23 33-3: Trench Backfill Density

Area	Percentage of Maximum Dry Density as defined by ASTM D1557 (Modified Proctor)
Trench Backfill (under pavement, slabs)	96
Trench Backfill (under structures or within 25 feet of structures)	96
Trench Backfill (through embankment)	98
Trench Backfill (under exterior concrete slab and sidewalks)	96
Trench Backfill (in open or grassed areas)	90

3.11 UTILITY IDENTIFICATION

- A. Install marking tape over all non-ferrous utilities, 12 inches below finish grade.
- B. Install trace wire at top center pull wire taut to remove any slack.
- C. Extend trace wire to utility boxes, manholes and junctions to allow for connection to subsurface location equipment.

3.12 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 – Quality Requirements for general requirements for field inspection and testing.
- B. Compaction shall be deemed to comply with the specifications when no more than one (1) test of any 3 consecutive tests falls below the specified relative compaction. The one (1) test shall be no



more than 3 percentage points below the specified compaction. Pay the costs for any retesting or additional testing of work not conforming to the specifications.

- C. Where compaction tests indicate a failure to meet the specified compaction, if possible due to size of excavation, additional tests shall be taken every 25 feet in each direction until the extent of the failing area is identified. Rework the entire failed area until the specified compaction has been achieved.
- D. Perform particle size distribution and gradation analyses using ASTM D422 and following standard practices in ASTM D421. Perform 1 test for every source and submit results to Engineer for acceptance. Repeat the moisture density test for every 5,000 cubic yards of material used.
- E. Perform field density testing in accordance with ASTM D6938 and the MDOT Density Testing and Inspection Manual.
- F. Evaluate field density test results in relation to maximum dry density as determined by testing material in accordance with ASTM D1557 (Modified Proctor).
- G. Perform tests in accordance with ASTM D4318 to determine Liquid Limit, Plastic Limit and Plasticity Index and submit test results to Engineer for acceptance. Complete a minimum of one (1) test per 5,000 cubic yards of soil for use as fill material and whenever classification of material is in doubt as determined by the Engineer.
- H. Location of field density tests shall be mutually acceptable to testing laboratory and Engineer.
- I. Frequency of field density tests:
 - 1. At least one (1) test shall be performed for every backfill installation including water main, water main structures, water services, sewers, sewer structures, and sewer lateral connections regardless of length of trench. The length requirements as listed below are only for continuous trenching and backfill installations.

Table 31 23 33-4	
Area	Frequency
Trench (Structural Areas)	1 per lift for each 250 linear feet of trench
Trench (Non-Structural Areas)	1 per lift for each 500 linear feet of trench
Regardless of the minimum testing frequency specified, field density tests shall be performed by the Contractor in sufficient number for the Contractor's quality control purposes to ensure that specified density is obtained.	

- J. The Owner may retain the services of an independent testing laboratory to conduct confirmatory testing and inspection.



3.13 ADJUSTING

A. Shrinkage:

1. Backfill to a height above finished grade which will allow for the shrinkage or consolidation of material. Initially, provide at all points, an excess of at least one (1) percent of total height of backfill measured from stripped surface to top of finished surface.
2. Supply specified materials and build up low places, without additional cost if embankment or backfilling settles to be below the indicated level for proposed finished surface at any time before final acceptance of the work.

3.14 PROTECTION

- #### A.
- Formulate excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines and embankments or existing structures and pipelines.

3.15 CLOSE-OUT ACTIVITIES

- #### A.
- Provide in accordance with Section 01 70 00 – Execution and Closeout Requirements.

END OF SECTION 31 23 33



SECTION 31 50 00 - EXCAVATION SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: The design, furnishing and installation of excavation support systems to maintain lateral support, prevent loss of ground, limit soil movements to acceptable limits and protect from damage existing and proposed improvements including pipelines, utilities, structures, roadways, railroads and other facilities.
- B. Related Requirements:
 - 1. Section 03 30 00 – Cast-in-Place Concrete.
 - 2. Section 31 23 33 – Trenching and Backfill.

1.2 STANDARDS

Except as modified herein, comply with the following Standards:

- A. American Concrete Institute (ACI):
 - 1. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- B. ASTM International (ASTM):
 - 1. ASTM A36 - Standard Specification for Structural Steel.
 - 2. ASTM A416 - Standard Specification for Strand Steel, Uncoated Seven Wire for Prestressed Concrete.
 - 3. ASTM A572 - Standard Specification for High-Strength Low Alloy Columbium-Vanadium Structural Steel.
 - 4. ASTM A615 - Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 - 5. ASTM A722 - Specification for Uncoated High Strength Steel Bar for Prestressing Concrete.
- C. American Wood Protection Association (AWPA) Standards:
 - 1. P234 - Standard for Chromated Copper Arsenate Type C (CCA-C).
 - 2. P50 - Standard for Fire Retardant FR-2 (FR-2).
- D. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.



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- E. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittal Requirements:

1. Submit the following qualifications four (4) weeks prior to the construction:
 - a. Qualifications of Contractor's excavation support system installer.
 - b. Qualifications of Contractor's independent tieback testing if a tieback system is utilized.
 - c. Qualifications of Contractor's excavation support system installation supervisor.
 - d. Qualifications of vacuum excavation subcontractor if DMPs for utilities are utilized.
2. Submit an excavation support plan stamped and signed by a Registered Professional Engineer licensed in the State of Michigan at least two (2) weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor remains responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
 - a. Proposed excavation support system(s), details, location, layout, depths, extent of different types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.
 - b. Certificate of Design: Comply with certificate requirements in Section 01 33 00 – Submittal Requirements. Submit a certificate of design signed by the Registered Professional Engineer.
 - c. A list of all design assumptions, including safety factors used for the excavation support system(s) and all lateral pressures used for each system.
 - d. If utilizing a tieback system, include tieback installation procedures and criteria for acceptance of tiebacks for performance and proof tests. Submit the tieback testing results to the Engineer for information only.
 - e. Requirements of dewatering during the construction.
 - f. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.
 - g. List of equipment used for installing the excavation support systems.
 - h. Monitoring schedule, installation procedures and location plans for vibration/noise monitoring, geotechnical instrumentation (deformation monitoring points and inclinometers) and observation wells/piezometers to monitor ground, excavation support system, adjacent structures and groundwater fluctuation during the entire construction period if required by the design.



3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.
4. Monitoring data within one (1) day of data collection from vibration and noise recording equipment, observation wells, and deformation monitoring points and offset lines if required by the design. Data shall include:
 - a. Horizontal and vertical movements of geotechnical instruments and groundwater readings.
 - b. New movements since the initial readings of the geotechnical instruments.
 - c. Weekly summary in tabular and graphic form at the end of each week.
 - d. A schematic plan of excavation and/or relevant construction activities at the time of monitoring.
5. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:
 - a. Survey locations of the excavation support systems, including coordinates of the ends and points of change in direction.
 - b. Type of the excavation support system.
 - c. Elevations of top and bottom of the excavation support systems left in place.

1.4 QUALITY ASSURANCE

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Comply with the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring".
- C. Construction operations shall comply with noise regulations provided in this Section.
- D. If utilizing deformation monitoring points (DMPs) for utilities, vacuum excavation shall be performed by subcontractor having five (5) years of experience in non-destructive vacuum excavation methods for utilities.
- E. Prepare design, including calculations and drawings, under the direction of a Professional Engineer registered in the state of Michigan and having the following qualifications:
 1. Not less than ten (10) years of experience in the design of specific excavation support systems to be used.
 2. Completed not less than five (5) successful excavation support system projects of equal type, size, and complexity within the last five (5) years.



F. Excavation Support System Installer's Qualifications:

1. Not less than three (3) year experience in the installation of similar types and equal complexity as the proposed system.
2. Completed not less than three (3) successful excavation support systems of similar type and equal complexity as the proposed system.

G. If utilizing a tieback system, employ an independent testing laboratory to test the tieback system with the following qualifications:

1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program.
2. Employ personnel conducting testing who are trained in the methods and procedures to test and monitor tieback systems of similar type and equal complexity, as the proposed system.
3. Have not less than five (5) years of experience in testing of tieback systems of similar type and equal complexity as the proposed system.
4. Have successfully tested at least three (3) tieback systems of similar type and equal complexity as the proposed system.

H. Install all excavation support systems under the supervision of a supervisor having the following qualifications:

1. Not less than five (5) years of experience in installation of systems of similar type and equal complexity as the proposed system.
2. Completed at least five (5) successful excavation support systems of similar type and equal complexity as the proposed system.

I. All welding shall be performed in accordance with AWS D1.1.

1.5 DESIGN CRITERIA

- A. Furnish, install, and maintain excavation support systems for the protection of workers in trenches, and to support adjacent utilities and structures.
- B. The requirement of specified excavation support systems in areas indicated on the drawings does not relieve the Contractor from the responsibility of furnishing and installing proper temporary excavation support systems in other areas.
- C. Extraction of steel sheetpile wall, timber sheetpile wall, or soldier piles are not permitted unless otherwise indicated, specified or approved by the Engineer.
- D. Wherever the word "sheeting" is used in this section or on the contract drawings, it shall refer to any type of excavation support system specified except trench box.



- E. Construction of the excavation support systems shall not disturb the existing structures or the completed proposed structures. Damage to such structures shall be repaired at Contractor's expense.
- F. Adjacent structures are those that are bear upon soils above the proposed excavation depth and within a distance equal to twice the total depth of the excavation away from the closest edge of the excavation. Monitor and protect adjacent structures as specified and indicated.
- G. Construction operations shall not exceed specified noise limits in the City of Detroit Code of Ordinances.
- H. Correct any failure, damage, subsidence, upheaval or cave-ins resulting from improper installation, maintenance or design of the excavation support systems. Pay for all claims, costs, and damages that result from the Work performed at the Contractor's expense.
- I. Design of excavation support systems shall meet the following minimum requirements:
 - 1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, roadways, railroads, and other surcharge loads.
 - 2. Design a bracing system to provide sufficient reaction to maintain stability.
 - 3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.
 - 4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. The toe of braced temporary excavation support systems shall not be less than 5 feet below the bottom of the excavation.
 - 5. Design excavation support systems to withstand an additional 2 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
 - 6. Maximum width of pipe trench excavation shall comply with Section 31 23 33 – Trenching and Backfill.
 - 7. Do not cast permanent structure walls directly against excavation support walls.
 - 8. The design location of the excavation support wall shall be determined such that the installed wall and bracing system components are all located outside the limits of the permanent structure. Construction tolerances (e.g., st. wall verticality) shall be considered in determining the plan location.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store sheeting and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

1.7 PROJECT CONDITIONS

- A. Subsurface Conditions: Refer to Section 31 23 33 – Trenching and Backfill.



- B. For reference or information only: Where the Owner, Engineer, or their consultants have made investigations of subsurface conditions in areas where work is to be performed, such investigations were made only for the purpose of study and design. The conditions indicated by such investigations apply only at the specific locations of each boring or excavation at the time the borings or excavations were made. Where such investigations have been made, bidders or contractors may inspect the records to such investigations subject to and upon the conditions hereinafter set forth. The records of such investigations are not part of the contract and are shown solely for the convenience of the bidder or Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.
- B. Steel Sheet Piling: ASTM A572, continuous interlocking type.
- C. Timber Lagging Left in Place: Pressured treated per AWWA P23.
- D. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.
- E. Raker Ties: ASTM A615 Grade 60.
- F. Cement Grout Materials and Admixtures for Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.
- G. Concrete: Section 03 30 00 – Cast-in-Place Concrete.
- H. Tamping tools adapted for backfilling voids after removal of the excavation support system.
- I. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

2.2 EQUIPMENT

- A. A vibratory hammer shall be utilized for driving the sheet piling providing that such operations do not exceed vibration/noise requirements of the specifications. Impact hammer shall be utilized when vibratory hammer is unable to drive sheet piling to required depth and/or unable to meet vibration requirements. Do not exceed a vibration limit of 2 in/sec peak particle velocity.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of the excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Install excavation support systems in accordance with the excavation support plan.
- C. If utilizing a tieback system, all performance and proof tests shall be conducted in the presence of the Engineer. Testing performed without the Engineer present is considered invalid. Repeat testing in the Engineer's presence at Contractor's expense.
- D. Do not drive sheeting within 100 feet of concrete less than seven (7) days old.
- E. Support excavations in such a manner as to prevent undermining or disturbing foundations of existing structures of Work ongoing or previously completed.
- F. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.
- G. Install and read geotechnical instrumentation in accordance with the excavation support plan. Notify the Engineer immediately if any geotechnical instrumentation is damaged. Repair or replace damaged geotechnical instrumentation at the sole option of the Engineer and at Contractor's expense.
- H. Continuously monitor movements of the ground adjacent to excavation support systems and adjacent structures. In events of the measured movements approaching or exceeding the allowable movements, take immediate steps to arrest further movement by revising procedures such as providing supplementary bracing, filling voids behind the trench box, supporting utilities or other measures (Construction Contingency Plan).
- I. Notify utility owners if existing utilities interfere with the excavation support system. Modify the existing utility with the utility owner's permission or have the utility owner make the modifications at Contractor's expense.

3.2 GROUND DEFORMATION ADJACENT TO EXCAVATION SUPPORT SYSTEMS

- A. Allowable Vertical (heave/settlement) and Lateral Movements: 2 inches maximum for the trench box excavation support system, and 1 inch maximum for other types of excavation support systems at any location behind the excavation support system.



- B. Monitoring personnel shall use a procedure for reading and recording geotechnical instrumentation data which compares the current reading to the last reading during data collection to eliminate spurious readings.
- C. Plot the observed ground deformation readings versus time. Annotate the plots with construction loading and excavation events having an impact on the readings. Evaluate plots by means of secondary rate-of-change plots to provide early warning of accelerating ground movements.
- D. Notify the Engineer when the allowable ground deformation is exceeded.
- E. Implement Construction Contingency Plan under direction of the temporary excavation support system designer and the Engineer.

3.3 REMOVAL OF EXCAVATION SUPPORT SYSTEMS

- A. Sheet piling shall be left in place unless otherwise indicated on the Drawings.
- B. The excavation support system left-in-place shall be cut-off a minimum of 2 feet below the bottom of the next higher foundation level or a minimum of 5 feet below finished grade.
- C. When indicated on the Drawings, remove the excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of excavation support systems with bank-run gravel, screened gravel or select borrow by tamping with tools specifically adapted for that purpose.
- D. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the Work.
- E. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.

3.4 CONTRACT CLOSEOUT

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.

END OF SECTION 31 50 00



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SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate Subbase.
2. Aggregate Base Course.
3. Aggregate Surface Course.

B. Related Requirements:

1. Section 31 23 33 - Trenching and Backfill.
2. Section 31 37 16.13 - Rubble-Stone Riprap.
3. Section 32 12 16 - Asphalt Paving.
4. Section 32 13 13 - Concrete Paving.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM International:

1. ASTM D75 - Standard Practice for Sampling Aggregates.
2. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
3. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
4. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. City of Detroit, Department of Public Works, City Engineering Division:

1. Standard Specifications for Paving and Related Construction.
2. Street and Alley Standard Plans.



D. Michigan Department of Transportation (MDOT):

1. 2012 Standard Specifications for Construction.
2. Density Testing and Inspection Manual (rev. 2017).

1.3 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Dense-Graded Aggregates for Base Course, Surface Course, Shoulders, Approaches and Patching: Class 21AA, 21A, 22A, 23A – MDOT 902.05. Aggregate base under bituminous shall be 22A, unless otherwise specified.
- B. Open-Graded Aggregates for Earthwork, Open Graded Drainage Courses and Underdrains: Class 4G, 34G, and 34R – MDOT 902.06.
- C. Granular Materials for Fill and Subbase: Class I, IIAA, II, IIA, IIAA, IIIA, III – MDOT 902.07.
- D. Fine Aggregate for Portland Cement Concrete and Mortar: 2NS, 2SS, and 2MS – MDOT 902.08.
- E. Aggregate General Requirements for HMA Mixtures: MDOT 902.09.

2.2 MATERIAL AVAILABILITY

- A. Sufficient aggregate material to complete the work is not available at the site. Secure source of material and permits to complete the project requirements. Obtain material from offsite borrow areas.

2.3 WATER FOR COMPACTION

- A. Water shall be free of organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/L, and a maximum sulfate concentration of 500 mg/L.



- B. Provide all water needed for earthwork. Provide temporary piping and valves to convey water from the source to the point of use. Obtain meter and backflow permit from DWSD.

2.4 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.
 - 1. Grab tensile strength (ASTM D1682): 100 lbs. minimum for a 1-inch grip.
 - 2. Apparent opening size per ASTM D4751: 0.425 mm maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work. Comply with Section 01 30 00 – Administrative Requirements.
- B. Verify that compacted substrate is dry and ready to support paving and imposed loads.
 - 1. Proof roll substrate with a fully loaded tri-axle dump truck (weight bearing on two (2) rear axles) in minimum two (2) perpendicular passes to identify soft spots.
 - 2. A fully loaded wheel loader may also be acceptable for smaller installation areas as approved by the Engineer.
 - 3. Remove soft substrate and replace with compacted fill as specified in Section 31 23 33 – Trenching and Backfill.
- C. Verify substrate has been inspected and gradients and elevations are correct.

3.2 PREPARATION

- A. The finished subgrade shall be within the tolerances listed below of the grade and cross-section indicated, shall be smooth and free from irregularities, and shall be at the specified relative compaction. The subgrade shall extend over the full width shown in the cross-sections and standard details.
- B. Remove soft material encountered and replace with structural backfill. Fill holes and depressions to the required line, grade, and cross-sections with structural backfill.
- C. After excavation of existing material or removal of unacceptable material at the exposed subgrade, scarify the final subgrade surface to a depth of 12 inches and compact to 95% relative compaction.
- D. Remove foreign materials and trash from the excavation before placing any fill material.



- E. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- F. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. If required, install geotextile fabric over subgrade according to manufacturer's instructions.
 - 1. Lap ends and edges minimum six (6) inches.
 - 2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.
- B. Place aggregate equal thickness layers to total compacted thickness indicated on Drawings.
 - 1. Maximum Layer Compacted Thickness: 6 inches.
 - 2. Minimum Layer Compacted Thickness: 4 inches.
- C. Roller compact aggregate to 95 percent maximum density.
- D. Level and contour surfaces to elevations, profiles, and gradients indicated.
- E. Maintain optimum moisture content of fill materials to attain specified compaction density.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment. Do not operate earthmoving equipment within 5 feet of walls of concrete structures. Place and compact backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.

3.4 MOISTURE CONTROL

- A. During the compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the material. Maintain uniform moisture content throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material. At the time of compaction, the water content of the material shall be at optimum water content or within two (2) percentage points above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

3.5 DISPOSAL OF EXCESS MATERIALS

- A. Excess site excavated or wasted material shall be disposed of off-site by the Contractor at his expense. No prearranged disposal site or related permits have been determined or secured by the Owner.



3.6 TOLERANCES

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Maximum Variation from Flat Surface: 1/4 inch measured with 10-foot straight edge.
- C. Maximum Variation from Thickness: 1/4 inch.
- D. Maximum Variation from Elevation: 3/8 inch.

3.7 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 – Quality Requirements for field inspecting, testing, adjusting, and balancing.
- B. Determine the density of soil in place by nuclear methods, ASTM D6938. Additional densities will be required if the backfill material is visually variable. Compaction tests will be performed for each lift or layer.
- C. Determine laboratory moisture-density relations of soils per ASTM D1557. If nuclear methods are used for in-place density determination, the compaction test results for maximum dry density and optimum water content shall be adjusted in accordance with ASTM D4718. This will be required for determination of percent relative compaction and moisture variation from optimum.
- D. Determine the relative density of cohesionless soils per the Michigan Cone Method.
- E. Sample materials per ASTM D75.
- F. "Relative compaction" is the ratio, expressed as a percentage, of the in-place dry density to the laboratory maximum dry density.
- G. When tests indicate Work does not meet specified requirements, remove Work, replace and retest. Compaction shall be deemed to comply with the specifications when no more than one (1) test of any three consecutive tests falls below the specified relative compaction. The one (1) test shall be no more than three percentage points below the specified compaction. The Contractor shall pay the costs of any retesting of work not conforming to the specifications.
- H. Frequency of Tests: Per MDOT Density Testing and Inspection Manual.

END OF SECTION 32 11 23



SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.

B. Related Requirements:

1. Section 31 23 33 – Trenching and Backfill.
2. Section 32 11 23 – Aggregate Base Courses.
3. Section 33 01 30.81 – Manhole Rehabilitation.
4. Section 33 05 61 – Concrete Manholes.

1.2 STANDARDS

Except as otherwise specified herein, comply with the latest edition of the following standards:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. City of Detroit, Department of Public Works, City Engineering Division:

1. Standard Specification for Paving and Related Construction.
2. Street and Alley Standard Plans.



C. Michigan Department of Transportation (MDOT):

1. 2012 Standard Specifications for Construction.
2. Density Testing and Inspection Manual (rev. 2017).
3. HMA Production Manual (rev. 2017).

D. Asphalt Institute:

1. AI SP-2 - Superpave Mix Design.

E. ASTM International:

1. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
2. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
3. ASTM D977 - Standard Specification for Emulsified Asphalt.
4. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
5. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
6. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
7. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
8. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
9. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
10. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
11. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
12. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
13. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements for the following materials:

1. Aggregate: Gradation.
2. Asphalt for Binder: Type and grade.
3. Prime Coat: Type and grade of asphalt.
4. Tack Coat: Type and grade of asphalt.



5. Seal Coat: Type and grade of asphalt.
6. Mixes: Conforms to job-mix formula.
7. Herbicide: Comply with Section 32 93 00 – Plants.
8. Paint for traffic and parking lot striping.
9. Pavement markers.

C. Submit test results for the following:

1. Mix Design:
 - a. Aggregate gradation.
 - b. Asphalt content.
 - c. Stability number.
2. Uncompacted Mix:
 - a. Asphalt content.
 - b. Aggregate gradation.
3. Asphalt cement for binder.

1.4 QUALITY ASSURANCE

- A. Mixing Plant: Conform to Michigan Department of Transportation (MDOT) Standard Specifications for Construction.
- B. Obtain materials from same source throughout.

1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience.

1.6 TESTING FOR COMPACTION

- A. Test for compaction as required by the MDOT Density Testing and Inspection Manual.

1.7 AMBIENT CONDITIONS

- A. Comply with Section 01 52 00 – Temporary Facilities.
- B. Do not place asphalt mixture between November 15 and May 5.
- C. Do not place asphalt mixture when ambient air or base surface temperature is less than 40°F or surface is wet or frozen.



PART 2 - PRODUCTS

2.1 ASPHALT PAVING

- A. Performance / Paving Design Criteria: Per Contract Drawings and Details.
- B. Asphalt Materials:
 - 1. Asphalt Cement: ASTM D946; penetration grade 85-100. Michigan Department of Transportation (MDOT) Standard Specifications for Construction.
 - 2. Asphalt Binder: MDOT Standard Specifications for Construction.
 - 3. Primer: MDOT Standard Specifications for Construction.
 - 4. Tack Coat: In accordance with MDOT Standard Specifications for Construction.
 - 5. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt paving.
- C. Aggregate Materials:
 - 1. Comply with Section 32 11 23 – Aggregate Base Courses.
 - 2. Coarse Aggregate: MDOT Standard Specifications for Construction.
 - 3. Fine Aggregate: MDOT Standard Specifications for Construction.
 - 4. Mineral Filler: ASTM D242; finely ground mineral particles, free of foreign matter.

2.2 MIXES

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Asphalt Paving Mixtures: Designed in accordance MDOT Standard Specifications for Construction with maximum 15 percent by weight reclaimed asphalt pavement.
 - 1. Base Course: As shown in the Contract Documents.
 - 2. Binder Course: As shown in the Contract Documents.
 - 3. Wearing Course: As shown in the Contract Documents.
- C. Temporary Patching:
 - 1. Cold patching or HMA mixture shall be approved by the Engineer prior to placement.
 - 2. Cold patching mixture shall be composed of an asphaltic binder in combination with a crushed limestone aggregate with the following gradation:



Gradation	% Passing
Sieve ½"	100
Sieve 3/8"	95 – 100
Sieve #4	35 – 65
Sieve #8	0 – 25
Sieve #200	0 – 4
Bitumen, % by weight	5.5 – 7.0

3. HMA patching mixture shall be any of the mixtures specified in the MDOT Standard Specifications for Construction.

2.3 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.
- B. Sealant: ASTM D6690, Type II or Type III; hot applied type.

2.4 SOURCE QUALITY CONTROL

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Submit proposed mix designs for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- C. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.
 1. Proof roll subbase with a fully loaded tri-axle dump truck (weight bearing on two (2) rear axles) in minimum two (2) perpendicular passes moving slowly to identify soft spots.
 2. A fully loaded wheel loader may also be acceptable for smaller installation areas as approved by the Engineer.
 3. Remove soft subbase and replace with compacted fill as specified in Section 31 23 33 – Trenching and Backfill.
- D. Verify gradients and elevations of base are correct.



- E. Verify gutter drainage grilles and frames and manhole frames are installed in correct position and elevation.

3.2 PREPARATION

- A. Prepare subbase in accordance with MDOT Standard Specifications for Construction.

3.3 DEMOLITION

- A. Saw-cut and notch existing paving as indicted on Drawings. Initially cut asphalt concrete pavement with pneumatic pavement cutter or other equipment at the limits of the excavation and remove the pavement. After backfilling excavation, saw-cut asphalt concrete pavement to a minimum depth of 2 inches at a point not less than 9 inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and remove the additional pavement.
- B. Saw-cut concrete pavement, including cross gutters, curbs and gutters, sidewalks, and driveways, to a minimum depth of 1-1/2 inches at a point one (1) foot beyond the edge of the excavation and remove the pavement. The concrete pavement may initially be cut at the limits of the excavation by other methods prior to removal and the saw cut made after backfilling the excavation. If the saw-cut falls within three (3) feet of a concrete joint or pavement edge, remove the concrete to the joint or edge.
- C. Make arrangements to dispose of the removed pavement.
- D. Final pavement saw cuts shall be straight along both sides of trenches, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Saw cut and remove damaged or disturbed adjoining pavement. Saw-cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same.
- E. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
- F. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.4 INSTALLATION

- A. Aggregate Subbase: Install as specified in Section 32 11 23 – Aggregate Base Courses.
- B. Primer: Apply primer in accordance with MDOT Standard Specifications for Construction.
- C. Tack Coat:
 - 1. Apply tack coat in accordance with MDOT Standard Specifications for Construction.
 - 2. Apply tack coat to contact surfaces of curbs and gutters.



3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

D. Single Course Asphalt Paving:

1. Install Work in accordance with MDOT Standard Specifications for Construction.
2. Place asphalt within 24 hours of applying primer or tack coat.
3. Place asphalt wearing course to thickness indicated on Drawings.
4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

E. Double Course Asphalt Paving:

1. Place asphalt binder course within 24 hours of applying primer or tack coat.
2. Place binder course to thickness indicated on Drawings.
3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
4. Place wearing course to thickness indicated on Drawings.
5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
6. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

F. Asphalt Paving Overlay:

1. Apply tack coat to existing paving surface at rate recommended by geotextile fabric manufacturer.
2. Install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints four (4) inches.
3. Place wearing course to thickness indicated on Drawings.
4. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 TEMPORARY PATCHING

A. Construction:

1. When temporary patching of a pavement surface is required, the surface shall be cleaned. The bituminous mixture shall be compacted so the patch is flush with the adjacent pavement.



2. When patching is required for repairing a cut in the pavement, backfilled aggregate base course shall be compacted to not less than 95 percent of the Maximum Unit Weight. An aggregate base course of not less than 9-inch compacted thickness, or a bituminous base of the specified thickness, shall be used.
3. The top of the aggregate base course shall be 2 inches to 2½ inches below the surface of the adjacent pavement. The compacted surface of the bituminous patch shall be smooth and shall not vary more than 1/4-inch from the crown and grade of the adjacent pavement. Any variations over 1/4-inch from the established grade shall be corrected.

3.6 CONNECTIONS WITH EXISTING PAVEMENT

- A. Where new paving joins existing paving, chip the existing surfaces 12 inches back from the joint line so that there will be sufficient depth to provide a minimum of one (1) inch of asphalt concrete. Dispose of waste material offsite. Tack chipped areas prior to placing the asphalt concrete. Meet lines shall be straight and the edges vertical. Paint the edges of meet line cuts with liquid asphalt or emulsified asphalt prior to placing asphalt concrete. After placing the asphalt concrete, seal the meet line by painting with a liquid asphalt or emulsified asphalt and then immediately cover with clean, dry sand.

3.7 TOLERANCES

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Flatness: Maximum variation of 1/4-inch measured with 10-foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4-inch.
- D. Variation from Indicated Elevation: Within 1/2-inch.

3.8 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Asphalt Paving Mix Temperature: Measure temperature at time of placement. It is the Contractor's responsibility to ensure that the mixture temperature is adequate for placement and compaction which for HMA shall not be below 250°F and not above 350°F.
- C. Asphalt Paving Thickness: ASTM D3549; test one (1) core sample from every 1000 square yards compacted paving.
- D. Asphalt Paving Density: ASTM D2950 nuclear method; test one location for every 1000 feet per width of 24 feet or less of compacted paving. HMA Paving shall be compacted to not less than 92 percent of the Maximum Unit Weight.



3.9 PROTECTION

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Immediately after placement, protect paving from mechanical injury for eight (8) hours or until surface temperature is less than 140°F.

END OF SECTION 32 12 16



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SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate base course.
2. Concrete paving for:
 - a. Concrete residential streets.
 - b. Concrete sidewalks.
 - c. Concrete stair steps.
 - d. Concrete integral curbs and gutters.
 - e. Concrete parking areas.

B. Related Requirements:

1. Section 01 52 00 - Temporary Facilities.
2. Section 03 10 00 - Concrete Forming.
3. Section 31 23 33 - Trenching and Backfill.
4. Section 32 11 23 - Aggregate Base Courses.
5. Section 32 12 16 - Asphalt Paving.
6. Section 33 05 61 - Concrete Manholes.

1.2 STANDARDS

This Section is intended for work within the City of Detroit and is not intended to cover all standards and specifications of other jurisdictions. At a minimum, except as specified herein, comply with the latest version of the following standards:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
2. AASHTO Standard Practice MP 12-04 for Detectable Warning Surfaces.

B. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.



C. ASTM International:

1. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
5. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
6. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
7. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
8. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33 - Standard Specification for Concrete Aggregates.
10. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
12. ASTM C136 - Standard Method for Analysis of Fine and Coarse Aggregate.
13. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
14. ASTM C150 - Standard Specification for Portland Cement.
15. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
16. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
17. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
18. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
19. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
20. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
21. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
22. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
23. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
24. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
25. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.



D. City of Detroit:

1. Department of Public Works (DPW), City Engineering Division:
 - a. Standard Specification for Paving and Related Construction.
 - b. Street and Alley Standard Plans.

E. Michigan Department of Transportation (MDOT):

1. 2012 Standard Specifications for Construction.
2. Density Testing and Inspection Manual (rev 2017).

1.3 PRE-INSTALLATION MEETINGS

- A. Comply with Section 01 30 00 – Administrative Requirements.
- B. Convene Pre-Installation Meeting a minimum of two (2) weeks prior to commencing work of this Section.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit data on concrete materials, joint filler admixtures and curing compounds.
- C. Design Data:
 1. Submit concrete mix design on MDOT Form 1976 for each concrete strength. Submit separate mix designs when admixtures are required for hot and cold weather concrete work.
 2. Identify mix ingredients and proportions, including admixtures.
 3. Identify chloride content of admixtures and whether chloride was added during manufacture.
 4. Submit finishing procedure for concrete hardscape located within local Historic District.
- D. Source Quality Control Submittals: Indicate results of material source and batch plant tests and inspections.

1.5 QUALITY ASSURANCE

- A. Perform Work according to MDOT Standard Specifications for Construction and this Section.

1.6 AMBIENT CONDITIONS

- A. Do not place concrete when base surface is wet or frozen. Ambient temperature must be 32 degrees F and rising.



PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Comply with Section 32 11 23 – Aggregate Base Courses.

2.2 CONCRETE PAVING

- A. Form Materials:

1. Comply with ACI 301 and Section 03 10 00 – Concrete Forming.
2. Joint and joint filler materials for use in concrete pavements shall conform to the specific requirements of the current MDOT Standard Specifications for Construction, Section 914.

- B. Reinforcement: Steel reinforcement for use in concrete pavements shall conform to the specific requirements of the MDOT Standard Specifications for Construction, Section 905.

- C. Concrete Materials:

1. Concrete Materials: MDOT Standard Specifications for Construction, Section 901.
2. Cement: ASTM C150, Type I - Normal Type IA - Air Entraining Type III - High Early Strength Type IIIA - Air Entraining. MDOT Standard Specifications for Construction, Section 901.
3. Fine and Coarse Aggregates: MDOT Standard Specifications for Construction, Section 902.
4. Water: ASTM C94; potable, without deleterious amounts of chloride ions.
5. Air Entrainment: ASTM C260.
6. Chemical Admixtures: ASTM C494 (No admixtures shall contain calcium chloride).
 - a. Type A - Water Reducing.
 - b. Type D - Water Reducing and Retarding.
7. Fly Ash: MDOT Standard Specifications for Construction, Section 901.
8. Slag: MDOT Standard Specifications for Construction, Section 901.

2.3 MIXES

- A. Concrete Mix - By Performance Criteria:

1. Mix and deliver concrete in conformance with MDOT Standard Specifications for Construction, Section 601.
2. Provide concrete to the following criteria:
 - a. Detroit City Engineering Grade A:
 - 1) Compressive Strength: 4,000 psi at 28 days.
 - 2) Minimum Cement Content: 611 pounds/cu yd.
 - b. MDOT Grade P-NC:



- 1) Compressive Strength: 3,000 psi at 7 days.
- 2) Compressive Strength: 3,500 psi at 28 days.
- 3) Minimum Cement Content: 658 pounds/cu yd.
- c. MDOT Grade P-1M:
 - 1) Compressive Strength: 2,600 psi at 7 days.
 - 2) Compressive Strength: 3,500 psi at 28 days.
 - 3) Minimum Cement Content: 470 pounds/cu yd.
- d. MDOT Grade P1:
 - 1) Compressive Strength: 2,600 psi at 7 days.
 - 2) Compressive Strength: 3,500 psi at 28 days.
 - 3) Minimum Cement Content: 564 pounds/cu yd.
- e. MDOT Grade P2:
 - 1) Compressive Strength: 2,200 psi at 7 days.
 - 2) Compressive Strength: 3,000 psi at 28 days.
 - 3) Minimum Cement Content: 517 pounds/cu yd.
- f. Air Entrainment: 5.0 % to 8.5 % percent.
- g. Slump:
 - 1) Street Pavement: 3 inches.
 - 2) Alley Pavement and Curbs: 4 inches.
 - 3) Sidewalks and Driveways: 5 inches.
3. Limit the following cementitious materials to maximum percentage by mass of all cementitious materials:
 - a. Fly Ash: 40 percent.
 - b. Blast Furnace Slag: 40 percent.
 - c. Fly Ash and Blast Furnace Slag (combined): 40 percent.
4. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
5. Use calcium chloride only when approved by the Engineer in writing.
6. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

2.4 FINISHES

A. Shop Finishing - Reinforcement:

1. Epoxy Coated Finish for Steel Bars: MDOT Standard Specifications for Construction, Section 905.
2. Epoxy Coated Finish for Steel Wire: MDOT Standard Specifications for Construction, Section 905.

2.5 ACCESSORIES

A. Curing Compound: MDOT Standard Specifications for Construction, Section 903.



- B. Joint Sealers: MDOT Standard Specifications, Section 914; hot applied type.
- C. Detectible Warning Surface: Supply detectible warning surface materials in conformance with the AASHTO Standard Practice MP 12-04 for Detectable Warning Surfaces.

2.6 SOURCE QUALITY CONTROL

- A. Testing and Inspection Services: Provide mix design for all concrete paving mixes and comply with Section 01 40 00 – Quality Requirements.
- B. Submit proposed mix design of each class of concrete for review on MDOT Form 1976 prior to commencement of Work.
- C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements. Use materials only from MDOT Approved Sources.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Verify compacted subgrade or granular subbase is dry and ready to support paving and imposed loads.
 - 1. Proof roll subbase with a fully loaded tri-axle dump truck (weight bearing on two rear axles) in minimum two perpendicular passes to identify soft spots.
 - 2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 33 – Trenching and Backfill.
- C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Moisten substrate to minimize absorption of water from fresh concrete.
- C. Manholes, inlets, and other structures shall be set to grade and alignment prior to, or during placement of concrete.
- D. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.
- E. Notify Engineer minimum 24 hours prior to commencement of concreting operations.



3.3 INSTALLATION

- A. Aggregate Base Course: Install as specified in Section 32 11 23 – Aggregate Base Courses.
- B. Forms:
 - 1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
 - 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Reinforcement:
 - 1. Place reinforcing as indicated on drawings or standard details.
 - 2. Place dowels to achieve paving and curb alignment as detailed.
 - 3. Provide doweled joints as detailed on drawings or standard details.
 - 4. Repair damaged epoxy coating to match shop finish.
- D. Placing Concrete:
 - 1. Place concrete using the slip form technique only if called for on the plans.
 - 2. Do not disturb reinforcing, inserts, embedded parts, formed joints and dowel bars during concrete placement.
 - 3. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
 - 4. Concrete shall be distributed or spread as soon as placed. A mechanical concrete spreader may be used. Re-handling shall be kept to a minimum to avoid separation and segregation of materials.
- E. Joints: Place and seal joints as called for by the City of Detroit, Department of Public Works, City Engineering Division Standard Specifications for Paving and Related Construction, and Street and Alley Standard Plans.
- F. Finishing:
 - 1. Sidewalk Paving: Light broom, and trowel joint edges, no greater than 1/4 inch radius.
 - 2. Median Barrier: Light broom, and trowel joint edges, no greater than 1/4 inch radius.
 - 3. Curbs and Gutters: Light broom.
 - 4. Direction of Texturing: Transverse to paving direction.
 - 5. Inclined Vehicular Ramps: Broomed perpendicular to slope.
 - 6. Pedestrian Ramps: Broomed perpendicular to slope. Place detectible warning panels as shown in plans and standard details.
 - 7. Place curing compound on exposed concrete surfaces immediately after finishing. Apply at rates specified in the MDOT Standard Specifications from Construction.
 - 8. The installation of concrete hardscape within local historic districts shall not be a “bright white”. Specifically, such concrete must be composed of an exposed aggregate, tinted grey, or finished with a clear or tinted grey curing compound.
- G. Curing and Protection:



1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.4 STAMPED CONCRETE

- A. Stamped Concrete shall be installed to match existing pattern and colors unless otherwise indicated by the Drawings.
- B. All products and materials used in the stamped concrete including color, hardeners, release agents, curing compounds, and seals shall be per installed per manufacturer's instructions.

3.5 TOLERANCES

- A. Comply with Section 01 40 00 – Quality Requirements and City of Detroit, Department of Public Works, City Engineering Division Standard Specifications for Paving and Related Construction, and Street and Alley Standard Plans.
- B. Maximum Variation of Surface Flatness: 1/4-inch in 10 feet.
- C. Maximum Variation from True Position: 1/4-inch.

3.6 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Perform field testing according to ACI 301.
- C. Inspect reinforcing placement for size, spacing, location, support.
- D. Testing firm will take cylinders and perform slump and air entrainment tests according to ACI 301.
- E. Strength Test Samples:
 1. Sampling Procedures: ASTM C172.
 2. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens, standard cured.
 3. Sample concrete and make one set of three cylinders for every 50 cu. yds or less of each class of concrete placed each day and for every 5,000 sf of surface area paving.
 4. Make one additional cylinder during cold weather concreting, and field cure.



F. Field Testing:

1. Slump Test Method: ASTM C143.
2. Air Content Test Method: ASTM C231.
3. Measure slump and temperature for each compressive strength concrete sample.
4. Measure air content in air entrained concrete for each compressive strength concrete sample.

G. Cylinder Compressive Strength Testing:

1. Test Method: ASTM C39.
2. Test Acceptance: Average compressive strength of three consecutive test maximum 500 psi less than specified compressive strength.
3. Test one (1) cylinder at 7 days.
4. Test two (2) cylinders at 28 days.
5. Retain one (1) cylinder for 28 days.
6. Dispose remaining cylinders when testing is not required.

H. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.7 PROTECTION

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit pedestrian or vehicular traffic over paving for ten (10) days minimum after finishing.

END OF SECTION 32 13 13



SECTION 32 13 14 – PERMEABLE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Permeable Concrete paving for:
 - a. Roadways.
 - b. Alleys.
 - c. parking areas.
 - d. Sidewalks.
 - e. Trails.

B. Related Requirements:

1. Section 31 05 17 – Aggregates for Storm Water Management.
2. Section 32 93 90 – Green Infrastructure Maintenance.

1.2 PRICE AND PAYMENT PROCEDURES

A. Section 01 20 00 - Price and Payment Procedures Contract Sum/Price.

B. Pervious Concrete Paving:

1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes forms, aggregate base, concrete, accessories, placing, finishing, curing, and testing.

1.3 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 522R-10 – Report on Pervious Concrete.
2. ACI 522.1-08 – Specifications for Pervious Concrete Pavement.
3. ACI 211.3R - Guide for Selecting Proportions for No Slump Concrete.

B. ASTM International:

1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.



2. ASTM C42- Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
4. ASTM C150 - Standard Specification for Portland Cement.
5. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
6. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
7. ASTM C1007 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction.
8. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
9. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
10. ASTM C1688 - Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete.
11. ASTM C1701 - Standard Test Method for Infiltration Rate of In Place Pervious Concrete.
12. ASTM C1754 - Standard Test Method for Density and Void Content of Hardened Pervious Concrete.
13. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete.
14. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
15. ASTM D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
16. MCA – Michigan Concrete Association.

1.4 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-Installation Meeting. Convene minimum one (1) week prior to commencing work of this Section.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Contractor Qualifications
 1. Contractor shall submit name and qualifications of the previous concrete installer, providing written evidence of the following:
 - a. Employment of at least one (1) Michigan Concrete Association (MCA) certified Pervious Concrete installer who shall be on site, overseeing each placement crew, during all concrete placement.
- C. Concrete Producer Qualifications
 1. Within seven (7) days after notice to proceed, Contractor shall furnish the name and location of an MDOT certified plant that will produce and provide pervious concrete.



D. Product Data:

1. Submit materials specifications for the concrete materials, aggregates, joint material, admixtures, pigments, and fibers.

E. Concrete Mix Design:

1. Not later than thirty-five (35) days before construction of pervious concrete, Constructor shall furnish:
 - a. A proposed mix design with proportions of materials for acceptance as described in this specification, or otherwise specified in the Contract Documents. The data shall include unit weight, void ratio, and strength.

- F. Test Panel: At least fifteen (15) working days before construction of pervious concrete, and following the Engineer's acceptance of the mix design, Contractor shall provide a test panel in accordance with this specification.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI 301, requirements of Section 03 10 00, Section 03 20 00, and Section 03 30 00.
- B. Obtain cementitious materials from same source throughout.
- C. Perform Work according to MDOT and MCA standards.
- D. Maintain one copy of each document on site.

1.7 TEST PANEL

- A. Section 01 40 00 - Quality Requirements: Requirements for mockup.
- B. Contractor shall provide a minimum of one (1) test panel for acceptance. Place, joint, and cure the test panel, a minimum of 150 square feet in size, or as specified in the Contract Documents, at the required project thickness to demonstrate that in place void contents, unit weights, and infiltration rates can be met and to demonstrate effective jointing that does not compromise the cured concrete integrity.
- C. Test Panel Infiltration: Test panels shall be tested for infiltration in accordance with ASTM C1701.
- D. Test Panel Cores: Test panels shall have three (3) cores, each six (6) inches in diameter, taken from the panel a minimum of seven (7) days after placement of the pervious concrete. At least one core shall be taken within six (6) inches of a contraction joint. The cores shall be measured for thickness, void structure, and unit weight. Untrimmed, hardened core samples shall be used



to determine thickness in accordance with ASTM C 42. After thickness determination, the cores shall be trimmed and measured for unit weight in a saturated condition and void content in accordance with ASTM C 1754.

E. Test Panel Acceptance: Satisfactory test panels will be determined by:

1. Infiltration rate of at least 60 inches per hour.
2. Compacted thickness within 1/4" of the specified thickness.
3. Void Content within two (2) percent of the design void content.
4. Unit weight within five (5) pounds per cubic foot of the design unit weight.

If the test panels meet the above-mentioned requirements, they can be left in place and included in the completed work. If test panels do not meet the above-mentioned requirements, they shall be removed and disposed of in an approved manner and replaced with an acceptable test panel at the contractor's expense.

F. Locate where directed by Engineer.

G. Remove Test Panel when directed by Engineer.

1.8 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.
- B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen. The concrete itself shall not be below fifty degrees Fahrenheit (50° F) at placement.

PART 2 - PRODUCTS

2.1 PERVIOUS CONCRETE

A. Form Materials:

1. Form Materials: Conform to ACI 301. As specified in Section 03 10 00.
2. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick.

B. Concrete Materials:

1. Cement: AASHTO M85 or ASTM C150, Portland type; gray color, unless otherwise specified on the plan.
2. Fine and Coarse Aggregates: ASTM C33, Class 4S.
 - a. Coarse Aggregate Maximum Size: #8.



- b. Fine aggregate should be a maximum 5-7% sand
 - c. Coarse and fine aggregate shall be double washed. Washing shall be sufficient to remove dust and other coatings.
3. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 130 > ksi; toughness 15 ksi; 3/4-inch-long fibers, 34 million/lb. fiber count.
 4. Water: ASTM C94; potable.
 5. Air Entrainment: ASTM C260.
 6. Chemical Admixture: ASTM C49.
 7. Color Pigment: ASTM C979; mineral oxides, alkali and fade resistant.
 - a. Color: As per plan.

2.2 MIXES

A. Concrete Mix - By Performance Criteria:

1. Comply with ASTM C94 and develop a concrete mix design meeting the following requirements in accordance with ACI 211.3R, Appendix 6:
2. Select proportions for normal weight concrete according to ACI 301 Method 2.
3. Provide concrete to the following criteria:
 - a. Minimum infiltration rate of 500 inches/hour. Testing in accordance with ASTM 1701.
 - b. Void content: 18-22%.
 - c. Compressive Strength: 2600 psi at seven (7) days.
 - d. Compressive Strength: 3500 psi at twenty-eight (28) days.
 - e. Combined coarse and fine aggregates gradation passing the #4 sieve shall be between 4% and 7%.
 - f. Mix water quantity shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. Mix water yielding a cement paste with a dull dry appearance has insufficient water for hydration. Insufficient water results in inconsistency in the mix and poor bond strength between aggregate particles. High water content results in the paste reducing or eliminating the void system required for porosity.
4. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
5. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.
6. Use accelerating admixtures in cold weather when temperatures are below 40 degrees F. Use of admixtures will not relax cold weather placement requirements.
7. Use set retarding admixtures during hot weather when temperatures are above 90 degrees F.



2.3 ACCESSORIES

- A. Curing Material:
 - 1. Six (6) mil thick polyethylene sheet.
 - 2. Alternative curing materials may be used as approved by the Engineer.
- B. Joint Sealers: AASHTO M324, Type II hot applied type.

2.4 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services: Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.
- B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- C. Test samples according to ASTM C94 ACI 301.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify compacted aggregate base is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Moisten substrate to minimize absorption of water from fresh concrete.
- C. Notify Engineer minimum twenty-four (24) hours prior to commencement of concreting operations.



3.3 INSTALLATION

- A. Install Aggregate Reservoir and Choker Layer per Section 31 05 17 – Aggregates for Storm Water Management.
- B. Forms:
 - 1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
 - 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Placing Concrete:
 - 1. Place concrete according to MDOT 602 standards, and:
 - a. Deposit concrete onto pre-wetted sub-grade either directly from transporting equipment or by conveyor, mixer truck chute, or buggy. Pervious concrete is not pumpable.
 - b. Discharge shall be completed within sixty (60) minutes of the introduction of mixture water to the cement. Increase time to ninety (90) minutes when using an extended set control admixture. Water addition is permitted at the point of discharge.
- D. Joints
 - 1. Contraction joints shall be installed at locations and spacing shown in the contract Documents at one quarter (1/4) the depth of the thickness or a maximum of one and a half (1-1/2) inches for roadway and alley pavements, and at one half inch (1/2") for sidewalks and trails. Allowable methods for joint placement, as directed by the Engineer include:
 - a. Rolled Joints: Shall be formed in plastic concrete using a steel pipe roller to which a beveled fin with the required diameter to achieve the joint depth has been attached around the circumference of the roller. Roller joints are formed immediately after roller compaction and before curing. Sidewalks and trails shall have rolled joints.
 - b. Sawed Joints: Shall be constructed as soon as the pervious pavement can be sawed without raveling the sawed edge and before initial cracking occurs, using a wet saw or an early entry saw. Sawed joints shall typically be constructed between twenty-four (24) hours and forty-eight (48) hours after concrete placement, depending on site conditions. At no time during the sawing process shall more pavement surface be exposed than that needed for sawing. Any dust or slurry generated during sawing shall be immediately removed during the sawing operation.
 - 2. Construction joints shall be installed at locations and spacing shown in the Contract Documents and whenever concrete placement is suspended for a sufficient length of time that concrete may begin to harden.
 - 3. Expansion joints shall be installed when pervious concrete will abut existing concrete slabs or other structures such as walls, footings, columns, catch basins, stairs, light poles, and other points of restraint.
 - 4. To reduce raveling at joints, or where pervious concrete meets impervious pavement, finishing may be necessary.
- E. Finishing:



1. Rolling compaction shall be achieved using a motorized or hydraulically actuated, rotating; weighted tube screed that spans the width of the section placed and exerts a minimum vertical pressure of 10 psi on the concrete. Alternatively, a steel pipe roller meeting the same criteria may be used.
2. Rolling shall be performed using a roller specifically designed to smooth and compact pervious concrete. Lawn rollers are not allowed.
3. Place curing compound on exposed concrete surfaces immediately after finishing.

F. Curing and Protection

1. Immediately after placement protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. The pavement surface shall be entirely covered with polyethylene sheet (within maximum twenty (20) minutes). Sheeting shall be cut to a minimum of the full lane width and pavement shall remain covered for at least seven (7) uninterrupted days.
3. Prior to covering, an evaporation retardant such as soy bean oil may be sprayed onto the pavement from both sides of the paving operation. Follow manufacturer's recommendations for application rate
4. Alternative curing materials may be used as approved by the Engineer.
5. Curing sheets shall be secured and kept secure at all times without using dirt.
6. Hot Weather Curing. A fog shall be sprayed above the surface, before cover, when required due to hot weather conditions. Equipment must include fog nozzles that atomize water using air pressure to create a fog blanket over the slab.
7. Cold Weather Curing: Curing shall be in accordance with MDOT 602.

3.4 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Thickness: + 3/4 inch; - 1/4 inch.
- C. Elevation: + or - 1/2 inch.
- D. Contraction joint depth: + 1/4 inch, -0 inches.

3.5 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Perform field inspection and testing according to MDOT 602.
- C. Testing firm will take cylinders and perform slump and air entrainment tests according to ACI 301.



- D. Conduct tests in accordance with ASTM C1688 at the beginning of each pervious concrete placement operation for each batch, or for every 50 cubic yards (maximum), or a minimum of one (1) test for each day's placement, to verify fresh density and void content.
- E. A minimum of seven (7) days following each placement, three (3) cores, and six (6) inches in diameter shall be taken. The cores shall be measured for thickness, void content, and unit weight determined using the methods in the Test Panel section of this specification. Satisfactory test panels will be determined by:
 - 1. Compacted thickness + 3/4", - 1/4" of the specified thickness.
 - 2. Void content + or - the two (2) % of the specified void ratio.
 - 3. Unit weight + or - five (5) pounds per cubic foot the design unit weight.
- F. If pervious concrete fails to meet the above requirements, the Engineer shall make a determination of acceptance, rejection, or acceptance at a reduced price.
- G. The infiltration of the pavement surface shall be tested in accordance with ASTM C 1701. All applied water shall infiltrate directly with puddle formation or surface runoff, and the testing shall be observed by the Engineer. A minimum infiltration rate of 60 inches per hour shall be achieved.
- H. Submit all test results to the Engineer.
- I. Core holes shall be filled with standard concrete.

3.6 PROTECTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit pedestrian traffic over paving for seven (7) days minimum after finishing.
- D. Do not permit vehicular traffic over paving for fourteen (14) days minimum after finishing.

END OF SECTION 32 13 14



SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.
4. Manual gates and related hardware.

B. Related Requirements:

1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 31 23 33 – Trenching and Backfilling.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. ASTM International:

1. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
6. ASTM A817 - Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcellled Tension Wire.
7. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
8. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
9. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
10. ASTM F552 - Standard Terminology relating to Chain Link Fencing.
11. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
12. ASTM F626 - Standard Specification for Fence Fittings.



13. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
14. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
15. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
16. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
17. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
18. ASTM F1183 - Standard Specification for Aluminum Alloy Chain Link Fence Fabric.
19. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.
20. ASTM F1345 - Standard Specification for Zinc - 5% Aluminum - Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric.

B. Chain Link Fence Manufacturers Institute (CLFMI):

1. CLFMI - Product Manual.

C. Michigan Department of Transportation (MDOT):

1. MDOT 2012 Standard Specifications for Construction, Section 808, Fencing.

1.3 SYSTEM DESCRIPTION

- A. Fence Height: Fabric height shall be 4 feet, 6 feet, 8 feet, 10 feet, or 12 feet accordingly, unless specified otherwise in the Drawings.
- B. Line Post Spacing: At intervals not exceeding 10 feet.
- C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Shop Drawings:
 1. Locations of fence, each gate, posts, rails, and tension wires and details of extended posts, extension arms, gate swing, cantilever gate or other operation, hardware, and accessories.
 2. Indicate materials, dimensions, sizes, weights, and finishes of components.
 3. Include plans, elevations, sections, gate swing, and other required installation and operational clearances, and details of post anchorage, attachments, and bracing.
- C. Product Data:



1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric.
3. Gates and hardware.
4. Material certifications and test documentation.

D. Samples: For the following products, showing the full range of color, texture, and pattern variations expected. Mark or tag each sample. Prepare samples from the same material to be used for the Work.

1. Provide a 1 sq. ft. piece of steel wire (for fabric).
2. Provide a 6-inch piece of post and rail materials, unless directed otherwise by the Engineer.
3. Provide 1 sample of each: latch type and locking assembly.
4. Provide 1 sample of each: stop, drop rod assembly and keeper(s).
5. Submit all samples in a single sample submission at least 30 days prior to erection of fence, unless directed otherwise by the Engineer.

1.5 CLOSEOUT SUBMITTALS

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.6 QUALITY ASSURANCE

- A. Supply material according to CLFMI - Product Manual.
- B. Complete installation according to ASTM F567, unless specified otherwise.

1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
- B. Identify each package with manufacturer's name.
- C. Store fence fabric and accessories in secure and dry place.



PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to “CLFMI Product Manual” and requirements indicated below:
 - 1. Fabric Height: Match existing height unless otherwise listed on the Drawings.
 - 2. Steel Wire for Fabric: Wire diameter of 0.148-inch (9-gauge).
 - a. Mesh Size: 2 inches, diamond, interwoven.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
 - c. Aluminum-Coated Fabric: ASTM A 491, Type, I, 0.40 oz./sq. ft.
 - 3. Salvage:
 - a. 4 ft. Fence Height and Under: Knuckled selvage on top and twisted selvage on bottom.
 - b. 6 ft. Fence Height and Taller: Twisted selvage on top and bottom.

2.2 TERMINAL, CORNER, AND PULL POSTS

- A. Round steel pipe: ASTM F1083 Schedule 40 standard weight pipe, 2.0 oz./sq. ft. hot dip galvanized zinc exterior and 2.0 oz./sq. ft. hot dip galvanized zinc interior coating. Regular Grade: Minimum steel yield strength 30,000 psi.
 - 1. Fence Height 6 ft. or shorter: 2-3/8-inch diameter O.D. 3.65 lb./ft.
 - 2. Fence Height Over 6 ft. to 8 ft.: 2- 7/8-inch diameter O.D. 5.80 lb./ft.
 - 3. Fence Height Over 8 ft. to 12 ft.: 4-inch diameter O.D. 9.12 lb./ft.
- B. Length: A minimum of 3’-6” longer than the specified height of the fence.

2.3 LINE POSTS

- A. Round steel pipe: ASTM F1083 Schedule 40 standard weight pipe, 2.0 oz./sq. ft. hot dip galvanized zinc exterior and 2.0 oz./sq. ft. hot dip galvanized zinc interior coating. Regular Grade: Minimum steel yield strength 30,000 psi.
 - 1. Fence Height 6 ft. or shorter: 1-7/8-inch diameter O.D. 2.72 lb./ft.
 - 2. Fence Height Over 6 ft. to 8 ft.: 2-3/8-inch diameter O.D. 3.65 lb./ft.
 - 3. Fence Height Over 8 ft. to 12 ft.: 2-7/8-inch diameter O.D. 5.80 lb./ft.
- B. Length: Line post length shall be in accordance with the footing requirements under Section 2.4.



2.4 LINE POST FOOTING

- A. Post shall be driven with a total length below finish grade according to the following:
1. Fence Height = 4': 4' below finish grade.
 2. Fence Height = 6': 4'-6" below finish grade.
 3. Fence Height = 8': 6' below finish grade.
 4. Fence Height = 10': 6' below finish grade.

2.5 TERMINAL, CORNER, AND GATE POST FOOTINGS

- A. In accordance with ATM F567 except:
1. For fence heights 8 ft. and under: Concrete footings shall be 12-inch diameter and a minimum 42 inches deep.
 2. For fence heights Over 8 ft. to 12 ft.: Concrete footings shall be minimum 18-inch diameter and a minimum 54 inches deep.
- B. Footing hole shall have a uniform vertical surface to the bottom of the footing.

2.6 PULL POST FOOTINGS

- A. Pull post footings shall be in accordance with ASTM F567, except for concrete footing(s) which shall be 10-inch diameter and a minimum of 42 inches deep with a uniform and plumb vertical surface.

2.7 TENSION WIRE

- A. Metallic Coated Steel Marcellled Tension Wire:
1. 7-gauge Marcellled wire complying with ASTM A 824.
 2. Type II Zinc-Coated, ASTM A 817 Class 5 – 2.0 oz./sq. ft.

2.8 BARBED WIRE

- A. Metallic Coated Steel Barbed Wire:
1. Comply with ASTM A 121, Design Number 12-4-5-14R, double 12-1/2-gauge twisted strand wire, with 4-point 14-gauge round barbs spaced 5 inches on center.
 2. Match coating type to that of the chain link fabric.
 3. Coating type Z- Zinc-Coated: Strand wire coating Type Z, Class 3, 0.80 oz./sq. ft., barb coating 0.70 oz./sq. ft.



2.9 FITTINGS

- A. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F 626, minimum steel thickness of 12-gauge, minimum width of 3/4-inch and minimum zinc coating of 1.20 oz./sq. ft. Secure bands with 5/16-inch galvanized steel carriage bolts.
- B. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: In compliance with ASTM F 626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz./sq. ft.
- C. Truss Rod Assembly: In compliance with ASTM F 626, 3/8-inch diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz./sq. ft., assembly capable of withstanding a tension of 2,000 lbs.
- D. Tension Bars: In compliance with ASTM F 626. Galvanized steel one-piece length 2 inches less than the fabric height. Minimum zinc coating 1.2 oz./sq. ft. Bars for 2-inch mesh shall have a minimum cross section of 3/16-inch by 3/4-inch.
- E. Barbed Wire Arms: In compliance with ASTM F 626, pressed steel galvanized after fabrication, minimum zinc coating of 1.20 oz./sq. ft., capable of supporting a vertical 250 lb. load.
 - 1. Typical Fence Line: Type I – three strand 45-degree arm.
 - 2. Typical Gate: Type II – three strand vertical arm.
- F. Tie Wire and Hog Rings for fabric attachment: Rings shall be 6-gauge galvanized steel. Tie wires shall be 6-gauge galvanized steel.

2.10 SWING GATES

- A. Include the entire assembly to construct the gate system to match existing height or at the height indicated on the Drawings to match gate fabric to that of the fence system specified (refer to Article 2.1).
 - 1. Swing gate shall be hot dip galvanized steel pipe, welded fabrication in compliance with ASTM F 900. Gate frame members shall be a minimum of 2-inch diameter O.D. schedule 40 galvanized steel pipe, in compliance with ASTM F 1083.
 - 2. Frame members shall be spaced no greater than 8 feet apart vertically and horizontally.
 - 3. After fabrication protect the welded areas by applying zinc-rich paint in accordance with ASTM practice A780 per the manufacturer's specifications.
 - 4. Fabric: Identical to that used on the fence assembly. Stretcher and tension bars, wire, rings, and clips shall be identical to the fence fabric.
 - 5. Hinges, Stops, Center Drop Rod and Keepers: Items shall be of structural steel and shall be of appropriate size and quality to accomplish hinges from not twisting and turning, including holding the gate in alignment with the rest of the fence. Latches shall keep the gates even with each other and in alignment with the fence line. Stops, center drop rod, and



- keepers shall prevent the fence from going in undesired areas and directions for the purpose intended. All appurtenances shall match color of fence fabric.
6. Latches: Provide commercial galvanized steel latches permitting operation from both sides of gate. Latches shall have integral eye openings for padlocking option. (Padlock by others).
 - a. Basis of Design for Single-leaf:
 - 1) Strong Arm Walk Gate Latch: Heavy duty galvanized steel manufactured by: DAC Industries, Inc., 615 Eleventh Street NW, Grand Rapids, MI 49504; (800) 888-9768.
 - 2) Or approved equal.
 - b. Basis of Design for Double-leaf:
 - 1) Strong Arm Double Gate Latch: Commercial galvanized steel manufactured by: DAC Industries, Inc., 615 Eleventh Street NW, Grand Rapids, MI 49504; (800) 888-9768.
 - 2) Or approved equal.
 7. Single Swing Gate Posts: ASTM F1083 Schedule 40 standard weight pipe, 2.0 oz./sq. ft. hot dip galvanized zinc exterior and 2.0 oz./sq. ft. hot dip galvanized zinc interior coating. Regular Grade: Minimum steel yield strength 30,000 psi.
 - a. For gate openings less than 13 ft.: 4" O.D. 9.12 lbs./ft.
 - b. For gate openings 13 ft. to 18 ft.: 6-5/8" O.D. 18.99 lbs./ft.
 - c. For gate openings 19 ft. to 20 ft.: 8-5/8" O.D. 28.58 lbs./ft.
 8. Double Swing Gate Posts: ASTM F1083 Schedule 40 standard weight pipe, 2.0 oz./sq. ft. hot dip galvanized zinc exterior and 2.0 oz./sq. ft. hot dip galvanized zinc interior coating. Regular Grade: Minimum steel yield strength 30,000 psi.
 - a. For gate leafs 13 ft. to 3 ft.: 4" O.D. 9.12 lbs./ft.
 - b. For gate leafs 14 ft. to 17 ft.: 6-5/8" O.D. 18.99 lbs./ft.
 - c. For gate leafs 18 ft. to 20 ft.: 8-5/8" O.D. 28.58 lbs./ft.
 9. When Double Gates are required: Provide and install the following.
 - a. Drop rod to hold gate leaf closed. To hold gate leaf in closed and secured drop rod to pavement, provide galvanized steel "U" channel 12" long securely positioned in the pavement, directly below the drop rod in the closed position, and that is parallel to the closed gate, and flush with pavement.
 - b. Gate stop to engage gate when in open position.



2.11 HORIZONTAL SLIDING GATES:

- A. Type I-Overhead Slide Gates: ASTM F 1184 Type I. Gate framing shall be welded construction, minimum of 2-inch diameter O.D. schedule 40 galvanized steel pipe, in compliance with ASTM F 1083.
1. Frame members shall be spaced no greater than 8 feet apart vertically and horizontally.
 2. After fabrication protect the welded areas by applying zinc-rich paint in accordance with ASTM practice A780 per the manufacturer's specifications.
 3. Positive locking latch, pressed steel, galvanized after fabrication. Galvanized steel drop bars shall be provided with double gates.
 4. Chain-link Fabric: Identical to that used on the fence assembly.
 5. Manufacturer's standard overhead beam/structure, track, rollers, and accessories designed to support the load of the gate panel taking into consideration wind load and possible icing. The support beam/structure shall be galvanized or receive proper corrosion protection.
 6. Gate posts shall be in compliance with ASTM F 1083 schedule 40 galvanized steel pipe.
 - a. For gate openings 10 ft. and less: Gate posts shall be 2-7/8" O.D. 5.80 lb./ft.
 - b. For gate openings 24 ft. and greater than 10 ft.: Gate posts shall be 4" O.D. 9.12 lb./ft.
 - c. For gate openings up to 40 ft. and greater than 24 ft.: Double gate posts shall be 4" O.D. 9.12 lb./ft.
- B. Cantilever Slide Gates:
1. Class 1 – External Roller Design: Horizontal top and bottom steel track members shall be 2-3/8" O.D. 3.65 lb./ft. Vertical and internal members, 1-7/8" O.D. 2.72 lb./ft. in compliance with ASTM F 1083 schedule 40 galvanized steel pipe.
 - a. Gate frame shall be fabricated by welding, vertical and horizontal members installed no greater than 8 ft. apart.
 - b. Welded joints shall be protected by applying zinc-rich paint in accordance with ASTM Practice A780.
 - c. Gates designed to open or close by applying an initial pull force no greater than 40 lbs.
 - d. Chain-link Fabric: Identical to that used on the fence assembly.
 - e. Positive locking pressed steel latch, galvanized after fabrication. Galvanized steel drop bars shall be provided with double gates.
 - f. Gate posts, 4" OD schedule 40 per ASTM F 1083 Provide safety protective guards for the top and bottom external rollers following ASTM F 1184 guidelines.
 2. Class 2-Internal Roller Design: Gate frame shall be fabricated by welding vertical and horizontal members installed no greater than 8 ft. apart. Class 2 cantilever slide gates shall comply with the performance deflection criteria listed in ASTM F 1184. Gates designed to open or close by applying an initial pull force no greater than 40 lbs. Internal truck assemblies designed to handle the forces required for gate size opening and height. Match



chain link fabric to that of the fence system. Gate posts, 4" O.D. schedule 40 pipe per ASTM F 1083.

- a. Aluminum Frame Design: Aluminum rectangular members of various shapes and wall thickness per manufacturers design for gate opening and height. Top horizontal member shall be one-piece extruded section having an integral internal track to accommodate truck assemblies.
- C. Electrically operated horizontal slide gates must be manufactured and installed to comply with safety requirements of ASTM F 2200 and UL 35.

2.12 CAST-IN-PLACE CONCRETE

- A. Materials: Portland cement complying with ASTM C150, Type 1, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete in accordance with ASTM C94.
 - 1. Concrete Mix: Normal weight concrete, air entrained, with not less than 3,500 psi compressive strength (28 days).
- B. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to the manufacturer's written instructions.
 - 1. Concrete Mix: Normal weight concrete, with not less than 3,500 psi compressive strength (28 days).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by the Engineer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Call Local Utility Line Information service Miss Dig (811) at 1-800-482-7171 not less than three full working days, excluding Saturdays, Sundays, and holidays, but not more than fourteen (14) calendar days before digging operations are scheduled to begin.



- B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, underground lawn sprinkler system, underground structures, benchmarks, and property monuments.
- C. Anchorages, footings or fence appurtenances shall not extend beyond the limits of the right-of-way, or private property, without the written consent of the abutting property owner.

3.3 CHAIN-LINK FENCE INSTALLATION

- A. General: Install framework, fabric, accessories, and gates according to ASTM F567 with the exceptions specified herein.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect above ground portion of posts from concrete splatter.
 - a. Exposed concrete shall be flush with the grade; shape and smooth to slope to shed water away from the post.
- D. Line Post Spacing: Set first corner, gate and pull posts first. Space line fence posts equally not exceeding 10 feet on center.
- E. Corner, Gate, Terminal, and Pull Post Footing: Install terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more, or at any abrupt change in grade, and at intervals not greater than 500 feet. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
 - 1. Corner, Gate, and Terminal post footings: Only concrete footings shall be used and shall be minimum 12-inch diameter and a minimum of 42 inches deep. 2 inches of concrete shall be placed below the bottom of the post.
 - 2. Pull post footings shall be minimum 10-inch diameter and a minimum 42 inches deep.
- F. Line Post Footings: Shall be driven to the proper depth depending on the height of the fence to match existing or as indicated on the Drawings.
- G. Post Bracing and Intermediate Rails:
 - 1. Maintain plumb position and alignment of fence posts.
 - 2. Diagonally brace terminal posts to adjacent line post with truss rods and turnbuckles.
 - 3. Install braces at end and gate post and at both sides of corner and pull posts.



4. Locate horizontal braces at mid-height of fabric with 72 inches or higher, on fences with top rail, and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- H. Top Rail: Maintain plumb position and alignment of fence posts. Run rail continuously (21 ft. lengths) through line post caps or barb arm loop tops, bending to radius for curved runs, and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Bottom Rails: Secure to posts with fittings.
- J. Fabric: Install fabric to the secure side of fence, outer side of enclosing framework. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released. If new fabric abuts existing fabric, the new fabric shall be woven into the existing fabric at both ends of the 2 sections.
1. Bottom clearance: Leave approximately 2 inches between the finish grade and bottom selvage.
- K. Tie Wires: Manually or power fastened ties configured to wrap a full 360 degrees around a rail or post and a minimum of 1 complete diamond of fabric. Twist ends one and one-half machine twists or three full manual twists and cut off protruding ends to preclude untwisting by hand.
1. Tie fabric to line posts with ties space at not more than 12 inches o.c.
 2. Tie fabric to tension wire with hog ring ties on 24 inches o.c.
- L. Tension or Stretcher Bars: Pull fabric taut, thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c. One tension bar for each terminal and 2 for each corner or pull post.
- M. Tension Wire: When indicated in the Drawings, in lieu of top rail, attach directly to the fabric not less than 3 inches or more than 6 inches from the top of the fabric. Tension wire shall be stretched taut, independently and prior to the fabric, between the terminal posts and secured to the terminal post using a brace band. Secure the tension wire to each line post with a tie wire.
1. Bottom Tension Wire (Optional): attach 6 inches from the bottom of the fabric with appropriate steel clips to match the fabric.
 2. For fences with barbed wire and no top rail: Install top tension wire through the barb arm loop.
- N. Tension Bands: Secure to terminal and corner posts using 5/16" carriage bolts at 15 inches on center.
- O. Barbed Wire: Install barbed wire uniformly spaced, to match existing or as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.



3.4 GATE INSTALLATION

- A. Install gate posts in accordance with manufacturer's instructions and as specified in Article 3.3, E. Set keepers, stops, sleeves, and other accessories into concrete and position out of the way of normal traffic, but located to provide reliable performance.
- B. Install gate plumb, level and secure for full operation without interference.
- C. Attach hardware by means which will prevent unauthorized removal.
- D. Adjust hardware for smooth operation and lubricate moving parts where necessary. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.5 ADJUSTING

- A. Fence and accessories shall be installed to match existing conditions or in strict accordance with the Drawings and Specifications in a workmanlike manner. Finished fence shall be in proper alignment with posts plumb, and fabric, tension, and barb wires taut.

3.6 CLEANING

- A. Fence installation will not be considered complete until excess excavated materials, cut wires, spilled concrete, and other debris, including existing fence to be removed, resulting from the fence construction, is removed and legally disposed of.

END OF SECTION 32 31 13



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CHAIN LINK FENCES AND GATES
DWSD Special Specification
March 2025

SECTION 32 31 29 - WOOD FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fence framework, pickets, gates, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.
4. Manual gates and related hardware.
5. Removal of existing fence.

B. Related Requirements:

1. Section 03 20 00 - Concrete Reinforcing.
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 31 10 00 - Site Clearing.
4. Section 31 23 33 - Trenching and Backfilling.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. ASTM International:

1. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
2. ASTM C150 - Standard Specification for Portland Cement.
3. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
4. ASTM D245 - Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.
5. ASTM F537 - Specification for Design, Fabrication, and Installation of Fences Constructed of Wood and Related Materials.
6. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples.

B. American Association of State Highway and Transportation Officials (ASHTO):

1. AASHTO M133 - Standard Specification for Preservatives and Pressure Treatment Processes for Timber.

C. Michigan Department of Transportation (MDOT):

1. MDOT 2012 Standard Specifications for Construction, Section 808.



1.3 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Manufacturer's printed product information indicating material compliance and specified options are to be submitted prior to installation. Submit manufacturer's product data sheets on each product to be used.
- C. Shop drawings shall include plans, elevations, sections, details, and attachments to other work. Drawings must be submitted for approval and be approved prior to installation.
- D. Submit samples for initial color selection. Submit samples of each specified finish.
 - 1. Product Data: Submit manufacturer's installation instructions and procedures, including details of fence and gate installation.
 - 2. Product literature, technical data and specifications, material of construction, etc.

1.4 CLOSEOUT SUBMITTALS

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.5 QUALIFICATIONS

- A. Manufacturing company with engineering and fabrication of custom fencing and gate systems for a minimum of three (3) years.
- B. Installation company with experience in manufacturer's products for a minimum of five (5) years. The Contractor shall provide trained laborers with prior experience in the type of construction involved as well as experience installing the material and techniques specified.
- C. Obtain each fence system and gate through one source from a single manufacturer.

1.6 QUALITY CONTROL

- A. The supplier is responsible for quality control and inspection of material. Material shall be graded before shipment in accordance with the grading rules of ASTM D245 and marked with the approved grading agency stamp showing the mill origin, species, and grade. The required grading agency stamp or marking must be legible on a wide face at the trimmed end before and after treating.



1.7 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard ten-year (10) limited warranty, from the date of purchase, against defects in materials and workmanship including projection against cracking, peeling, blistering, and corrosion (rusting).

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver fence materials and accessories in packed cartons or pallets.
- B. Identify each package with manufacturer's name.
- C. Store fence materials and accessories in secure and dry place.
- D. Upon delivery to the jobsite, inspect all materials for damage that might have occurred during shipment.
- E. Handle and store materials in manufacturer's packaging until materials are ready to be installed. Store materials in such a way as to prevent damage and theft.

1.9 PROJECT CONDITIONS

- A. Verify actual locations of walls and other construction contiguous with fencing and gates by field measurements before fabrication and indicate measurements on shop drawings. Provide allowance for trimming and fitting onsite.

1.10 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for fencing and gates. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to the Project Site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support systems temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

- A. All wood materials shall be treated wood, or wood of natural resistance to decay. Materials shall be free from loose knots, cracks, and other imperfections.



B. Wood Boards or Slats:

1. Wood boards or slats shall be of cedar, redwood, combed spruce or similar.
2. Wood boards or slats shall be between 3/8 inches and 5/8 inches thick and no greater than 6 inches wide unless otherwise noted or approved by the Engineer.
3. Posts:
 - a. Wood posts shall conform to the details and dimensions indicated on the Drawings, or in the case of replacement as found in the field to best match the existing fence.
 - b. Wood posts shall be straight, sound, seasoned with ends sawed off square or as indicated. All knots shall be trimmed flush with the surface.
 - c. Wood posts shall be peeled and treated with preservative in accordance with AASHTO M133. When native cedar posts are called for on the Drawings, the requirements for peeling and for treating may be omitted.
4. All dimension timber and lumber required for fences or gates shall be sound, straight, and free from knots, splits, and shakes. It shall be of the species and grades indicated on the Drawings, or in the case of replacement as found in the field to best match the existing fence.
5. Concrete posts shall be made of concrete of the class specified and shall contain steel reinforcement as shown on the Drawings.
6. Posts shall be pressure treated redwood, Douglas fir-larch, cedar or similar.
7. Fence and gate posts shall be 4-inch by 4-inch unless otherwise noted or approved by the Engineer.
8. Buried post ends should be treated with an approved wood preservative product.
9. Truck Gate posts shall be at minimum dual 6-inch by 6-inch or as recommended by manufacturer.

C. Gates:

1. Provide additional horizontal, vertical, and diagonal members to ensure proper gate operation and for attachment of wood, hardware and accessories. Consult manufacturer as necessary.
2. Gate stops, latches and locks shall be accessible from either side of gate.
3. Openings shall be a minimum of 3-feet wide.
4. Types: Man Gates and Truck Gates.

2.2 HARDWARE

A. Gate Hardware:

1. Gate hardware including, but not limited to, latches, hinges, stops and bolts shall be stainless steel, powder coated black, or galvanized.
2. Hinges and Pins shall be heavy duty and sized as per manufacturer's recommendations.
3. For truck gates (double-leaf), a drop rod or stop shall be installed on one (1) leaf, include at least one (1) guide and shall extend into concrete base or similarly solid base.



4. Dual access (accessible and lockable from either side) latch and lock systems are required on all gates.

2.3 CAST-IN-PLACE CONCRETE

- A. Materials: Portland cement complying with ASTM C150, Type 1, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete in accordance with ASTM C94.
 1. Concrete Mix: Normal weight concrete, air entrained, with not less than 4,000 psi compressive strength (28 days).
- B. Materials: Dry-packaged concrete mix complying with ASTM C387 for normal-weight concrete mixed with potable water according to the manufacturer's written instructions.
 1. Concrete Mix: Normal weight concrete, with not less than 4,000 psi compressive strength (28 days).

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform such clearing and grubbing as may be necessary to construct or replace the fence to the required grade and alignment as shown on the Drawings or to match existing conditions as found in the field.
- B. At locations where breaks in a run of fencing are required, appropriate adjustments in fence alignment and/or post spacing shall be made to satisfy requirements or conditions encountered.

3.2 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by the Engineer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.



3.3 PREPARATION

- A. Call Local Utility Line Information service Miss Dig (811) at 1-800-482-7171 not less than three full working days, excluding Saturdays, Sundays, and holidays, but not more than fourteen (14) calendar days before digging operations are scheduled to begin.
- B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500-feet or line of sight between stakes.
- C. Indicate locations of utilities, underground lawn sprinkler system, underground structures, benchmarks, and property monuments.
- D. Anchorages, footings or fence appurtenances shall not extend beyond the limits of the right-of-way, or private property, without the written consent of the abutting property owner.

3.4 FENCE INSTALLATION

- A. Comply with the manufacturer's recommendations.
- B. Use workers knowledgeable in the building of wood privacy fences.
- C. Install fences in accordance with manufacturer's instructions.
- D. Where clearing for fence is required, clear the fence line.
- E. Place posts in the ground a minimum of 30-inch or as shown on the plans. Excavate post holes a minimum of 12-inch in diameter. Set posts upright and plumb and fill the holes with concrete to within 4-inch of the top of the ground, unless otherwise directed by the Engineer. Place soil on top of the concrete to make the area level with the surrounding soil. Place posts at 8-feet on center. Terminate concrete 6 inches below grade.
- F. Make all splices only at the posts.
- G. The pickets shall be screwed to the rails with galvanized wood screws of appropriate size, as approved by the Engineer. Fasten pickets with two (2) screws at each rail. Make the fence so that the pickets form one continuous wall on the front side and posts and rails are visible only on the back side.
- H. Tighten all screws so that the heads are flush with the face of the picket.
- I. Post and rail connections must be approved by the Engineer prior to beginning work.
- J. Set finished height of posts slightly above the top rail so that they cannot be seen from the front side of the fence. Do not use pickets with open or loose knot holes, cracks, stains, warps or other visible defects. Do not use any warped or structurally unsuitable rails.



- K. Construct fence so that it is plumb, vertically straight and the top of the pickets will form a continuous line with no dips or abrupt vertical changes.

3.5 INSTALLATION POSTS

- A. Posts shall be set true to line and grade.
- B. Set posts in 12-inch diameter concrete footings extending at least 30-inch into undisturbed natural ground or properly compacted fill.

3.6 GATE INSTALLATION

- A. Install gate posts in accordance with manufacturer's instructions. Set keepers, stops, sleeves, and other accessories into concrete and position out of the way of normal traffic, but located to provide reliable performance.
- B. Install gate plumb, level and secure for full operation without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer.
- C. Attach hardware by means which will prevent unauthorized removal.
- D. Lubricate moving parts where necessary. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- E. Man Gates:
 - 1. Shall be installed on all enclosed or fenced-in areas or to replace an existing man gate when other work has been completed.
 - 2. Shall be configured to allow resident or Owner to enter or exit the enclosed area.
 - 3. Once gate is installed coordinate with Engineer or resident on lock installation.
- F. Truck Gates:
 - 1. Shall be installed at the request of the Engineer and shall be at no additional cost to the Owner.
 - 2. Shall open/close in direction as directed by Engineer.
 - 3. Shall be configured to allow Owner or resident vehicles to enter the enclosed area to perform work or park.
 - 4. Once gate is installed coordinate with Engineer or resident on lock installation.



3.7 REMOVAL OF EXISTING FENCE

- A. All rails, braces, posts, and the like shall be removed and disposed of or salvaged by Contractor to allow construction of the Work. Confirm salvageability of a particular segment of fence with the Engineer.

3.8 ADJUSTING

- A. Fence and accessories shall be installed to match existing conditions or in strict accordance with the Drawings and Specifications in a workmanlike manner. Finished fence shall be in proper alignment with posts plumb.

3.9 PROTECTION

- A. Protect finishes from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units.

3.10 CLEANING

- A. Remove cutting and drilling chips that are attachment to the fencing, post, brackets, or additions to prevent corrosion.
- B. Repair scratches and other installation-incurred damage using manufacturers recommended paint. Use paint of the appropriate color with a zinc additive to prevent rust from forming.
- C. Clean up debris, unused material, and remove from Site.

END OF SECTION 32 31 29



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WOOD FENCES AND GATES
DWSD Special Specification
March 2025



SECTION 32 92 19 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Sodding.
6. Native Seeding.
7. Maintenance.

B. Related Requirements:

1. Section 31 24 00 – Bioretention.
2. Section 32 93 00 – Plants.
3. Section 32 93 90 – Green Infrastructure Maintenance.

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished ground surface of planting soil after construction.
- B. First Hard Frost: Temperatures falling below 28 degrees Fahrenheit for more than two hours.
- C. Inert Matter: Soil particles, stones, chaff, stems, leaves, flowers, cone scales, pieces of bark, pieces of resin, etc. Pieces of broken and damaged seed units of crops which are half the original size or less. Damaged weed seed with over half the embryo missing.
- D. Other Crop Seed: Seed of plants grown as crops (other than the kind or cultivar included in pure) shall be considered other crop seeds, unless recognized as weed seeds by laws, regulations, or by general usage. Further classification of species is determined with the use of the reference, AOSA Rules for Testing Seeds Volume 3. Uniform Classification of Weed and Crop Seeds, AOSA 2013.
- E. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- F. Pure Seed: Includes all seeds of each kind and/or cultivar under consideration which are present in excess of 5% of the whole (whole meaning the sum of the four (4) components).



- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.
- H. Weeds: Vegetative species other than specified species to be established in given area.
- I. Weed Seed: Seeds, florets, bulblets, tubers, or sporocarps of plants recognized as weeds by laws, regulation or by general usage shall be considered weed seeds. Further classification of species is determined with the use of the reference, AOSA Rules for Testing Seeds Volume 3. Uniform Classification of Weed and Crop Seeds, AOSA 2013.

1.3 STANDARDS

- A. ASTM International:
 - 1. ASTM C602 - Standard Specification for Agricultural Liming Materials.
- B. Association of Official Seed Analysts (AOSA).
- C. Michigan Department of Transportation (MDOT) - "Standard Specifications for Construction," Current Edition.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Product Data:
 - 1. Within four (4) weeks following the issuance of Notice to Proceed, submit seed supplier and certifications including: name and location of seed supplier(s) and a complete list of each seed mix by weight and proportion that is being supplied before the seed mix is ordered.
 - 2. Seed Labels: Submit seed labels from bags showing mix composition.
 - 3. Sod: Submit name of sod grower and product data.
 - 4. Fertilizer.
 - 5. Herbicides and Pesticides.
 - 6. Seed and mulch equipment.
 - 7. Turf maintenance equipment.
- C. Source Quality Control:
 - 1. Certifications:
 - a. Lawn Seed: Certification from seed vendor for each grass seed mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Include identification of source and name and telephone number of supplier.



- b. Pest Applicator: State commercial pesticide business license and commercial pesticide application certification.
- c. Fertilizer: Submit two (2) copies attesting to the fertilizer composition for review.

1.5 CLOSE-OUT SUBMITTALS

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Maintenance Data: Prior to the issuance of substantial completion, submit recommended procedures for the Owner to implement for maintenance of turf after Final Acceptance during a calendar year.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. All seed shall comply with applicable sections of the following references:
 - a. Federal Seed Act.
 - b. Michigan Seed Law Act 329 of 1965.
 - c. Association of Official Seed Analysts (AOSA): "Rules for Testing Seed."
- B. Required Topsoil Testing:
 - 1. The Contractor shall engage an approved agronomic soil-testing laboratory and an approved physical analysis-testing laboratory. The cost of testing to be borne by the Contractor.
 - 2. All agronomic soil sampling and testing shall comply with procedures specified in the United States Department of Agriculture Ag. Handbook 60: Diagnosis and improvement of Saline and Alkali Soils.
 - 3. Required Tests:
 - a. Chemical analysis indicating:
 - 1) Fertility: pH, nitrate, nitrogen, ammonia nitrogen, phosphate, phosphorous, potassium, calcium, magnesium.
 - 2) Nutrient data shall be provided in parts per million (ppm).
 - b. Physical properties including:
 - 1) Organic content.
 - 2) Particle size distribution.
 - 3) Saturated hydraulic conductivity in one (1) hour.
 - c. Amendment recommendations from testing laboratory for providing ideal soils for intended vegetative uses.



1.7 QUALIFICATIONS

- A. **Installer Qualifications:** The Work of this Section shall be performed by a contractor with a minimum of five (5) years of documented experience and specializing in seeding lawn installations and turf maintenance.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. All seeds shall be packaged and kept dry to ensure adequate protection against damage and to maintain dormancy while in transit, storage, or during planting operations. Replace any seed damaged during transit and storage.
- B. All seed mixture(s) shall be delivered to the site in vendor's sealed containers and labeled, in compliance with the Federal Seed Act and applicable State laws.
- C. Seed shall not be delivered and stored longer than nine (9) months prior to date of installation.
- D. Herbicides and other chemicals delivered to the site must be in clearly labeled, unopened containers showing weight, analysis, and name of manufacturer.
- E. Fertilizers and other chemicals delivered to the site must be in clearly labeled, unopened containers showing weight, analysis, and name of manufacturer.
- F. Straw mulch shall be stored off the ground under a cover that provides protection from moisture and humidity.
- G. **Bulk Materials:**
 - 1. Do not dump or store bulk materials near structures, utilities, that block walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate material certificates.

1.9 SCHEDULING

- A. **Seeding Season:** Seed during one (1) of the following periods. Coordinate seeding periods with initial maintenance periods to implement timely maintenance from the date of Substantial Completion.
 - 1. Allowable seeding and sodding periods:
 - a. Spring Seeding: April 15 until June 1.
 - b. Fall Seeding: September 1 – November 1.



- B. Seeding outside of the calendar windows noted above or for temporary seeding establishment will only be permitted if approved in writing by the Engineer prior to installation.
- C. Weather Limitations: Proceed with seeding only when current and forecasted weather conditions permit seeding and sodding to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions and in accordance with the manufacturer's written specifications and as per Engineer's acceptance.

1.10 WARRANTY

- A. Notify the Engineer in writing when the Work is complete. The Engineer will inspect the Work and if the Engineer is in concurrence, the acceptance date will serve as the date to start the turf establishment period and the warranty period.
- B. The Contractor shall establish and maintain all turf in a vigorous, well-kept condition and warrant them against defects including death, improper maintenance, and unsatisfactory growth for a period of one (1) year.
 - 1. The Contractor will not be responsible for defects resulting from neglect by the Owner, abuse or damage by others, or unusual phenomena or incidents beyond the landscape installer's control which result from natural causes such as floods, lightning, storms, freezing rains, winds over 60 miles per hour, fires, or vandalism.
- C. Final Inspection: Final Inspection and Acceptance will be at the end of the turf establishment period. Acceptance will be based on the required Work having uniform finished grades conforming to the drawings and vigorous complete ground cover of species established, free of weeds, and conditions inconsistent with the installation specified. For any area identified without a uniform density of at least 80 percent grass cover, or bare spots greater than one (1) foot by one (1) foot, as determined by Engineer, Contractor shall reseed as originally specified. The Contractor shall provide materials and labor necessary to correct any deficiencies in accordance with the original Specifications during the warranty period. Make replacements/repairs as soon as is seasonally acceptable. Fully restore areas damaged by replacement operations to their original specified condition.
 - 1. If, in the opinion of the Engineer, it is advisable to extend the warranty, an inspection at the end of the warranty period will be made to determine acceptability of all items involved.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Topsoil which has been stripped from on-site may be utilized as topsoil on the project provided it is pulverized, tested, and therefore meets the requirements of these specifications and any necessary amendments added per the recommendations of the testing results.



B. Topsoil required shall be furnished as specified below:

1. A fertile, friable, loamy surface soil without admixture of subsoil, free of stones, stumps, root, trash, debris, and other materials deleterious to plant growth.
2. The pH range shall be 6.0 to 7.0. Topsoil that does not meet this pH range shall not be approved by the Engineer.
3. Nutrient data in parts per million (ppm) dry soil.

Phosphorus	Min. 75 lb./Ac
Potassium	Min. 300 lb./Ac
Calcium	Min. 1,500 ppm
Magnesium	Min. 100 ppm
Cation Exchange Capacity	Min. 20 meq/100g
Soluble Salt	Max. 1,000 ppm

4. Organic content shall be greater than 3 percent and less than 10 percent determined by loss through ignition.
5. Gradation:
 - a. All topsoil imported, or on-site reused materials, shall be pulverized and screened.
 - b.

<u>Sieve Designation</u>	<u>Percent Passing</u>
1" screen	100
1/4" screen	97 – 100
No. 10 U.S.S. mesh sieve	95 – 100
No. 140 U.S.S.	60 – 90
 - c. Clay content determined by Bouyoucos Hydrometer Test shall range between 5 percent and 15 percent.
 - d. Percentages shall be based on dry weight of the sample.

2.2 SEED MIXTURE

- A. Lawn Seed: Seed shall be fresh, clean, dry, new-crop seed complying with the AOSA's "Rules for Testing Seed," tested for purity and germination tolerances. Seed mixtures shall have a maximum weed seed content of 0.5 percent, with no noxious weed seed, and shall be composed of certified seed of the purity, germination and proportion by weight as indicated in the following table:

MDOT Type THM Seed Mixture			
Species	Minimum Purity (percent)	Germination (percent)	Seed Mixing Proportions (percent by weight)
Kentucky Blue Grass	98	85	30
Perennial Rye Grass	96	85	20
Creeping Red Fescue	97	85	50



- B. Bioretention Area Lawn Seed: When low maintenance is desired for a bioretention system, short growth grass with a dense root zone may be specified as vegetative cover for the infiltration bed and side slopes instead of perennials and shrubs. The seed mix for grassed bioretention areas shall be:

Bioretention Seed Mixture			
Species	Minimum Purity (percent)	Germination (percent)	Seed Mixing Proportions (percent by weight)
Perennial Rye Grass	98	85	40
Annual Rye Grass	96	85	30
Creeping Red Fescue	97	85	30

- C. Native Area Seeding: Species as specified on design plans.
- D. Seeding Rates:
1. Lawn Seeding: Sow the seed mix uniformly at a rate of 6 lbs./1000 square feet (260 lbs./acre).
 2. Native Seeding: As recommended by seed manufacturer.
- E. Substitutions: Other cultivars of grass species may be substituted for approval by the Engineer, but they must be newer, more improved cultivars than what is listed.

2.3 SOD

- A. Sod shall be palletized small roll (2 feet x 5 feet; 10 square feet per roll).
- B. Sod shall be certified blend of at least two blue grass varieties with at least 30 percent creeping red fescue densely rooted sod in accordance with MDOT 917.13 and as approved by the Engineer for use in establishing grass on lawn areas.
- C. Sod shall be grown and harvested from a sod nursery at an average soil thickness of 1/2 inch to 3/4 inch thick.
- D. Sod must be installed within 24 hours of harvesting.

2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew-and seed-free, slat hay or threshed straw of wheat, rye, oats, or barley. Straw mulch shall be baled, air-dry, clean, mildew and seed free, salt hay or threshed straw of wheat, rye, oats, or barley. Material for anchoring mulch shall be as per Division 9 of the current MDOT Standard Specifications for Construction.
- B. Non-Asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.



C. Wood Excelsior:

1. Green wood fibers, baled or blanket of type and manufacture acceptable to the Owner.
2. Wood excelsior shall be made of green timber fiber baled so that the bales weigh 80 to 90 pounds at the time of manufacture.
3. Wood excelsior blankets shall be made of a uniform web of interlocking fibers with a backing of fabric netting on one (1) side only. The fabric net shall have a mesh size not exceeding 1-1/2 inches x 3 inches and shall be a woven of either cotton cord, twisted paper cord or a synthetic biodegradable fiber. Blankets shall be produced in the form of a tightly compressed roll 36 inches +/- 1 inch wide and approximately 120 feet long. Blanket shall have a fiber net on the outside of the fiber mat. Blanket roll weight, when manufactured shall average 85 pounds +/- 10%. Each roll shall have separator sheets of 40-pound Kraft paper placed at the beginning and at the end of each roll to facilitate unrolling and handling at the job site. The Kraft paper sheet at the end of each roll shall also form a wrapper for the roll.

D. Netting:

1. Twisted Kraft paper or synthetic fiber, biodegradable woven mesh net material suitable for the application and acceptable to Owner.
2. The net shall consist of a biodegradable mesh with openings not to exceed 1-1/2 inches x 3 inches.
3. The net shall be furnished in widths not less than 35 inches.

E. Proprietary Mulch Material: Biodegradable natural and synthetic materials suitably fabricated and acceptable to the Owner.

2.5 MULCH ANCHORING MATERIAL

- A. Emulsified Asphalt: ASTM D977, Rapid Setting (R.S. 1 or 2), Medium Setting (M.S. 2 or 2h) or Slow Setting (S.S.1).
- B. Mulch Anchoring Tool: Suitable unit having a series of flat, notched discs for punching and anchoring mulch in soil, or a regular farm disc weighted and set nearly straight as an alternative.
- C. Latex Base Adhesive: Latex base adhesive mixed with water at a ratio of 25 gallons of water to 1-gallon adhesive with 25 pounds of recycled newsprint as a tracer.
- D. Recycled Newsprint: Mix 7 pounds of newsprint with 7 gallons of water.
- E. Guar Gum: Mix 1 pound of dry adhesive with 26.5 gallons of water with 5 pounds of recycled newsprint as a tracer.



2.6 FERTILIZER

- A. The percentages by weight shall be determined per recommendations of the soil testing reports for lawns.
- B. Granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis professional fertilizer confirming to the following:
 - 1. Type A: Starter Fertilizer containing 20% nitrogen, 26% phosphoric acid, and 6% potash by weight, or similar approved composition.
 - 2. Type B: Secondary fertilizer containing 31% nitrogen, 3% phosphoric acid, and 10% potash by weight, or similar approved composition.
- C. Fertilizer for hydraulic seeding shall be soluble or ground to a fineness that will permit complete suspension of all insoluble particles in the slurry.
- D. No fertilizers other than compost (as specified in Section 31 24 00 – Bioretention) shall be applied within a bioretention system or other green storm water infrastructure system, and within 50 feet of any drainage areas draining to such system.

2.7 METAL EDGING

- A. Metal edging shall comply with ASTM A1000, sized 3/16-inch thick x 4 inches wide x 16 feet length, made of steel, colored black, fabricated in sections with stake pockets stamped, punched, or welded to face of sections approximately 30 inches apart, with 3/16-inch x 16-inch long stakes, as manufactured by J.D. Russell Co., or approved equal.

2.8 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb./sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

2.9 WATER

- A. Source: Water shall be provided by the Contractor unless otherwise approved by the Engineer.
- B. Quality: Water shall be clean, potable, and free of substances harmful to plant growth.
 - 1. Water shall be free of wastewater effluent or other hazardous chemicals.



2. Lawn watering equipment, hoses or other methods of water transportation shall be furnished by the Contractor.

2.10 PESTICIDES AND HERBICIDES

- A. Pesticides and herbicides shall be registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by the manufacturer for each specific problem and as required for the project conditions and application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Prior to seeding or sodding, the Contractor shall examine and verify the acceptability of the job site. Notify the Engineer if conditions are detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions, or obstructions. Do not proceed with the Work until unsatisfactory conditions have been corrected or resolved in writing by the Engineer.
- C. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
- D. Coordination is required to ensure rainfall/groundwater seepage does not result in soil moisture conditions that will cause excessive rutting during lawn installation operations. Suspend soil spreading, grading and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- E. Utilities: Have all underground utilities located by servicing agencies. In the vicinity of utilities, hand excavate to minimize possibility of damage.
- F. Coordination with Other Work:
 1. The Contractor shall coordinate his/her work with other contractors or trades to determine the appropriate sequence of lawn installation with respect to other work on the site.
 2. Work installed out of construction sequence which is disturbed by the completion of Work by other trades shall be repaired at no cost to the Owner.
 3. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.

3.2 SITE PROTECTION

- A. Protect existing grounds, plants, lawns, and vegetation to remain.



1. Protect existing trees to remain in place against unnecessary cutting, breaking, skinning, or bruising of roots and bark, smothering of trees by compaction or stockpiling construction materials or excavated materials within five (5) feet of outer edge of drip line.
 - a. Erect minimum of four (4) foot high fence five (5) feet outside drip line of trees to remain.
 - b. Erect tree protection before starting site work of any kind. Maintain fencing during construction period.
 - c. Interfering branches may only be removed with prior consent from the Engineer.
 - d. Identify any trees the Engineer would like mulched, vertically, trimmed or repaired as a result of construction impact at end of project. All Work shall be performed by a certified arborist approved by the Engineer.
2. Contractor is responsible for all damage to plants that shall remain. Cost for tree replacement shall be determined in accordance with the "Guide for Plant Appraisal" by the Council of Tree and Landscape Appraisers (International Society of Agriculture, Publication #P1209).

- B. Temporary Construction Access: Project site access and equipment access routes within the project site must be approved by the Engineer prior to commencement of Work. Any temporary gravel path or access way must include a geotextile fabric separator to ensure full removal of gravel/stone from project site at the project completion.

3.3 STRIPPING AND STORAGE OF EXISTING TOPSOIL

- A. Strip topsoil to its full depth at areas impacted and at all areas that will be regraded or resurfaced.
- B. Stop topsoil stripping outside drip line of trees to remain/do not strip as to impact root line of trees to remain.
- C. Dispose of roots, stone, and other debris; store topsoil in piles within the work limits.
 1. Obtain approval of Engineer prior to establishing topsoil storage areas.
 2. Grade and slope stockpiles for proper drainage and to prevent erosion.
- D. The reuse of stockpiled topsoil within the project site must be approved for placement by the Engineer.

3.4 PREPARATION OF SEED BED/SODDED AREAS

- A. De-compaction: De-compact areas trafficked by construction activities to a minimum depth of 12 inches.
- B. Rough Grading: Grade surfaces to assure drainage away from structures and to prevent ponding and pockets of surface drainage. Provide subgrade free from irregular surface changes and as follows:



1. Rough grade shall equal plus/minus 0.20 feet, subgrade tolerance shall be free of exposed boulders or stones exceeding 1 inch in greatest dimension.
 2. Fill in all areas of settlement to proper grade before subsequent placement of topsoil.
- C. Topsoil Depths: Lawn areas to receive sod or seed must have between 4 and 6 inches of topsoil placed.
- D. Topsoil Spreading and Fine Grading: Grade area to a smooth, free draining even surface with a loose, moderately coarse texture. Roll, scarify, rake and level as necessary to obtain a true, even lawn surface and fill depressions as required to drain. Seed bed shall be approximately ½ inch to 1 inch below all sidewalks, curbs, and metal edging if used. Do not move heavy power equipment except necessary lawn installation equipment over the lawn areas after the soil is prepared unless it is loosened and re-graded. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading.
- E. Fertilizing:
1. Apply Type A / starter fertilizer to indicated turf areas at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft. or as directed.
 2. Apply fertilizers by mechanical drop or rotary distributor, thoroughly and evenly incorporated with soil to a depth of 3 inches by disking or other approved method. Fertilize areas inaccessible to power equipment with hand tools and incorporate into soil.

3.5 SEEDING

- A. Do not sow seed when weather conditions are unfavorable, such as during drought or high winds. Perform seeding operations when soil is dry and when winds do not exceed 15 miles per hour.
- B. Perform seeding work only after planting and other work affecting the ground surface have been completed. Limit preparation of seed areas to those ready for immediate seeding.
- C. Prior to placing seed materials, water topsoil to a depth of four (4) inches at least 48 hours prior to seeding operations to obtain a loose friable seed bed. Time and depth of watering operations shall be varied at the direction of the Engineer for varying conditions at the site of the Work. Watering shall be performed in sufficient durations and intervals such that the seeded area thrives and shall be approved upon final inspection.
- D. Seed immediately after preparation of bed.
- E. Seed shall be applied uniformly at a rate of 6 lbs./1,000 square feet. All areas shall be seeded in at least two directions, spreading one (1) half of the specified amount in one (1) direction and then seeding the remaining one (1) half of the seed at right angles to the first seeding pattern using the same method. Turf grass seeds shall not be covered by more than ¼ inch. The seeding device shall lightly roll the seed bed to provide good moisture contact between the seed and soil.
- F. Apply hydro-mulch with hydro-mulch equipment immediately after seeding. Slurry shall be composed of clean water and mulch. Apply mulch slurry at a minimum rate of 1,500 pounds to



2,000 pounds per acre on slopes steeper than 4:1. Direct slurry to evenly cover designated seed areas. Repair ruts, depressions, and all damage caused by hydro-mulching equipment.

- G. Immediately reseed and reapply hydro-mulch to areas that show poor germination.
- H. The Contractor shall keep the freshly applied seeded areas moist, through daily watering if necessary, to assure germination of the grass seeds. The lawn areas shall be maintained by watering, mowing, trimming, weed control application, fertilizing and any other maintenance necessary.
- I. The Contractor shall provide all maintenance of the seeded lawns as described above for at least two weeks after completion of the repair operation.
- J. Any part of any area that fails to show a uniform germination shall be reseeded and such reseeding shall continue until a dense lawn is established.

3.6 SODDING

- A. Perform sodding work only after planting and other work affecting the ground surface have been completed. Limit preparation of sodded areas to those ready for immediate sodding.
- B. Sod immediately after preparation of bed.
- C. Sod must be installed within 24 hours of harvesting.
- D. Install initial row of sod in a straight line, beginning at the bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and tightly against previously installed row.
- E. Lay sod to form a solid mass with tightly fitted joints. Sod strips shall butt close together with no voids between the pieces. Care shall be exercised to ensure that the sod is not stretched or overlapped. Lateral joints shall be staggered. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
- F. To enhance rooting, moisten the soil to a depth of four (4) to six (6) inches twenty-four hours before laying sod. Do not lay sod on a hot dry soil surface.
- G. Do not lay, place or install dormant sod pads on saturated or frozen soil.
- H. Peg sod on slopes greater than 3:1 to prevent slippage at a rate of two (2) stakes per yard of sod. Space pegs no greater than 24 inches apart and drive flush with the sod surface.
- I. Water sod thoroughly with a fine spray immediately after laying/installation. Tamp or roll sod immediately after it is laid. The finished surface shall be true to grade, smooth, even, and equally firm at all points.



- J. Tamp or roll sod with light lawn roller immediately after it is laid to ensure contact with subgrade. The finished surface shall be true to grade, smooth, even, and equally firm at all points.
- K. Begin watering sod within 30 minutes of installation and water daily for the first two weeks; twice a day in hot dry weather. Keep soil in sodded areas moist but not soaked to 1.5 inches below sod. After sod is installed, re-sod all areas which have browned out or fail to show a uniform stand of grass. Repair cracks or gaps in sod more than one (1) quarter at no additional cost to the Owner.

3.7 HYDROSEEDING

- A. Hydroseeding shall be performed using suitably acceptable hydraulic seeding equipment and a homogeneous slurry solution of water, seed, fertilizer and suitable mulch material as approved by the Engineer. Seed slurry mixture shall be distributed uniformly at a rate approved by the Engineer for the seed materials, fertilizer, and mulch materials used to suite the seed application rate. Seed application rate shall be 300 lbs. per acre.

3.8 TEMPORARY SOIL STABILIZATION

- A. On disturbed areas that will not receive final landscape/plant material installation or final seeding within two weeks of being disturbed, the Contractor shall provide temporary soil stabilization. Contractor shall apply straw mulch to all exposed areas after scarifying and fine grading takes place.
- B. Spread a loosely applied layer of clean, chopped straw at the rate of 2 tons/acre (90 lbs./1000 square feet) to form a continuous blanket 1-1/2" in loose thickness.

3.9 MULCHING

- A. Mulching shall consist of placing a mulch material on areas that have or are to be seeded. Mulch shall be placed in a loose enough condition to allow penetration of sunlight and circulation of air, but thick enough to shade the ground, reduce rate of water evaporation and prevent or reduce erosion by wind or water. Mulch shall be secured with suitably acceptable anchoring material.
- B. On slopes steeper than 6H:1V, reinforcement mats shall be used. Satisfactory mulching materials include the following:
 - 1. Straw or grass hay applied at 1-1/2 to two (2) tons per acre, anchored with asphalt or netting tie down.
 - 2. Asphalt emulsion alone at 600 to 1,200 gallons per acre.
 - 3. Commercially available erosion control netting of jute, paper or biodegradable synthetics.
 - 4. Continuous filament fiberglass at 1,000 pounds per acre anchored with 150 gallons of asphalt emulsion.
 - 5. Anchor straw or hay mulch by the methods as specified herein.
 - 6. Wood chips will not need anchoring when used on workable slopes.



- C. Commercially manufactured netting and/or fiberglass materials shall be anchored in accordance with the manufacturer's printed instructions for the material used.
- D. Punch and or anchor mulch material into soil using mulch anchoring tool. Soil must be moist, free of stones and loose enough to permit disc penetration to a depth of three (3) inches.
- E. Blow on liquid or emulsified asphalt materials with the straw or hay mulch or spray or sprinkle asphalt tie down materials immediately after mulch is spread.
- F. Apply emulsified asphalt at 0.04 gallons per square yard. Do not apply emulsified asphalt during freezing weather since it contains approximately 50% water. Apply liquid (cut back) asphalt at approximately 0.10 gallons per square yard. Liquid asphalt may be applied during freezing weather since it is cut back with kerosene.

3.10 TURF RENOVATION

- A. Paved areas over which hauling operation have been conducted shall be kept clean. Promptly remove materials spilled on pavement.
- B. Repair existing lawns damaged by construction operations. Repair shall include finish grading, seeding, as required to match existing grade and lawn, and maintenance of repair areas.
 - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - 2. Install new planting soil as required.
- C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil. Upon completion of lawn installation, remove from the site and legally dispose of the following:
 - 1. Surplus subgrade material.
 - 2. Stone and foreign matter.
- E. Mow, dethatch, core aerate, and rake existing turf.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped bare, and compacted areas thoroughly to a soil depth of 6 inches.



- I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
- J. Apply seed and hydroseed as required for new turf.
- K. Water newly planted areas and keep adequately watered through establishment period.

3.11 CLEAN-UP AND PROTECTION

- A. Promptly remove soil and debris resulting from lawn installation Work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off the Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 19



SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of Subsoil and Topsoil.
2. Trees, Plants, and Ground Cover.
3. Mulch.
4. Fertilizer.
5. Pruning.
6. Landscape Edging.
7. Maintenance.

B. Related Requirements:

1. Section 32 92 19 – Seeding.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
2. ANSI Z60.1 - Nursery Stock.

B. Forest Stewardship Council (FSC):

1. FSC Guidelines - Forest Stewardship Council Guidelines.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

C. Backfill: The earth used to replace or the act of replacing earth in an excavation.



- D. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- E. Container Grown Stock: Healthy, vigorous, well rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Finish Grade: Elevation of finished surface of planting soil.
- G. Growing Season: April 1 to First-Frost in Autumn.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. Pests included insects, mites, grubs, mollusks, (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Existing, on site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. Plant: Plants; Plant material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called “trunk flare.” The area at the base of the plant’s stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.



B. Product Data: Submit product data for the following items:

1. Plant material including quantities, sizes, and source.
2. Fertilizers.
3. Pesticides.
4. Anti-desiccants.
5. Landscape edging.
6. Tree staking and guying materials.
7. All other planting accessories indicated on Drawings.

C. Plant Materials: Include species, cultivar names, quantities, sizes, quality, and sources for plant materials.

D. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the project.

E. Qualification Data: For Landscape Installer. Include the following:

1. A list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons. Installer must have minimum five (5) years' experience.
2. Name, years of experience, and certifications for the construction supervisor or foreman that will be supervising work. Supervisor/Foreman must have minimum five (5) years' experience.

F. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

G. Samples: 1-pint volume of Shredded Hardwood Bark Mulch in sealed plastic bag.

1.5 CLOSEOUT SUBMITTALS

A. Comply with Section 01 70 00 - Execution and Closeout Requirements.

B. Operation and Maintenance Data: Summary of maintenance activities including frequencies and quantities performed during establishment period including schedules.

1.6 QUALITY ASSURANCE

A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.



- B. Perform Work according to the State of Michigan requirements.
- C. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five (5) years' experience in landscape installation in addition to requirements in Section 01 40 00 "Quality Requirements".
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in one (1) of the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician – Exterior, with installation and maintenance specialty area(s), designated CLT – Exterior.
 - b. Certified Ornamental Landscape Professional designated COLP.
 - c. Pesticide Applicator: State licensed, commercial.
- D. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required size.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches of roots tip to tip. Take caliper measurements six (6) inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- E. Plant Material Observation:
 - 1. Engineer may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality.
 - 2. Engineer may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease, symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work.
 - 3. Remove rejected trees or shrubs immediately from Project site.
 - 4. Notify Engineer of sources of planting materials 3 days in advance of delivery to site.
- F. Required Topsoil Testing:
 - 1. The Contractor shall engage an approved agronomic soil-testing laboratory and an approved physical analysis-testing laboratory. The cost of testing to be borne by the Contractor.
 - 2. All agronomic soil sampling and testing shall comply with procedures specified in the United States Department of Agriculture Ag. Handbook 60: Diagnosis and improvement of Saline and Alkali Soils.
 - 3. Required Tests:
 - a. Chemical analysis indicating:



- 1) Fertility: pH, nitrate, nitrogen, ammonia nitrogen, phosphate, phosphorous, potassium, calcium, magnesium.
 - 2) Nutrient data shall be provided in parts per million (ppm).
- b. Physical properties including:
- 1) Organic content
 - 2) Particle size distribution
 - 3) Saturated hydraulic conductivity in one (1) hour.
- c. Amendment recommendations from testing laboratory for providing ideal soils for intended vegetative uses.

1.7 PRE-INSTALLATION MEETINGS

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Convene minimum one (1) week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect and maintain plant life until planted.
- C. Deliver plant life materials immediately prior to placement. Keep plants moist.
- D. Plant material damaged as a result of delivery, storage or handling will be rejected.
- E. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws is applicable.
- F. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion control measures to prevent erosion or displacement of bulk materials; discharge of soil bearing water runoff; and airborne dust reaching adjacent properties, water conveyance, or walkways.
 3. Accompany each delivery of bulk materials with appropriate certificates.



- G. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- H. Contractor to provide the Engineer at least 48 hours' notice before making any delivery of plant material. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
- I. All planting stock shall be handled by the container or the root ball and never by any part of the plant itself.
- J. Apply anti-desiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two (2) weeks after planting.
- K. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- L. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 2. Do not remove container grown stock from containers before time of planting.
 - 3. Water root systems of plants stored on site deeply and thoroughly with a fine mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 - 1. Notify Engineer or Owner no fewer than two (2) days in advance of proposed interruption of each service or utility.



2. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
1. Spring Planting: April 15 - June 1.
 2. Fall Planting: September 1 – November 1.
- D. Weather Limitations:
1. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained.
 2. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
 3. Do not install plant life when ambient temperatures may drop below 40 degrees F or rise above 90 degrees F within 48 hours of planting.
 4. Do not install plant life when wind velocity exceeds 25 mph.
- E. Coordination with Seeding Areas:
1. Plant trees, shrubs, and other plants after finish grades are established.
 2. It is preferred that plants be installed before seed.
 3. If plants are installed after seed, protect seed and promptly repair damage due to planting operations.

1.10 WARRANTY

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Special Warranty: Installer agrees to repair or remove, furnish and replace plantings and accessories that fail in materials, workmanship, or growth within the specified warranty period.
1. Planting failures include, but are not limited to, the following as determined by the Engineer:
 - a. Plants that are more than 25 percent dead.
 - b. Plants that have clear evidence of disease.
 - c. Unsatisfactory growth.
 - d. Structural failures including broken limbs, branches, or stems or plantings that have fallen or blown over.
 - e. Damaged or broken limbs, bark, or trunk.
 - f. Faulty performance of tree stabilization.
 2. Warranty Periods: From date of the project's Substantial Completion:
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.



- C. Final Warranty Inspection: At the conclusion of the warranty period the Contractor and Engineer or Engineer shall conduct a final warranty inspection at a time mutually agreeable and during the growing season. It will be the Engineer's responsibility to notify the Contractor in writing of the inspection.
 - 1. Engineer must provide in writing a list or drawing that identifies all plant material that has failed and requires replacement.
 - 2. Contractor shall provide replacement plant material for all plants which has deemed to have failed. Any necessary repairs under the warranty shall be made within thirty (30) days after receiving notice of need, weather permitting. In the event the contractor does not make repairs accordingly, the owner, without further notice, may provide materials and labor to make such repairs at the expense of the contractor. The replacement shall be on the same variety, size and character as specified for original planting, unless Engineer specifies a substitute.
- D. Extended Warranty for Replacement Plantings: All replacement plant material shall receive an extended warranty equal to the original warranty period, at no additional cost to the Owner.

1.11 MAINTENANCE SERVICE

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Maintain plant life immediately after placement. Continue maintenance until termination of warranty period.
- C. Maintenance includes:
 - 1. Cultivation and weeding plant beds and tree pits.
 - 2. Applying herbicides for weed control. Remedy damage resulting from use of herbicides.
 - 3. Remedy damage from use of insecticides.
 - 4. Irrigation sufficient to saturate root system.
 - 5. Pruning, including removal of dead or broken branches.
 - 6. Disease control.
 - 7. Maintaining wrapping, guys, and stakes.
 - 8. Replacement of mulch.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well shaped, fully branched, healthy, vigorous stock,



densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scale, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut off limbs more than $\frac{3}{4}$ inch in diameter; or with stem girdling roots are unacceptable.
 2. Collected Stock. Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z 60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Engineer, with a proportionate increase in size of roots or balls.
- C. Root Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSIZ60.1. Root flare shall be visible before planting.
- D. Labeling: Label each tree/shrub and one (1) of each massing of groundcovers or perennial. Label shall identify variety size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant. Shipped product shall be accompanied by a packing slip that clearly lists shipped species by scientific and common name, and the number of each species shipped.
- E. Provide healthy, disease free plants of species and variety shown or listed, with well-established root systems reaching to the sides of container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 TOPSOIL

- A. Topsoil which has been stripped from on-site may be utilized as topsoil on the project provided it is pulverized, tested, and therefore meets the requirements of these specifications and any necessary amendments added per the recommendations of the testing results.
- B. Topsoil required shall be furnished as specified below:
1. A fertile, friable, loamy surface soil without admixture of subsoil, free of stones, stumps, root, trash, debris, and other materials deleterious to plant growth.
 2. The pH range shall be 6.0 to 7.0. Topsoil that does not meet this pH range shall not be approved by the Engineer.
 3. Nutrient data in parts per million (ppm) dry soil.

Phosphorus	Min. 75 lb./Ac
Potassium	Min. 300 lb./Ac
Calcium	Min. 1,500 ppm
Magnesium	Min. 100 ppm
Cation Exchange Capacity	Min. 20 meq/100g



Soluble Salt

Max. 1,000 ppm

4. Organic content shall be greater than 3 percent and less than 10 percent determined by loss through ignition.
5. Gradation:
 - a. All topsoil imported, or on-site reused materials, shall be pulverized and screened.
 - b.

<u>Sieve Designation</u>	<u>Percent Passing</u>
1" screen	100
¼" screen	97 – 100
No. 10 U.S.S. mesh sieve	95 – 100
No. 140 U.S.S.	60 – 90
 - c. Clay content determined by Bouyoucos Hydrometer Test shall range between 5 percent and 15 percent.
 - d. Percentages shall be based on dry weight of the sample.

2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.



2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.5 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip type, long lasting, slow release, commercial grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - 1. Size: 10-gram tablets.
 - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.
- B. Engineered planting soils used in bioretention systems and other similar green storm water infrastructure systems shall not be treated with fertilizers, except by addition of compost amendments as specified for the planting mix. When additional organic matter is necessary or recommended by Engineer, compost shall be added only within the root zone of the planting soil, and not throughout the entire soil depth.

2.6 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Triple-shredded, 100% organic hardwood mulch.
 - 2. Mulch Length: 3 inches maximum.
 - 3. Mulch Particle Size: shall pass through a #3 sieve and be sized between 3/8" and 1/2".
 - 4. Depth: As indicated on Drawings.
 - 5. Color: Natural Dark Brown. No dyes or chemicals.



6. Shredded former wood products are not allowed (ex. wood pallets).
7. Mulch must be aged six weeks and not longer than twelve months.

2.7 PESTICIDES

- A. Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction. Do not use herbicides in storm water management areas. Pre-emergent herbicides are not allowed.
- B. Post Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated. Do not use herbicides unless authorized in writing by Engineer and by authorities having jurisdiction.

2.8 TREE STABILIZATION MATERIALS

- A. Stakes and Guys:
 1. Upright and Guy Stakes: Rough sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2 by 2-inch nominal by length indicated, pointed at one end. Stakes shall be lodge pole stakes free of knots and of diameters and lengths appropriate to the size of the plant as required to adequately support the plant.
 2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treat with specified wood pressure preservative treatment.
 3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
 4. Guys and Tie Wires: Tree guying shall be flat woven polypropylene material, 3/4-inch wide, and 900-pound break strength.
 5. Tree Tie Webbing: UV resistant polypropylene or nylon webbing with brass grommets.
 6. Guy Cables: Five strand, 3/16-inch diameter, galvanized steel cable, with zinc coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
 7. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
 8. Proprietary staking and Guying Devices: Proprietary stake and adjustable tie systems to secure each new planting by plant stem; sized as indicated and per manufacturer's written recommendations.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Arborbrace; ArborBrace Tree Guying System.
 - 2) Decorations for Generations, Inc; Reddy Stake or Meta Stake System.



2.9 SUBSTITUTIONS

- A. Plant material may be substituted due to lack of availability only after approval from the Engineer. Contact the Engineer immediately if a particular species or cultivar is unavailable and submit a request for substitution accompanied with a list of nurseries contacted in the search for the required plant material and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or of a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications but are available for substitution. Failure to notify the Engineer in a timely manner does not relieve the Contractor from providing the plant materials specified.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Verify that plants and vehicles loaded with plants can travel to planting location adequate overhead clearance.
 - 3. Suspend planting operations during periods of excessive soil moisture until the moisture control reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable, or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways.



- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Engineer's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations direct by Engineer. Stake locations of individual trees and shrubs and outline areas for mass perennial or groundcover plantings.
- E. Apply anti-desiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.
- F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 TREE PLACEMENT

- A. Plant trees in locations designated on drawings. Trees being replaced in kind shall be planted in as close to the original location as possible. All newly planted trees shall meet the below requirements.
 - 1. Trees shall not be planted directly above existing or proposed water or sewer lines. Place trees with the following offset requirements, measured from the center of the trunk to the edge of the utility.
 - a. Water Lines: 5-foot minimum separation.
 - b. Sewer Lines: 5-foot minimum separation.
 - 2. Trees shall have the following minimum clearances from streets and sidewalks, as measured from the center of the trunk to the edge of pavement.
 - a. Streets: 3-foot minimum clear.
 - b. Sidewalks: 3-foot minimum clear.
 - 3. If proposed tree planting locations conflict with the above requirements, consult Engineer for alternative tree planting locations.

3.4 PLANTING AREA SOIL PREPARATION

- A. Subgrade:
 - 1. Bring subsoil to required levels, profiles and contours suitable for receiving the required finish surfaces. Make changes in grade gradual. Blend slopes into level areas.
 - 2. Loosen subgrade of entire planting area to a minimum depth of 12 inches. Remove stones larger than 1-inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 3. Apply superphosphate fertilizer directly to subgrade before loosening.
- B. Topsoil:



1. Contractor shall re-use existing site topsoil where possible. If existing topsoil is not available or does not meet topsoil requirements, contractor shall provide imported topsoil.
 2. Amend topsoil as required by topsoil testing.
 3. Topsoil Depth in all planted areas shall be 6 inches.
 4. Spread approximately one-half the topsoil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade.
 5. Spread remaining topsoil to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- D. Before planting, obtain Engineer's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.5 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 2. Excavate approximately three (3) times as wide as ball diameter for balled and burlapped stock and container stock.
 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 7. Maintain supervision of excavations during working hours.
 8. Keep excavations covered or otherwise protected overnight.
 9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
 10. Planting Pits within Bioretention Planting Areas and other green infrastructure storm water management systems: Planting soils within the bioretention planting areas shall be field compacted per Section 31 24 00 - Bioretention. Planting pits in bioretention areas shall be manually dug only. Compact the area under the plant by lightly tamping to provide a stable base for the shrubs or perennials in order to prevent settling. Add only approved planting soil shall be used for backfilling in lightly compacted layers of not more than nine inches (9") and each layer watered sufficiently to settle before the next layer is put in place.



Compact as necessary to ensure the root flare will be at or above adjacent grades after planting as shown on Drawings.

11. When working in bioretention filled with engineered soils, the Contractor shall make all efforts to not destroy soil structure by excessive traffic, working, or compacting the soil throughout the planting operation. Utilize the smallest practicable piece of low ground pressure mechanical equipment in the adjacent areas. To prevent potential for plant settlement, do not over excavate prior to planting.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
- C. Obstructions:
1. Notify Engineer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 2. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10-feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Engineer if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.6 TREE AND SHRUB PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.
- D. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
1. Use planting soil for backfill.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.



3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about one (1) inch from root tips; do not place tablets in bottom of the hole. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Set container-grown stock plumb and in center of planting pit or trench with root flare two (2) inches above adjacent finish grades.
1. Use planting soil for backfill.
 2. Carefully remove root ball from container without damaging root ball or plant.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
 6. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.7 TREE AND SHRUB PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Engineer.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Engineer, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.8 TREE STABILIZATION

- A. General Requirements:
 1. All staking materials must be approved by the Engineer prior to installation.
 2. Guying shall be tied in such a manner as to create a minimum 12-inch loop to prevent girdling.
 3. Stakes shall be driven to a sufficient depth to hold the tree rigid.



4. Remove guys and stakes after one (1) year.
- B. Conditions Warranting Tree Stabilization: Do not provide tree stabilization unless one (1) of the following conditions is met.
1. Large Caliper Trees. Stake and guy trees more than 14 feet in height and more than three (3) inches in caliper unless otherwise indicated on Drawings. Securely attach no fewer than three guys to stakes 30 inches long, driven to grade.
 2. Steep Slopes. Stake and guy all trees located on slopes exceeding 4H:1V.
 3. Abnormal Site Conditions. Sites with soft soils, windy conditions, wet sites, or other special conditions may require staking and guying. Initially plant trees with no stakes and guys to test stability. If trees will not stay plumb, then add stakes and guys as needed or as directed by the Engineer.
- C. Staking:
1. Upright Staking and Tying: Use a minimum of two (2) stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches or one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 2. Use two stakes for trees up to 12-feet high and 2-1/2 inches or less in caliper; three (3) stakes for trees less than 14-feet high and up to four (4) inches in caliper. Space stakes equally around trees.
 3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 4. Support trees with two (2) strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- D. Staking and Guying:
1. Site-Fabricated Staking-and-Guying Method:
 - a. For trees more than six (6) inches in caliper, anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle and compression spring for each guy wire and tighten securely.
 - b. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle and compression spring. Allow enough slack to avoid rigid restraint of tree.
 - c. Support trees with strands of cable or multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle and compression spring. Allow enough slack to avoid rigid restraint of tree.
 - d. Attach flags to each guy wire, 30 inches above finish grade.
 - e. Paint turnbuckles and compression springs with luminescent white paint.
 2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.



- E. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
 - 1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
 - a. Install stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation. Saw stakes off at horizontal stake.
 - b. Install screws through horizontal hold-down and penetrating at least (one) 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
 - c. Install second set of stakes on other side of root trunk for larger trees as indicated.
 - 2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.9 GROUND COVER AND HERBACEOUS PLANTING

- A. Set out and space ground cover and plants other than trees and shrubs as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots. Use soil excavated from planting holes for backfill.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two (2) nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees in Turf Areas: Apply mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within three (3) inches of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole



surface of planting area, and finish level with adjacent finish grades. Do not place mulch within three (3) inches of trunks or stems.

3.11 LANDSCAPE EDGING

- A. Install edging where indicated on Drawings according to manufacturer's written instructions. Anchor with stakes per manufacturer's written instructions.

3.12 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C.
- D. For bioretention systems and other vegetated storm water management systems, all chemicals used during the maintenance period must be approved by the Engineer for suitability before application.
- E. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease.
 1. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
 2. Pesticides used in storm water treatment areas shall be applied such that no pesticide comes in contact with the soil and shall be applied only during dry periods. All pesticides must be submitted to Engineer for approval.

3.13 PESTICIDE AND HERBICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Non-Selective):
 1. Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.



2. Herbicides used in storm water treatment areas shall be applied such that no herbicide comes in contact with the soil and shall be applied only during dry periods. All herbicides must be submitted to Engineer for approval.

3.14 REPAIR AND REPLACEMENT

- A. Repair or replace trees and plants that are damaged by construction operations in a manner approved by Engineer.
 1. Submit details of proposed pruning and repairs.
 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 3. Furnish and replace trees and plants that have failed (as defined in Section 1.11), as determined by Engineer. Replacements shall comply with this Section.
 4. 100% of plant material must be alive and healthy prior to the start of the warranty period.
- B. Warranty Period:
 1. At the conclusion of the warranty period, plants shall be evaluated by the Engineer to determine if any plants have failed.
 2. Replace all trees and plants that have failed as determined by the Engineer. Replacement trees and plants of same size and species as those being replaced. Substitutions may occur if approved in by Engineer.
 3. Provide extended warranty for period equal to original warranty period for replaced plant material.

3.15 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off the Site.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.16 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance



immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: Twelve (12) months from date of Substantial Completion.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
1. Maintenance Period: Twelve (12) months from date of Substantial Completion.
- C. Prune only injured, dying or dead branches from trees and shrubs. Do not prune to shape.

END OF SECTION 32 93 00



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SECTION 33 01 30.18 – SECURITY CLEARANCES AND COMMUNICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all equipment, tools, labor, materials and incidental services necessary to perform all security clearances and communications as indicated and in compliance with the Contract Documents.

1.2 OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON-DISCLOSURE

- A. The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City of Detroit and shall not be appropriated for the Contractor's own use or for the use of any third party.
- B. The Contractor shall not make any public announcements or press releases regarding the Contract without the prior written authorization of the Owner.
- C. The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Owner:
 - 1. Information provided to the Contractor by the City or acquired by the Contractor during the course of the Work.
 - 2. The Contract and all deliverables produced or developed.
 - 3. Any statement of fact or opinion regarding any aspect of the Contract.

1.3 SITE INVESTIGATION

- A. The Bidder may visit the Site to verify site conditions without making an appointment.
- B. The Bidder shall not be entitled to rely on any information or interpretation received regarding the Site unless that information or interpretation is the Bidder's direct observation or is provided by the Owner in writing.

1.4 SECURITY CLEARANCES

- A. This section indicates requirements for each individual proposed to perform the following portions of the Work:
 - 1. Any Work on, or requiring access to, private property.
 - 2. Communicating with residents and homeowners in person or by telephone.



- B. Prior to the award of Contract, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Owner with a background check obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform such Work.
- C. Any individual for whom a background check is not provided, or for whom a background check indicates any convictions or pending charges related to property offences or crimes against another person will not be permitted to perform any Work on the Contract.
- D. Any background check obtained will be deemed valid for the duration of the Contract subject to a repeated records search as specified herein.
- E. Notwithstanding the foregoing, at any time during the term of the Contract, the Owner may, at its sole discretion and acting reasonably, require an updated background check. Any individual who fails to provide a satisfactory background check as a result of a repeated background check will not be permitted to continue to perform any Work on the Contract.

1.5 PRIVATE PROPERTY DAMAGE

- A. In the event of any private property damage caused whole or in part by the Contractor, the Contractor shall:
 - 1. Notify the Engineer immediately when damage to property occurs.
 - 2. The Contractor shall provide written reports as specified in Section 01 35 29 – Safety Program.

1.6 CONTRACTOR IDENTIFICATION

- A. Identification Badges:
 - 1. The Contractor shall be required to secure identification badges and each individual shall clearly display their identification while performing the Work.
 - 2. Identification badges shall be produced by the Contractor and shall conform to the following:
 - a. Measure 3.375" x 2.125" in size.
 - b. Be waterproof, made of plastic and/or laminated to protect the information that is provided on the identification badge.
 - c. Hole punched to facilitate a mylar strap or lanyard.
 - d. Badges must feature the following:
 - 1) DWSD Logo.
 - 2) Individual's Name.
 - 3) Photograph of the Individual.



B. Signs for Vehicles:

1. Contractors and inspectors performing Work of the Contract must be in vehicles featuring magnetic signs and/or removable signs that include the DWSD logo referenced above.
2. 12" x 24" standard size magnetic signs will be affixed to each vehicle door.
3. The material is 30 MIL Magnet with digital printing.
4. The magnets are not reflective.
5. Owner will provide artwork for sign production.

1.7 COMMUNICATIONS

A. Preconstruction Meeting:

1. Comply with preconstruction meeting requirements in section 01 30 00 – Administrative Requirements.

B. Progress Meetings:

1. Comply with preconstruction meeting requirements in section 01 30 00 – Administrative Requirements.

C. Resident Notifications:

1. The Owner will provide the Contractor with print-ready door hanger files it has identified as necessary to properly inform the community of Work planned.
2. The Contractor will print the appropriate count of door hangers for distribution to residences and businesses within the Contract areas.
3. The Contractor will hand-deliver door hangers to residences and businesses in accordance with the Work schedule as approved by the Owner.
4. The Contractor will attend a customized outreach training to ensure protocols are met when distributing door hangers to the community.
5. The Contractor shall provide proof of notice for door hanger delivery. Time stamped photos will be collected depicting the address of recipient and door hangers in one image. Photos and files are organized in folders by date and neighborhood.
6. Door hangers will notify the community of the scheduled Work as well as inform the community what to expect during Work activities. This Work activity can include but will not be limited to water and sewer condition assessments and water and sewer upgrades and construction.
7. If the Contractor needs to access private property for condition assessment or construction activities, the protocol below shall be followed:



- a. Homeowner is home and gives permission to access property:
 - 1) If the homeowner gives permission to access property, Work will proceed as scheduled.
 - 2) Once the Work is completed, the Contractor will notify the resident that Work has been completed by leaving a “Thank You” door hanger.
 - b. Homeowner is not home:
 - 1) If access can be gained, the Contractor will proceed with the Work and leave a “Thank You” door hanger when Work is completed.
 - 2) If access cannot be gained, the Contractor will leave a “Notice to Access” door hanger.
 - 3) The “Notice to Access” door hanger must be delivered at least 24 hours prior to returning to a home to access the property.
 - c. Homeowner does not give permission to access property:
 - 1) Contractor will not access property.
 - 2) Property address will be recorded by Contractor along with impediments to access.
 - 3) Owner will work with the Contractor to determine next steps.
8. Door hanger delivery for condition assessment activities:
- a. A “General Notification” door hanger will notify the public of the Work planned and will be delivered at least 48 hours prior to start of Work.
9. Door hanger delivery for construction activities:
- a. A “General Notification” door hanger will notify the public of the Work planned and will be delivered no more than ten (10) days and no less than five (5) days prior to the start of Work. The door hanger will require project and location specific information to be filled in and shall be completed by the Contractor and distributed. There are two types of “General Notification” door hangers for construction:
 - 1) Water main upgrade door hangers
 - 2) Sewer pipeline upgrade door hangers
 - b. A “Temporary Service Interruption” door hanger will be distributed to each address that will be impacted by interruption as a result of construction or upgrades. This door hanger will be distributed no more than five (5) days and no less than three (3) days prior to water and sewer interruptions. There are two (2) types of Service Interruption door hangers for construction:
 - 1) Water main
 - 2) Sewer pipeline
 - c. A “Notice of Service Restoration” door hanger will be distributed to all homes and businesses whose service was temporarily interrupted as a result of construction.



PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION 33 01 30.18



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SECTION 33 01 30.30 - SEWER PIPELINE INSPECTION FOR CONDITION ASSESSMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Specification covers inspection of gravity sewers using internal video and other multi-sensor inspection technologies (MSI), such as LASER and SONAR, for the purposes of assessing thoroughness of cleaning, observing and recording structural mainline and lateral defects, evaluating construction, operational performance and miscellaneous features of existing sewer assets, and to verify rehabilitated or new sewer construction prior to acceptance by Engineer.
- B. The Contractor shall provide all equipment, tools, labor, materials, and incidental services necessary to perform all work for closed circuit television (CCTV) and other MSI inspections of sewer lines as indicated and in compliance with the Contract Documents.
- C. For sewer condition assessment projects, GPS data collection must be performed on the sewer assets prior to initiating CCTV, manhole or catch basin inspection or other inspection or investigative activities on the same assets.
- D. Types of cleaning to be performed shall be undertaken in accordance with Section 33 01 30.32 - Sewer Cleaning for Condition Assessment in order to conduct a NASSCO- compliant inspection. This also provides specifications for Cleaning, Excessive Grease and Root Removal, Physically Attached Solid Debris Cutting and Removal of Intruding Taps.
- E. For pipes of height of 35 inches or less, regardless of the number and type of cleaning passes performed, the final pass of cleaning shall be undertaken in conjunction with the CCTV camera inspection that is to be provided as the final inspection deliverable. During the final cleaning pass, the CCTV inspection camera shall be mobilized to inspect the sewer segment while the jet nozzle pulls water away from the camera, drawing the water level down (if necessary) to maximize the exposure of the sewer pipe circumference. The use of the cleaning equipment in conjunction with the CCTV camera inspection shall not be considered an additional pass but shall be incidental to the Contract.
- F. Inspections may be witnessed by the Engineer.
- G. In addition to standard NASSCO inspection, the Contractor shall also be required to locate and record any sinkholes or cave-ins along the pipe alignment for up to 20 feet on either side of the pipe that are greater than six (6) inches deep and two (2) feet wide within the public right of way or easement prior to performing the CCTV inspection.
- H. The Contractor shall provide all equipment, tools, labor, materials, and incidental services necessary to perform all work for locating, exposing and raising manholes as indicated and in compliance with the Contract Documents.



- I. The Contractor shall comply with all requirements of MISS DIG Public Act 174 including contacting MISS DIG, hand excavation near utilities, and contacting 911 in case of emergency.
- J. The Contractor shall be required to enter MISS DIG tickets for all work requiring excavation. When entering the MISS DIG ticket, the following information shall be added by the Contractor to the “Locate Info” field: Contractor shall enter “*ENG*” followed by “:Project Number*” and followed by a description requesting utility location markings that encompasses the entire work area. Example of entry for a Contract with Project Number 917: *ENG*:917* Locate all utilities in front and both sides of street.
- K. Related Requirements:
 - 1. Section 33 01 30.32 - Sewer Cleaning for Condition Assessment
 - 2. Section 33 01 30.31 - Manhole Inspection for Condition Assessment
 - 3. Section 33 01 30.18 – Security Clearances and Communication
 - 4. Section 33 01 30.81 – Manhole Rehabilitation

1.2 DEFINITIONS

- A. CCTV Inspection: Operation necessary to complete a true-color, audio-visual inspection for verification of existing internal sewer line conditions.
- B. Moving Pictures Expert Group (MPEG): Family of international standards used for coding audio-visual information in a digital compressed format.
- C. AVI: Audio Video Interleave, developed by Microsoft®, is the acronym given to a family of multimedia container formats as part of its video for Windows® software.
- D. MOV: Common multimedia container file format developed by Apple® for use and compatible with both Macintosh® QuickTime and Windows® platforms. MOV files commonly use the MPEG-4 codec for compression.
- E. Portable Hard Disk Drive (HDD): For the purposes of this Specification, HDD shall be written in accordance with the ISO-9660 Level 2 Specifications.
- F. Engineer: DWSD Engineer / Owner’s Representative / Owner / Field Inspector.

1.3 STANDARDS

- A. National Association of Sewer Service Companies (NASSCO):
 - 1. Pipeline Assessment and Certification Program (PACP) Reference Manual.
 - 2. Manhole Assessment and Certification Program (MACP) Reference Manual.

1.4 SUBMITTALS



A. Sample Inspection Reports: Prior to initiating the Work, the Contractor shall submit to the Engineer the following documentation for compliance:

1. Sample Report of a sewer inspection for a pipe of height of 35 inches or less and for a pipe greater than 72 inches in height, including digital data files, of an actual sewer with lateral tap connections performed by each device to be used on this Contract for review at least one (1) month before beginning the inspection work. The Sample Report shall include:
 - a. One (1) copy of the visual recording.
 - b. One (1) PACP (version 7.0.0 or newer) compliant Microsoft Access, CCTV inspection database containing inspection and defect information. Sewer condition coding shall be submitted as a PACP.mdb file accordingly.
 - c. One (1) PDF copy of the television inspection logs. Logs shall record defects according to NASSCO PACP standard. The report shall be in a tabular format without any graphics.
 - d. Sample observation photos to accompany the sample submittal.
 - e. CCTV Inspection Data Submittal Tracking Spreadsheet. A template is provided at the end of the Specification.
2. Sample Data and Reports of a LASER and SONAR sewer inspection, including all digital files representative of the deliverables performed by each device to be used to perform the work, for review at least one (1) month before the beginning of the inspection work.
3. Sample “empty header” or “0-ft MSA” inspection for a sewer segment that cannot be inspected.
4. Sample QA Review Report of the inspections.
5. Clear identification of the equipment makes model and serial number for the sample and all submittals.
6. Demonstration of the resolution of each camera using the recording resolution specified herein.

If the contents of the Sample Reports or recordings are incomplete, defective or not of adequate quality, the Contractor shall correct deficiencies and re-perform the sewer inspection at the Contractor’s expense. The Contractor shall use the Sample Report submissions accepted by the Engineer as a benchmark for subsequent inspection report submissions. No inspection work is to be performed until the sample inspection reports have been accepted by the Engineer.

B. The Contractor shall submit a written description of procedures to be used to the Engineer, including product literature for all digital video equipment per the equipment section of this Specification including, but not limited to cabling, camera, monitor, footage counter, digital video titling device, and recorder.

C. Bi-weekly data submittals to the Engineer:

1. Bi-weekly data submittals shall be completed within two (2) weeks of the completion of a work area for CCTV, LASER and SONAR inspections. The inspection reports must include both the pipe inspection videos and manhole scans for contiguous assets within the work area.



2. For the bi-weekly data submittals, the Contractor shall submit one (1) copy of the visual recording.
 3. For the bi-weekly data submittals, the Contractor shall submit one (1) PACP (version 7.0.0 or newer) compliant Microsoft Access CCTV inspection Database containing inspection and defect information. Sewer condition coding shall be submitted as a PACP.mdb file accordingly. Name the PACP database according to the following file specification:
[Contractor Name]_[P/O Number]_PACP_Submittal_[Number].mdb
e.g., ACME_DWS-999_PACP_Submittal_025.mdb
 4. For the bi-weekly data submittals, the Contractor shall submit a PDF copy of the television inspection logs. Logs shall record defects according to NASSCO's PACP.
 5. For the bi-weekly data submittals, the Contractor shall submit a submittal tracking spreadsheet.
 6. For the bi-weekly data submittals, the Contractor shall submit a QA Review Report of the inspections.
- D. Prior to initiating cleaning or inspection efforts, the Contractor shall submit an Emergency Plan that outlines proposed methods for recovering their cleaning or inspection equipment that has become lodged, lost or uncontrollable within the manhole or sewer, including confined space entry procedures.
- E. The Contractor shall provide a daily schedule to the Engineer with planned inspection assets and locations.

1.5 QUALITY ASSURANCE

- A. The Contractor shall comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- B. All inspections shall be performed one pipe segment at a time based on DWSD Asset IDs and as per NASSCO requirements.
- C. Inspection shall be performed in accordance with most current NASSCO's Pipeline Assessment and Certification Program (PACP) standards and in accordance with these specifications.
- D. Inspection shall be performed by certified Operators and Reviewers in accordance with NASSCO having attained and retained their PACP certification. Contractor shall ensure each operator is fully trained and certified in all aspects of sewer inspection and capable of making accurate observations and coding and recording all conditions that may be encountered during inspection activities.
- E. Coding accuracy shall be a function of the number of defects or construction features not recorded or omitted as well as of the correctness of the coding and classifications recorded. Coding accuracy is to satisfy the following requirements:
 1. Header accuracy: 95%.



2. Detail and defect coding accuracy: 85%.

Inspections failing to meet these criteria shall be rejected, re-inspected if required, recoded, and resubmitted at no additional cost to the Owner.

- F. The Contractor shall implement a formal coding accuracy verification system before starting the work, which shall include:
 1. Verification of coding accuracy on a random basis on a minimum of 10% of the inspection reports. Submit coding accuracy checks with the corresponding video recording. The Contractor shall complete the CCTV Inspection Data Submittal Tracking Spreadsheet and a QA Review Report documenting the results of the coding accuracy verification, attached separately, and include it with each respective data submission. Where QA has been undertaken by the Contractor, PACP Section Header Fields 3 and 4 must be populated by the Contractor.
 2. Re-coding of inspections not satisfying the accuracy requirements and verify the accuracy of the inspection immediately preceding and immediately following the non-compliant inspection. Repeat the process until the preceding and subsequent inspections meet the accuracy requirements.
- G. The Contractor shall maintain an up-to-date Progress Log that tracks the progress of the work and status of inspections, provided to the Engineer on a weekly basis. The log should document the following information at a minimum:
 1. Pipe Asset ID.
 2. Upstream and Downstream Manhole Asset IDs.
 3. Date of inspection.
 4. Date of data submission.
 5. Status of data acceptance / rejection.
 6. Date of data acceptance / rejection.
 7. Date of segment re-inspection (as required).
 8. Date of data resubmittal (as required).
 9. Date of resubmitted data acceptance (as required).
 10. e-Builder submittal number.
 11. Pipe size.
 12. Pipe shape.
 13. Survey length.
 14. Comments.
- H. The Engineer shall be entitled to an audit of the control system and be present when assessments of the sewer integrity are being determined. When requested by the Engineer in writing, the Contractor shall forward to the Engineer sufficient details and information for such audit assessment.
- I. Submittals may be subjected to an independent Quality Control/Quality Assurance (QA/QC) audit by the Engineer. Where inconsistencies are noted, the Contractor shall be responsible, where necessary and at no additional cost to the Owner, for corrections including, re-inspection,



recoding and entering additional information.

1.6 QUALIFICATIONS

- A. The Contractor shall submit documentation for Engineer approval to demonstrate the following experience as a business engaged in the CCTV, LASER and SONAR inspection of sewer lines per the contract documents:
 1. The Contractor shall be in good standing under local contracting requirements or otherwise properly registered, licensed or permitted by law to carry on business within the State of Michigan, County of Wayne throughout the term of the Contract, and shall provide the Engineer with evidence thereof per the contract documents.
 2. At any time during the term of the Contract, the Engineer may, at their sole discretion and acting reasonably, request updated evidence of good standing. A Contractor, who fails to provide satisfactory evidence, shall not be permitted to continue to perform any Work.
- B. The Contractor and/or any proposed Subcontractor, for the portion of the Work proposed to be contracted to them, shall meet the minimum qualifications as listed in the Contract Documents.
- C. The Contractor shall provide the Engineer with a complete list of Subcontractors whom the Contractor proposes to use prior to the commencement of Work.
- D. The Contractor shall be fully capable of performing the Work required in strict accordance with the terms and provisions of the Contract Documents.
- E. The Contractor shall submit, for the Engineer's approval, documentation to demonstrate the following experience of the staff proposed for this project:
 1. Operator certification documentation of each inspection operator/coder and reviewer's NASSCO PACP certificates, and for manhole inspectors, MACP certificates. The PACP and MACP certificates for all operators and reviewers performing the work shall be current on the day of the Contractor's submission and shall remain current throughout the performance of this work.
 2. Documentation of supervisors' and operators' training certifications, listing of completed projects, and a minimum of five (5) years of experience in the internal inspection of sewers using CCTV, LASER, and SONAR inspection technologies.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall furnish the television inspection studio, television camera, audio-visual digital encoding equipment/software, and other necessary equipment, materials, electricity, labor and technicians, as may be needed to perform the television inspection.



2.2 EQUIPMENT

- A. The Contractor shall submit a list describing all equipment to be used for review for compliance with the Contract.
- B. Alternate inspection technologies may be considered on a case-by-case basis.
- C. The Contractor shall be responsible for determining if their proposed equipment is capable of being inserted into the sewers through the existing standard manhole frames used in DWSD's system. The majority of the manhole frame inside diameter clear openings are 20 inches in diameter.
- D. Sewer and manhole inspection units are to consist of a self-contained vehicle with separate areas for viewing and storage, complete with the following equipment at a minimum:
 - 1. Cellular telephone and suitable communication system linking all crew members.
 - 2. Fans and blowers capable of removing fog that may be present in sewers at the time of the inspection.
 - 3. Video cameras, lighting, cables and power source.
 - 4. Video monitor and digital video recorder.
 - 5. Computer system with video capture card or dedicated unit and other related equipment.
 - 6. Temporary manhole covers to provide fall-in protection while performing work.
- E. Sewer CCTV Video Inspection Equipment:
 - 1. A complete closed-circuit color television system, including a camera, lighting, electronic footage counter, television monitor, mobile television studio, and digital video recorder/player used for the televising operations shall be specifically designed and constructed for sanitary, storm, or combined sewer inspections. Video inspection is to consist of the following:
 - a. Video camera capable of panning 360 degrees and tilting 270 degrees with optimum picture quality provided by focus and iris adjustment. Focal range to be adjustable from three (3) inches to infinity.
 - b. For pipes with a height of 35 inches or less, the inspection equipment shall be capable of inspecting up to 1,000 linear feet of sewer line without access to a manhole in between.
 - c. For pipes with a height of 36 inches or greater, the inspection equipment shall be capable of inspecting up to 2,000 linear feet of sewer line without access to a manhole in between.
 - d. The inspection equipment shall be capable of clearly televising the interior of 6 inch to 180-inch height sewer sizes.
 - e. The camera should be specifically designed and constructed for such sewer inspections and shall have above ground control for forward and backward movement in the sewer using tracked, wheeled, or tethered skid or flotation devices.
 - f. CCTV camera equipped with a locating sonde, designed for locating deep utilities and sewers, including those ten (10) feet deep or greater, or buried structures and



- junctions that cannot be located or accessed from ground surface.
- g. Capture the inspections in digital format in color from the live video source to the following minimum requirements:
 - i. Camera resolution at the point of capture / Picture Size: Pipes with a height of 35 inches or less shall be 720x480 at 29.97 frames per second. Pipes with a height of 36 inches or greater shall be 1920x1080 at 29.97 frames per second.
 - ii. Data/Bit Rate: 6.0Mbit/sec.
 - h. Inspections are to be provided on archival grade HDD to the following minimum requirements:
 - i. MPEG-2 or MPEG-4 format (H.264 MPEG-4 preferred).
 - ii. Picture Size: Pipes with a height of 35 inches or less shall be 720x480 at 29.97 frames per second. Pipes with a height of 36 inches or greater shall be 1920x1080 at 29.97 frames per second.
 - iii. Data/Bit Rate: 6.0 Mbit/sec.
 - i. Videos exhibiting any upscaling of the resolution that differs from the resolution obtained by the camera lens at the point of capture shall not be accepted.
 - j. Any manipulation of the aspect ratio that differs from the aspect ratio obtained by the camera lens at the point of capture shall not be accepted.
 - k. Lighting for the camera shall be waterproof and suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative and provide a clear picture in 100 percent humidity conditions. Lighting shall be adjustable to allow an even distribution of light around the sewer perimeter without loss of contrast, flare out of picture, or shadowing. Lighting shall illuminate the sewer or manhole ahead of the camera to be able to determine general condition, features and upcoming defects.
 - l. An unclear picture due to excessive lighting (image flare), the lack of lighting or the presence of fog, steam, or excessive humidity shall be considered unsatisfactory. The Contractor is responsible for identifying and implementing corrective actions to obtain suitable video quality, such as using fans or ventilation systems to dissipate the fog or by the heating of incoming air to mitigate fog.
 - i. A blurred picture due to fats, oil or grease shall be considered unsatisfactory. The Contractor is responsible for identifying and implementing corrective actions to obtain suitable video quality, such as cleaning the sewer mainline, having the camera lens cleaned prior to reinspection of the mainline.
 - ii. The Contractor is responsible for presenting issues regarding questionable video quality immediately to the attention of the Engineer.
 - m. Video overlay equipment capable of superimposing a minimum of 15 lines with up to 30 characters per line of alphanumeric information onto the video recording.
 - n. The focal length is the intersection point between the camera lenses widest horizontal viewing angle and the pipe's side periphery (03 or 09 o'clock) when the camera is level and looking forward. The rear of the camera must be positioned at the start of the pipe where the camera's physical distance is added to the focal length. This total distance is known as the cable calibration distance. Record the distance



- from the manhole to pipe interface to the cable calibration distance at the start of the inspection and adjust the distance reading so that zero is at the manhole to start of pipe interface.
- o. Sewers with a height of 35 inches and less shall be inspected with equipment which shall:
 - i. Have self-propelled rubber tired or crawler tractor capable of passing over minor surface imperfections including but not limited to broken joints and solid debris up to four (4) inches in height.
 - p. Sewers with a height of 36 inches and greater shall be inspected using an in-line inspection platform, which shall:
 - i. Be capable of inspecting a minimum of 2,000 linear feet of sewer line without access to a manhole in between.
 - ii. Have independently controlled drive tracks that enable the platform to maneuver around bends and climb over debris up to 12 inches in height.
 - iii. Be operable under partially or fully submerged flow conditions.
 - iv. Be operable in sewers of various cross-sections, and constructed of standard pipe materials including, but not limited to, brick, clay, concrete, PVC, HDPE, and steel.
 - v. Be tethered to facilitate extraction of the platform from the sewer, without causing damage to the sewer infrastructure, in the event the equipment fails or otherwise becomes uncontrollable within the sewer.
 - vi. Be equipped with sufficient high intensity lighting to illuminate the sewer for visual inspection.
 - vii. Have capability for simultaneous data collection from multiple inspection sensors/technologies including, but not limited to, CCTV video inspection, LASER and SONAR scanning.
 - viii. Transport equipment must be capable of allowing for adjustable camera height to be centered within pipe heights of up to and including 180 inches.
 - q. Minimum requirements of in-line inspection sensors / technologies: CCTV video inspection equipment shall conform to the requirements of the Contract Documents, and as modified herein:
 - i. Equipment shall be capable of continuously capturing digital video from first generation recordings with no frame loss, regardless of the progression of the inspection for the entire length being inspected.
 - ii. Incorporate a suitable distance-reading device to measure the location of the equipment in the pipe, to an accuracy of $\pm 0.5\%$ of the length of the inspection.
 2. An electronic footage counter shall accurately measure the distance of the CCTV inspection equipment from the centerline of the starting manhole within ± 2 feet. This measurement shall be displayed on the monitor and recorded on the video at all times and shall be termed the calibrated footage counter measurement. The importance of accurate distance measurements is emphasized.
 3. In areas where self-propelled track-mounted platforms are not practical given the conditions of the sewer during inspections, the inspections shall be performed using



alternate methods including tethered float or skid robotic systems, jetter assistance, or by man-entry methods. The Contractor shall notify the Engineer prior to the use of alternate inspection platforms as means of establishing tethers for floatation or skid systems where consensus on the appropriate methods of platform conveyance must be agreed.

F. Sewer Three-Dimensional (3D) LASER Scanning Inspection:

1. “Three-Dimensional (3D) Light Amplification by Stimulated Emission of Radiation Scanning” (LASER) is a technique to determine the surface profile of mainline pipes using a 3D LASER on the entire circumference above fluid level of the pipe which does not need to be attached to the CCTV inspection equipment.
2. LASER scanning equipment shall provide an accurate determination of pipe geometry (features and defects) above the fluid level.
3. LASER scanning shall be conducted on identified sewer pipe entities and be conducted from access point to access point.
4. Minimum equipment requirements are:
 - a. The provision of LASER scanning Internal Diameter and Deflection graphs shall be used to quantify internal pipe wall material loss/gain or deformation (ovality and deflection) at a given location. Pipe cross-sections obtained from high resolution scans shall be used to provide quantitative information regarding internal pipe diameter, including ovality. Precision Scans are produced with multi- color indication depicting deviations from as built conditions as well as localized material gain and/or loss.
 - b. The LASER shall be Class 1; eye-safe for operator safety.
 - c. Surface corrosion measurements accurate to 13/64 inch at 9 feet in 48-inch pipes and larger.
 - d. Precision ovality/deflection detailed range LASER measurement scans accurate to $\pm 1\%$.
 - e. LASER equipment shall be moved through the pipeline on a transport vehicle capable of supporting the LASER inspection equipment above the water level.
 - f. LASER scans shall produce a point cloud with a maximum distance between points of 3/8 inch in the transverse direction and 1 1/2 inch in the longitudinal direction. The rate of scan shall not exceed 18 feet per minute.

G. Sewer SONAR Scanning Inspection:

1. Sound Navigation and Ranging (SONAR) scanning equipment shall accurately measure the depth to sediment or pipe surface below the fluid level at regular intervals throughout the inspection.
2. SONAR scanning shall be conducted on identified sewer pipe entities and be conducted from access point to access point.
3. Minimum equipment requirements:
 - a. SONAR equipment must be programmable multi-frequency profiling SONAR specifically adapted to using sound waves to locate and map subaqueous sewer irregularities by creating continuous SONAR images recorded in “real time” mode.
 - b. SONAR equipment shall be digital and support a range of frequencies from 600



- kHz to 2.25 MHz to minimize noise.
- c. The range resolution measurement error shall be no greater than 5/64 inch from distances of three (3) to 12 feet, and no greater than 13/32 inch from distances of beyond 15 feet.
- d. The minimum detectable range for the SONAR unit shall be three (3) inches.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The Contractor shall comply with all residence notification requirements in Section 33 01 30.18 – Security Clearances and Communications.
- B. Working hours shall be in accordance with Section 01 14 00 – Work Restrictions.
- C. Sewers and associated upstream or downstream manholes and/or catch basins shall be cleaned of loose or settled debris and removed from the sewer prior to inspection with the methods and equipment detailed in this Specification.
- D. It shall be the responsibility of the Contractor to locate manholes, pipes and/or catch basins identified for survey or required for access to pipes identified for survey in the contract mapping by whatever means necessary including, but not limited to, searching for visual evidence of the manhole, use of a metal detector, use of GPS survey equipment, and use of CCTV equipment and a sonde locator. The use of these tools and technologies, and time spent to locate manholes, catch basins or pipes, are incidental to the cost for cleaning and inspection of manholes, catch basins and pipes, and no additional payment shall be allowed.
 - 1. If the CCTV camera cannot reach the manhole due to pipe access issues such as collapses, cross-bores or other conditions requiring an external point repair, the Contractor shall notify the Engineer. The Engineer shall notify the Contractor to return if the Engineer arranges for the performance of the external point repair. If the Contractor, having attempted the search from all possible pipe directions, determines that the manhole does not exist at that location and the GIS mapping is incorrect or if the Contractor arrives at a bulkhead, blind tie, catch basin or other termination point which is not a manhole, the Contractor shall notify the Engineer. The Engineer shall review the efforts of the Contractor and determine if the search shall be considered complete. If the Engineer considers the search complete, the Contractor shall mark the inspection as not found (NF) in the Manhole Inspection, providing adequate detail on efforts made to locate the asset and site observations, provide a manhole empty header record in accordance with 3.4 of Section 33 01 30.31 - Manhole Inspection for Condition Assessment, and move on to the next asset for inspection.
 - 2. If a manhole is buried at a depth of less than two (2) feet in unpaved areas, the Contractor shall arrange for the manhole to be exposed. This work shall be considered incidental to the sewer inspection and no additional payment will be allowed. The Contractor shall



notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Engineer may direct the Contractor to either fill the hole back in at no additional cost to the Owner or to raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Unpaved Areas –Less Than Two (2) Feet”.

3. If a manhole is buried at a depth greater than or equal to two (2) feet in unpaved areas, the Contractor shall arrange for the manhole to be exposed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Contractor shall raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to expose and raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Unpaved Areas - Greater Than or Equal To Two (2) Feet”.
4. If a manhole is buried in paved areas, the Contractor shall arrange for the manhole to be exposed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Contractor shall raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to expose and raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Paved Areas”.
5. Furthermore, for additional work where efforts to open manholes that may be welded shut, have stripped bolts, broken locking devices, stuck or broken covers, or other conditions preventing the opening of the structure and requiring mechanical equipment and/or hand tools to open, the Contractor shall be compensated by time and materials using the allowance, “Provisional Allowance”. This item shall be used in agreed-upon locations, after one (1) hour of labor expended in the Contractor’s reasonable attempt to access and gaining entry to an individual manhole that has been located.
6. The Contractor shall edit the record drawings or provide the Engineer with a legible sketch drawing to identify the approximate location of any manholes, structures, or piping that are not accurately depicted on the mapping (more than ten (10) feet from the location shown in the mapping, or outside of the ROW or easement shown on the mapping), does not exist, or is not shown on the mapping. The Contractor shall GPS survey any newly found manholes or structures, or those not accurately depicted to submeter accuracy. Markups shall be confirmed with the Engineer and should be legibly recorded in the record drawings. The edited record drawings or sketches shall be provided to the Engineer with each bi-weekly inspection submittal or upon request by the Engineer.
7. Once any phase of the work is started in an area, work shall continue in a timely manner, until all manholes and pipe sections are cleaned and inspected in that area. Complete internal inspection of manholes within a week after cleaning assuming that the manhole is still clean upon initial inspection.
8. For pipes less than 36 inches in height, the final pass of cleaning shall be undertaken in conjunction with the CCTV camera inspection that is to be provided as the final inspection deliverable.

- E. Sewers and manholes may be located in easements, through public or private property, City-owned parklands, rights-of-way and restricted alleyways where no paved access may exist, or where paved access is obstructed to the extent that would inhibit equipment and materials



mobilization. It shall be the Contractors responsibility to identify these sewers and arrange for access using “Door Hanger” notifications as necessary and to restore any surface damage to private and City-owned property.

- F. Where access routes to various manhole locations must be cleared of heavy vegetation, the Contractor shall perform the clearing of pathways and alleyways to the extents necessary to facilitate mobilization of cleaning and internal sewer inspection equipment. The Contractor shall not remove vegetation on private property or outside of the sewer easement or right-of-way.
 - 1. Any vegetation or other debris cleared by the Contractor shall be removed and disposed of properly by the Contractor, and the site restored by the Contractor.
 - 2. Trees larger than six (6) inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall not be removed as part of the work. The Contractor shall notify the Engineer of site conditions that impede the completion of the work.
 - 3. Trees smaller than six (6) inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall be removed as part of the work and shall be incidental to the Contract.
- G. The Contractor shall clear restricted alleyways or easements to enable the mobilization of inspection and cleaning equipment. This work shall be incidental to the sewer cleaning and inspection activities.
- H. The Contractor shall schedule, maintain, and coordinate all activities and shall cooperate with the Engineer such that a minimum of interruption to the services results. The Contractor shall not operate existing system valves, controls, or other appurtenances at any time, but when the same is needed to facilitate and accommodate activities, shall request such operation from the Engineer. The Contractor shall provide the Engineer with 48-hour advance notice for such assistance.
- I. The Contractor is hereby made aware that no flow shall be discharged to any waterbody, wetland, floodplain or storm outlet during cleaning or inspection operations. Additionally, no sewage shall be permitted to surcharge to the point that it overflows to any of the above or back into private buildings through lateral connections. The Contractor must notify the Engineer immediately of any spill event. Any damage or fines resulting from such occurrences are the sole responsibility of the Contractor.
- J. The Contractor shall notify the Engineer 96 hours prior to mobilizing for internal inspection or cleaning activities.

3.2 FLOW CONTROL

- A. Undertake flow control measures such as working during off-peak hours, the use of sewer cleaning equipment to lower downstream flow levels or blocking/plugging if sewer flows are hampering effective sewer cleaning.
- B. Provide the Engineer with at least 48 hours of advance notice and proposed method of flow control before undertaking flow control measures for sewers larger than 18 inches in height.



- C. Use sewer plugs to stop or reduce sewer flow that tether to and are removable from the ground surface.
- D. Monitor flow levels upstream of a plugged sewer at all times to ensure flooding of public or private property does not occur.
- E. Flow control shall be incidental to the contract. It is not the intent of this Specification to require bypass pumping to control heavy flow; however, the Contractor must, at a minimum, make reasonable effort to control the flow by using pipe-cleaning equipment to temporarily retain flow or to remove standing water.
- F. The Contractor must also consider weather conditions and low diurnal flow patterns to obtain the best video image of the sewer. This may require the Contractor to schedule video work to times that are after major rain events or to overnight shifts when the sewer system attains a lower dry weather flow environment. These inspections need to be coordinated with City to identify opportune times for low flows expected from the hydraulic model.
- G. The Contractor is to maximize visual inspection to as great a degree as possible. For pipes of height of 35 inches or less, regardless of the number and type of cleaning passes performed, the final pass of cleaning shall be undertaken in conjunction with the CCTV camera inspection that is to be provided as the final inspection deliverable. During the final cleaning pass, the CCTV inspection camera shall be mobilized to inspect the sewer segment while the jet nozzle pulls water away from the camera, drawing any water level down to maximize the exposure of the sewer pipe circumference.
- H. The Contractor is to maximize visual inspection to as great a degree as possible. For pipes of height of 35 inches or less where the water level continues to be greater than 50% of the pipe height after the Contractor has attempted to lower the water level by means of hydraulic equipment, the Contractor is to inform the Engineer. The Engineer may direct the Contractor to not clean the pipe and perform the inspection with a combination of CCTV and SONAR equipment mounted on a multi-sensor platform.
- I. No flow control shall be undertaken for sewer pipes with a height of 36 inches and larger.

3.3 CCTV INSPECTION

- A. All open access structures or manholes shall be attended at all times. All access structures or manholes that were sealed or bolted to control odors, or to prevent entry of extraneous water, or for security reasons, shall be resealed or re-bolted after entry and exit. The Contractor shall provide evidence that sealed or bolted chambers have been adequately sealed or bolted, after inspection.
- B. The Contractor understands that DWSD shall incur significant and substantial penalties from the state of Michigan in the event that sewage is discharged onto the ground or into any streams as related to the work in this Contract. In the event that sewage is released into the environment as a result of the Contractor's work, the Contractor shall immediately rectify the situation and notify



the Engineer.

- C. At the commencement of each CCTV inspection, temporarily insert a survey rod or steel tape from the manhole surface to the invert of the pipe that is to be surveyed so that the rod or tape vertically crosses the 12 to 6 o'clock positions. The gradations shall be clearly visible in the resultant video footage so the pipe height can be verified by viewing the footage.
- D. Ensure camera speed does not exceed 30 feet / minute during sewer and manhole inspections.
- E. Inspect sewer pipelines and manholes with pan and tilt conventional television imagery to record relevant features and defects of the pipeline under inspection. Inspection of pipelines shall be carried out in accordance with NASSCO PACP standards in conjunction with cleaning operations in accordance with the requirements of the contract documents. A NASSCO PACP certified technician or supervisor, who shall be located at the control panel in the mobile television studio, shall control the operation of the television equipment.
- F. If television inspection of an entire section cannot be successfully performed from one manhole, perform a reverse setup to obtain a complete television inspection.
 - 1. Perform a reverse set-up inspection when a blockage in the sewer prevents completion of the inspection from one manhole. Move the equipment to the other manhole at the opposite end of the sewer segment and attempt to complete the inspection of the entire sewer to the original manhole.
 - 2. Immediately advise the Engineer when a complete sewer inspection cannot be completed. In the event the Contractor is unable to completely perform CCTV inspection or cleaning from both directions (with the exception of a cross-bore or collapse), the Contractor must inform the Engineer of this immediately. Upon approval by the Engineer, the Contractor shall, within two weeks, have the obstructions removed using specialty cleaning equipment capable of removing the obstruction and simultaneously viewing the cleaning activity from the same vantage point in order to view the cleaning operation and not cause any damage to the host pipe. The Contractor shall then televise the pipe segment in its entirety.
 - 3. If the Contractor cannot complete the inspection after attempting to use specialty cleaning equipment, the Contractor and Engineer shall jointly select one of the following alternatives regarding the obstruction:
 - a. Abandon the inspection.
 - b. Re-perform the inspection subsequent to completion of external or emergency repair.
- G. Note in a log the Asset IDs for the pipe and connecting manholes, surface distance or calibrated footage counter measurement, upstream and downstream length from associated manhole, length of missing video and the reason the inspection could not be completed on a weekly basis.
- H. Whenever prevailing conditions allow, position the camera head to reduce the risk of picture distortion. In circular sewers, position the camera lens centrally (i.e., in prime position) within the sewer. In noncircular sewers, picture orientation shall be taken at mid-height, unless otherwise agreed, and centered horizontally. Direct the camera lens along the longitudinal axis of the sewer



when in prime position. A positioning tolerance of +/- 10 percent of the vertical sewer dimension shall be allowed when the camera is in prime position.

- I. Indicate on the monitor screen accurate automatic distance measurement that begins to move immediately as the camera moves. Ensure measurement is accurate from the cable calibration point to the pipe to finish manhole interface.
- J. Above Ground Measure (AGM) is required in order to check the horizontal footage of the inspected sewer at the surface as compared to the footage listed in the CCTV video. If a difference in the recorded footage exceeds a tolerance of 2 feet, calibration of CCTV equipment may be needed.
 1. Measure the distance between the center of the start and finish manholes on the ground surface above the sewer to the nearest half an inch using a survey grade ISO 16331- 1:2012 (E) approved outdoor LASER distance measurer capable of attaining 500 feet minimum surface distance, or alternative approved measuring methods, before beginning the sewer inspection. The center of the manhole shall be based on the center of the manhole cover regardless of the manhole configuration. If bends are identified to exist within the sewer segment, the Contractor shall approximate the measurement on the ground surface using incremental distances to the approximate alignment of the sewer between the start and finish manholes.
- K. All defects and observations are to be circumferentially located based on the side periphery only.
- L. Stop the camera and position to provide a steady two (2) second perpendicular view of connections, junctions, major branches and major defects including deformed sewers, displaced bricks, holes, large displaced joints, missing bricks, missing mortar, obstructions, and large open joints.
- M. Tap observation distances must occur at the center of the tap and the side periphery. To determine use and deficiencies of the tap, the camera must continue to travel, camera centered in the perspective view (to capture other observations), to stop perpendicular to the tap and pan so that the camera can view directly into the barrel of the lateral, to enable the inspector to apply modification and descriptor codes to the tap as per NASSCO PACP standards as necessary.
- N. All sewer laterals (taps) shall be associated to a physical property address, and this shall be recorded within the PACP inspection. Further to coding Taps, the Contractor shall conform to NASSCO requirements; however, where defective Taps are identified, the most significant observed defect seen within the lateral shall be communicated within the "Remarks" field as per PACP requirements including but not limited to appropriate dimensioning, percentage values and clock references relating to its defect, but also providing the associated property address of the Tap comma separated for data processing requirements, but also providing the sewer location if it is in the rear, side or front of the property (e.g., "RM, 50%, 03, 09, 456 Second Avenue, Rear"). Furthermore, the Contractor shall identify the affected property by completing a steel tape or calibrated footage counter measurement on the surface to confirm property number and note this within the "Remarks" field with an associated photograph taken of the offending defective tap.



- O. Perform television inspections during low flow conditions. If it is determined that effective conventional television inspection cannot be performed, notify the Engineer in writing.
- P. Observations that are critical to public safety or pose imminent threat to the public or environment shall be reported within 24 hours.

3.4 MULTI-SENSOR INSPECTION

- A. For inspection of circular brick pipe where the pipe is 36 inches in height or greater and non-circular pipe for all materials where the pipe is 36 inches in height or greater, the LASER capability on multi- sensor inspection equipment shall be turned on and data shall be collected. Post-processing of the LASER data shall be performed with the confirmation of the Engineer after initial review of the processed PACP coded inspection data. LASER and SONAR deliverables are to be provided in standard Windows software compliant formats. Any proprietary software to view data must be provided to the Owner by the Contractor at no additional cost or Contractor shall convert data from any proprietary software formats to one that is compliant with standard Windows software.
- B. SONAR shall be performed on gravity sewers 18 inches in height and greater, where needed, with the confirmation of the Engineer.

3.5 DIGITAL VISUAL RECORDING

- A. Take continuous digital video recordings of the inspection view as it appears on the television monitor. The recording shall be used as a permanent record of defects. The video recording shall be in MPEG file format. The digital video encoding shall include video information that can be reproduced with a video image equal or very close to the quality of the original picture on the television monitor. The replay of the recorded video information when reviewed by the appropriate MPEG 2/4 viewing software, shall be free of electrical interference and shall produce a clear, stable image.
- B. Create separate MPEG video files for each sewer line segment. In case of a reverse setup, store such inspection in a separate MPEG file. The MPEG video files shall be written to 2.5-inch portable HDD, or other digital media acceptable to the Engineer and delivered to the Engineer. Multiple digital videos may exist on each HDD. Each HDD folder shall be labeled, at a minimum, with the following information: Project Name, Date and time of inspection, pipe segment referenced Asset ID, Sewer Line Sections with manhole IDs, Direction of survey, Current distance along reach (calibrated footage counter measurement), and TV Inspection Contractor's firm name.
- C. For sewers, provide file names for each digital video file in accordance with the following:
[P/O Number]_[Pipe Asset ID]_[Upstream Manhole ID]_[Downstream Manhole ID]_[Direction]_[YYYYMMDD]_[HHMMSS – 24 hour format].filetype
 e.g., DWS-
 999_WWGM0000158929_WWMH0000046603_WWMH0000003063_D_20211130_134159.m



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- D. Digital video still frame images shall be captured in the highest resolution based upon the appropriate picture size for the diameter from the video captured in JPEG format for every observation. Photographs shall be clear and accurately show the observation. Photographs shall have the following annotation:
[Pipe Asset ID]_[Upstream Manhole ID]_[Downstream Manhole ID]_[Direction]_[YYYYMMDD]_[HHMMSS – 24 hour format]_[Code]_[Footage]_[Clock At From].jpg.
 e.g.,
 WWGM0000158929_WWMH0000046603_WWMH0000003063_D_20211130_134129_DAE_27.0_3.jpg
- E. CCTV video header information shall be recorded for each pipe segment video and shall be displayed for a minimum of 30 seconds at the start of all inspections. Inspection of the sewer shall not proceed while the information screen is being displayed. The data must be presented in a format with white text on a black background. The following information shall be provided in the video header.
1. Project Number: Use Project Number for this, e.g., DWS-999
 2. Date: Date inspection was completed. Format: MM-DD-YYYY. e.g., 12-20-2022
 3. Time: Time survey was initiated. Format: 24-hour military, HH:MM. e.g., 15:22
 4. Surveyed By: Name of PACP certified inspection operator conducting the inspection. e.g., Robert Jones
 5. Certificate Number: NASSCO certificate number of the operator conducting the inspection. e.g., U-070070012345
 6. Company: Name of company completing the inspection. e.g., ACME
 7. Start MH ID: Asset ID number of the manhole where the inspection is initiated. e.g., WWMH0000001234
 8. Finish MH ID: Asset ID of the manhole where the inspection is ended. e.g., WWMH0000001235
 9. Pipeline Reference Asset ID: Asset ID of the pipe segment. e.g., WWGM0000123456
 10. Street: Physical address (number and name). e.g., 1234 Elm Street
 11. Location Details: Enter further details on the location. Use permanent landmarks and building for reference instructions to help locate start manhole in the future. e.g., "back yard under a deck".
 12. Survey Direction: Direction of inspection in relation to flow in the sewer, e.g., Upstream or Downstream.
 13. Material: Material composition of sewer being inspected. Format: NASSCO PACP code. e.g., VCP
 14. Height: Nominal sewer dimensions, in inches. Pipe diameter if circular, height if non-circular. e.g., 24
 15. Width: Nominal sewer dimensions, in inches. Maximum width if non-circular. Must be populated if the pipe is non-circular. e.g., 18
- F. The Contractor shall supply digital video files containing all video inspections and coding data to the Engineer. The Contractor shall provide at least three (3), 2.5-inch portable HDD, complete with all associated drivers and software, power adaptors and USB cables, delivered on a bi-weekly



rotation exchange that contains completed sewer inspection video with viewing software and sewer condition coding data to the Engineer. Sewer condition coding shall be submitted as a PACP.mdb files accordingly. Retained HDDs shall be returned at an agreed frequency. Alternatively, data may be provided through the use of a cloud-based application with the confirmation of the Engineer. The final determination for data transfer shall be confirmed by the Engineer.

- G. All HDDs shall be sized and formatted appropriately to accommodate all above-mentioned files and have dual USB 3.0 (preferable) and (a minimum) USB 2.0 compatibility with a minimum data transfer rate of 480 MB/s.
- H. The Contractor shall organize data accordingly within the following folder structure when providing PACP data submittals:
 - 1. Database (folder)
 - 2. Videos (folder)
 - 3. Photos (folder)
 - 4. Reports (folder)
 - 5. CCTV Inspection Data Submittal Tracking Spreadsheet
 - 6. QA Review Report

3.6 UNMAPPED ASSETS

- A. If television inspection reveals new manholes, locate, mark by painting or flagging and name the manhole in accordance with the methodology for temporary or new Asset ID for new manholes and sewers per the specification. The manhole shall be exposed and raised, if required, in accordance with 3.1.D of this Specification.
- B. All unmapped manholes shall be inspected as per the Specification and also internally scanned during the pipe inspection.
- C. For manholes that are more than ten (10) feet from the location shown in the mapping, or outside of the ROW or easement shown on the mapping or for newly found manholes, the Contractor shall provide the Engineer with a legible sketch drawing that provides the location of the manholes, structures, or piping and GPS survey the manhole to submeter accuracy. The edited record drawings or sketches will be provided to the Engineer with each bi-weekly inspection submittal or upon request by the Engineer. All sketches shall be named in the following format:

[P/O Number]_[Pipe Asset ID]_[Contractor Name]_PACP_Submittal_[Number].pdf e.g.,
 DWS-999_WWGM0000158929_ACME_PACP_Submittal_025.pdf
- D. Unmapped assets, including manholes and pipes, shall be assigned Asset IDs through the use of DWSD's Field Maps App by the Contractor. It shall be the responsibility of the Contractor to coordinate their work and incorporate the newly mapped assets and corresponding Asset IDs into their GPS, sewer pipe and manhole inspections. Care should be taken by the Contractor not to name the same unmapped asset with a different Asset ID through the Field Maps App when it is



used by different inspection crews.

- E. The split pipe segments resulting from newly found manholes shall be assigned Asset IDs by the Contractor through the use of DWSD's Field Maps App. The original Asset ID of the pipe shall remain as-is from the start node of the survey to the point of the newly found manhole and the Asset ID generated by the Field Maps App shall be assigned to the next portion of the pipe section to the originally mapped end node.
- F. If a newly found pipe is encountered from a manhole survey, it shall be inspected.
- G. Any unmapped assets discovered in the field shall be reported to DWSD on a daily basis.
- H. Manhole inspections shall be conducted in accordance with NASSCO MACP version 7.0.0 (or newer) Level 2 standards but by utilizing non-man-entry techniques as noted in Section 33 01 30.31 - Manhole Inspection for Condition Assessment.
- I. All open access structures or manholes shall be attended at all times, and all access structures or manholes that were sealed to control odors or entry of extraneous water shall be resealed after entry.

3.7 INSPECTION REPORTS

- A. Prepare a television inspection report covering the television inspection work and the information acquired. Inspection forms shall be completed and submitted for all pipe sections requiring inspection, including those for which an actual inspection cannot be performed as described in this Specification.
- B. Name the report files according to the following file specification:
[P/O Number]_[Pipe Asset ID]_[Upstream Manhole ID]_[Downstream Manhole ID]_[Direction]_[YYYYMMDD]_[HHMMSS – 24 hour format].pdf
 e.g., DWS-999_WWGM0000158929_WWMH0000046603_WWMH0000003063_D_20211130_134159.pdf
- C. Report sewer defects in accordance with the National Association of Sewer Service Companies (NASSCO) program known as Pipeline Assessment and Certification Program (PACP).
- D. In addition to completing all mandatory PACP inspection required fields, the Contractor shall complete the following fields in the PACP Header Section shown in the table below. Additional notes are as follows:
 - 1. Field 3 – “Reviewed By” shall be required only for those inspections that are QA reviewed.
 - 2. Field 4 – “Reviewer Certificate Number” shall be required only for those inspections that are QA reviewed.
 - 3. Field 5 - “Owner” is DWSD.
 - 4. Field 7 – “P/O Number” is the Project Number, e.g., DWS-999.
 - 5. Field 10 – “Project” is the Project Area, e.g., Neighborhood A.



6. Field 18 – “Purpose of Survey” is to be set to “G”.
7. Field 25 – “Pipe Segment Reference” is the Asset ID of the pipe.
8. Field 32 – “Width” must be populated if the pipe is non-circular.
9. Field 37 – “Pipe Joint Length” is only mandatory for pipes with obvious joints at regular intervals and is not applicable to brick, segmental block, clay tile or monolithic cast-in-place concrete.
10. Field 38 – “Total Length” is the Above Ground Measurement.

Pipe Header Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
General Information	1	Surveyed By (Operator / PACP User Name)	Yes	Yes
	2	Certificate Number	Yes	Yes
	3	Reviewed By	Optional	Optional
	4	Reviewer Certificate Number	Optional	Optional
	5	Owner	Optional	Yes
	6	Customer	Optional	Yes
	7	P/O Number	Optional	Yes
	8	Work Order	Optional	Optional
	9	Media Label	Optional	Optional
	10	Project	Optional	Optional
	11	Date	Yes	Yes
	12	Time	Optional	Yes
	13	Sheet Number	Yes	Yes
	14	Weather	Optional	Yes
	15	Pre-Cleaning	Yes	Yes
	16	Date Cleaned	Optional	Yes
	17	Flow Control	Optional	Yes
	18	Purpose of Survey	Optional	Yes
	19	Direction of Survey	Yes	Yes
	20	Inspection Technology Used	Optional	Yes
	21	Inspection Status	Yes	Yes



Location	22	Consequence of Failure	Optional	Optional
	23	Pressure Value	Optional	Optional
	24	Drainage Area	Optional	Optional
	25	Pipe Segment Reference	Optional	Yes
	26	Street (Name and Number)	Yes	Yes
	27	City	Yes	Yes
	28	Location Code	Optional	Yes
	29	Location Details	Optional	Yes
Pipe	30	Pipe Use	Yes	Yes
	31	Height (Diameter)	Yes	Yes
	32	Width	Yes	Yes
	33	Shape	Yes	Yes
	34	Material	Yes	Yes
	35	Lining Method	Optional	Yes
	36	Coating Method	Optional	Optional



PipeHeader Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
	37	Pipe Joint Length	Optional	Yes
	38	Total Length	Optional	Yes
	39	Length Surveyed	Optional	Yes
	40	Year Construction	Optional	Optional
	41	Year Renewed	Optional	Optional
Measurements	42	Upstream Manhole (MH) Number	Yes	Yes
	43	Upstream MH Rim to Invert	Optional	Yes
	44	Upstream MH Rim to Grade	Optional	Optional
	45	Upstream MH Grade to Invert	Optional	Optional
	46	Upstream MH Northing	Optional	Optional
	47	Upstream MH Easting	Optional	Optional
	48	Upstream MH Elevation	Optional	Optional
	49	Downstream Manhole (MH) Number	Yes	Yes
	50	Downstream MH Rim to Invert	Optional	Yes
	51	Downstream MH Rim to Grade	Optional	Optional
	52	Downstream MH Grade to Invert	Optional	Optional
	53	Downstream MH Northing	Optional	Optional
	54	Downstream MH Easting	Optional	Optional
	55	Downstream MH Elevation	Optional	Optional
	56	MH Coordinate System	Optional	Optional
	57	MH Vertical Datum	Optional	Optional
	58	GPS Accuracy	Optional	Optional
	59	Additional Information	Optional	Yes*

Yes* - if required.

- E. An “empty header” or “0-ft MSA” inspection shall be completed for sewer segments that cannot be inspected for reasons such high flow, depths or velocities, inaccessibility to the sewer due to inaccessible or unlocated access structures, heavy debris, etc. The inspection form header and detail sections shall comply with NASSCO PACP guidelines populating all required header fields. The contractor shall abandon the survey at a distance of 0-ft inspected and provide a general comment that describes the reason that the inspection cannot be conducted in the Additional Information field. An “empty header” inspection shall also be created for reversal inspections that cannot be completed. Contractor shall record at least one photo documenting conditions preventing the inspection of the pipe segment. Empty header records, and image references for the photos, shall be included in the PACP database as submitted by the contractor with adjoining segments.



- F. Contractor shall provide a summary listing of all manholes or structures included in the original task order, listing the date of inspection or attempted inspection, and indicating if the manhole was inspected, or if not, the reason, e.g., not found (NF), no access (NA), not opened (NO), structure is a lamphole (LH) or cleanout (CO), or other reason.
- G. The MSI Report shall include the following information:
1. LASER Scanning Inspection:
 - a. Summaries of pipe corrosion and debris build-up, presented as unrolled color-coded full-circumference graphical illustrations of pipe condition, over the length of the sewer inspected. Where the presence of fluids in the pipe necessitates interpolation to complete the full circumference view, the method and calculations used to support these assumptions shall be presented.
 - b. Cross-sectional scans, taken at regular intervals along the inspected sewer segment, showing measured pipe cross section superimposed over as-built pipe cross section, and color highlighted to identify all areas of apparent cross-section loss and gain, construction or defective pipe features in alignment with CCTV payout distances.
 - c. All raw and post processed LASER data shall be submitted with associated and compiled reports that shall determine pipe geometry for features including but not limited to defects, construction features and pipe shape above fluid level.
 - d. LASER deliverables are to be provided in standard Windows software compliant formats. Any proprietary software must be provided to the Owner at no additional cost to the Owner.
 - e. Summaries of pipe ovality and deflection, including:
 - i. Vertical and horizontal diameter plots of individual diameter measurements versus pipe length, for each section of sewer inspected.
 - ii. Ovality plots depicting percent deviation from as-built records.
 - iii. LASER data as VRML (Virtual Reality Modeling Language) 3D computer graphic representations, in WRL format, with software viewer that can be used to display and interpret the LASER data.
 2. SONAR Scanning Inspection:
 - a. Graphical summaries of sediment thickness and cumulative sediment volumes in the trough of the pipe below the water line versus pipe location, and pipe capacity depicting actual versus original theoretical storage capacity.
 - b. Statistical average, minimum, and maximum values of sediment accumulation along the sewer, where appropriate, as determined by calculating the portion of the pipe obstructed by sediment and presented as a percentage of the pipe area.
 - c. Cross-sectional scans, taken at regular intervals along the inspected sewer segment, showing sediment and pipe shape to identify all apparent cross-section loss or gain in alignment with CCTV payout distances.
 - d. Video file of SONAR data in AVI, MOV, MPEG-2 or MPEG-4 file formats.
 - e. All raw and post processed SONAR data shall be submitted with associated and compiled reports that shall determine pipe geometry for features including but not limited to potential defects, debris and water levels and pipe shape below fluid level.



- f. SONAR deliverables are to be provided in standard Windows software compliant formats. Any proprietary software must be provided to the Owner at no additional cost to the Owner.

3.8 OBSERVED FAILURES DURING SEWER AND MANHOLE INSPECTIONS

- A. Cross-bores are intersections of one utility pipeline through another, such as when a gas pipeline is inadvertently installed through a sewer pipeline. Cross-bores generally occur when a third-party utility is installed using a trenchless method that prevents visibility of the underground sewer pipeline and are commonly a water or gas service.
 1. Cutting devices are to be used in conjunction with CCTV equipment only.
 2. Cutting devices are not to be used in the vicinity of cross-bores.
 3. Capture photograph or digital images and notify the Engineer immediately where third-party cross-bores are observed during the sewer or manhole inspection. Provide the captured CCTV images and the distance from the start node of the inspection along the pipe to note the location of the cross-bore to the Engineer immediately after observation.
 4. MISS DIG (811) should be contacted to provide locates prior to all cleaning operations located in the right of way to reduce impact with potential cross-bores.
 5. A reverse set-up inspection shall be performed when a cross-bore prevents completion of the inspection from the initial access point. Move the equipment to a different access point and attempt to complete the inspection of the pipe up to the cross-bore location.
- B. In addition to standard NASSCO inspection, the Contractor shall also be required to record and locate any sinkholes or cave-ins along the pipe alignment for up to 20 feet on either side of the pipe that are greater than six (6) inches deep and two (2) feet wide within the public right of way or easement prior to performing the CCTV inspection. Upon confirmation by the Engineer, immediately following the initial condition assessment CCTV inspection, certain sinkholes shall be dye-tested to determine if the dye reaches the sewer and the location where the dye is observed shall be recorded as part of a Dye-Test CCTV inspection for verification purposes. The Contractor shall record the sinkhole information in DWSD's Esri Field Maps App or Cityworks application. The Contractor shall provide the two (2) captured images of the sinkhole (image from above and location image), submeter X and Y coordinates, location and dimensions of the sinkhole, if the sinkhole was dye-tested and the results of the dye-test including the Asset ID of the televised pipe or manhole where the dye was observed. This work shall be paid under the bid item, "Sewer Inspection Dye Testing for Sinkholes/Cave-ins".
- C. Capture photographs or digital images and notify the Engineer immediately after observation where issues identified in the tables below are observed during the sewer or manhole inspection. Provide the captured images in addition to Asset IDs, observed issue identified by defect code and description, and footage along the pipe to the Engineer immediately via e-mail after observation. The format of this communication is shown in the Appendix. The Engineer shall create the incident within the ArcGIS Esri Field Maps or Cityworks application for review by Engineering.
 1. Structural:



Defect	Grade	Description
X	5	Collapse
DR	5	Deformed Rigid
H	5	Hole
HSV	5	Hole Soil Visible
HVV	5	Hole Void Visible
X (Lateral)	5	Collapsed Lateral

2. Operational:

Defect	Grade	Description
OBI	5	Obstruction Intruding Through Wall
RBB	5	Roots Ball Barrel
IG	5	Infiltration Gusher
IR	4	Infiltration Runner

3. Miscellaneous:

Defect	Grade	Description
MWLS	5	Miscellaneous Water Level > 75%

- D. Place barricades around the location above the sewer or manhole where a void is visible or suspected to be outside of the sewer pipe or manhole and immediately notify the Engineer, or Detroit Water and Sewerage Department (DWSD) Emergency Services at telephone number 313-267-8000 after normal working hours if the Engineer cannot be reached. Caller should be prepared to share project specific information such as address, street intersections, and describe the emergency situation.
- E. The Engineer shall arrange for emergency sewer or manhole repairs to be performed if required as soon as possible if the inspection cannot be completed or the sewer or manhole condition poses an immediate operational or safety concern such as a complete collapse.
- F. Emergency sewer or manhole repairs shall be prioritized if more than one emergency repair arises at the same time.
- G. Carry out inspection of other sewers not affected by the emergency repair and complete inspection of the sewer when notified by the Engineer that the emergency repair has been completed.
- H. Perform repeat cleaning of the sewer in accordance with Section 33 01 30.32 - Sewer Cleaning for Condition Assessment if required.



3.9 REMOVAL OF EQUIPMENT THAT BECOMES STUCK IN A SEWER

- A. No additional compensation shall be provided to remove equipment or repair the sewer in the event the Contractor's equipment becomes stuck in the pipe or is otherwise damaged as a result of conducting work in the sewer.
- B. The Contractor shall advise the Engineer immediately if equipment becomes stuck in a sewer. The Contractor shall attempt to remove equipment that is stuck using whatever means are necessary for up to four (4) hours. The Contractor shall advise the Engineer if the equipment cannot be freed after four (4) hours and mark the position on the surface over the sewer where the equipment is stuck.
- C. The Engineer shall arrange to have an excavation made to the top of the sewer where the equipment is stuck within a reasonable time frame of notification the equipment cannot be freed at the expense of the Owner.
- D. The Contractor shall advise the Engineer if bypass pumping is required to ensure the normal sewer flow continues while the obstruction is present. All costs incurred due to the bypass pumping activity shall be at the cost of the Owner.
- E. The Contractor and Engineer shall be present during the excavation and once the top of the sewer is exposed and the excavation is secured, the Contractor shall do one of the following:
 - 1. Remove the top of the sewer pipe and retrieve the equipment stuck in the sewer or;
 - 2. Defer removal of the top of the sewer and retrieval of the stuck equipment to the excavation contractor. Damages caused to the stuck equipment shall not be the responsibility of the excavation contractor. No claim for equipment damages shall be made against the excavation contractor.
- F. The Engineer shall arrange to have the sewer repaired after removal of the equipment that was stuck at the expense of the Owner.
- G. The contractor shall clean and remove backfill and debris that may have entered the sewer during removal of the equipment and subsequent repair of the sewer.

3.10 TRAFFIC CONTROL

- A. Contractor shall provide traffic control as required and in compliance with the Local and State governing authorities and in accordance with Section 01 55 26 – Traffic Control.
- B. Contractor shall coordinate traffic control with City of Detroit and other jurisdictional authorities.
- C. The work of Maintaining Traffic consists of furnishing all labor, equipment, and materials required for maintaining traffic throughout the project area in accordance with Sections 104.07.C, 104.11, 812, and 922 of the MDOT 2012 Standard Specifications for Construction and this Specification.



1. Notify the Engineer a minimum of 72 business hours prior to the implementation of any road closures, lane closures, or major traffic shifts. The Contractor shall be required to contact all local and state police, fire, and emergency services that shall have jurisdiction within 72 business hours prior to the implementation of any lane closure.
2. Construction Influence Area (CIA) – The CIA includes the right-of-way of the roadways within the project limits.
3. General Traffic Restrictions:
 - a. Normal work hours are Monday thru Friday from 7:00 a.m. to 7:00 p.m., or as approved by the Engineer. Work outside the normal work hours shall require prior approval from the Engineer.
 - b. No work or lane closures shall be allowed during Independence Day, Memorial Day weekend or Labor Day weekend. Holiday weekends are defined as beginning at 12:00 p.m. on Friday and ending at 6:00 a.m. on the following Tuesday, or as defined by the Engineer. No work shall be allowed during any standard holiday weekends, which shall be defined by the Engineer. No work or lane closures shall be allowed on holiday weekends when the holiday occurs on or is observed on Fridays or Mondays.
 - c. Maintain access to all residential and business driveways at all times. Maintain access to driveways in active work zones, when possible, as confirmed by the Engineer.
 - d. All labor, equipment, and aggregate required to maintain street, intersections, and driveways for traffic shall be included in the execution of the Work.
 - e. Coordinate operations with the other Contractors performing work on projects within or adjacent to the CIA. Maintenance crews and/or Contractor Maintenance Agencies may perform maintenance work within or adjacent to the CIA. The Maintenance Division of MDOT and/or Contract Maintenance Agency shall coordinate their operations with the Engineer to minimize interference to the Contractor. No additional payment shall be made to the Contractor for joint use of the traffic control items.
 - f. Maintain access for emergency vehicles at all times through the work area.
 - g. Provide fencing to protect open trenches and pits during working and non-working hours.
4. Project General: During work hours, equipment material, and company vehicles may be parked or stored within the right-of-way as confirmed by the Engineer. The contractor is responsible for restoring to its original condition any area damaged by their equipment, material, or company vehicles. Restoration of damaged areas shall be in accordance with the plans and 2012 MDOT Standard Specifications for Construction and this Specification.

3.11 ACCEPTANCE OF WORK

- A. The Contractor shall submit completed video, LASER or SONAR inspections of each sewer segment to the Engineer for review for compliance with the Contract.
- B. The sewer inspections shall also be used by the Engineer to determine compliance with the



Contract of sewer and manhole cleaning, physically attached solid debris cutting, removal of excessive grease and roots and intruding sewer tap removal where undertaken. If physically attached solid debris cutting, removal of excessive grease and roots, or intruding sewer tap removal occurs, the Contractor shall submit the survey abandonment videos from the initial survey attempts in addition to the final completed survey to the Engineer for review for compliance with the Contract.

- C. The Engineer shall review the contiguous pipe inspection videos and manhole scans within fifteen (15) working days of submission for compliance with the Contract.
- D. The Contractor shall re-perform sewer inspections that are not in compliance with the Contract.
- E. The Contractor shall correct non-compliant inspection submissions and resubmit the corrected inspections to the Engineer within five (5) working days.
- F. The Contractor shall repeat the process until the inspection submissions are in compliance with the Contract. Work to perform remedial work shall not be eligible for additional payment.

END OF SECTION 33 01 30.30



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SEWER PIPELINE INSPECTION FOR CONDITION ASSESSMENT
DWSD Special Specification
March 2025

SECTION 33 01 30.60 – SPOT REPAIR OF EXISTING SEWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies sewer rehabilitation by spot repair of existing sewers as shown on the contract documents for the selected liner method, or as authorized by the Engineer.
- B. Man-entry repairs shall be defined as repairs in pipes 42-inches and larger in height or diameter. Non-man-entry repairs shall be defined as repairs in pipes less than 42-inches in height or diameter.
- C. Rehabilitate sewers to their original function as specified herein and in accordance with the Contract Documents, or as otherwise authorized by the Engineer. Furnish all labor, materials, utilities, operation, equipment and incidentals necessary to complete the spot repairs in entirety and provide rehabilitated sewers ready for operation.
- D. Related Requirements:
 - 1. Section 01 55 26 – Traffic Control.
 - 2. Section 01 57 15 – Temporary Sewer Bypass Pumping.
 - 3. Section 03 20 00 – Concrete Reinforcing.
 - 4. Section 03 60 00 – Grouting.
 - 5. Section 31 23 33 – Trenching and Backfill.
 - 6. Section 31 50 00 – Excavation Support Systems.
 - 7. Section 33 01 30.61 – Packer Injection Grouting.
 - 8. Section 33 01 30.72 – Cured-In-Place Sewer Lining.
 - 9. Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.

1.2 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

- A. International Concrete Repair Institute (ICRI):
 - 1. ICRI 03732 – Guidelines for Surface Preparation of Concrete.
- B. American Concrete Institute (ACI):
 - 1. ACI 439.5R-18 – Comprehensive Guide for the Specification, Manufacture and Construction Use of Welded Wire Reinforcement.



C. ASTM International:

1. ASTM C32 – Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
2. ASTM C67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
3. ASTM C91 – Standard Specification for Masonry Cement.
4. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
5. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C150 – Standard Specification for Portland Cement.
7. ASTM C191 - Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
8. ASTM C1173 – Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
9. ASTM F2599 - The Sectional Repair of Damaged Pipe By Means of An Inverted Cured-In-Place Liner.

D. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 CFR 1926 – U.S. Occupational Safety and Health Standards, Current Edition.

1.3 QUALITY ASSURANCE

- A. Comply with Section 01 40 00 – Quality Requirements.
- B. Contractor's Qualifications: The Sewer Rehabilitation Contractor shall have a minimum of five (5) years continuous successful experience in the repair of sewers similar to that required under this Contract.
- C. Work Schedule: Coordinate with applicable authorities, agencies, and Engineer in preparing Contractor's work schedule.

1.4 PRODUCT SHIPPING, STORAGE AND HANDLING

- A. Protect all materials and prevent damage during shipping, handling, and storage.
- B. Comply with manufacturer-recommended practices for shipping, storage, handling, and installation of materials.

1.5 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.



- B. Submit documented experience of completion of at least three (3) projects of similar scope. Submit in accordance with Section 01 33 00 – Submittal Procedures, documentation for each project the name of project, location (city and state), value of the sewer repair work performed under the contract, the name of the Owner or Owner’s representative, and contact information.
- C. Submit shop drawings that include a complete list showing materials, fittings, special joints and assembly thereof, dimensions, and construction details. When required for spot repair, shop drawings shall also include for each installation all excavation locations, interfering utilities, excavation dimensions, flow control schematics, and traffic control schematics.
- D. At least two (2) weeks prior to the start of Work, submit a spot repair schedule identifying the Contractors sequence of work, locations, daily work hours, and working dates for each installation.
- E. Submit the manufacturer’s recommended cure schedule.
- F. Submit a Flow Control Plan to the Engineer for approval prior to the start of Work.
- G. After Work is completed, submit a video documenting the repair to the Engineer.
- H. Submittal information required by the referenced Specification Sections.

1.6 GUARANTEE

- A. Submit written guarantee of all Work as specified in General Terms and Conditions Article 8.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products for spot repairs are specified or referenced under each rehabilitation type described herein. Each material shall be manufactured specifically for the particular type of spot repair for which the material is applied.
- B. The repair materials shall be compatible with the substrate to which the material is applied.

2.2 WATER

- A. Water shall be potable. Furnish all water required for the Work.
- B. Obtain the necessary permits and meet all other requirements of the Engineer or other local agencies if obtaining water from fire hydrants or other public or private water suppliers. Make arrangements with such agencies for metering water use.



2.3 PIPE REHABILITATION: MAN-ENTRY SEWER REPAIRS

- A. Missing and Displaced Bricks and Clay Tiles Repair: Repair material for brick replacement repair at locations that are below 45 degrees from the crown of the sewer in each direction for missing and displaced brick repairs may be either Sewer Brick and Cement Mortar or Repair Mortar. Repair material must be Repair Mortar for repair locations that are at are 45 degrees from the crown of the sewer and above. These limits also apply to equivalent perimeter for pipes that are non-circular. Repair material for missing and displaced Clay Tile repairs must be Repair Mortar.
1. Sewer Brick shall conform to ASTM C32, Grade SS for sewers. Average dimensions of brick shall be those to match existing for repair and replacement work.
 2. Cement Mortar
 - a. Masonry cement shall conform to ASTM C91. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.
 - b. Aggregate for mortar shall be sand conforming to ASTM C144.
 - c. Water shall be clean, potable, and free from substances, which could adversely affect the mortar.
 - d. Mortar shall contain an admixture of Master Builders Rheomix 235, Sonneborn Hydrocide Powder, or approved equal.
 - e. Mortar shall be ASTM C270, Type M for sewer walls and other load-bearing or shear-wall masonry with exception to re-pointing materials. Waterproofing compound shall be added in accordance with manufacturer's recommendations. Air content shall not be less than 11 percent. Dye colored mortar shall not be used.
 - f. Premixed mortar shall be ASTM C270, Type M for use as specified herein. Water proofing compound shall be added in accordance with manufacturer's recommendation. Air content shall not be less than 11 percent. Die colored mortar shall not be used.
 - g. Admixtures shall be used in cement mortar to accelerate curing. The accelerator shall provide for workability, shall not adversely affect bonding or compressive strength, and shall provide for a final set time of 3 to 5 hours. The cement mortar accelerator shall be non-chloride. Accelerator shall be Trimix-NCA as manufactured by Sonneborn, Accelguard 80 as manufactured by Euclid Chemical Company, or approved equal.
 3. Repair Mortar:
 - a. Repair mortar shall be a one-component system consisting of processed cement, graded aggregate, and microsilica and polypropylene fibers. The repair mortar shall be specifically designed for sewer pipe repair, shall be resistant to hydrogen sulfide attack in environments with pH greater than or equal to 2, capable of installation on damp surfaces and non-shrinking, and impermeable to infiltration.
 - b. The mortar consistency prior to application shall be a paste form capable of being troweled or sprayed on without sagging when applied in horizontal or overhead configurations with up to 1-1/2-inches of mortar depth on one (1) pass. The repair mortar shall have a maximum initial set of 2 to 3 hours and a maximum final set time of 3 to 4 hours. The repair mortar shall have the following properties as determined by independent testing laboratory:



Flexural Strength, ASTM C78-84	Minimum 1,300 psi @ 28 days
Compressive Strength, ASTM C109	Minimum 9,000 psi @ 28 days
Splitting Tensile Strength, ASTM C496	Minimum 900 psi @ 28 days
Slant Shear Bond Strength, ASTM C882 (Modified)	Minimum 3,000 psi @ 28 days

- c. Repair mortar shall be ThoRoc SP-15 as manufactured by Thoroc, EMACO S88 CI as manufactured by BASF, Sika Repair 224 as manufactured by Sika Corporation, or approved equal.

4. Rapid-Set Repair Mortar:

- a. Rapid-set repair mortar shall be a rapid setting mortar consisting of a blend of cements, chemical additives, and graded aggregate and free of chloride admixtures. The mortar shall be designed for high early strength to minimize downtime of the sewers. The repair mortar shall be specifically designed for sewer pipe repair, shall be resistant to hydrogen sulfide attack, capable of installation on damp surfaces and non-shrinking, and impermeable to infiltration.
- b. The mortar consistency prior to application shall be trowelable or pourable to suit the application. The repair mortar shall have a maximum initial set of 20-minutes and a maximum final set time of 30-minutes. The repair mortar shall comply with ASTM C928 and have the following properties as determined by independent laboratory testing:

Flexural Strength, ASTM C78-84	Minimum 1,100 psi @ 28 days
Compressive Strength, ASTM C109	Minimum 9,000 psi @ 28 days
Splitting Tensile Strength, ASTM C496	Minimum 1,300 psi @ 28 days
Slant Shear Bond Strength, ASTM C882 (Modified)	Minimum 3,100 psi @ 28 days

- c. Rapid-set mortar shall be ThoRoc 1060 Rapid Mortar as manufactured by Thoroc, EMACO T415 as manufactured by BASF, Sika Repair 223 as manufactured by the Sika Corporation, or approved equal.

5. Cementitious Hydraulic Repair Mortar:

- a. Shall be a one-(1) component, cementitious, very fast-setting restoration/repair mortar and water/sewer plug and shall have the following properties as determined by laboratory testing:
- | | |
|------------------------------------|--|
| 1) Compressive Strength, ASTM C109 | 3,000 psi @ 1 day
6,500 psi @ 28 days |
| 2) Set Time, ASTM C191 | Initial: 3-5 minutes
Final: 6-8 minutes |



B. Missing Mortar Repair: Repair material for missing mortar brick re-pointing repair shall be Pre-Mix Hydraulic Cement:

1. Pre-Mix hydraulic cement shall be a premixed Portland cement based hydraulic cement consisting of Portland cement, graded silica aggregates, and plasticizing and accelerating agents. It shall not contain chlorides, gypsum, plasters, iron particles or gas forming agents, or promote the corrosion of steel it may come in contact with. The pre-mix hydraulic cement shall have an initial set time not greater than 30-minutes, designed to be troweled or knead applied and shall provide a watertight seal when cured. The cured product shall have the following physical properties:

<u>Property</u>	<u>Result</u>
Set Time (ASTM C-191-92)	Maximum 30-minutes
Compressive Strength (ASTM C-109-91)	
1 Hour	600 psi (4.2 MPa)
1 Day	2,200 psi (15.2 MPa)
8 Days	5,000 psi (34.6 MPa)

2. The pre-mix hydraulic cement shall be ThoRoc Patch as manufactured by ThoRoc, Sika Set Mortar, as manufactured by Sika Corporation, or approved equal.

C. Fracture/Crack Repair:

1. Repair material for fracture repair shall be repair mortar as specified herein, unless specified otherwise.
2. Where crack repair in brick sewer crowns is approved by the Engineer, make repairs with:
 - a. Sika Sikadur 31 Hi-Mod gel LPL
 - b. Sidakur Anchor Fix-3 or Sikadur Anchor Fix-4,
 - c. Or approved equal.

D. Hole Repairs (Brick or Concrete Sewer):

1. Repair material for hole repair shall be repair mortar as specified herein. The Contractor has the option of using Rapid-Set Repair Mortar when performing hole repairs below the spring line of the pipe. Rapid-Set Repair Mortar shall be as specified herein.
2. Pipe Deterioration Repair: Repair material for pipe deterioration repair and additional pipe deterioration repair shall be Repair Mortar as specified herein.

E. Sewer Repair Reinforcement: Repair material for sewer repair reinforcement shall be in accordance with Section 03 20 00 – Concrete Reinforcing. If the Contract Drawings do not indicate a concrete reinforcement detail, concrete reinforcement for sewer repair shall be designed by the Contractor and submitted to the Engineer for approval. All sewer repair reinforcement materials shall be coated with one (1) of the following epoxy primers:

1. ThoRoc Rebar Primer as manufactured by ThoRoc.
2. EMACO P-22 as manufactured by Master Builders.
3. Or approved equal.



- F. Service Repair by Grout: Repair material for service repairs shall be repair mortar as specified herein and PVC pipe as specified in Section 33 31 11 – Public Sanitary Sewerage Gravity Piping.
- G. Abandon Service: Repair material for capping non-active services shall be non-shrink grout as specified in Section 03 60 00 – Grouting.
- H. Joint Repair, Concrete Pipe: Repair material for Joint Repair, Concrete Pipe shall be Repair Mortar as specified herein.
- I. External Grout for Sewers/Manholes (Cementitious): Repair material for external grout for sewers (cementitious) shall be cement grout as specified in Section 03 60 00 – Grouting.
- J. Elimination of Inflow/Infiltration: Repair material to seal inflow/infiltration shall be hydraulic cement and, if approved, Chemical Grout.
- K. Hydraulic Cement:

1. The hydraulic cement shall be a rapid-set hand-mixed cementitious compound specifically formulated for use in stopping infiltration water entering the pipe through the pipe wall. The repair material shall be specifically designed for direct application to active infiltration, shall have a minimum set time of 5 minutes, and shall be resistant to hydrogen sulfide attack and non-shrinking.
2. The mortar consistency prior to application shall be trowelable or pourable to suit the application. The hydraulic cement material shall have the following properties as determined by independent laboratory testing:

Compressive Strength, ASTM C109	Minimum 2,000 psi @ 24 hrs.
Bond Strength, ASTM C900/D4541	Minimum 150 psi @ 24 hrs.

3. Rapid-set hydraulic cement shall be ThoRoc Plug as manufactured by Thoroc, EMACO 503 as manufactured by BASF, Sika Set Plug as manufactured by the Sika Corporation, or approved equal.

L. Chemical Grout:

1. The Contractor has the option to select either an acrylate based, or methane based, gel grout. Acrylamide grouts are prohibited. Acceptable grouts are as follows:

Chemical Grout	Type of Grout	Manufacturer
AV-254	Urethane	Avanti International
5610	Urethane	3M Company
FLEXGEL	Urethane	DeNef America, Inc.

2. Chemical Grout Additives:
 - a. Unless otherwise specified, incorporate into the grout mixture; chemical additives for shrink control, root control and strength in accordance with the manufacturer's written instructions. Diatomaceous earth, such as Celite 292 as manufactured by Johns Manville, shall be added for strength at a ratio of 50 pounds per 50 gallons



- of grout catalyst (water). Dichlobenil shall be added to the grout catalyst for root control to achieve a minimum concentration of 200 ppm. Add a shrink control additive to the grout catalyst at a ratio of 10 to 15 percent of the volume of catalyst.
- b. The applied grout mixture shall consist of eight parts catalyst to one-(1) part urethane. Follow the manufacturers written instructions regarding chemical handling, storage, application and disposal.

2.4 PIPE REHABILITATION: NON-MAN-ENTRY REPAIRS

- A. Open Cut Point Repair: Repair material for mainline replacement by open cut repair shall be pipe and fittings as specified in Section 33 31 11 – Public Sanitary Sewerage Piping. All flexible couplings shall conform to ASTM C1173, match the pipe size to which the coupling is applied, and be specifically designed for the connections to the pipe materials. Flexible couplings shall be Fernco 1000 RC Series or approved equal. Coupling fasteners and bands shall be stainless steel.
- B. Sewer Service repair by Open Cut: Repair material for service repair by open cut shall be pipe and fittings as specified in Section 33 31 11 – Public Sanitary Sewerage Piping. All flexible couplings shall conform to ASTM C1173, shall match the pipe size to which the coupling is applied, and shall be specifically designed for the connections to the pipe materials. Flexible couplings shall be Fernco 1000 RC Series or approved equal. Coupling fasteners and bands shall be stainless steel. The annulus space between the service and connecting mainline pipe shall be filled with 2,000 psi concrete as specified in Section 03 30 00 – Cast-in-Place Concrete and in the DWSD Sewer Standard Detail for Wye, Connection and Extension.
- C. Sewer Trenchless Point Repair and Lateral Tee Liner by CIPP Liner:
 - 1. General:
 - a. Trenchless Point Repairs shall be the installation of a segmented CIPP liner to be installed on a section of existing sewer that will not reach manhole to manhole. Lateral tee liner is the installation of a CIPP liner in a sewer service (lateral) from the sewer main to improve the sewer service connection to the main.
 - b. Trenchless Point repairs and lateral tee liners shall generally conform to ASTM F2599 - The Sectional Repair of Damaged Pipe by Means of An Inverted Cured-In-Place Liner and F2561-11 - Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-in-Place Liner.
 - 2. Material:
 - a. The liner assembly shall be continuous in length and consist of one (1) or more layers of absorbent textile material (i.e., needle punched felt or circular knit) that meet the requirements of ASTM F1216 and ASTM D5813 Sections 6 and 8. The textile tube and sheet shall be constructed to withstand installation pressure, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections. The wet-out textile tube and sheet shall meet ASTM F1216, and shall have a uniform thickness and 5% to 10% excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.



- b. The outside layer of the textile tube (before inversion) and interior of the textile sheet shall be coated with an impermeable, translucent flexible membrane. The textile sheet before insertion shall be permanently marked as a “Service Identification” correlating to the address of the building or footage and the service pipe services. The sheet and tube shall be surrounded by a second impermeable, flexible translucent membrane (translucent bladder) that will contain the resin and facilitate vacuum impregnation while monitoring of the resin saturation during the resin impregnation (wet-out) procedure.
2. Resin System:
- a. The resin/liner system shall conform the ASTM D5813 Section 8.2.2 – 10,000-hour test.
 - b. The resin shall be a corrosion resistant polyester, vinylester, epoxy or silicate resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project.
 - c. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of ASTM F1216.

Table 33 01 30.60-1: CIPP Initial Structural Properties

Property	ASTM Test	Minimum Value
Flexural Strength	D 790	4,500 psi
Flexural Modulus	D 790	250,000 psi

3. Design Considerations:
- a. The CIPP shall be designed per ASTM F1216, Appendix X1 as a gravity pipe in a fully deteriorated pipe condition.
 - b. The liner shall be sized in accordance with the design objectives to provide a close-fit with the host pipe with no annulus with the exception of the maximum allowable diametric shrinkage due to curing permitted in ASTM D5813.
 - c. A design check shall be performed to confirm that the rehabilitated section of pipe will have a hydraulic capacity equal to or greater than the existing pipeline. This design check shall be based on full flow capacity and the use of Manning’s formula. The assumed long-term Manning’s ‘n’ for the CIPP Section shall be 0.012. The roughness of the existing section shall be estimated based on the observed condition of the pipeline from the CCTV inspection.
 - d. The design features of the point repair and lateral tee liner system shall also include:
 - 1) Tapered end section to promote a smooth transition from point repair to host pipe.
 - 2) A means to facilitate flow through by-pass of existing wastewater during the course of the repair with the exception of sewer laterals which can be blocked but must not cause any resident backups at any time.



- D. Sewer Trenchless Point Repair by Packer Injection Grouting: Repair material for mainline or service repair in locations as approved by the Engineer shall be as specified in Section 33 01 30.61 – Packer Injection Grouting.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor is responsible for inspection of existing pipe in order to determine accurate location and extent of the repair. Conditions may have changed from previous condition assessment or inspections provided to the Contractor. Television inspection shall be in accordance with Section 33 01 30.16 – Sanitary Sewer Pipeline Inspection and performed with appropriate flow control. Inspection for the purpose of locating and determining extent of repair will not require PACP coding.
- B. Where a specific method of applying the repair materials is not specified herein, select and submit to the Engineer for review a proposed mechanical method of applying the repair materials that is suited for the Contractor's execution of the Work. Options include troweling, forming and low-pressure pumping, forming and pouring, and low-pressure spray application. Do not proceed to use the application method prior to review and acceptance by the Engineer. Regardless of type of mechanical application approved by the Engineer, apply all materials in strict accordance to manufacturer's requirements and meet the intent of the specifications herein.
- C. Review and be familiar with the specified repair products to ensure that surfaces are adequately prepared, proper mixing ratios are met, and that the Contractor's Work Plan considers the applicable material set times to avoid wasting materials.

3.2 FLOW CONTROL

- A. Maintain continuous operation of the sewer system utilizing special construction techniques in the wet, bypass pumping, or other means of handling flows. Divert flow around the Contractor's Work in accordance with the requirements of Section 01 57 15 – Temporary Sewer Bypass Pumping.
- B. Control all flow around Contractor's Work until the sewer repairs are complete and approved by the Engineer.

3.3 SURFACE PREPARATION OF SEWERS FOR SPOT REPAIRS

- A. Clean and prepare all the surfaces and substrates to be repaired. Prior to beginning Work on each spot repair, verify the size of the existing pipe, ovality, alignment and other dimensional constraints. Physical conditions that do not provide for suitable installation of the specified sewer rehabilitation type shall be immediately brought to the attention of the Engineer. The Engineer will review the site conditions and determine the appropriate action to be taken for execution of



the repair. The Engineer shall be the final authority for deciding whether or not the specified sewer rehabilitation type is suitable for the site conditions.

- B. Surface preparation of the pipe shall be performed at each spot repair location and shall be specific to each spot repair depending on the condition of the pipe.
 - 1. All pipe surfaces to be repaired shall be contaminate-free and shall have no dirt, dust, oil, grease, efflorescence, rust, previous costings of any kind, encrustations, spalled masonry (including mortar, concrete, and brick), projections and loosely adhering materials.
 - 2. Exposed pipe reinforcement shall be clean and be free of scale and rust.
 - 3. The finished surfaces shall consist of sound pipe materials, shall be dry and have a pH between 7 and 9 before applying any material.
 - 4. Water blasting utilizing appropriate nozzles and application pressures shall be the primary method of cleaning; however, other methods such as wet or dry sandblasting, citric acid wash, concrete cleaners, degreasers, wire brushing and scraping, or other mechanical means may be required to properly clean the surface.
 - 5. No acids, cleaners or degreasers shall be hazardous, nor have a deleterious effect on waste water plant operations. Proposed chemicals shall be approved by the Engineer before use.
- C. If the Engineer determines that the pipe does not appear sufficiently clean for the spot repair methods, re-clean the spot repair area until acceptable to the Engineer and at no additional cost to the Owner.
- D. Take precautions to preserve the condition of pipe material surrounding the spot repair area so that intact and sound materials are not damaged. Prior to utilizing hydraulic, chemical or mechanical cleaning equipment and methods on sewer pipes, demonstrate to the Engineer that the proposed cleaning equipment and methods will not damage intact and sound pipe material. The Contractor's demonstration shall consist of the Contractor field-testing the proposed cleaning method in the presence of the Engineer at one (1) spot repair for each type of pipe material, and in the case of clay tile and brick pipes, in each pipe reach designed for spot repairs. Provide live CCTV video of the demonstration for the Engineer's viewing. Determine the maximum allowable application pressure use to during cleaning procedures to meet the specifications herein. Adjust application pressures after Engineer-witnessing the field demonstrations to optimize surface preparation while preserving the condition of pipe material.
- E. For man-entry spot repairs, within five (5) feet in any direction beyond extents of the spot repair, the pipe walls shall be visually examined and physically sounded or probed by use of a hammer or similar equipment for detection of unsound materials and void areas outside of the pipe. Care shall be taken to avoid damaging sound pipe materials. Unsound materials shall be removed, and the pipe and soil voids repaired with the specified materials. Existing voids found to exist behind walls and external to the pipe shall be repaired after the pipe wall defect is repaired. Payment for repairs outside of the limits listed on the plans will be paid for under the appropriate Additional Payment Item.



3.4 ELIMINATION OF SEWER INFLOW/INFLTRATION

A. General:

1. Inflow/Infiltration is defined as water that penetrates the inside of a pipe from outside of the pipe. Active inflow/infiltration quantity may occur over a wide flow range and evidence of infiltration will vary from a damp pipe surface to dripping water to a steady stream of flow. Additionally, inflow/infiltration may occur in a small specific area such as a pipe joint over a large surface area of pipe. Identify, isolate, and eliminate inflow/infiltration in repair areas indicated on the Drawings and elsewhere as directed by the Engineer under all inflow/infiltration conditions encountered in the pipe. Unless otherwise specified or authorized by the Engineer, repair inflow/infiltration with hydraulic cement as specified herein.
2. All inflow/infiltration repairs shall be made during dry weather periods defined as at least 48 hours of no recorded precipitation prior to commencement of the repair.
3. If the quantity of inflow/infiltration through the pipe wall is large enough where troweling or pressure injection installation of a sewer plug from inside the pipe cannot eliminate the inflow/infiltration, up to four holes may be drilled around the base of the pipe to act as relief ports and allow the water to seep into the pipe flow channel. The diameter of the holes shall be such that grouting the holes with sewer plug will stop inflow/infiltration through the relief holes. If four relief holes do not provide sufficient relief of inflow/infiltration, drill up to four additional relief holes until sufficient relief of inflow/infiltration is achieved. Relief holes shall be grouted after all other inflow/infiltration has been eliminated. The cost of drilling and grouting relief holes shall be included in the cost of the repair type and at no additional cost to the Engineer.
4. When inflow/infiltration conditions exist, which preclude the use of hydraulic cement, submit to the Engineer a request to proceed with a chemical grout repair. The Engineer will review the site conditions and make the final determination on which repair material should be used. Unless otherwise specified, do not proceed with chemical grout repairs without written approval from the Engineer. Chemical grout repairs shall be performed as specified herein. Chemical grouting shall be paid for under the appropriate Additional Payment Item.

B. Application of Hydraulic Cement :

1. Prior to application of the sewer plug, the substrate shall be prepared in accordance with manufacturer's requirements and as specified herein. The material shall be constructed by applying wet on wet layers without allowing previous layers to dry out. Protect against material sags and slumps. If the repair material sags and slumps, it shall be removed and replaced with new material at a layer thickness and interval that does not allow sag or slump. All excess material shall be removed, and the final layer shall be struck flush with the surface of the substrate.
2. Cure the material in accordance with the manufacturer's requirements and protect against freezing temperatures and washout throughout the curing period.



C. Application of Chemical Grout:

1. The grouting equipment shall be compatible with the requirements of mixing, pumping and placing the specified chemical grouting materials. The materials shall have the ability to accept suspended additives for increased strength and shall be mixed in strict conformance with manufacturer's requirements. Chemical grouts and admixtures shall be continuously agitated to keep the admixtures in suspension. All mixing and agitation equipment shall be power operated with variable speed controls. The applied chemical grout shall have the following properties:
 - a. A controllable reaction time, from ten seconds to one (1) hour at temperatures from ambient to freezing.
 - b. It shall be a true viscous solution that remains constant until gelatinization occurs.
 - c. The ability to tolerate ground water dilution and react in moving water.
 - d. The final reaction shall produce a continuous irreversible impermeable stiff gel, which is not rigid or brittle.
 - e. The base solution can be varied by an addition of suspended solids, such as diatomaceous earth or other inactive solids. The effect of additives not specifically mentioned herein must be submitted and approved by the Engineer prior to use in the field.

3.5 SURFACE RESTORATION

- A. Surface conditions that are altered through the Contractor's Work shall be restored to match existing conditions.
- B. Replacement of roadways, driveways, walks, curbs, and other surface materials shall be in accordance with these Specifications.

3.6 TRAFFIC CONTROL

- A. Furnish traffic control as required by the local agency having jurisdiction.
- B. Comply with the requirements of Section 01 55 26 – Traffic Control.

3.7 CLEANUP

- A. During the progress of the Work, maintain all job sites in a clean and orderly condition.
- B. Restore facilities and site areas damaged by construction operations to existing condition before spot repair.



3.8 PIPE REHABILITATION – MAN-ENTRY SEWER REPAIRS

A. Abandon Service:

1. Only as directed by the Engineer, inactive services shall be abandoned in place.
2. Fill the inactive services with grout to a minimum of 6-inch depth from the face of the service at the connecting mainline pipe into the service pipe.
3. Protect from grout entering the service beyond 12-inches from the face of the service at the connecting mainline pipe into the service pipe.
4. The grout shall be struck flush with the face of the service at the adjoining mainline pipe.

B. Cut Protruding Service/Tap Repair: Services protruding into the adjoining mainline pipe that inhibit liner insertion or other rehabilitation methods Engineer shall be trimmed flush with the interior surface of the connecting mainline pipe. Services intruding into the pipe twenty percent (20%) or greater of the diameter of the pipe may be called out to be cut even if a subsequent lining or rehabilitation is not requested.

C. Chemical Grout: As indicated on the Drawings or where directed by the Engineer, and where hydraulic cement does not stop active inflow/infiltration, inflow/infiltration shall be stopped using chemical grout as specified herein.

D. Concrete Deterioration, Fracture/Crack, and Hole Repair for Concrete Pipe and Brick/Clay Tile Sewers:

1. Hole defects in concrete pipe, and brick sewers (where all courses are missing, and soil is exposed) shall be prepared in accordance with manufacturer's requirements and as specified herein.
2. Remove all loose and unsound pipe materials.
3. For concrete deterioration repairs, cut or chisel the edges of the areas to be repaired to a depth of at least 2 inches and then roughen the smooth cut edges to create a profiled edge for material bonding. Feathered edges are prohibited. For superficial repairs where saw-cutting the defect edges is not applicable, mechanical means or abrasive blasting shall be used to roughen the substrate to create a profiled surface for material bonding.
4. For hole repairs, cut or chisel the edges of the areas to be repaired to a depth of at least ½-inches, and then roughen the smooth cut edges to create a profiled edge for material bonding. Feathered edges are prohibited. Mechanical means or abrasive blasting shall be used to roughen the substrate to create a profiled surface for material bonding.
5. For fracture repairs, pre-clean crack/fracture with hand tools and pressure wash to remove any loose debris and pressure wash crack. Cut or chisel the edges of the areas to be repaired to a width of at least ¼-inches and a depth of at least ¼-inches. Existing fractures having width and depth exceeding ¼-inches do not require enlargement; however, the facing surfaces on the sides of the fractures shall be cut or chiseled square. Once the fracture has been cut square, all surfaces shall be roughened to create a profiled edge for material bonding. Feathered edges are prohibited.
6. For large holes, after surface preparation of the defect area, reinforcement shall be placed as specified herein and as shown on the Drawings.



7. For concrete deterioration repairs, existing reinforcing shall be completely exposed with a 3/4-inch minimum clearance at all sides. Thoroughly clean reinforcing and completely encapsulate the existing reinforcing steel with repair material. If the existing steel reinforcing is deteriorated, completely expose and remove all deteriorated steel and replace with new reinforcing steel. The Engineer will review and approve all areas prior to removal of concrete. Any replacement steel shall provide a minimum area of steel equal with that which has been removed or deteriorated. All new reinforcing shall be anchored into the existing concrete sufficiently to develop the strength of the reinforcing bars and should provide a minimum of two (2) inches of concrete cover.
8. Thoroughly soak the substrate with water and then remove excess water to provide a saturated surface dry condition immediately prior to application of the repair material. Once the defect is fully prepared to receive the repair material, install the repair material in accordance with the manufacturer's requirements, Section 03 60 00 – Grouting, and as specified herein.
9. For concrete deterioration, brick/clay tile sewer, and fracture repair, the repair material shall be applied in layers not less than 1/2-inches thick but not more than the manufacturer's recommendations. The required material thickness for concrete deterioration repair shall be equal to the depth of the defect or, when preparation of the defect results in a hole completely through the pipe wall, the total material thickness shall be equal to the total pipe wall thickness. The required material thickness to complete the brick repair shall be equal to the total pipe wall thickness surface. The required material thickness to complete the fracture repair shall be equal to the depth of the of the prepared mortar joint void.
10. The repair material shall be constructed by applying wet-on-wet layers without allowing previous layers to dry out. Protect against material sags and slumps. Use guide wires, rodding and forming for final shaping and elevations of the repair material. If the repair material sags or slumps, it shall be removed and replaced with new material at a layer thickness and interval that does not allow sag or slump. All excess material shall be removed, and the final layer shall be struck flush with the surface of the substrate.
11. Cure the material in accordance with the manufacturer's requirements and protect against freezing temperatures and washout throughout the curing period.
12. Where specifically approved by the Engineer, fractures may be repaired by filling with epoxy gel. The fracture shall be cleaned of any loose debris and pressure washed using low pressure. The surface shall be allowed to dry to prevent any standing water prior to injecting gel. Fill fracture in crown of pipe with approved epoxy gel. Install with a bulk caulk gun full depth of crack. Strike off surface with a trowel following installation of gel.

E. Missing Mortar and Missing/Displaced Bricks/Clay Tiles Repair:

1. Pipe brick and mortar defects under this repair type shall be prepared in accordance with the manufacturer's requirements and as specified herein. Remove all loose and unsound pipe materials. For brick repointing, cut or chisel the areas to be repointed to a uniform depth of 3/4-inches, or deeper as required to reach sound mortar; once the unsound materials are removed, all surfaces shall be roughened to create a profiled edge for material bonding. For missing/displaced brick repair, use mechanical means or abrasive blasting to roughen the edges of the area to be repaired to create a profiled edge for material bonding. Feathered edges are prohibited.



2. After surface preparation of the defect area, thoroughly soak the substrate with water and then remove excess water to provide a saturated surface dry condition immediately prior to application of the repair material. Once the defect is fully prepared to receive the repair material, install the repair material in accordance with the manufacturer's requirements and as specified herein.
3. The repair material shall be applied in layers not less than 1/2-inches thick, but not more than the manufacturer's recommendations. For brick repointing, the required material thickness to complete the repair shall be equal to the depth of the prepared mortar joint void. For missing/displaced brick/clay tiles repair, the required material thickness to complete the repair shall be equal to the total pipe wall thickness.
4. The material shall be constructed by applying wet-on-wet layers without allowing previous layers to dry out. Protect against material sags and slumps. Use guide wires, rodding and forming as required for final shaping and elevations of the repair material. If the repair material sags or slumps, it shall be removed and replaced with new material at a layer thickness and interval that does not allow sag or slump. All excess material shall be removed, and the final layer shall be struck flush with the surface of the substrate.
5. Cure the material in accordance with the manufacturer's requirements and protect against freezing temperatures and washout throughout the curing period.
6. Missing/displaced bricks/clay tiles repaired using brick and mortar shall be prepared as specified herein.

F. Sewer Repair Reinforcement:

1. Sewer repair reinforcement shall be placed as specified herein and on the Contract Drawings and as otherwise required by standards identified in the referenced reinforcement material specifications.
2. Expose the full circumference of corroded steel in areas to be repaired and remove loose scale and corrosion deposits. Pay particular attention to the back of exposed steel. Reinforcing which has lost 25% of its section area due to corrosion or erosion shall be cut out and replaced with new reinforcing equal to original size and grade of that removed. Additional reinforcing shall be installed as shown on the Contract Drawings. Welded wire fabric or reinforcing steel shall be added as required by ACI 439.5R-18. Reinforcing shall be mechanically fastened to existing reinforcing or to the substrate when existing reinforcing does not exist, and to be secured against movement during application of repair materials.
3. Corrosion deposits shall be removed from pits and imperfections in the existing reinforcement surface. Reinforcement shall be primed promptly after cleaning and or installation. The reinforcement primer shall be applied in accordance with the primer manufacturer's instructions and allowed to cure before application of the overlaying repair materials.

G. Joint Repair, Concrete Pipe:

1. Joint Repairs are defined as pipe deterioration repairs occurring at pipe joints. Joint repairs will require additional forming for both the interior face and the joint edge. After surface preparation of the defect area, reinforcement shall be placed as specified herein. Thoroughly soak the substrate with water and then remove excess water to provide a saturated surface dry condition immediately prior to application of the repair material.



Once the defect is fully prepared to receive the repair material, install the repair material in accordance with the manufacturer's requirements and as specified herein.

2. Set forms over the area to be repaired to conform to the interior face of the surrounding pipe and to form the pipe edge. The joint space consistent with the remainder of the joint shall be maintained. Multiple forms may be utilized to cover an odd shape or large repair areas. The repair material shall be thoroughly packed into the form filling the area completely, without any gaps or air pockets. After repair material is cured, the forming shall be removed. The repair thickness shall restore the pipe to the total pipe wall thickness.
3. If the repair is specified to be constructed of multiple layers of material, it shall apply wet on wet layers without allowing previous layers to dry out. Protect against material sags and slumps. Use guide wires, rodding and forming as required for final shaping and elevations of the repair material. If the repair material sags or slumps, it shall be removed and replaced with new material at a layer thickness and interval that does not allow sag or slump. All excess material shall be removed, and the final layer shall be struck flush with the surface of the substrate.
4. Cure the material in accordance with the manufacturer's requirements and protect against freezing temperatures and washout throughout the curing period.

H. External Grout for Sewers/Manholes (Cementitious)

1. Voids outside of the sewer pipe shall be repaired by pressure grouting as specified herein. The Engineer may direct the Contractor to perform external grout repair to be performed along with, or independent of other rehabilitation types. The Engineer may also direct the Contractor to modify the Contractor's grouting methods to suit the site conditions and intent of the external grout repair.
2. Placement of Grout:
 - a. The Contractor shall ensure that the pipe surface to receive grouting materials is prepared in accordance with manufacture requirements, that the grouting material is applied in accordance with the manufacturers recommendations for application, that the grouting period is consistent with the grout setup time, and when pressure grouting, that the void pressure is sufficient to cause the grout to penetrate and seal the defect without causing damage to the sewer.
 - b. Care shall be taken so that grout does not escape from the local void and be forced into nearby basements, manholes, or adjacent sewers, or cause damage to adjacent utilities. Formwork and formwork sealing required to maintain grout in the applied position prior to set shall be that specified for cast-in-place concrete and in accordance with these specifications. Reinforcement for grout shall be that specified for cast-in—place concrete in accordance with these specifications.
 - c. Pressure Grouting for Man-Entry Sewers:
 - 1) Where shown on the drawings or directed by the Engineer, the Contractor shall perform external cementitious grouting to stabilize the soil conditions outside the pipe/manhole wall. In general, external grouting shall be performed from inside the existing pipes as described herein. Grouting shall be done using remote equipment or from the ground surface on pipes requiring external grouting that are not suitable for personnel entry.



- 2) After the pipe has been properly prepared, injection ports shall be drilled into the pipe wall where grout is to be applied. Injection ports shall be drilled at an angle from areas of sound pipe material to the void area or, when formwork is used, injection ports may be constructed integral to the formwork. The grout is to be injected by drilling minimum 1-inch and maximum 3-inch diameter holes along both sides of the pipe below the springline at a longitudinal interval of 6 feet. At any given, time the Contractor will have at least two (2) holes drilled on each side of the pipe. Grout shall be pumped through two (2) drilled holes on either side of the pipe simultaneously, with equal flow volume and pressure. Once drilled or constructed, injection ports shall allow a visual placement and travel route of the grout for the applicator.
 - 3) Once commenced, grouting shall be completed without stoppage. In case of breakdown of equipment, the Contractor shall wash out the grouting system sufficiently to ensure fresh grout and adequate bond and penetration will occur upon restarting the grouting operation. Grout pressure shall be maintained until grout has set.
 - 4) A lateral camera shall be used to continually inspect laterals within 25 feet of the location of grout application during grouting operations. If grouting is to be performed prior to liner installation the Contractor shall internally brace the pipe to prevent damage or collapse of the existing pipe. Grout that enters a lateral shall be removed immediately by the Contractor.
- d. Limits of Grout Placement:
- 1) The Contractor shall continuously monitor pressure and volume of grout placed. Grout placement shall be limited as follows. Limitation of volume of grout placed shall take precedence over limitations by grout pressure.
- e. Limits of Grout Pressure:
- 1) For pipes that are above the ground water elevation the Contractor shall inject grout simultaneously through two (2) corresponding holes drilled through the pipe walls until a pressure of 5 psi is achieved. If grout begins to flow out of the adjacent hole preventing the desired pressure, the grout operation shall be moved to the adjacent holes.
 - 2) For pipes that are below ground water the Contractor shall inject grout to achieve a maximum pressure of 5 psi. If when 5 psi is reached, the grouting pressure is not sufficient to overcome hydrostatic pressure of the groundwater, the Contractor shall gradually increase the pressure at increments of 0.5 psi until such time that grout begins to flow. Grouting shall then continue until such time that the measured grout pressure is 1.0 psi over the pressure required for the grout to flow. In no instance shall the grout pressures exceed 8 psi. Grout pressure shall be measured as close as practically possible to the injection point.



- f. Limitation by Grout Volume:
 - 1) The quantity of cementitious grout to be placed shall be limited to a maximum of 0.5 cubic yard per foot of length of the associated defect repaired whether or not the desired pressure is achieved. The quantity of the grout may only be adjusted as directed by the Engineer.
 - 2) The equipment to be employed and method to be used for injecting grout is to be determined by the Contractor.
 - 3) During grouting the inside of the pipe and all sewer laterals in the area shall be continuously monitored. If grout is observed entering through any lateral joints, pipe joints or pipe walls, or if any deflection of the pipe walls is observed, grouting shall be ceased immediately
- g. Chemical Grouting:
 - 1) Chemical grout is intended to stop infiltration and shall be used as such. The quantity shall be measured and placed increments of 1/4 gallons in the presence of the Engineer. Chemical grouting shall cease when the active infiltration being addressed stops or as directed by the Engineer. Chemical grout shall be installed through holes less than 1 -inch in diameter.
3. Grouting Reports:
 - a. The Contractor shall maintain daily grouting reports. The reports shall document repairs made and shall include:
 - 1) Type of defect repaired.
 - 2) Date repaired.
 - 3) Location repaired indicating the sewer reach's upstream manhole and downstream manhole.
 - 4) Footage from upstream of downstream manhole and clock position(s) of the repair and.
 - 5) Unit quantity of the repair using the units indicated on the summary tables included on the plan sheets.
 - b. The Reports shall be provided to the Engineer's site representative no later than close of business the following workday.
- I. Cutting of CIPP lining of tee (blind taps): CIPP liners to be installed with one (1) end concluding in a tee and connecting to a man-entry sewer shall be cut and sealed via access to the man-entry sewer. All CIPP requirements within this specification for CIPP liner shall apply to the CIPP lining, cutting of the liner and application of the end seal.



3.9 NON-MAN-ENTRY REPAIRS

A. Cut Protruding Services/ Taps: See Paragraph 3.8.B.

B. Open Cut Point Repair: and Open Cut Service Repair:

1. The Contractor is responsible for inspection of existing pipe in order to determine accurate location and extent of the repair. Conditions may have changed from previous condition assessment or inspections provided to the Contractor.
2. Mainline replacement by open cut and service repair by open cut shall be performed where specified or otherwise designated by the Engineer.
 - a. Excavation, bedding, and backfill shall be in accordance with Section 31 23 33 – Trenching and Backfill.
 - b. Pipe trench construction details shall be in accordance with the Contract Drawings.
 - c. Sheet piling, shoring and bracing requirements shall be in accordance with 29 CFR 1926 Subpart P - Excavations and other applicable OSHA requirements.
 - d. Mainline pipes shall be excavated to the extents of the designated spot repairs. The Contractor may, for Contractor's convenience, over excavate to remove damaged pipe to the nearest joint but shall do so at no additional cost to the Owner.
3. Unless additional excavation is requested in writing by the Engineer, any and all cost for additional excavation length to that specified or shown will not be paid as extra Work and such costs shall be borne by the Contractor.
4. Pipe Installation:
 - a. After the spot repair is located and the pipe exposed, unless otherwise specified, fix defective joints, wyes, tees, taps and sections of damaged pipe by removal and replacement of defective materials. Replacement pipe, fittings and couplings shall be as specified. Remove defective pipe either at exposed joints or by cutting the pipe perpendicular to the pipe axis at extents of section to be repaired. If required, connections to existing pipe shall be made with flexible couplings. Service connections shall be made using factory wyes or tees. The replacement pipe ends shall mate square with the existing pipe, with flowlines matching. Coupling sizes shall be as recommended by the manufacturer and shall be long enough to overlap pipe ends by a minimum of 6 inches; flexible couplings shall be installed on clean pipe and shall be watertight.
 - b. For egg shaped sewers, a circular pipe shall be selected that best matches the dimensions of the egg-shaped sewer. Use manhole brick and mortar as specified herein to build a brick collar or a poured-in-place concrete collar to seal the space between the egg-shaped sewer and circular replacement sewer. Flow lines shall be matched.
 - c. Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are used. Existing and replacement pipe ends and interiors shall be cleaned thoroughly and kept clean during laying and connection. Lower pipe into the trench in a manner to avoid any physical damage. All defective or damaged pipes shall be immediately removed from the job site.



- d. After replacement pipe and fittings have been fully coupled to the existing sewer, all services shall be reinstated. Pipe testing shall be as specified in the individual pipe material specifications.
 5. Cleaning and Acceptance:
 - a. Following the repair, the Contractor shall clean the full pipe segment from manhole to manhole per Section 33 01 30.19 – Sanitary Sewer Pipeline Cleaning.
 - b. The Contractor shall submit required CCTV video inspection of the full manhole to manhole repaired and cleaned sewer segment per Section 33 01 30.16 – Sanitary Sewer Pipeline Inspection. The Engineer shall review and determine if the Work performed is acceptable.
- C. Repairs by Grouting: See Section 33 01 30.61 Packer Injection Grouting.
- D. Sewer Repair by Segmented CIPP Liner
1. Sewer Cleaning and Preparation:
 - a. The Contractor shall remove all loose and solid debris and intruding connections, in accordance with this specification, to adequately prepare the sewer for internal point repairs.
 2. Installation:
 - a. Flow control shall be per Section 33 31 11 – Public Sanitary Sewerage Gravity Piping and Section 01 57 15 – Temporary Sewer Bypass Pumping. The upstream manhole shall be monitored at all times and an emergency deflating system shall be incorporated so that the plugs may be removed at any time without requiring confined space entry.
 - b. The interior of the pipeline shall be carefully inspected to determine the location of any condition that may prevent proper installation, such as roots, and collapsed or crushed pipe sections. All existing service services shall be cleared of obstructions that may prevent the proper insertion and expansion of the lining system. Changes in pipe size shall be accommodated. Obstructions may include dropped or offset joints of no more than 20% of inside pipe diameter.
 - c. The liner shall be encapsulated within the translucent bladder (liner/bladder assembly) and shall be vacuum-impregnated with resin (wet-out) under controlled conditions. The volume of resin used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. No dry or unsaturated area in the mainline sheet or service tube will be acceptable upon visual inspection.
 - d. After liner placement is complete, pressure shall be maintained by pressing the liner firmly against the inner pipe wall. The liner shall be chemically cured at ambient temperatures or by a suitable heat source. The curing of the CIPP shall account for the existing pipe material, resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles.



- e. Curing shall be done without pressure interruption with air or a mixture of air and steam for the proper duration of time per the resin manufacturer's recommendations.
- 3. Finish: The finished CIPP shall be continuous over the entire segment slated for repair. The CIPP shall smooth with minimal wrinkling and increase flow rate. The CIPP shall be free of dry spots, lifts, and delaminated portions. The CIPP shall taper at each end providing a smooth transition for accommodating video equipment and maintaining proper flow in the mainline. After the Work is completed, provide the Engineer with video documenting the repair.
- 4. Inspection and Testing Practices:
 - a. Sampling: Samples shall be prepared by securing a flat plate mold using the textile tube material and resin system as used for the rehabilitated pipe.
 - b. Pressure: The pressure applied on the plate sample shall be equal to the highest pressure exerted on the service tube during the inversion process.
 - c. Length: The minimum length of the sample must be able to produce at least five specimens for testing in accordance with the current version of ASTM D790.
 - d. Conditioning: Condition the test specimens at $73.4 \pm 3.6^{\circ}\text{F}$ and $50 \pm 5\%$ relative humidity for not less than 40 hours prior to test in accordance with Practice ASTM D618, for those tests where conditioning is required.
 - e. Short-Term Flexural (Bending) Properties: The initial tangent flexural modulus of elasticity and flexural stress shall be measured for gravity and pressure pipe applications in accordance with Test Method D790 and shall meet the minimum requirements of Table 33 01 30.60-1.

END OF SECTION 33 01 30.60



Contractor:

Submittal Number:

Total Length Surveyed (LF):

Glossary of Terms:

The unique ID identifying an individual survey within the PACP database.

The date of the survey recorded; recorded format MM/DD/YYYY.

The time at the beginning of the survey; recorded in the 24 hour time format HH:MM:SS.

Further details on the location for reference to help locate structure in the future; such as address, permanent landmarks or buildings.

The unique ID identifying the pipe segment surveyed; this is the pipe Asset ID

The reference number for the manhole or access point of the survey as given in the established referencing system; Upstream MH or node Asset ID.

The reference number for the manhole or access point as given in the established referencing system; Downstream MH or node Asset ID.

The direction of survey in relation to the direction of flow - using codes D = Downstream and U = Upstream.

The dimension is the pipe height (diameter) at the manhole wall estimated to the nearest whole inch.

The dimension is maximum pipe width (if not circular) at the manhole wall estimated to the nearest whole inch; if circular, width and height are the same.

The Above Ground Measured distance from the wall of the starting access point to the wall of the finishing access point; this is expected pipe length but not necessarily the length surveyed.

The distance actually surveyed i.e. the distance displayed on the counter; this may differ from the GIS Length.

The number representing the unique insertion of the floating camera; specific only to surveys captured using the floating camera.

The file name of the CCTV video for the survey; recorded format according to the specifications.

The project area in which the pipe segment surveyed is located per the header file data provided/web GIS data viewer.

Number associated with the DWSO sewer section infrastructure mapping.

[illegible]

SECTION 33 01 30.31 – MANHOLE INSPECTION FOR CONDITION ASSESSMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Specification covers inspection of manholes and other NASSCO-defined access points (Access Junction Boxes, Access Meter Structures, Access Other Special Structures, Access Siphon Chambers, Access Wastewater Accesses and Access Wet Wells) using side scanning imaging and point cloud collection equipment to perform National Association of Sewer Service Company's (NASSCO) Manhole Assessment Certification Program (MACP) Level 2 inspections for the purposes of assessing thoroughness of cleaning, observing and recording structural and service defects, evaluating construction, operational performance and miscellaneous features of existing manhole assets, and to verify rehabilitated or new manhole construction prior to acceptance.
- B. The Contractor shall provide all equipment, tools, labor, materials, and incidental services necessary to perform all work for inspection of manholes as indicated and in compliance with the Contract Documents.
- C. For sewer condition assessment projects, GPS data collection must be performed on the sewer assets prior to initiating CCTV, manhole or catch basin inspection or other inspection or investigative activities on the same assets.
- D. Type of cleaning to be performed shall be undertaken in accordance with Section 33 01 30.32 - Sewer Cleaning for Condition Assessment in order to be able to conduct a NASSCO compliant inspection. This also provides specifications for Cleaning, Excessive Grease and Root Removal, Physically Attached Solid Debris Cutting, Removal of Intruding Taps and Manhole Cleaning.
- E. Inspections may be witnessed by the Engineer.
- F. The Contractor shall provide all equipment, tools, labor, materials, and incidental services necessary to perform all work for locating, exposing and raising manholes as indicated and in compliance with the Contract Documents.
- G. The Contractor shall comply with all requirements of MISS DIG Public Act 174 including contacting MISS DIG, hand excavation near utilities, and contacting 911 in case of emergency.
- H. The Contractor shall be required to enter MISS DIG tickets for all work requiring excavation. When entering the MISS DIG ticket, the following information shall be added by the Contractor to the "Locate Info" field: Contractor shall enter "*ENG*" followed by "Project Number*" and followed by a description requesting utility location markings that encompasses the entire work area. Example of entry for a Contract with Project Number 917: *ENG*:917* Locate all utilities in front and both sides of street.



I. Related Requirements:

1. Section 33 01 30.32 - Sewer Cleaning for Condition Assessment
2. Section 33 01 30.30 - Sewer Pipeline Inspection for Condition Assessment
3. Section 33 01 30.18 – Security Clearances and Communications
4. Section 33 01 30.81 – Manhole Rehabilitation

1.2 REFERENCES

A. National Association of Sewer Service Companies (NASSCO):

1. Pipeline Assessment and Certification Program (PACP) Reference Manual.
2. Manhole Assessment and Certification Program (MACP) Reference Manual.

1.3 DEFINITIONS

- A. Digital Inspection: Operation necessary to complete a true-color visual inspection for verification of existing internal manhole chamber conditions.
- B. Closed-Caption Television (CCTV) Inspection: Operation necessary to complete a high-definition, true-color audio-visual inspection for verification of existing internal sewer line conditions.
- C. Moving Pictures Expert Group (MPEG): a family of international standards fused for coding audio-visual information in a digital compressed format.
- D. Portable Hard Disk Drive (HDD): For the purposes of this Specification, HDD shall be written in accordance with the ISO-9660 Level 2 Specifications

1.4 SUBMITTALS

- A. Sample Inspection Report: Prior to initiating the Work, the Contractor shall submit to the Engineer the following documentation for compliance:
 1. Sample Report of each manhole inspection type, including digital data files of an actual manhole performed by each device to be used to perform the work, for review at least one (1) month before beginning the inspection work. The Sample Report shall include:
 - a. One (1) copy of the data. Provide the appropriate viewing software, associated image and point cloud data and associated files to enable the interactive review of the inspection of the sample inspection for each device used as part of the submittal where viewing software shall be provided at no additional cost to the Owner.



- b. One (1) MACP (version 7.0.0 or newer) compliant Microsoft Access, manhole inspection database containing inspection and defect information. Sewer condition coding shall be submitted as a MACP.mdb file accordingly.
 - c. One (1) PDF copy of the manhole inspection logs. Logs shall record defects according to NASSCO MACP standard. The report shall be in a tabular format without any graphics.
 - d. Sample observation photos to accompany the sample submittal.
 - e. Manhole Inspection Data Submittal Tracking Spreadsheet. A template is provided at the end of the Specification.
2. Sample “empty header” or “0-ft MSA” inspection for a manhole that cannot be inspected.
 3. Sample QA Review Report of the inspections.
 4. Clear identification of the equipment make, model, and serial number for the Sample Report and all submittals.
 5. Demonstration of the resolution of each camera using the recording resolution specified herein.

If the contents of the Sample Report or recordings are incomplete, defective or not of adequate quality, the Contractor shall correct deficiencies and re-perform the manhole inspection at the Contractor’s expense. The Contractor shall use the Sample Report submission accepted by the Engineer as a benchmark for subsequent inspection report submissions.

No inspection work is to be performed until the Sample Report has been accepted by the Engineer.

- B. The Contractor shall submit a written description of all procedures to be used to the Engineer, including product literature for all digital video equipment per the equipment section of this Specification including, but not limited to, side scanning post processed and point cloud data and reader software.
- C. Bi-weekly data submittals to the Engineer:
 1. Bi-weekly data submittals shall be completed within two (2) weeks of the completion of a work area. The inspection reports must include both the pipe inspection videos and manhole scans for contiguous assets within the work area.
 2. For the bi-weekly data submittals, submit one (1) copy of the data. If the image data are defective or not of adequate quality, the Contractor shall re-perform the MACP inspection at the Contractor’s expense.
 3. For the bi-weekly data submittals, submit one (1) MACP (version 7.0.0 or newer) compliant Microsoft Access, manhole inspection Database containing inspection and defect information. Sewer condition coding shall be submitted as a MACP.mdb file accordingly. Name the MACP database according to the following file specification:
[Contractor Name]_[P/O Number]_MACP_Submittal_[Number].mdb
 e.g., ACME_DWS-999_MACP_Submittal_025.mdb
 4. For the bi-weekly data submittals, submit a PDF copy of the manhole inspection logs. Logs shall record defects according to NASSCO MACP Standard.



5. For the bi-weekly data submittals, the Contractor shall submit a submittal tracking spreadsheet.
 6. For the bi-weekly data submittals, the Contractor shall submit a QA Review Report of the inspections.
- D. Prior to initiating cleaning or inspection efforts, the Contractor shall submit an Emergency Plan that outlines proposed methods for recovering their cleaning or inspection equipment that has become lodged, lost or uncontrollable within the manhole or sewer, including confined space entry procedures.
- E. The Contractor shall provide a daily schedule to the Engineer with planned inspection assets and locations.

1.5 QUALITY ASSURANCE

- A. The Contractor shall comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- B. The inspections shall be performed one manhole at a time as per NASSCO requirements.
- C. Inspection shall be performed in accordance with most current NASSCO's Manhole Assessment and Certification Program (MACP) standards and in accordance with these specifications.
- D. Inspection shall be performed by certified Operators and Reviewers in accordance with NASSCO, with all staff having attained and retained their MACP certification. Contractor shall ensure each operator is fully trained and certified in all aspects of manhole inspection and capable of making accurate observations, as well as and coding and recording all conditions that may be encountered during inspection activities.
- E. Coding accuracy shall be a function of the number of defects or construction features not recorded or omitted as well as of the correctness of the coding and classifications recorded. Coding accuracy is to satisfy the following requirements:
 1. MACP Header accuracy: 95%.
 2. MACP Component Observation Section: 95%
 3. Component defect coding accuracy: 85%.

Inspections failing to meet these criteria shall be rejected, re-inspected and recoded (if required), and resubmitted at no additional cost to the Owner.

- F. The contractor shall implement a formal coding accuracy verification system before starting the work, which shall include:
 1. Verification of coding accuracy on a random basis on a minimum of 10% of the digital inspection reports. Submit coding accuracy checks with the corresponding digital data. The



Contractor shall complete the Manhole Inspection Data Submittal Tracking Spreadsheet and a Quality Assurance (QA) Review Report documenting the results of the coding accuracy verification, attached separately, and include it with each respective data submission. Where QA has been undertaken by the Contractor, MACP Section Header Fields 3 and 4 must be populated by the Contractor.

2. Re-code inspections not satisfying the accuracy requirements and verify the accuracy of the inspection immediately preceding and immediately following the non-compliant inspection. Repeat the process until the preceding and subsequent inspections meet the accuracy requirements.

G. The Contractor shall maintain an up-to-date Progress Log that tracks the progress of the work and status of inspections, provided to the Engineer on a weekly basis. The log should document the following information at a minimum:

1. Manhole Asset ID.
2. Date of inspection.
3. Date of data submission.
4. Status of data acceptance / rejection.
5. Date of data acceptance / rejection.
6. Date of manhole re-inspection (as required).
7. Date of data resubmittal (as required).
8. Date of resubmitted data acceptance (as required).
9. e-Builder submittal number.
10. Comments.

H. The Engineer shall be entitled to an audit of the control system and be present when assessments of sewer integrity are being determined. When requested by the Engineer in writing, the Contractor shall forward to the Engineer sufficient details and information for such audit assessment.

I. Submittals may be subjected to an independent Quality Assurance/Quality Control (QA/QC) audit by the Engineer. Where inconsistencies are noted, the Contractor shall be responsible, where necessary and at no additional cost to the Owner, for corrections including, re-inspection, recoding and entering additional information.

1.6 QUALIFICATIONS

A. The Contractor shall submit documentation for Engineer approval to demonstrate the following experience as a business engaged in the digital inspection of manhole entities per the contract documents:

1. The Contractor shall be in good standing under local contracting requirements or otherwise properly registered, licensed or permitted by law to carry on business within the State of Michigan, County of Wayne throughout the term of the Contract, and shall provide the Engineer with evidence thereof per the contract documents.



2. At any time during the term of the Contract, the Engineer may, at their sole discretion and acting reasonably, request updated evidence of good standing. A Contractor, who fails to provide satisfactory evidence, shall not be permitted to continue to perform any Work.
- B. The Contractor and/or any proposed Subcontractor, for the portion of the Work proposed to be contracted to them, shall meet the minimum qualifications as listed in the Contract Documents.
 - C. The Contractor shall provide the Engineer with a complete list of Subcontractors whom the Contractor proposes to use prior to the commencement of Work.
 - D. The Contractor shall be fully capable of performing the Work required in strict accordance with the terms and provisions of the Contract Documents.
 - E. The Contractor shall submit, for Engineer's approval, documentation to demonstrate the following experience of the staff proposed for this project:
 1. Operator certification documentation of each inspection operator / coder and reviewer's NASSCO PACP certificates and, for manhole inspectors, MACP certificates. The PACP and MACP certificates for all staff performing work shall be current on the day of the Contractor's submission and shall remain current throughout the performance of this work.
 2. Documentation of supervisors' and operators' training certifications, listing of completed projects, and a minimum of five (5) years of experience in the internal inspection of manholes using manhole sidewall scanning inspection technologies.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall furnish the inspection studio, camera, audio-visual digital encoding equipment/software, and other necessary equipment, materials, electricity, labor, technicians, as may be needed to perform the inspection.

2.2 EQUIPMENT

- A. The Contractor shall submit a list describing all equipment to be used for review for compliance with the Contract.
- B. Sewer and manhole inspection units are to consist of a self-contained vehicle with separate areas for viewing and storage complete with the following equipment as a minimum:
 1. Cellular telephone and/or suitable communication systems linking all crew members.
 2. Fans and blowers capable of removing fog that may be present in sewers at the time of the inspection.
 3. Video cameras, lighting, cables and power source.
 4. Video monitor, videocassette recorder and digital video recorder.



5. Computer system with video capture card or dedicated unit and other related equipment.
6. Temporary manhole covers to provide fall-in protection while performing work.

C. Digital Inspections:

1. Manhole inspections are to be performed using digital inspection systems that use sidewall scanning technologies such as the IBAK PANORAMO or equivalent meeting the following criteria:
 - a. The inspection camera system must be 100% digital. Any analog or NTSC video camera shall be deemed unacceptable.
 - b. The inspection camera system must have a minimum of two independently or simultaneously controlled digital cameras, one facing in the downward direction and one facing in the upward direction to encapsulate all observations and features within the chamber. Each camera must have a minimum of 185-degree field of view.
 - c. The inspection camera system must provide sufficient illumination of the interior of the manhole to obtain proper exposure without introducing any motion blur. The light shall be positioned 360 degrees around the camera to distribute the light evenly onto the structure walls. The lighting must be able to illuminate manholes up 120 inches in diameter without the need of any auxiliary lighting. Auxiliary lighting may be required within larger special purpose chambers and shall be inclusive to the Contract.
 - d. Distance 0.0 foot shall be set to the manhole rim level in alignment to and above the 6 o'clock outgoing pipe (or first encountered outgoing pipe rotating clockwise from due north, if more than one outgoing pipe is encountered as per MACP) where all measurements for all respective manhole component observation depths shall be recorded.
 - e. The inspection system shall produce individual images or frames with no more than 0.001 inches of movement during image or frame exposure to produce crisp, clear images. Inspections showing evidence of blurred, corrupt or erroneous imagery, scratched lenses or protective glass plate or similar due to poor handling and application shall be rejected.
 - f. The inspection camera must provide a minimum of 3,000 lines of vertical resolution in the side view and a minimum of 500 lines in the perspective view.
 - g. Contractor is responsible for reviewing collected data, coding observations, however the Engineer must have the ability to view the digital film file in the same way that the contractor views them, including full control of the virtual pan and tilt. Survey and coded metadata shall be preserved within the file deliverables for future reference by the Engineer.
 - h. The digital film files shall be captured to a "High Quality" setting that must include an unfolded view of the manhole with a minimum of 3,000 lines of vertical resolution, providing all front, back and wrapped images that shall be, at a minimum height and width of 1040x1040 pixels, to a resolution of 96 dots per inch. Latest 4k technologies shall also be reviewed for acceptance. The unfolded view shall provide the user both a depth and clock visual reference (ruler, scale or similar) to any observation or feature seen within the chamber.



- i. Contractor to also provide file names within the executable software and the manholes are to be in alpha numeric order to ensure efficient reference.
- j. The inspection system must descend to the lowest point within the manhole chamber to a depth that shall facilitate accurate perpendicular measurements using the software's measuring tools to occur. Manhole depths are provided as an Appendix to the Contract Documents.
- k. Any inspection exhibiting an incomplete descent having a distance greater than three (3) feet above the invert or water level resulting in data interpolation shall be rejected unless appurtenances or obstructions are present within the chamber.
- l. The digital film files must include the capability to produce a three-dimensional representation of the manhole structure. This data shall be used to perform geometric measurements. This file shall be exportable to common CAD and/or GIS formats for further analysis.
- m. The digital files must include a distortion-free virtual pan and tilt allowing the review of the manhole structure from any angle from any depth. The virtual pan and tilt must be able to view 360 degrees in any direction. The virtual pan and tilt must consist of views from the top and bottom camera, any virtual pan and tilts that artificially create this view from a single camera shall be deemed unacceptable due to distorted images on the direct side view.
- n. The virtual pan and tilt and unfolded views must be able to be viewable with all the required software included at no additional cost to the Owner.
- o. Scratches identified on glass camera lens or protective covers that inhibit clear views shall be rejected with instruction to re-inspect using repaired or replaced equipment. Excessive glare caused by sunlight that inhibits clear views shall be rejected with instruction to re-inspect using appropriate shielding.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The Contractor shall comply with all residence notification requirements in Section 33 01 30.18 – Security Clearances and Communications.
- B. Working hours shall be in accordance with Section 01 14 00 – Work Restrictions.
- C. Manholes and/or catch basins shall be cleaned of loose or settled debris and the debris removed from the structure prior to inspection with the methods and equipment detailed in this Specification.
- D. It shall be the responsibility of the Contractor to locate manholes, pipes and/or catch basins identified for survey or required for access to pipes identified for survey in the contract mapping by whatever means necessary including, but not limited to, searching for visual evidence of the manhole, use of a metal detector, use of GPS survey equipment, and use of CCTV equipment



and a sonde locator. The use of these tools and technologies, and time spent to locate manholes, catch basins or pipes, are incidental to the cost for cleaning and inspection of manholes, catch basins and pipes, and no additional payment shall be allowed.

1. If the CCTV camera cannot reach the manhole due to pipe access issues such as collapses, cross-bores or other conditions requiring an external point repair, the Contractor shall notify the Engineer. The Engineer shall notify the Contractor to return if the Engineer arranges for the performance of the external point repair. If the Contractor, having attempted the search from all possible pipe directions, determines that the manhole does not exist at that location and the GIS mapping is incorrect or if the Contractor arrives at a bulkhead, blind tie, catch basin or other termination point which is not a manhole, the Contractor shall notify the Engineer. The Engineer shall review the efforts of the Contractor and determine if the search shall be considered complete. If the Engineer considers the search complete, the Contractor shall mark the inspection as not found (NF) in the Manhole Inspection, providing adequate detail on efforts made to locate the asset and site observations, provide a manhole empty header record in accordance with 3.4 of this Specification and move on to the next asset for inspection.
2. If a manhole is buried at a depth of less than (2) feet in unpaved areas, the Contractor shall arrange for the manhole to be exposed. This work shall be considered incidental to the sewer inspection and no additional payment will be allowed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Engineer may direct the Contractor to either fill the hole back in at no additional cost to the Owner or to raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Unpaved Areas –Less Than Two (2) Feet”.
3. If a manhole is buried at a depth greater than or equal to two (2) feet in unpaved areas, the Contractor shall arrange for the manhole to be exposed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Contractor shall raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to expose and raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Unpaved Areas - Greater Than or Equal To Two (2) Feet”.
4. If a manhole is buried in paved areas, the Contractor shall arrange for the manhole to be exposed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Contractor shall raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to expose and raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Paved Areas”.
5. Furthermore, for additional work where efforts to open manholes that may be welded shut, have stripped bolts, broken locking devices, stuck or broken covers, or other conditions preventing the opening of the structure and requiring mechanical equipment and/or hand tools to open, the Contractor shall be compensated by time and materials using the allowance, “Provisional Allowance”. This item shall be used in agreed-upon locations, after one (1) hour of labor expended in the Contractor’s reasonable attempt to access and gaining entry to an individual manhole that has been located.
6. The Contractor shall edit the record drawings or provide the Engineer with a legible sketch



drawing to identify the approximate location of any manholes, structures, pipes, or other assets that are not accurately depicted on the mapping (more than ten (10) feet from the location shown in the mapping, or outside of the ROW or easement shown on the mapping), are determined to not exist or be abandoned, or is not shown on the mapping. The Contractor shall GPS survey any newly found manholes structures, or those not accurately depicted to submeter accuracy. Markups shall be confirmed with the Engineer and should be legibly recorded in the record drawings. The edited record drawings or sketches shall be provided to the Engineer with each bi-weekly inspection submittal or upon request by the Engineer.

7. Once any phase of the Contract is started in an area, work shall continue in a timely manner until all manholes and pipe sections are cleaned and inspected in that area. Completion of internal inspection of manholes shall be within one (1) week after cleaning assuming that the manhole is still clean upon initial inspection.
- E. Sewers and manholes may be located in easements, public or private property, City-owned parklands, rights-of-way and restricted alleyways where no paved access may exist, or where paved access is obstructed to the extent that would inhibit equipment and materials mobilization. It shall be the Contractor's responsibility to identify these sewers and arrange for access using "Door Hanger" notifications as necessary and to restore any surface damage to private and City-owned property.
- F. Where access routes to various manhole locations must be cleared of heavy vegetation, the Contractor shall perform the clearing of pathways and alleyways to the extents necessary to facilitate mobilization of cleaning and internal sewer inspection equipment. The Contractor shall not remove vegetation on private property or outside of the sewer easement or right of way.
1. Any vegetation or other debris cleared by the Contractor shall be removed and disposed of properly by the Contractor, and the site restored by the Contractor.
 2. Trees larger than six (6) inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall not be removed as part of the work. The Contractor shall notify the Engineer of site conditions that impede the completion of the work.
 3. Trees smaller than six (6) inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall be removed as part of the work and shall be incidental to the work.
- G. The Contractor shall clear restricted alleyways or easements to enable the mobilization of inspection and cleaning equipment. This work shall be incidental to the manhole cleaning and inspection activities.
- H. The Contractor shall schedule, maintain, and coordinate all activities and shall cooperate with the Engineer to ensure a minimum interruption to services. The Contractor shall not operate existing system valves, controls, or other appurtenances at any time, however, if operation of assets is necessary to facilitate and accommodate activities, shall request such operation from the Engineer. The Contractor shall provide the Engineer with 48-hour advance notice for such assistance.



- I. The Contractor is hereby made aware that no flow shall be discharged to waterbodies, wetlands, floodplains, or any other storm outlet during cleaning or inspection operations. Additionally, no sewage shall be permitted to surcharge to the point that it overflows to any of the above or back into private buildings through lateral connections. The Contractor must notify the Engineer immediately of any spill event. Any damage or fines resulting from such occurrences are the sole responsibility of the Contractor.
- J. The Contractor shall notify the Engineer 96 hours prior to mobilizing for internal inspection or cleaning activities.

3.2 HIGH FLOW CONDITIONS

- A. The Contractor shall attempt inspections at times that facilitate obtaining the maximum visible image above the flow surface which are typically at the diurnal low flow periods each day or, subject to public notification, at night. Work that cannot be completed due to excess water levels shall be coordinated with the Engineer. If work is deemed necessary, flow controls and diversion shall be submitted to the Engineer for approval.
- B. If manhole chambers are observed to be surcharged, the Contractor shall communicate the observation to the Engineer prior to inspection.
 - 1. The Engineer and Contractor shall collaborate to determine if there is a hydraulic or operational restriction within the area.
 - 2. If hydraulic overload is determined to be present, inspection shall take place during a low diurnal period, such as nighttime, to facilitate a full inspection of the chamber is completed.
 - 3. If an operational issue exists, the cleaning of associated sewers shall be completed to alleviate and reduce flow. Otherwise, the Engineer may direct that an incomplete inspection may be carried out of the surcharged manhole chamber.

3.3 MACP MANHOLE INSPECTION

- A. Manhole inspections shall be conducted in accordance with NASSCO MACP version 7.0.0 (or newer) Level 2 standards but by utilizing non-man-entry techniques as noted herein.
- B. If television inspection reveals new manholes, locate, mark by painting or flagging and name the manhole in accordance with the methodology for temporary or new Asset ID for new manholes and sewers per the specification. The manhole shall be exposed and raised, if required, in accordance with 3.1.D of this Specification.
- C. All unmapped manholes shall be inspected as per the Specification.
- D. For manholes that are more than ten (10) feet from the location shown in the mapping, or outside of the ROW or easement shown on the mapping or for newly found manholes, the Contractor



shall provide the Engineer with a legible sketch drawing that provides the location of the manholes, structures, or piping and GPS survey the manhole to submeter accuracy. The edited record drawings or sketches will be provided to the Engineer with each bi-weekly inspection submittal or upon request by the Engineer. All sketches shall be named in the following format:

[P/O Number]_[Manhole ID]_[Contractor Name]_MACP_Submittal_[Number].pdf e.g.,
DWS-999_WWMH0000003063_ACME_MACP_Submittal_010.pdf

- E. Unmapped assets, including manholes and pipes, shall be assigned Asset IDs through the use of DWSD's Field Maps App by the Contractor. It shall be the responsibility of the Contractor to coordinate their work and incorporate the newly mapped assets and corresponding Asset IDs into their GPS, sewer pipe and manhole inspections. Care should be taken by the Contractor not to name the same unmapped asset with a different Asset ID through the Field Maps App when it is used by different inspection crews.
- F. The split pipe segments resulting from newly found manholes shall be assigned Asset IDs by the Contractor through the use of DWSD's Field Maps App. The original Asset ID of the pipe shall remain as-is from the start node of the survey to the point of the newly found manhole and the Asset ID generated by the Field Maps App shall be assigned to the next portion of the pipe section to the originally mapped end node.
- G. If a newly found pipe is encountered from a manhole survey, it shall be inspected.
- H. Any unmapped assets discovered in the field shall be reported to DWSD on a daily basis.
- I. A NASSCO MACP certified technician or supervisor who shall be located at the control panel in the mobile data collection studio shall control the operation of the digital inspection equipment. The Contractor shall perform manhole inspections in accordance with the following:
 - 1. From the top to the bottom of the manhole.
 - 2. From the manhole frame to the center line elevation of the existing sewer.
 - 3. Ensure the frame of the manhole is clearly visible at the start of the inspection.
 - 4. Provide a black chalkboard placed adjacent to the closed manhole cover, within the inspection imagery, noting the manhole Asset ID, location details (i.e., address), date and physical measurement of manhole rim to invert dimension.
 - 5. Spray paint a mark (with a color consistent for the duration of the project) indicating north using an arrow visible on the surface and within the manhole frame.
 - 6. Spray paint a mark (with a color consistent for the duration of the project and a different color to the north mark) indicating the 6 o'clock position that is in reference to the first outgoing pipe (taken from north in a clockwise direction, as per NASSCO MACP requirements) visible on the surface and within the manhole frame.
 - 7. Block ambient light during the inspection to minimize problems related to lens flare and poor contrast.
 - 8. Inspect the manhole to the lowest depth that shall facilitate accurate perpendicular measurements using the software's measuring tools.
 - 9. Complete all survey rod or calibrated footage counter measurements pertinent to mandatory MACP Level 2 measurements that are located at or around the cover and frame



area. In accordance with NASSCO MACP standards, the Contractor shall measure the rim to invert using a steel tape or survey rod from the surface to validate the measurement available from the scan.

10. No confined space entry shall be completed.
-
- J. The inspection device must descend to the lowest point within the chamber to minimize interpolated data beyond the scanning range or the inspection shall be rejected if insufficient evidence is reported. If the equipment cannot be lowered sufficiently due to permanent internally fitted appurtenances, the Contractor shall complete the inspection, reporting all observations and reasoning for survey abandonment. Debris in manhole shall not be a reason for survey abandonment.
 - K. If temporary flow control equipment and monitoring devices are discovered within the chamber, the Contractor shall not proceed with the inspection and notify the Engineer of their discovery. This equipment is sensitive to movement and disturbance. The Engineer shall make reasonable efforts to have the equipment temporarily removed for re-inspection. Costs incurred for re-mobilization to the manhole shall be inclusive of the Contractor's unit price.
 - L. Contractor shall document manhole conditions in digital photographs and digital scan. Digital photographs shall be taken of the surface (showing the manhole cover and ground surface), manhole interior, and of all observed defects (using a zoom lens or scan as needed). Additionally, and separate from the scan, the Contractor shall take a digital photograph of the manhole cover with a black chalkboard documenting the manhole Asset ID, location details (i.e., address), date and physical measurement per NASSCO standards of manhole rim to invert dimension, of both the outgoing pipe and manhole invert (if different), written in chalk and laid adjacent to the closed manhole cover, one photograph of the outside of the manhole (capturing physical address, intersection or nearest landmark that can be used to readily identify the location of the manhole) and an interior photo looking down from the rim with the outgoing pipe at 6 o'clock.
 - M. Name the digital scan files or folder according to the following file specification:
[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format].filetype or folder e.g.,
WWMH0000003063_20181130_104159.ipf or WWMH0000003063_20181130_104159
 - N. Name the digital photograph files for observations according to the following file specification:
[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format]_[Code]_[Footage].jpg e.g.,
WWMH0000003063_20181130_134159_DB_1.3.jpg
 - O. Name the digital photograph files for pipe connections according to the following file specification:
[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format]_Connection_[pipe connection number].jpg
e.g., WWMH0000003063_20181130_134159_Connection_1.jpg
 - P. Name the digital interior photograph file according to the following file specification:
[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format]_Interior.jpg e.g.,
WWMH0000003063_20181130_134159_Interior.jpg



- Q. Name the digital exterior location photograph file according to the following file specification: **[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format]_Exterior Location.jpg** e.g., WWMH0000003063_20181130_134159_Exterior Location.jpg
- R. Name the digital exterior cover photograph file according to the following file specification: **[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format]_Exterior Cover.jpg** e.g., WWMH0000003063_20181130_134159_Exterior Cover.jpg
- S. All open access structures or manholes shall be attended at all times. All access structures or manholes that were sealed or bolted to control odors, to prevent entry of extraneous water, or for security reasons, shall be resealed or re-bolted after entry and exit. The Contractor shall provide evidence that sealed or bolted chambers have been adequately sealed or bolted, after inspection.
- T. All chambers including control structures that exhibit weir wall or spill pipe weir levels as observed within the field must be measured from manhole rim to weir crest where possible and detailed within the Inspection Comments field. Chambers exhibiting weir walls with no coded depth observations provided shall be rejected.
- U. All pipe connections (taps) shall be associated to a physical property address, and this shall be recorded within the MACP inspection. Further to coding of taps, the Contractor shall conform to NASSCO requirements; however, where defective taps are identified, the most significant observed defect seen within the lateral shall be communicated within the “Remarks” field as per MACP requirements including, but not limited to, appropriate dimensioning, percentage values and clock references relating to its defect, but also providing the associated property address of the tap comma separated for data processing requirements but also providing the sewer location if it is in the rear, side or front of the property (e.g., “RM, 50%, 03, 09, 456 Second Avenue, Rear”). Furthermore, the Contractor shall identify the affected property by completing a steel tape or calibrated footage counter measurement on the surface to confirm property number and note this within the “Remarks” field with an associated photograph taken of the offending defective tap.

3.4 INSPECTION REPORTS

- S. The Contractor shall prepare inspection reports covering the inspection work and the information acquired.
- T. Contractor shall report manhole defects in accordance with the National Association of Sewer Service Companies (NASSCO) program known as Manhole Assessment and Certification Program (MACP).
- U. Contractor shall provide a summary listing of all manholes or structures included in the original task order listing the date of inspection or attempted inspection, and indicating if the manhole was inspected, or if not, the reason, e.g., not found (NF), no access (NA), not opened (NO), structure is a lamphole (LH) or cleanout (CO), or other (OTHER) reason.



- V. An “empty header” or “MSA” inspection shall be completed for manholes that cannot be inspected for reasons such as high flow, depths or velocities, inaccessibility or unlocated access structures, heavy debris, etc. The inspection form header and detail sections shall comply with NASSCO MACP level 1 guidelines populating all required header fields. The contractor shall abandon the survey at a distance of 0-ft inspected and provide a general comment that describes the reason that the inspection cannot be conducted in the Additional Information field. Contractor shall record at least one photo documenting conditions preventing the inspection of the manhole including inaccessible and survey abandoned conditions, and one (1) photo documenting manhole location. Empty header records, and image references for the photos, shall be included in the MACP database as submitted by the contractor with manholes on adjoining segments.

- W. In addition to completing all mandatory MACP inspection required fields, the Contractor shall complete the following fields in the MACP Header Section shown in the table below. Additional notes are as follows:
 - 1. Field 3 – “Reviewed By” shall be required only for those inspections that are QA reviewed.
 - 2. Field 4 – “Reviewer Certificate Number” shall be required only for those inspections that are QA reviewed.
 - 3. Field 5 - “Owner” is DWSD.
 - 4. Field 7 – “P/O Number” is the Project Number, e.g., DWS-999.
 - 5. Field 10 – “Project” is the Project Area, e.g., Neighborhood A.
 - 6. Field 17 – “Purpose of Survey” is to be set to “G”.
 - 7. Field 22 – “Manhole/Access Point Number” is the Asset ID of the manhole or access point.
 - 8. Field 38 – 43 - data shall be collected using a hand-held GPS device to achieve Nearest (N) or sub-meter (M) accuracies dependent upon available satellite coverage.
 - 9. Field 38 – “Northing” is the Y Coordinate.
 - 10. Field 39 – “Easting” is the X Coordinate.
 - 11. Field 40 – “Elevation” is the Z Coordinate.
 - 12. Field 44 – Additional Information should include physical measurement of rim to lowest point in the manhole.
 - 13. Field 106 – Additional Component Information should be populated with the recorded height of evidence of surcharge (from manhole rim to surcharge level).



Manhole Header Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
General Information	1	Surveyed By (Operator / MACP User Name)	Yes	Yes
	2	Certificate Number	Yes	Yes
	3	Reviewed By	Optional	Optional
	4	Reviewer Certificate Number	Optional	Optional
	5	Owner	Optional	Yes
	6	Customer	Optional	Yes
	7	P/O Number	Optional	Yes
	8	Work Order	Optional	Optional
	9	Media Label	Optional	Optional
	10	Project	Optional	Optional
	11	Date	Yes	Yes
	12	Time	Optional	Yes
	13	Sheet Number	Yes	Yes
	14	Weather	Optional	Yes
	15	Pre-Cleaning	Yes	Yes
	16	Date Cleaned	Optional	Yes
	17	Purpose of Survey	Yes	Yes
	18	Inspection Level	Yes	Yes
	19	Inspection Status	Yes	Yes
	20	Consequence of Failure	Optional	Optional
Location	21	Drainage Area	Optional	Optional
	22	Manhole/Access Point Number	Yes	Yes
	23	Street (Name and Number)	Yes	Yes
	24	City	Yes	Yes
	25	Location Code	Yes	Yes
	26	Surface Type	Yes	Yes
	27	Inflow Potential from Runoff	Optional	Optional
	28	Location Details	Optional	Yes
Manhole	29	MH Use (Use of Access Point/Structure)	Yes	Yes
	30	Access Type	Yes	Yes
	31	Year Constructed	Optional	Optional
	32	Year Renewed	Optional	Optional
	33	Evidence of Surcharge	Yes	Yes



Manhole Header Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
Measurements	34	Rim to Invert (Outgoing)	Yes	Yes
	35	Rim to Grade (Outgoing)	Yes	Yes
	36	Grade to Invert (Outgoing)	Yes	Yes
	37	Rim to Grade Exposed	Optional	Optional
	38	Northing	Optional	Yes
	39	Easting	Optional	Yes
	40	Elevation	Optional	Yes
	41	Coordinate System	Optional	Yes
	42	Vertical Datum (Elevation)	Optional	Yes
	43	GPS Accuracy	Optional	Yes
	44	Additional Information	Optional	Yes

The following fields shall be used when completing the “Manhole Component Observation Section” details in the manhole component observation form.

Manhole Component Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
Cover	45	Cover Type	Yes	Yes
	46	Cover Shape	Yes	Yes
	47	Cover Size	Yes	Yes
	48	Centre Cover Size	Optional	Optional
	49	Cover Size Width	Yes	Yes
	50	Cover Material	Yes	Yes
	51	Hole Diameter (Vent)	Yes	Yes
	52	Hole Number (Number of Vent Holes)	Yes	Yes
	53	Cover Bearing Surface Diameter	Yes	Yes
	54	Cover Bearing Surface Width	Yes	Yes
	55	Cover/Frame Fit	Yes	Yes
	56	Cover Condition	Yes	Yes



Manhole Component Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
Cover Insert	57	Insert Type	Yes	Yes
	58	Cover Insert Condition	Yes	Yes
Manhole Cover Adjustment Ring	59	Adjustment Ring Type	Yes	Yes
	60	Adjustment Ring Material	Yes	Yes
	61	Ring Condition (Adjustment Ring)	Yes	Yes
	62	Adjustment Ring Height	Optional	Optional
Frame	63	Frame Material	Yes	Yes
	64	Frame Bearing Surface Width	Yes	Yes
	65	Frame Bearing Surface Depth	Yes	Yes
	66	Frame Clear Opening Diameter	Yes	Yes
	67	Frame Clear Opening Width	Yes	Yes
	68	Frame Condition	Yes	Yes
	69	Seal Condition	Yes	Yes
	70	Frame Offset Distance	Yes	Yes
	71	Frame Seal Inflow	Yes	Yes
	72	Frame Depth	Optional	Optional
Chimney	73	Chimney Present	Yes	Yes
	74	Chimney First Material	Yes	Yes
	75	Chimney Second Material	Optional	Optional
	76	Chimney I/I	Optional	Optional
	77	Chimney Clear Opening	Optional	Optional
	78	Chimney Depth	Yes	Yes
	79	Chimney Lining Interior (Coating)	Optional	Optional
	80	Chimney Lining Exterior (Coating)	Optional	Optional
	81	Chimney Condition	Yes	Yes
Cone	82	Cone Type	Yes	Yes
	83	Cone Material	Yes	Yes
	84	Cone Depth	Yes	Yes
	85	Cone Lining Interior	Optional	Optional
	86	Cone Lining Exterior	Optional	Optional
	87	Cone Condition	Yes	Yes



Manhole Component Section	Field No.	Field Name	NASSCO Mandatory	DWSD Mandatory
Wall	88	Wall Diameter (Length)	Optional	Yes
	89	Wall by Size (Width)	Optional	Optional
	90	Wall Material	Yes	Yes
	91	Wall Depth	Yes	Yes
	92	Wall Lining Interior (Coating)	Optional	Optional
	93	Wall Lining Exterior (Coating)	Optional	Optional
	94	Wall Condition	Yes	Yes
Bench	95	Bench Present	Yes	Yes
	96	Bench Material	Yes	Yes
	97	Bench Lining (Coating)	Optional	Optional
	98	Bench Condition	Yes	Yes
Channel	99	Channel Installed	Yes	Yes
	100	Channel Material	Yes	Yes
	101	Channel Type	Yes	Yes
	102	Channel Exposure	Yes	Yes
	103	Channel Condition	Yes	Yes
Manhole Steps	104	Step Number	Yes	Yes
	105	Step Material	Yes	Yes
Additional Component Information	106	Additional Component Information	Optional	Yes*
	107	Pipe Number	Yes	Yes
	108	Clock Position	Yes	Yes
	109	Rim to Invert	Yes	Yes
	110	Direction	Yes	Yes
	111	Material	Yes	Yes
	112	Shape	Yes	Yes
	113	Height (Diameter)	Yes	Yes
	114	Width	Yes	Yes
	115	Pipe Condition	Yes	Yes
	116	Pipe Seal Condition	Yes	Yes
	117	Pipe Type	Yes	Yes
	118	Structure ID (Pipe/Lateral Segment Reference)	Optional	Yes
	119	Pipe Comments	Optional	Optional

Yes* - when required

3.5 OBSERVED FAILURES DURING MANHOLE INSPECTIONS

- S. Cross-bores are intersections of one utility pipeline through another, such as when a gas pipeline



is inadvertently installed through a manhole. Cross-bores generally occur when a third-party utility is installed using a trenchless method that prevents visibility of the underground sewer pipeline and are commonly water or gas services.

1. Capture images of the cross-bore and notify the Engineer immediately where third party cross-bores are observed during the manhole inspection. Provide the captured digital images of the cross-bore with the manhole Asset ID to the Engineer immediately after observation.
- T. Capture photographs or digital images and notify the Engineer immediately after observation where issues identified in the tables below are observed during the sewer or manhole inspection. Provide the captured images in addition to Asset IDs, observed issue identified by defect code and description, and footage along the pipe to the Engineer immediately via e-mail after observation. The format of this communication is shown in the Appendix.

1. Structural:

Defect	Grade	Description
X	5	Collapse
DR	5	Deformed Rigid
H	5	Hole
HSV	5	Hole Soil Visible
HVV	5	Hole Void Visible
X (Lateral)	5	Collapsed Lateral
MB	4	Missing Brick

2. Operational:

Defect	Grade	Description
OBI	5	Obstruction Intruding Through Wall
RBB	5	Roots Ball Barrel
IG	5	Infiltration Gusher
IR	4	Infiltration Runner

3. Miscellaneous:

Defect	Grade	Description
MWLS	5	Miscellaneous Water Level > 75%

- U. Follow the Traffic and Safety protocols contained in this Specification. At a minimum, place barricades around the location above the manhole where a void is visible or suspected to be outside of the sewer pipe or manhole and immediately notify the Engineer. Call Detroit Water



and Sewerage Department (DWSD) Emergency Services at telephone number 313-267-7401 after normal working hours.

- V. The Engineer shall arrange for emergency manhole repairs to be performed if required as soon as possible if the inspection cannot be completed or the sewer or manhole condition poses an immediate operational or safety concern such as a complete collapse.
- W. Emergency manhole repairs shall be prioritized if more than one emergency repair arises at the same time.
- X. Carry out inspection of other manholes not affected by the emergency repair and complete inspection of the manhole when notified by the Engineer when the emergency repair has been completed.
- Y. Repeat cleaning of the manhole in accordance with Section 33 01 30.32 - Sewer Cleaning for Condition Assessment if required.

3.6 TRAFFIC CONTROL

- S. Contractor shall provide traffic control as required and in compliance with the Local and State governing authorities and in accordance with Section 01 55 26 – Traffic Control.
- T. Contractor shall coordinate traffic control with City of Detroit and other jurisdictional authorities.
- U. The work of Maintaining Traffic consists of furnishing all labor, equipment, and materials required for maintaining traffic throughout the project area in accordance with Sections 104.07.C, 104.11, 812, and 922 of the MDOT 2012 Standard Specifications for Construction and this Specification.
 - 1. Notify the Engineer a minimum of 72 business hours prior to the implementation of any road closures, lane closures, or major traffic shifts. The Contractor shall be required to contact all local and state police, fire, and emergency services that have jurisdiction within 72 business hours prior to the implementation of any lane closure.
 - 2. Construction Influence Area (CIA) – The CIA includes the right-of-way of the roadways within the project limits.
 - 3. General Traffic Restrictions:
 - a. Normal work hours are Monday thru Friday from 7:00 a.m. to 7:00 p.m., or as approved by the Engineer. Work outside the normal work hours shall require prior approval from the Engineer.
 - b. No work or lane closures shall be allowed during Independence Day, Memorial Day weekend or Labor Day weekend. Holiday weekends are defined as beginning at 12:00 p.m. on Friday and ending at 6:00 a.m. on the following Tuesday, or as defined by the Engineer. No work shall be allowed during any standard holiday weekends, which shall be defined by the Engineer. No work or lane closures shall be allowed on holiday weekends when the holiday occurs on or is observed on Fridays or Mondays.



- c. Maintain access to all residential and business driveways at all times. Maintain access to driveways in active work zones when possible, as confirmed by the Engineer.
 - d. All labor, equipment, and aggregate required to maintain street, intersections, and driveways for traffic shall be included in the execution of the Work.
 - e. Coordinate operations with the other Contractors performing work on projects within or adjacent to the CIA. Maintenance crews and/or Contractor Maintenance Agencies may preform maintenance work within or adjacent to the CIA. The Maintenance Division of MDOT and/or Contract Maintenance Agency shall coordinate their operations with the Engineer to minimize interference to the Contractor. No additional payment shall be made to the Contractor for joint use of the traffic control items.
 - f. Maintain access for emergency vehicles at all times through the work area.
 - g. Provide fencing to protect open trenches and pits during working and non-working hours.
4. Project General: During work hours, equipment, material, and company vehicles may be parked or stored within the right-of-way as confirmed by the Engineer. The contractor is responsible for restoring to its original condition any area damaged by their equipment, material, or company vehicles. Restoration of damaged areas shall be in accordance with the plans and 2012 MDOT Standard Specifications for Construction and this Specification.

3.7 PROJECT DELIVERABLES

- S. The Contractor shall submit a formal Inspection Report, in digital formats, that summarizes all inspection activities and includes all inspection data in their raw format, along with any software required to view or utilize the raw data. Free viewer software, at no expense to the Owner, must be provided by the Contractor to allow dimension verification and measurement and complete viewing of the data for MACP scans including, but not limited to, the unfolded view and virtual pan and tilt.
- T. In addition to the viewing software, raw data to include but not limited to point cloud, contour and other .dat files (or similar) shall be provided in addition to scanned front, back and wrapped images and snapshots of any pertinent defects or features.
- U. The Contractor shall provide at least three (3), 2.5-inch portable hard disk drives (HDD), complete with all associated drivers and software, power adaptors and USB cables, delivered on a bi-weekly rotation exchange that contains completed inspections and data with viewing software and sewer condition coding data to the Engineer. Manhole condition coding shall be submitted as MACP.mdb files accordingly. Retained HDD's shall be returned at an agreed frequency. Alternatively, data may be provided through the use of a cloud-based application with the confirmation of the Engineer. The final determination for data transfer shall be confirmed by the Engineer.
- V. All HDD's shall be sized appropriately to accommodate all above-mentioned files and have dual USB 3.0 (preferable) and (a minimum) USB 2.0 compatibility with a minimum data transfer rate of 480 MB/s.



- W. Submit one MACP (version 7.0.0 or newer) compliant Microsoft Access, macp.mdb inspection database containing observed construction, structural, operational and miscellaneous observations for batches of manhole inspections that coincide with agreed submittal schedule to the Engineer. Name the MACP database according to the following file specification:
[Contractor Name]_[P/O Number]_MACP_Submittal_[Number].mdb.
 e.g., ACME_DWS-999_MACP_Submittal_025.mdb
- X. Name the report files according to the following file specification:
[P/O Number]_[Manhole ID]_[YYYYMMDD]_[HHMMSS – 24 hour format].pdf
 e.g., DWS-999_WWMH0000003063_20211130_134159.pdf
- Y. The Contractor shall organize data accordingly within the following folder structure when providing MACP data submittals:
 - 1. Database (folder)
 - 2. Scans (folder)
 - 3. Photos (folder)
 - 4. Reports (folder)
 - 5. MH Inspection Data Submittal Tracking Spreadsheet
 - 6. QA Review Report

3.8 ACCEPTANCE OF WORK

- S. The contractor shall submit completed manhole scan inspections of each manhole to the Engineer for review for compliance with the Contract.
- T. The Engineer shall review the contiguous pipe inspection videos and manhole scans within fifteen (15) working days of submission for compliance with the Contract.
- U. The Contractor shall re-perform manhole inspections that are not in compliance with the Contract.
- V. The Contractor shall correct non-compliant inspection submissions and resubmit the corrected inspections to the Engineer within five (5) working days.
- W. The Contractor shall repeat the process until the inspection submissions are in compliance with the Contract. Additional work needed to achieve compliance shall not be eligible for additional payment.
- A.

END OF SECTION 33 01 30.31



[illegible]

SECTION 33 01 30.32 - SEWER CLEANING FOR CONDITION ASSESSMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Description of Work:

1. Provide all equipment, tools, labor, materials and incidental services necessary to perform all gravity sewer line, manhole and catch basin cleaning work as indicated and in compliance with the Contract Documents.
2. Loose or settled debris includes but is not limited to loose, settled or not physically attached, asphalt, concrete, bricks, rocks, broken pipe, broken encrustation, construction debris, sludge, dirt, sand, gravel, grit, solids, roots, grease, and other solid and semi-solid debris per NASSCO standards.
3. The intent of sewer cleaning is to remove loose or settled debris with a high-pressure water jetter in order to be able to conduct a NASSCO compliant inspection for pipes of height of 35 inches or less.
4. For cleaning evaluation purposes, sewers shall be considered clean when 95 percent of the cross-sectional area of the pipe is free of loose or settled debris of any size.
5. The intent of manhole cleaning is to remove loose or settled debris using multiple passes using a cleaning wand associated with the high-pressure water jetter equipment and removal of debris from the bench and channel in order to be able to conduct a NASSCO compliant inspection. Only manholes that connect to mainline pipes of height 35" or less are to be cleaned.
6. The intent of catch basin cleaning is to remove loose or settled debris using multiple passes using a cleaning wand associated with the high-pressure water jetter equipment in order to be able to conduct a visual inspection, to clean the catch basin lead and to perform tracing to locate its connection to the sewer main.
7. Comply with all requirements of MISS DIG Public Act 174 including contacting MISS DIG, hand excavation near utilities, and contacting 911 in case of emergency.
8. The Contractor shall be required to enter MISS DIG tickets for all work requiring excavation. When entering the MISS DIG ticket, the following information shall be added by the Contractor to the "Locate Info" field: Contractor shall enter "*ENG*" followed by ": Project Number*" and followed by a description requesting utility location markings that encompasses the entire work area. Example of entry for a Contract with Project Number 917: *ENG*:917* Locate all utilities in front and both sides of street.
9. The Contractor shall contact MISS DIG (811) in accordance with Public Act 174 to provide locates prior to all cleaning operations in all storm sewers and shallow sewers (less than six (6) feet deep, based on the available information from GIS or engineering records) located in the right of way to reduce impact with potential cross bores when cleaning.



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10. The Contractor shall provide all equipment, tools, labor, materials, and incidental services necessary to perform all work for locating, exposing and raising manholes as indicated and in compliance with the Contract Documents.
- B. Types of Cleaning are described below. Regardless of the number and type of cleaning passes performed, the final pass of cleaning shall be undertaken in conjunction with the CCTV camera inspection that is to be provided as the final inspection deliverable. The use of the cleaning equipment in conjunction with the CCTV camera inspection shall not be considered an additional pass, but shall be incidental to the contract:
1. Cleaning: Cleaning of the entire length of the sewer segment using a high-pressure water jetter using the step-cleaning method described in this Contract for the entire length of the pipe. The intent of cleaning is to remove loose or settled debris with a high-pressure water jetter in order to be able to conduct a NASSCO compliant inspection. If the Contractor's equipment cannot pass through the pipe due to a blockage, the Contractor may request approval from the Engineer to initiate Specialty Cleaning such as Excessive Grease and/or Root Removal, Physically Attached Solid Debris Cutting and/or Removal of Intruding Taps as described herein.
 2. Excessive Grease and Root Removal: Excessive grease and root removal shall include the cutting and removal from the sewer of grease or roots that block the passage of the cleaning or inspection equipment that could not be removed with standard cleaning, and requires the use of remote controlled hydraulically or mechanically driven saw or blade cutters or grinders, remotely operated robots or other types of equipment capable of removing grease and roots. To be completed only at locations confirmed by the Engineer.
 3. Physically Attached Solid Debris Cutting: Physically Attached Solid Debris Cutting shall include the cutting and removal from the sewer of physically attached solid debris that blocks the passage of the cleaning or inspection equipment including, but not limited to, concrete, asphalt or encrustation that is attached to the pipe surface and could not be removed with standard cleaning, and requires the use of remote controlled, hydraulically or mechanically driven saw or blade cutters or grinders, remotely operated robots or other types of equipment capable of removing solid debris. To be completed only at locations confirmed by the Engineer.
 4. Removal of Intruding Taps: This work shall include the cutting and removal from the sewer of intruding taps that block the passage of the cleaning or inspection equipment, requiring the use of remote controlled hydraulically or mechanically driven saw or blade cutters or grinders, remotely operated robots or other types of equipment capable of removing solid taps to be cut and ground and removed from the sewer. To be completed only at locations confirmed by the Engineer.
 5. Debris Removal: The extraction of and proper disposal of foreign material from the sewer that includes but is not limited to loose or settled debris of any size.
 6. Manhole Cleaning: Cleaning of the entire height of the manhole using a cleaning wand associated with the high-pressure water jetter equipment and removal of loose or settled debris from the bench and channel.



7. Catch Basin Cleaning: Cleaning of the entire height of the catch basin using a cleaning wand associated with the high-pressure water jetter equipment, cleaning of the catch basin lead, tracing of the catch basin led to locate its connection to the sewer main and removal of loose or settled debris from the catch basin as described in these Specifications.

C. Related Requirements:

1. Section 33 01 30.30 - Sewer Pipeline Inspection for Condition Assessment.
2. Section 33 01 30.31 - Manhole Inspection for Condition Assessment.
3. Section 33 01 30.18 – Security Clearances and Communications.
4. Section 33 01 30.81 – Manhole Rehabilitation.

1.2 DEFINITIONS

- A. Closed-Circuit Television (CCTV) Inspection: Operation necessary to complete a true-color audio-visual inspection for verification of existing internal sewer line conditions.

1.3 STANDARDS

A. National Association of Sewer Service Companies (NASSCO):

1. Pipeline Assessment and Certification Program (PACP) Reference Manual.
2. Manhole Assessment and Certification Program (MACP) Reference Manual.

1.4 SUBMITTALS

- A. Submit the submittals of this section in accordance with Section 01 33 00 – Submittal Procedures.
- B. Submit a written description of procedures to be used, including product literature for all high-pressure water jetter equipment to be used per the equipment section of this Specification including, but not limited to hosing, jetter nozzles, water tanks, auxiliary engines, pumps, hydraulically driven hose reels, wash down wands, vacuum units and backflow prevention devices. The Contractor shall submit information on all equipment to be used for review for compliance with the contract at least one (1) month before beginning the cleaning work.
- C. Provide written procedure for method of dewatering and debris disposal for review for compliance with the contract.
- D. Prior to initiating cleaning or inspection efforts, the Contractor shall submit an Emergency Plan that outlines proposed methods for recovering their cleaning or inspection equipment that has become lodged, lost or uncontrollable within the manhole or sewer, including confined space



entry procedures.

- E. Contractor is to provide a daily schedule to the Engineer with planned cleaning locations.

1.5 QUALITY ASSURANCE

- A. Comply with the requirements of Section 01 40 00 – Quality Requirements and Section 33 01 30.30 – Sewer Pipeline Inspection for Condition Assessment.
- B. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.
- C. No discharge of sewage resulting from the Contractor's operations shall be allowed. The Contractor shall be responsible to pay all fines associated with sewage discharges resulting from the Contractor's activities.
- D. The Contractor shall not discharge into the sewer system, any water containing silt, mud or any other concentrated settleable material.

1.6 QUALIFICATIONS

- A. The Contractor shall submit documentation for Engineer approval to demonstrate the following experience as a business engaged in the cleaning of sewer lines per the contract documents:
 - 1. The Contractor shall be in good standing under local contracting requirements or otherwise properly registered, licensed or permitted by law to carry on business within the State of Michigan, County of Wayne, throughout the term of the Contract, and shall provide the Engineer with evidence thereof per the contract documents.
 - 2. At any time during the term of the Contract, the Engineer may, at their sole discretion and acting reasonably, request updated evidence of good standing. A Contractor, who fails to provide satisfactory evidence, shall not be permitted to continue to perform any Work.
- B. The Contractor and/or any proposed Subcontractor, for the portion of the Work proposed to be contracted to them, shall meet the minimum qualifications as listed in the Contract Documents.
- C. The Contractor shall provide the Engineer with a complete list of Subcontractors whom the Contractor proposes to use prior to the commencement of Work.
- D. The Contractor shall be fully capable of performing the Work required in strict accordance with the terms and provisions of the Contract Documents.



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PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. The Contractor shall submit information on all equipment to be used for review for compliance with the Contract. Pipe equipment that could cause damage to pipes such as “knockers” or “chain flails” will not be permitted except with express permission by the Engineer.
- B. The Contractor shall provide documentation of availability of the following equipment (or equivalent) for this project:
 1. High Velocity Jetting Equipment:
 - a. Jetting Pump must have minimum capability to clean at 80 GPM at pressures up to 2,000 psi.
 - b. Cleaning equipment must have capability to clean a maximum gravity sewer pipe length of 1,500’.
 - c. Jetting Pump Equipment with pressures between 2,000 psi and 3,000 psi may be used.
 - d. Jetting Pump Equipment with pressures exceeding 3,000 psi will be considered on a case by case basis.
 - e. The equipment shall have a selection of two or more velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines to be cleaned.
 - f. Equipment shall also include a high velocity wand for washing and scouring manhole walls and floor. The wand shall be capable of producing flows from a fine spray to a long-distance solid stream.
 - g. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.
 - h. All controls shall be located so the equipment can be operated above ground.
 - i. Jetting nozzles and floor skids designed specifically for the size ranges specified in the Contract Documents. Demonstrate availability of appropriate heads for the various work requirements.
 2. Debris Removal Equipment: Vacuum unit(s) used for removing sewer debris to include the following:
 - a. Positive displacement pumps or fans must have a vacuuming capability to remove sewer debris from a sixty (60) vertical feet deep manhole. The unit must have sufficient cubic feet per minute (CFM) of air movement, vacuum rating and length of 6 inch to 10-inch diameter vacuum pipe with an articulating boom to meet this vacuuming capability.
 - b. Storage tank with configuration to allow the liquid portion of the debris to be



- returned to the sewer.
 - c. Water-tight debris boxes with decant system.
 - 3. Mobile TV Studios in accordance with Section 33 01 30.30 – Sewer Pipeline Inspection for Condition Assessment. CCTV camera equipped with a locating sonde.
 - 4. Water tank, generators, pumps, and air compressors.
 - 5. Approved backflow prevention device for filling water tank from a hydrant.
- C. Physically Attached Solid Debris Cutting and Intruding Sewer Tap Removal and Excessive Grease and Root Cutting (Specialty Cleaning) Equipment:
 - 1. Cutting equipment to consist of remote controlled hydraulically driven saw, grinders or blade cutters, specialty nozzles (e.g. forward penetrating nozzle), remotely operated robots or other types of equipment capable of removing physically attached solid debris, excessive grease and roots.
 - 2. Intruding sewer tap pipe removal equipment to consist of remote controlled hydraulically driven cutters and reamers and remotely operated robotic routers or grinders capable of cutting back intruding sewer service pipes.
 - 3. Select the cutting equipment to be used considering debris type, pipe material, and sewer pipe condition.
 - 4. The specialty cleaning equipment shall include a unit that has a cutting nozzle and camera on the same platform, capable of removing an obstruction while simultaneously viewing the cleaning activity from the same vantage point. This unit is to be used where blockages are encountered in both directions that prevent completion of the CCTV inspection for the entire length of the pipe or in cases where the pipe can only be accessed from one access point and a blockage prevents completion of the CCTV inspection.
- D. Communication Equipment: Equipment cleaning crews shall have and utilize a suitable communication system, linking all crewmembers.
- E. Flow Control and By-Pass Pumping Equipment
 - 1. Flow Control:
 - a. Undertake flow control measures such as off-peak work, plugging or use of sewer cleaning equipment to lower downstream flow levels if sewer flows are hampering effective sewer cleaning.
 - 2. By-Pass Pumping
 - a. Comply with Section 01 57 15 – Temporary Sewer Bypass Pumping.
 - 3. The Contractor shall select pumping/bypassing equipment that shall not have excessive noise levels from pumping/bypassing equipment and shall be restricted to a maximum of ninety decibels (90 dB) at a distance of 50 feet. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum and in accordance with



the local requirements for noise control.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with all residence notification requirements in Section 33 01 30.18 – Security Clearances and Communications.
- B. Working hours shall be in accordance with Section 01 14 00 – Work Restrictions.
- C. Sewers and associated upstream or downstream manholes and/or catch basins shall be cleaned of loose or settled debris and removed from the sewer with the methods and equipment detailed in this Specification.
- D. It shall be the responsibility of the Contractor to locate manholes, pipes and/or catch basins identified for survey or required for access to pipes identified for survey in the contract mapping by whatever means necessary including but not limited to searching for visual evidence of the manhole, use of a metal detector, use of GPS survey equipment, and use of CCTV equipment and a sonde locator. The use of these tools and technologies and time spent to locate manholes, catch basins or pipes are incidental to the cost for cleaning and inspection of manholes, catch basins and pipes, and no additional payment shall be allowed.
 1. If the CCTV camera cannot reach the manhole due to pipe access issues such as collapses, cross- bores or other conditions requiring an external point repair, the Contractor shall notify the Engineer. The Engineer shall notify the Contractor to return if the Engineer arranges for the performance of the external point repair. If the Contractor, having attempted the search from all possible pipe directions, determines that the manhole does not exist at that location and the GIS mapping is incorrect or if the Contractor arrives at a bulkhead, blind tie, catch basin or other termination point which is not a manhole, the Contractor shall notify the Engineer. The Engineer shall review the efforts of the Contractor and determine if the search shall be considered complete. If the Engineer considers the search complete, the Contractor shall mark the inspection as not found (NF) in the Manhole Inspection, providing adequate detail on efforts made to locate the asset and site observations, provide a manhole empty header record in accordance with 3.4 of Section 33 01 30.31 - Manhole Inspection for Condition Assessment and move on to the next asset for inspection.
 2. If a manhole is buried at a depth of less than (2) feet in unpaved areas, the Contractor shall arrange for the manhole to be exposed. This work shall be considered incidental to the sewer inspection and no additional payment will be allowed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Engineer



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may direct the Contractor to either fill the hole back in at no additional cost to the Owner or to raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Unpaved Areas – Less Than Two (2) Feet”.

3. If a manhole is buried at a depth greater than or equal to two (2) feet in unpaved areas, the Contractor shall arrange for the manhole to be exposed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Contractor shall raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to expose and raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Unpaved Areas - Greater Than or Equal to Two (2) Feet”.
4. If a manhole is buried in paved areas, the Contractor shall arrange for the manhole to be exposed. The Contractor shall notify the Engineer when the manhole is exposed. Once viewed by the Engineer, the Contractor shall raise the manhole to grade in accordance with Section 33 01 30.81 – Manhole Rehabilitation. Work performed to expose and raise the manhole to grade shall be paid under the payment item, “Structure, Adjust Existing Casting to Grade – Paved Areas”.
5. Furthermore, for additional work where efforts to open manholes or catch basins that may be welded shut, have stripped bolts, broken locking devices, stuck or broken covers, or other conditions preventing the opening of the structure and requiring mechanical equipment and/or hand tools to open, the Contractor shall be compensated by time and materials using the allowance, “Provisional Allowance”. This item shall be used in agreed-upon locations, after one (1) hour of labor expended in the Contractor’s reasonable attempt to access and gaining entry to an individual manhole or catch basin that has been located.
6. The Contractor shall edit the record drawings or provide the Engineer with a legible sketch drawing to identify the approximate location of any manholes, structures, or piping that are not accurately depicted on the mapping (more than ten (10) feet from the location shown in the mapping, or outside of the ROW or easement shown on the mapping), does not exist, or is not shown on the mapping. The Contractor shall GPS survey the newly found manholes or structures, or those not accurately depicted to submeter accuracy. Markups shall be confirmed with the Engineer and should be legibly recorded in the record drawings. The edited record drawings or sketches shall be provided to the Engineer with each bi-weekly inspection submittal or upon request.
7. Determination of the cleaning technique proposed by the Contractor must meet the requirements of the Contract Documents. Contingent work items require approval of the Engineer.
8. Clean line sections by the procedure proposed by the Contractor and confirmed by the Engineer. Properly dispose of all material, debris, etc. removed from the sections at an approved disposal site to include applicable disposal fees and provide a copy of the manifest to the Engineer.
9. Once any phase of the Contract is started in an area, work shall continue in a timely manner,



until all manholes and pipe sections are cleaned and inspected in that area. Complete internal inspection of manholes within a week after cleaning assuming that the manhole is still clean upon initial inspection. For pipes less than 36 inches in height, the final pass of cleaning shall be undertaken in conjunction with the CCTV camera inspection that is to be provided as the final inspection deliverable.

- E. During all cleaning operations, precautions shall be taken to protect sewer lines from damage. Any damage to the sewer caused using cleaning equipment, regardless of the cleaning method, shall be repaired by the Contractor at no additional cost to the Owner.
- F. Sewers and manholes may be in easements, through public or private property, City owned parklands and rights-of-way and restricted alleyways where no paved access may exist, or paved access is obstructed to the extent that would inhibit equipment and materials mobilization. It shall be the Contractor's responsibility to identify these sewers and arrange for access using "Door Hanger" notifications as necessary and to restore any surface damage to private and City owned property.
- G. Where access routes to various manhole locations must be cleared of heavy vegetation, the Contractor shall perform the clearing of pathways to the extents necessary to facilitate mobilization of cleaning and internal inspection equipment. The Contractor shall not remove vegetation on private property or outside of the sewer easement or right-of-way.
 - 1. Any vegetation or other debris cleared by the Contractor shall be removed and disposed of properly by the Contractor, and the site restored by the Contractor.
 - 2. Trees larger than 6 inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall not be removed as part of the work. Notify the Engineer of site conditions that impede the completion of the work.
 - 3. Trees smaller than 6 inches in diameter measured at a point 4.5 feet above grade (diameter at breast height) shall be removed as part of the work and shall be incidental to the Contract.
- H. The Contractor shall remove and clear restricted alleyways or easements to enable the mobilization of inspection and cleaning equipment. This work shall be incidental to the sewer cleaning and inspection activities.
- I. The Contractor shall schedule, maintain, and coordinate all activities and shall cooperate with the Engineer such that a minimum of interruption to the services results. The Contractor shall not operate existing system valves, controls, or other appurtenances at any time, but when the same is needed to facilitate and accommodate activities, shall request such operation from the Engineer. The Contractor shall provide the Engineer with 48-hour advance notice for such assistance.
- J. The Contractor is hereby made aware that no flow shall be discharged to the river, streams, banks, or any other storm outlet during cleaning or inspection operations. Additionally, no sewage shall be permitted to surcharge to the point that it overflows to any of the above or back into private



buildings through lateral connections. The Contractor must notify the Engineer immediately of any spill event. Any damage or fines resulting from such occurrences are the sole responsibility of the Contractor.

- K. The Contractor shall notify the Engineer 96 hours prior to mobilizing for internal inspection or cleaning activities.

3.2 FLOW CONTROL

- A. Undertake flow control measures such as working during off-peak hours, the use of sewer cleaning equipment to lower downstream flow levels or blocking/plugging if sewer flows are hampering effective sewer cleaning.
- B. Provide the Engineer with at least 48 hours' notice and proposed method of flow control before undertaking flow control measures for sewers larger than 18 inches in height.
- C. Use sewer plugs to stop or reduce sewer flow that tether to and are removable from the ground surface.
- D. Monitor flow levels upstream of a plugged sewer always to ensure flooding of public or private property does not occur.
- E. Flow control shall be incidental to the contract. It is not the intent of this Specification to require bypass pumping to control heavy flow; however, the Contractor must, at a minimum, make reasonable effort to control the flow by using pipe-cleaning equipment to temporarily retain flow or to remove standing water.
- F. The Contractor must also consider weather conditions and low diurnal flow patterns to obtain the best video image of the sewer. This may require the Contractor to schedule video work to times that are after major rain events or to overnight shifts when the sewer system attains a lower dry weather flow environment. These inspections need to be coordinated with the city to identify opportune times for low flows expected from the hydraulic model.
- G. The Contractor is to maximize visual inspection to as great a degree as possible. For pipes of height of 35 inches or less, regardless of the number and type of cleaning passes performed, the final pass of cleaning shall be undertaken in conjunction with the CCTV camera inspection that is to be provided as the final inspection deliverable. During the final cleaning pass, the CCTV inspection camera shall be mobilized to inspect the sewer segment while the jet nozzle pulls water away from the camera, drawing any water level down to maximize the exposure of the sewer pipe circumference.
- H. The Contractor is to maximize visual inspection to as great a degree as possible. For pipes of



height of 35 inches or less where the water level continues to be greater than 50% of the pipe height after the Contractor has attempted to lower the water level by means of hydraulic equipment, the Contractor is to inform the Engineer. The Engineer may direct the Contractor to not clean the pipe and to perform the inspection with a combination of CCTV and SONAR equipment mounted on a multi-sensor platform.

- I. No flow control shall be undertaken for sewer pipes with a height of 36 inches and larger.

3.3 PERFORMANCE

- A. All open access structures or manholes shall be attended at all times. Access structures or manholes that were sealed or bolted to control odors, to prevent entry of extraneous water or for security reasons shall be resealed or re-bolted after entry and exit. The Contractor shall provide evidence that sealed or bolted chambers have been adequately sealed or bolted, after inspection.
- B. The Contractor understands that DWSD shall incur significant and substantial penalties from the state of Michigan if sewage is discharged onto the ground or into any streams as related to the work in this Contract. If sewage is released into the environment as a result of the Contractor performing the work, the Contractor shall immediately rectify the situation and notify the Engineer.
- C. All cleaning shall commence with the most upstream sections of the sewer lines to be cleaned and end with the most downstream sections of the sewer lines to be cleaned regardless of the method chosen to clean the sections. The cleaning process shall be carried out using the step-cleaning method using the appropriate carrying capacity of each jetter nozzle for the respective sewer pipe height and shape. All sediments and residual wastes shall be evacuated from each successive manhole as cleaning progresses.
 1. Suitable equipment shall be temporarily installed as necessary in the downstream manholes to ensure that solids and debris are trapped and no loose or settled debris shall be allowed to pass into the adjacent pipes.
 2. Under no circumstances shall sewage or solids removed from the sewer be dumped onto streets or into catch basins, storm drains, or receiving waters.
 3. All materials removed shall be properly disposed at a landfill licensed to receive the applicable wastes.
- D. Each designated sewer line section shall be cleaned using a high-pressure water jetter. The equipment selected for cleaning shall be capable of removing loose or settled debris from the sewer lines and manholes.
 1. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole at the opposite end of the sewer segment



- and a reversal clean again attempted, without additional compensation.
2. In the event the Contractor is unable to completely perform CCTV inspection or cleaning from both directions (except for a cross bore and collapse), the Contractor must inform the Engineer of this immediately. Upon approval by the Engineer, the Contractor shall, within two weeks, have the obstructions removed using specialty cleaning equipment capable of removing the obstruction and simultaneously viewing the cleaning activity from the same vantage point in order to view the cleaning operation and not cause any damage to the host pipe.
3. The Contractor shall attempt to remove a specific blockage in the pipe using standard cleaning for up to one (1) hour before advising the Engineer the blockage cannot be removed. The Contractor shall provide the Engineer with the following information for blockages that cannot be removed.
 - a. Location of the blockage indicated by a paint mark on the ground surface above the sewer and the distance from the nearest manhole.
 - b. An inspection photograph, video recording or digital file of the blockage.
 - c. The effect the blockage has on completion of the Work and the requirement for action to deal with the blockage such as an emergency sewer repair or scheduled maintenance.
4. If the Contractor cannot complete the inspection after attempting to use specialty cleaning equipment, the Contractor and Engineer shall jointly select one of the following alternatives regarding the obstruction:
 - a. Abandon the inspection.
 - b. Re-perform the inspection after completion of external or emergency repair.
5. Sewer cleaning shall be considered the use of a step method to work through the pipe in increments that removes debris in a segmented and controlled manner throughout the full length of the pipe to be cleaned. This means that the Contractor shall clean an initial portion of the pipe for a length appropriate to the carrying capacity of each jetter nozzle, sewer pipe height and shape and level of debris encountered, pulling back debris to the manhole. The Contractor shall then clean successive increments of pipe in the same way, each time pulling the displaced debris in solution back over increments of pipe previously cleaned. The Contractor shall complete the cleaning using the step method approach through the entire segment of the pipeline with a high-pressure water jetter to ensure the sewer is adequately cleaned to complete the work. During the final cleaning pass, the CCTV inspection camera shall be mobilized to inspect the sewer segment while the jet nozzle pulls water away from the camera, drawing any water level down to maximize the exposure of the sewer pipe circumference.
6. The Contractor shall evaluate if the line is adequately cleaned to justify televising inspection work after each cleaning pass. The Contractor is wholly responsible to ensure the line is adequately cleaned to complete televising inspection.
7. During all sewer cleaning operations, satisfactory precautions shall be taken to protect the



sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property being served by the sewer segment involved.

8. No additional compensation will be provided to remove equipment or repair the sewer in the event the Contractor's equipment becomes stuck in the pipe or is otherwise damaged as a result of conducting work in a pipeline.
- E. The catch basin cleaning and inspection shall include fully cleaning the catch basin sump/well and the vacuuming and removal of all loose or settled debris.
1. The Contractor shall transport and dispose of the debris/sludge at an approved landfill.
 2. The Contractor shall be required to rod 30 linear feet of each catch basin lead, through the catch basin trap, to determine whether the catch basin is properly flowing after cleaning.
 3. The Contractor shall take an exterior location photo, an exterior cover photo, and an interior photo of each cleaned catch basin and add them to the inspection in DWSD's ArcGIS Esri Field Maps or Cityworks application.
 4. The Contractor shall also be required to inspect and determine the type, size, condition, and location of connection to sewer of each catch basin and record the information from the condition assessment into the ArcGIS Esri Field Maps or Cityworks application or delivered to the Engineer in the approved project record documentation.
 - a. The location of the connection to the existing sewer system shall be identified via flow or dye test and recorded with the manhole Asset ID, pipe Asset ID, or catch basin Asset ID clearly identified where evidence of the dye or flow was observed.
 - b. The approximate location of the catch basin lead from the catch basin to the location of the connection to the existing sewer system shall be drawn in the ArcGIS Esri Field Maps or Cityworks application.
 - c. During a condition assessment contract, upon arrival of the contractor's crew at each catch basin or after cleaning each catch basin, the crew shall create an asset inspection report, including the catch basin Asset ID, in the ArcGIS Esri Field Maps or Cityworks application to record the catch basin inspection information. The Contractor's crews shall ensure that no duplicate accounts are created.
- F. Each designated manhole chamber indicated within the Contract Documents shall be cleaned using a high-pressure water jetter with jetter wash down wand to ensure the chamber is adequately cleaned to facilitate the manhole inspection. The equipment selected for cleaning shall be capable of removing loose or settled debris and obstructions from the sewer lines and manholes using the provided types of cleaning per these Specifications to facilitate a full inspection.
- G. Manhole cleaning shall be considered the use of a rotation method to work down the chamber



through the components in increments that remove debris in a segmented and controlled manner throughout the full depth of the chamber to be cleaned. Cleaning shall include the trapping and removal of all loose or settled debris from the invert of the manhole including the bench and channel as the cleaning progresses. Any loose or settled debris moved into the associated mainline sewers shall be subsequently cleaned.

1. Suitable equipment shall be temporarily installed as necessary in the downstream manholes to ensure that solids and debris are trapped and no loose or settled debris shall be allowed to pass into the adjacent pipes.
 2. The cleaning and inspection submittal shall be rejected if the inspection observes debris within the interconnecting mainline sewers. The Contractor shall be instructed to revisit, re-clean and re-inspect the asset.
 3. Under no circumstances shall sewage or solids removed from the sewer be dumped onto streets or into catch basins, storm drains, or receiving waters.
 4. All materials removed shall be properly disposed at a landfill licensed to receive the applicable wastes.
- H. The Contractor shall evaluate if the manhole is adequately cleaned to justify scanning inspection work after cleaning. The Contractor is wholly responsible for determining if the manhole is adequately cleaned to complete the scanning inspection.
- I. During all manhole cleaning operations, satisfactory precautions shall be taken to protect the manhole chamber from damage that might be caused by the improper use of cleaning equipment. Whenever hydraulically propelled or pressurized cleaning tools which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the manhole chamber are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to the manhole or to public or private property being served by the manhole or surrounding sewers involved.

3.4 CROSS-BORES

- A. Cross-bores are intersections of one utility pipeline through another, such as when a gas pipeline is inadvertently installed through a sewer pipeline. Cross-bores generally occur when a third-party utility is installed using a trenchless method that prevents visibility of the underground sewer pipeline and are commonly a water or gas service.
1. Cutting devices are to be used in conjunction with CCTV equipment only.
 2. Cutting devices are not to be used in the vicinity of cross-bores.
 3. Capture photograph or digital images and notify the Engineer immediately where third-party cross-bores are observed during the sewer or manhole inspection. Provide the captured CCTV images and the distance from the start node of the inspection along the pipe to note the location of the cross-bore to the Engineer immediately after observation.



4. MISS DIG (811) should be contacted to provide locates prior to all cleaning operations in storm sewers and shallow sewers located in the right of way to reduce impact with potential cross-bores.
5. A reverse set-up inspection shall be performed when a cross-bore prevents completion of the inspection from the initial access point. Move the equipment to a different access point and attempt to complete the inspection of the pipe up to the cross-bore location.

3.5 TRAFFIC CONTROL

- A. Contractor shall provide traffic control as required and in compliance with the Local and State governing authorities and in accordance with Section 01 55 26 – Traffic Control.
- B. Contractor shall coordinate traffic control with City of Detroit and other jurisdictional authorities.
- C. The work of Maintaining Traffic consists of furnishing all labor, equipment, and materials required for maintaining traffic throughout the project area in accordance with Sections 104.07.C, 104.11, 812, and 922 of the MDOT 2012 Standard Specifications for Construction and this Specification.
 1. Notify the Engineer a minimum of 72 business hours prior to the implementation of any road closures, lane closures, or major traffic shifts. The Contractor shall be required to contact all local and state police, fire, and emergency services that shall have jurisdiction within 72 business hours prior to the implementation of any lane closure.
 2. Construction Influence Area (CIA) – The CIA includes the right-of-way of the roadways within the project limits.
 3. General Traffic Restrictions:
 - a. Normal work hours are Monday thru Friday from 7:00 a.m. to 7:00 p.m., or as approved by the Engineer. Work outside the normal work hours shall require prior approval from the Engineer.
 - b. No work or lane closures shall be allowed during Independence Day, Memorial Day weekend or Labor Day weekend. Holiday weekends are defined as beginning at 12:00 p.m. on Friday and ending at 6:00 a.m. on the following Tuesday, or as defined by the Engineer. No work shall be allowed during any standard holiday weekends, which shall be defined by the Engineer. No work or lane closures shall be allowed on holiday weekends when the holiday occurs on or is observed on Fridays or Mondays.
 - c. Always maintain access to all residential and business driveways. Maintain access to driveways in active work zones, when possible, as confirmed by the Engineer.
 - d. All labor, equipment, and aggregate required to maintain street, intersections, and driveways for traffic shall be included in the execution of the Work.
 - e. Coordinate operations with the other Contractors performing work on projects



within or adjacent to the CIA. Maintenance crews and/or Contractor Maintenance Agencies may perform maintenance work within or adjacent to the CIA. The Maintenance Division of MDOT and/or Contract Maintenance Agency shall coordinate their operations with the Engineer to minimize interference to the Contractor. No additional payment shall be made to the Contractor for joint use of the traffic control items.

- f. Always maintain access for emergency vehicles through the work area.
 - g. Provide fencing to protect open trenches and pits during working and non-working hours.
4. Project General: During work hours, equipment, material, and company vehicles may be parked or stored within the right-of-way as confirmed by the Engineer. The contractor is responsible for restoring to its original condition any area damaged by their equipment, material, or company vehicles. Restoration of damaged areas shall be in accordance with the plans and 2012 MDOT Standard Specifications for Construction and this Specification.

3.6 REMOVAL OF EQUIPMENT THAT BECOMES STUCK IN A SEWER

- A. No additional compensation shall be provided to remove equipment or repair the sewer in the event the Contractor's equipment becomes stuck in the pipe or is otherwise damaged as a result of conducting work in the sewer.
- B. The Contractor shall advise the Engineer immediately if equipment becomes stuck in a sewer. The Contractor shall attempt to remove equipment that is stuck using whatever means are necessary for up to four (4) hours. The Contractor shall advise the Engineer if the equipment cannot be freed after four (4) hours and mark the position on the surface over the sewer where the equipment is stuck.
- C. The Engineer shall arrange to have an excavation made to the top of the sewer where the equipment is stuck within a reasonable time frame of notification the equipment cannot be freed at the expense of the Owner.
- D. The Contractor shall advise the Engineer if bypass pumping is required to ensure the normal sewer flow continues while the obstruction is present. All costs incurred due to the bypass pumping activity shall be at the cost of the Owner.
- E. The Contractor and Engineer shall be present during the excavation and once the top of the sewer is exposed and the excavation is secured, the Contractor shall do one of the following:
 - 1. Remove the top of the sewer pipe and retrieve the equipment stuck in the sewer or;
 - 2. Defer removal of the top of the sewer and retrieval of the stuck equipment to the excavation contractor. Damages caused to the stuck equipment shall not be the responsibility of the



excavation contractor. No claim for equipment damages shall be made against the excavation contractor.

- F. The Engineer shall arrange to have the sewer repaired after removal of the equipment that was stuck at the expense of the Owner.
- G. The Contractor shall clean and remove backfill and debris that may have entered the sewer during removal of the equipment and subsequent repair of the sewer.

3.7 DAMAGE TO OWNER AND PRIVATE PROPERTY

- A. In the event of damage to Owner's assets and private property, the Contractor shall immediately notify the Engineer.
 - 1. The Contractor shall provide written reports to the Engineer for each property attended for investigation of damage. Reports shall include photographs of all damage, dates and times, written agreements with property owner and all actions taken or proposed to rectify the damage. Reports shall be submitted to the Engineer within 24 hours of attending the property.
 - 2. Sewers and manholes may be in easements, through public or private property, City owned parklands and rights-of-way and restricted alleyways where no paved access may exist, or where paved access is obstructed to the extent that would inhibit equipment and materials mobilization. It shall be the Contractors responsibility to identify these sewers and arrange for access using "Door Hanger" notifications as necessary and to restore any surface damage to private and City owned property.
 - 3. Sewer backup or "blow-back" on private property resulting from cleaning or inspection activities is not acceptable and shall be avoided. It is expected that where this possibility exists, the Contractor shall take appropriate measures such as making modifications to cleaning equipment and/or taking additional time to clean such sewers.
 - a. Clean-up of affected residences shall be done by cleaning professionals. Under no circumstances are cleaning equipment operators to enter residences unless they are neat and presentable, and the Engineer has received a Background Check for that individual in accordance with Section 33 01 30.18 – Security Clearances and Communications.
 - b. Where actual sewage or "grey water" has flooded private property, the Contractor shall immediately clean and disinfect all affected areas. The Contractor shall immediately hire an independent certified water damage or flood restoration Contractor to assess any damage to contaminated building materials such as drywall, insulation, carpets, flooring or sub-floors, and immediately make any required repairs at the sole cost of the Contractor.
 - c. If a residence is uninhabitable as a result of a sewer back-up the Contractor shall pay



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for reasonable hotel accommodations and meals for all affected residents at the sole cost of the Contractor.

4. The Contractor shall provide the Engineer with a 24-hour contact number in the event the Contractor needs to be notified that damage has occurred at a property. The Contractor shall arrange for immediate clean-up and repair of private property by cleaning professionals, at the expense of the Contractor.
5. The Contractor shall be solely responsible for the repair of willful and negligent damage done to private and public property at no additional cost to the Owner.

3.8 REMOVAL OF EXCESSIVE GREASE AND/OR ROOTS

- A. Excessive grease and/or roots shall be reported to the Engineer.
- B. Excessive grease and/or roots shall be removed, at locations confirmed by the Engineer, where excessive grease and/or root intrusion prevents passage of the camera or inspection platform. Special precautions should be exercised during the cleaning operation to assure virtually complete removal of visible roots from the joint area.
 1. Contractor shall cut and remove grease and/or roots that cannot be removed through standard cleaning efforts.
 2. Contractor may use mechanical devices such as expanding root cutters and hydraulic procedures such as high-pressure jet cleaners.
 3. Contractor may use hydraulically driven saw, grinder or blade cutters to remove grease and/or roots.
 4. Contractor must remove grease and or roots to within one-half (1/2) inch of the inside surface of the sewer to flush with the pipe surface.
 5. Contractor shall monitor the entire removal operation and while the removal equipment is travelling within the pipe to reach the work area by CCTV.
 6. Flushing the sewer or the use of “spin nozzles” to remove grease shall not be permitted.
- C. Contractor shall inspect the entire sewer section in accordance with Section 33 01 30.30 – Sewer Pipeline Inspection for Condition Assessment after completion of the excessive grease and/or root removal.

3.9 REMOVAL OF INTRUDING SEWER TAPS

- A. Intruding sewer taps shall be removed, at locations confirmed by the Engineer, where the intruding tap prevents passage of the camera or inspection platform. Special precautions should be exercised during the grinding operation to assure unnecessary damage does not occur to the tap given the conditions of the sewer main and tap. Contractor shall complete the work as follows:



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1. Contractor shall cut and remove intruding sewer taps from the sewer at the locations confirmed by the Engineer from the sewer inspection. The cut tap pieces shall be removed from the sewer.
 2. Contractor shall select the cutting equipment to be used considering tap material and sewer pipe condition.
 3. Contractor shall leave intruding sewer taps finished smooth and within one-half (1/2) inch of the inside surface of the sewer to flush with the pipe surface.
 4. Contractor shall monitor the entire intruding sewer tap removal process and while the cutting equipment is travelling within the pipe to reach the work area by CCTV.
 5. The use of “knockers” or “chain flails” to cut and grind taps shall not be permitted.
- B. Contractor shall inspect the entire sewer section in accordance with Section 33 01 30.30 – Sewer Pipeline Inspection for Condition Assessment after completion of the intruding sewer tap removal.

3.10 PHYSICALLY ATTACHED SOLID DEBRIS CUTTING

- A. Removal of physically attached solid debris that cannot be removed using standard cleaning methods shall be undertaken, at locations confirmed by the Engineer, where the physically attached solid debris prevents passage of the camera or inspection platform. The work shall be done using solid debris cutting equipment that shall consist of remote controlled hydraulically driven saw, grinders or blade cutters, remotely operated robots or other types of equipment capable of removing solid debris such as concrete, asphalt, and encrustation.
1. Contractor shall complete the work and remove solid debris from the sewers for the limits confirmed by the Engineer from the sewer inspection.
 2. Solid debris removal equipment is to consist of remote controlled hydraulically driven cutters and reamers capable of cutting back the solid debris.
 3. Contractor shall select the cutting equipment to be used considering debris type and sewer pipe condition. Remove solid debris to within one-half (1/2) inch of the inside surface of the sewer to flush with the pipe surface.
 4. Contractor shall monitor the entire cutting operation and while the cutting equipment is travelling within the pipe to reach the work area by CCTV.
- B. Contractor shall inspect the entire sewer section in accordance with Section 33 01 30.30 – Sewer Pipeline Inspection for Condition Assessment after completion of the physically attached solid debris cutting.

3.11 DEBRIS REMOVAL

- A. All loose or settled debris and material resulting from all cleaning operations shall be removed at



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the downstream manhole of the section of sewer being cleaned. Passing material from manhole section to manhole section which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment, shall not be permitted.

- B. Contractor shall be responsible for daily removal of the removed material from the work site and the proper disposal of the removed material at an approved disposal site. Material shall not be accepted by the Engineer for disposal.
- C. All debris, residue and other materials resulting from cleaning operations shall be removed from the site no less often than at the end of each workday and shall be disposed of in an approved manner. Under no circumstances shall the accumulation of debris, residue, etc., be left at the worksite overnight, unless prior written authorization is given for storage in totally enclosed containers.
- D. Decant or dewater debris removed from sewers and catch basins and legally dispose of solid and semi-solid debris. Return decanted or dewatered liquid to the sewer of origin as soon as possible, but not within three (3) sewer sections upstream of a lift station. If decanting is required, it shall be done immediately downstream of the lift station. Any spillage from the container system is not allowed. Any off-site decanting methods shall be confirmed by the Engineer.
- E. Store debris in totally sealed containers always and remove from the Site at the end of each day. Vehicles used to transport sewage within the Owner's limits must conform to City of Detroit laws, licensing and permits as necessary.
- F. Off-site debris dewatering facilities must meet State environmental regulations and requirements. Obtain approval from Owners Waste Control Branch and provide copies of required licenses, permits and relevant documentation required for dewatering facility to the Engineer before starting the Work.
- G. Landfill reports and weigh tickets must be submitted. Keep a log containing the following information for each debris disposal unit.
 - 1. Contract Name and Number.
 - 2. Vehicle ID – License Number.
 - 3. Date of Disposal.
 - 4. Time of Disposal.
 - 5. Origin of Debris.
 - 6. Net Weight of Load.
- H. The Contractor is responsible for monitoring weather conditions continuously during the cleaning operations. If the combined storm and sanitary sewer flows, including increased flows due to storm or snow melt runoff, disrupt the cleaning operation at any time during the Work, the Contractor must be prepared to remove their equipment and restore the sewer system to normal



operation. Any Contractor costs that are a result of high flows or unsuitable weather conditions shall not be reimbursed by the Engineer.

- I. Immediately upon completion of work, the Contractor shall ensure that the entire area is cleaned of all debris, and that all debris is disposed of properly.

3.12 WATER SUPPLY FOR SEWER CLEANING

- A. Obtain permit(s) for hydrant use for water supply for sewer cleaning in accordance with DWSD as necessary.
- B. Water supply for the Work may be taken from DWSD hydrants in accordance with the following:
 1. The DWSD GIS Data Viewer which identifies the location and Asset ID of the hydrants shall be provided to the Contractor by the Engineer.
 2. Submit a list of proposed hydrant location(s) with their corresponding Asset IDs to the Engineer for approval. If a proposed hydrant location is not approved, the Contractor shall submit an alternate hydrant location for approval.
 3. Only hydrants confirmed by the Engineer shall be used for water supply.
 4. The Contractor shall supply and use a Backflow Protection Arrangement when taking water from the Engineer's hydrants. Alternatively, the Contractor may rent the Backflow Protection Arrangement from the Engineer if available. All costs associated with the supply of the Backflow Protection Arrangement or rental of same from the Engineer shall be included in the cost of sewer and manhole cleaning. The Engineer shall supply a meter and locks for the Backflow Protection Arrangement.
 5. The Contractor is permitted to turn approved hydrants on and off provided the Contractor has received training by the Engineer and the turn-ons and turn-offs are done in the presence of the Engineer.
 6. Hydrants approved for use shall be "in the Contractor's control" from the time the Contractor has turned the hydrant on until the Contractor has notified the Engineer the hydrant is no longer being used and the flow meter has been removed.
 7. The Contractor shall take all necessary precautions to prevent freezing of hydrants and related appurtenances for hydrants in their control and shall be responsible to pump out hydrants turned off by Emergency Services. Under freezing conditions, protection of hydrants shall be required by the Contractor. All costs associated with hydrant protection shall be included in the price of cleaning items.
 8. If a hydrant or appurtenance is damaged due to freezing or improper turn-on or turn-off procedures while in the Contractor's control, the Engineer shall assess the damage and determine if the Engineer shall repair the damage or if the Contractor shall be responsible to repair the damage. Costs for repairs completed by the Engineer shall be deducted from payments owing the Contractor. Repairs completed by the Contractor shall be at the Contractor's expense.



9. Erect and maintain appropriate signage warning oncoming traffic of hose crossings. Construction ramps shall be employed during the Contract.
10. Connection of sewer flushing equipment to a hydrant without the use of a Backflow Protection Arrangement is not permitted.
11. No fire hydrant shall be obstructed so as to prevent its use in case of a fire in the area served by the hydrant.

3.13 ACCEPTANCE OF WORK

- A. The Contractor shall submit completed video inspections of the cleaned sewer to the Engineer for review for compliance with the Contract.
- B. If physically attached solid debris cutting, removal of excessive grease and roots, and intruding sewer tap removal occurs, the Contractor shall submit the survey abandonment videos from the initial survey attempts in addition to the final completed survey to the Engineer for review for compliance with the Contract.
- C. The Contractor shall submit required inspections of the manhole to the Engineer for review for compliance with the Contract.
- D. The Engineer shall visually inspect catch basins in the field for review for compliance with the Contract.
- E. Additionally, the Contractor shall submit required interior photographs of the catch basins to the Engineer for review for compliance with the Contract. The photographs must show cleaned catch basins with no loose or settled debris and be taken immediately after cleaning.
- F. The Contractor shall submit required weigh tickets to the Engineer for review for compliance with the Contract.
- G. The Engineer shall review the contiguous pipe inspection videos and manhole scans within fifteen (15) working days of submission for review for compliance with the Contract.
- H. The Contractor shall perform remedial work for sewer, manhole and catch basin cleaning, cutting of physically attached solid debris, removal of excessive grease and roots, and removal of intruding sewer taps and a re-inspection for the locations where the work was determined by the Engineer as not being in compliance with the contract. Work to perform remedial work shall not be eligible for additional payment.



END OF SECTION 33 01 30.32



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SECTION 33 01 30.81 – MANHOLE REHABILITATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The Work specified in this Section includes all labor, materials, accessories, equipment and tools necessary for the repair and rehabilitation of the sanitary sewer manholes shown on the Plans.
2. Manhole Rehabilitation as shown in the contract documents includes cleaning and surface preparation, filling all voids, stopping all leaks by repair and chemical grout injection, and applying a spray-on liner on the bench, barrel, and cone (terminating at the frame), or providing FRP insert liners, or providing polymer concrete insert liners for the existing manholes.
3. Structural Restoration.
4. Eliminate Inflow and/or Infiltration.
5. Step replacement or repair.
6. Base and channel repair.
7. Excavation.
8. Removal and disposal of all excess materials.
9. Restoration.
10. Backfill.
11. Permanent and temporary pavement replacement.
12. Clearing and grubbing.
13. Locating and raising buried manhole to grade.
14. Resetting manhole frame and cover.
15. Replacing manhole frame and cover.
16. Reconstruction of manholes above grade.
17. Dewatering.
18. Flow Control/Bypass Pumping.
19. Grouting.
20. Post-Rehabilitation Photographs.

B. Related Requirements:

1. Section 01 57 15 – Temporary Sewer Bypass Pumping.
2. Section 03 37 13 – Shotcrete.
3. Section 03 60 00 – Grouting.
4. Section 31 10 00 – Site Clearing.
5. Section 31 23 19 – Dewatering.
6. Section 31 23 33 – Trenching and Backfill
7. Section 31 23 23.33 – Flowable Fill.
8. Section 33 01 30.61 – Packer Injection Grouting.



9. Section 33 05 61 – Concrete Manholes.

1.2 STANDARDS

Except as modified herein, comply with the latest edition of the following standards:

A. American Concrete Institute (ACI):

1. ACI 506 – Standard Specification for Shotcrete.

B. ASTM International:

1. ASTM A48 – Standard Specification for Gray Iron Castings.
2. ASTM C33 – Standard Specification for Concrete Aggregates.
3. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
4. ASTM C150 – Standard Specification for Portland Cement.
5. ASTM C293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center Point Loading).
6. ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
7. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
8. ASTM C496 – Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
9. ASTM C596 – Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
10. ASTM C642 – Standard Test Method for Density, Adsorption, and Voids in Hardened Concrete.
11. ASTM C666 – Standard Test Method for Resistance of Concrete to Rapid freezing and Thawing.
12. ASTM C780 – Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
13. ASTM C857 – Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
14. ASTM C882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
15. ASTM C900 – Standard Test Method for Pullout Strength of Hardened Concrete.
16. ASTM C1244 – Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.



17. ASTM D412 – Standard Testing Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
18. ASTM D638 – Standard Testing Methods for Tensile Properties of Plastics.
19. ASTM D648 – Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
20. ASTM D695 – Standard Testing Methods for Compressive Properties of Rigid Plastics.
21. ASTM D790 – Standard Test Method for Flexural Properties of Unreinforced/Reinforced Plastics.
22. ASTM D903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
23. ASTM D1004 – Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
24. ASTM D2240 – Standard Testing Methods for Rubber and Durometer Hardness.
25. ASTM D2584 – Standard Test Method for Ignition Loss of Cured Reinforced Resins.
26. ASTM D3753 – Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wet wells.
27. ASTM F2551-09 – Standard Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Comply with all residence notification requirements in Section 33 01 30.18 – Security Clearances and Communications.
- C. Product Data: Submit information for products indicated and proposed materials at least 30 days prior to starting Manhole Rehabilitation.
- D. Shop Drawings:
 1. Detail of manhole liners including plans, elevations, sections, details, frames, covers, and mixes.
 2. Field quality-control test reports.
 3. Traffic control plans.
 4. Manhole Liner Certification.
 5. Flow Control/Bypass pump plan.
- E. Contractor Qualifications:
 1. Submit a copy of manufacturer's licensee certificate. If the Contractor is not licensed by the manufacturer, then a manufacturer's representative shall be on-site for the duration of the Work.
 2. Submit qualification of each nozzle men: Each nozzle men is required to be ACI certified through the Nozzle men Certification Program.



3. Submit a list of ten (10) similar regional projects completed within the last three (3) years including information such as number of manholes on project, type of rehabilitation, date of completion, and project cost.
- F. Material Certifications: Submit the manufacturer's product data, installation instructions, applicable referenced work standards (ASTM, ACI, etc.), approved laboratory test reports that verify strength requirements of this Specification, and materials certification for each product used.
- G. Material Safety Data Sheets: Submit Material Safety Data Sheets (MSDS) for all materials used for Manhole Rehabilitation.
- H. Application Methods and Equipment: Submit a written description of the material application methods including the equipment that will be used.
- I. Liner Thickness Design: Submit recommended liner thickness design to withstand groundwater pressure as specified within this Specification.

1.4 CLOSEOUT SUBMITTALS

- A. Comply with Section 01 70 00 – Execution and Closeout Requirements.
- B. Project Record Documents: Record all changes made to manholes and submit to Engineer.
- C. Identify and describe discovery of undocumented utilities.

1.5 QUALITY ASSURANCE

- A. Contractor's Qualifications:
 1. The Manhole Rehabilitation Contractor shall be a firm having a minimum of three (3) years continuous successful experience in the rehabilitation of manholes similar to that required of this Project.
 2. The manhole lining Contractor shall be certified and trained by the lining material manufacturer to install the manhole liner if the material requires a certified applicator. Furnish an on-site manufacturer's representative for a minimum of four (4) working hours for each supplied material.
 3. The flexible chimney seal installer shall be certified and trained by the material manufacturer to install their product if the material requires a certified applicator. Furnish an on-site manufacturer's representative for a minimum of four (4) working hours for each supplied material.
 4. The testing laboratory shall be an independent material testing laboratory contracted and paid for by the Contractor and approved by the Engineer.
 5. The Engineer may perform Quality Assurance tests independently as necessary.



1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage, and Handling shall be no less than that of the Manufacturer's written recommendations.
 - 1. Cementitious materials shall be stored in weather tight, original packaging to protect against moisture and contamination.
 - 2. Polymer manhole lining materials shall be stored in unmixed containers in a sheltered area between 50 and 95 degrees Fahrenheit.

1.7 PROJECT CONDITIONS

- A. Visit each site and examine the local conditions to be encountered, improvements to be protected, permit conditions, and complete other research necessary to assure a thorough understanding of all conditions and constraints which may be encountered during construction.
- B. Conduct excavation and backfill operations in such manner as to cause no damage to any existing utility or affect the safety of the public or Contractor's employees during and after construction.
- C. Comply with all the applicable OSHA regulations and all applicable requirements of EM385 and in particular 29 CFR1910.146, Permit Required for Confined Space Entry.
- D. Provide a system to capture and remove cleaning material from the wet well without entry into the wet well.
- E. Furnish and maintain all traffic control necessary by permit. Traffic control shall include flagging, all applicable signage, and/or detours as designated by the contract documents and Michigan Department of Transportation (MDOT).
- F. Provide each potentially affected Utility with a minimum three (3) week notice of road closures.
- G. Comply with all residence notification requirements in Section 33 01 30.18 – Security Clearances and Communications for all adjacent landowners within 150 feet of the Work.
- H. Service to occupied facilities shall not be interrupted unless the requirements of Section 33 01 30.18 – Security Clearances and Communications have been followed and then only after arranging to provide temporary water and sewer service according to requirements indicated:
- I. Use caution when working in sewers, especially during rain events. Sewers may reach capacity quickly and/or head up.

1.8 WARRANTY

- A. Comply with Section 01 70 00 – Execution and Close-Out Requirements.



- B. Provide manufacturer's standard written guarantees and warranties dated from time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cementitious Manhole Liner w/ Corrosion Resistance:

1. Standard Cements – Maximum CA.
2. Standard Cements – Reliner MSP.
3. BASF – MasterEmaco S488/S488-CI.
4. Milliken – GeoSpray.
5. SewperCoat PG – Kerneos.
6. Quadex AluminaLiner – Quadex, Inc.
7. SewperCoat – LaFarge Aluminates.
8. Strong-Seal MS2-C, High Performance Mix – Strong-Seal Systems.
9. CA Liner 100 – Parson Environmental.
10. PerpetuCrete CA – Protective Liner Systems.
11. Or Approved Equal.

- B. Epoxy Manhole Liner:

1. SprayRoq Protective Lining Systems – Spray Wall.
2. Raven 405 – Raven Lining Systems.
3. Cor-Cote SC – Sherwin-Williams.
4. PerpetuCoat PLS-613 – Protective Liner Systems.
5. RELINER Inside Drop Bowl – RELINER / Duran Inc.
6. Sauereisen SewerGard – Sauereisen.
7. Inland Product (Eco Cast).
8. Or Approved Equal.

- C. Fiber Reinforced Plastic Manhole Liner:

1. Hobas.
2. Flowtite.
3. LFM Fiberglass Structure.
4. Or Approved Equal.

- D. Polymer Concrete Manhole Liner:

1. US Composite Pipe, Inc.
2. Armorock.
3. Or Approved Equal.



E. Flexible Chimney Seal:

1. Cretex Specialty Products – Internal Chimney Seal.
2. NPC Flex Rib Frame Chimney Seals.
3. Sealing Systems Inc. – Flex-Seal Utility Sealant.
4. Wrap id Seal (CANUSA).
5. Or Approved Equal.

F. Manhole Casting Riser Ring:

1. American Highway Products – Stainless Steel Manhole Riser.
2. Concrete.
3. EJ Group INFRA-RISER Rubber Composite.
4. Or Approved Equal.

2.2 MATERIALS

A. Liner Thickness Design: Each lining system shall be designed and installed in accordance with the manufacturer's recommendation to withstand groundwater pressures. For manholes less than 12 feet in depth, the lining shall withstand the pressures associated with a groundwater depth of 12 feet measured from manhole bench to top of ground surface. For manholes greater than 12 feet in depth, the lining shall withstand the pressure associated with a groundwater depth equal to the manhole depth measured from manhole bench to top of ground surface.

B. Patching Material:

1. All non-leaking holes, cracks or voids shall be patched with a quick setting, non-shrink, fiber reinforced, corrosion resistant calcium aluminate or equivalent material that is compatible with the chosen liner system and shall be approved and applied in accordance with the manufacturer's recommendation for basecoat materials:
 - a. Sikadur 31, HiMod Gel.
 - b. Or Approved Equal.

C. Infiltration Control Material (Chemical Grout): Comply with Section 33 01 30.61 – Packer Injection Grouting.

D. Cementitious Liner:

1. The material shall be a 100% calcium aluminate mortar designed to stop infiltration, restore structural integrity, and provide protection against microbiologically-induced corrosion. It shall be spray applied to form a structurally enhanced monolithic liner covering all interior substrate surfaces with the following minimum requirements:
 - a. Compressive Strength per ASTM C109: > 8,000 psi (28 Days).
 - b. Tensile Strength per ASTM C900: > 800 psi.
 - c. Flexural Strength per ASTM C293: > 1,200 psi (28 Days).
 - d. Shrinkage @ 90% R.H. per ASTM C596: < 0.08% (28 Days).



- e. Freeze/Thaw per ASTM C666: No Damage After 300 Cycles.
 - f. Air Void Content per ASTM C457: 2-4% (7 Days).
 - g. Specific Gravity/Absorption Test per ASTM C642: 3-5% (7 Days).
2. The material thickness application shall be a minimum of three-eighths (0.375) inches and not more than 2 inches per pass. The minimal acceptable finished thickness shall be 1 inch from the inside face of the manhole wall. The final finished liner thickness shall be greater than 1 inch if determined to be necessary by the liner manufacturer to withstand groundwater pressures as specified herein.
 3. The lining shall be applied in not more than two (2) passes from bottom to top. No more than 24 hours shall elapse between successful passes on each manhole. The second pass shall not be made until the first pass has achieved initial set. If more than 24 hours elapse between passes, then initial coat shall be removed, and the process restarted.
 4. Coordinate with the manufacturer to furnish and install product according to the manufacturer's recommendations. If manufacturer's recommendation conflicts with Specification, notify the Engineer prior to installation.

E. Epoxy Liner:

1. The material shall be 100% solids, solvent-free two (2)-component epoxy resin system with select inorganic fillers to minimize permeability and provide sag resistance acceptable to the following minimum requirements:
 - a. Hardness, Shore D per ASTM D2240: 70.
 - b. Tensile Strength per ASTM D638: > 7,000 psi.
 - c. Flexural Strength per ASTM D790: > 10,000 psi.
2. Coordinate with the manufacturer to furnish and install product according to the manufacturer's recommendations. If manufacturer's recommendation conflicts with Specification, notify the Engineer prior to installation.
3. The final finished liner thickness shall be as recommended by the liner manufacturer to withstand groundwater pressures as specified herein.

F. FRP Manhole Liners:

1. In accordance with ASTM D3753.
2. The resins used shall be an unsaturated polyester resin or vinyl ester resin.
3. The reinforcing materials shall be type E glass in the form of continuous roving and chop roving, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin per ASTM D3753.
4. Interior Surfacing Material:
 - a. The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inch thick.
 - b. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two (2) passes of chopped roving of minimum length 0.5-inch to maximum length of two (2) inch and shall be applied uniformly to an equivalent weight of 3 oz./ft.



- c. Each pass of chopped roving shall be rolled prior to the application of additional reinforcement.
 - d. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inch.
- 5. Wall Construction Procedure:
 - a. After inner layer has been applied the manhole liner wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition.
 - b. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one (1)-piece unit.
 - c. Seams shall be fiber glassed on the inside and the outside using the same glass-resin jointing procedure.
 - d. Field joints shall not be acceptable by anyone except the manufacturer.
- 6. UV inhibitor shall be applied to the exterior surface of the manhole liner and shall have gray pigment and shall be a minimum thickness 0.125 inches.
- 7. Fillers and Additives:
 - a. Fillers, when used, shall be inert to the environment and manhole construction.
 - b. Sand shall not be accepted as an approved filler.
 - c. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. The resulting reinforced-plastic material shall meet the requirements of this Specification.
- 8. Manhole Liner Design:
 - a. All manholes shall have 0.50-inch minimum wall thickness. The final finished liner thickness may need to be greater than 0.50 inch as recommended by the liner manufacturer to withstand groundwater pressures as described in Part 2.2.A of this Section.
 - b. All manhole liners shall be designed so that a ladder can be supported by the installed manhole liner. No manhole steps shall be installed.
 - c. Manway cone sections shall be concentric with respect to the larger portion of the manhole liner diameters through 60 inches. Larger manhole liners may have concentric or eccentric manway reducer openings.
 - d. The manhole liner shall provide an area for which grade rings to be installed to accept a manhole frame and cover and have the strength to support a traffic load without damage to the manhole liner.
- 9. Other Requirements:
 - a. The exterior surface of the liner shall be smooth with no sharp projections. Hand-work finish may be acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 0.5 inch in diameter, delamination or fiber show.
 - b. The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 0.5 inch in diameter and wrinkles of 0.125 inch or greater in depth. Surface pits shall be permitted if they are less than



0.75 inch in diameter and less than 0.0625 inch deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 0.5 inch in diameter and less than 0.0625 inch thick.

- c. Any manhole liner repairs shall meet all requirements of this Specification.
- d. Manhole liner widths shall be in 6-inch increments +/- 2 inches.
- e. Tolerance of inside diameter shall be +/- 1% of required manhole diameter.
- f. The complete manhole liner shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM 3753 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lbs.
- g. The manhole cylinder shall have the minimum pipe-stiffness values shown in the table below when tested in accordance with ASTM 3753 paragraph 8.5 (note 1).

STIFFNESS REQUIREMENTS

LENGTH (ft)	F/AY (PSI)
3 – 6.5	0.75
7 – 12.5	1.26
13 – 20.5	2.01
21 – 25.5	3.02
26 – 35	5.24

- h. To determine soundness, apply an air or water pressure test to the manhole test sample. Test pressure shall not be less than 3 psig nor greater than 5 psig. While holding at the established pressure, inspect the entire manhole for leaks. Any leakage through the laminate is cause for failure of the test. Comply with ASTM 3753 paragraph 8.6.
- i. The FRP manhole and all related components shall be fabricated from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems.

10. The required physical properties shall be as follows:

	Hoop Direction	Axial Direction
Tensile Strength (psi)	18,000	5,000
Tensile Modules (psi)	0.6×10^6	0.7×10^6
Flexural Strength (psi)	26,000	4,500
Flexural Modules (psi)	1.4×10^6	0.7×10^6
Compressive (psi)	18,000	10,000

11. All tests shall be performed as specified in ASTM D3753 latest edition, Section 8. Test method D-790 (note 5) and test method D-695.



12. Coordinate with the manufacturer to furnish and install product according to the manufacturer's recommendations. If manufacturer's recommendation conflicts with Specification, notify the Engineer prior to installation.

G. Polymer Concrete Manhole Liners:

1. This application shall not be made unless ambient temperatures inside the structure is 50 degrees or higher and all surfaces that are to be coated are dry.
2. Polymer Concrete liners shall be designed manufactured to meet the design requirements of AASHTO HS-20 design live loading applied to manhole cover and riser sections and shall be designed based upon live and dead load criteria in ASTM C857.
3. Polymer mixture shall consist solely of thermosetting resin, sand and aggregate. No cementitious or calcium carbonate materials shall be allowed.
4. Thermosetting Resin:
 - a. Resin used shall be unsaturated, certified, isophthalic polyester resins or vinyl ester resins.
 - b. The resin shall have a minimum of deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648.
 - c. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584.
 - d. Resin selection shall be suitable for applications in the corrosive conditions to which the structures will be exposed.
 - e. Mixing lots of resin from different manufacturers will not be allowed.
5. The polymer manhole sleeve shall have a minimum wall thickness of 2 inches and an outside diameter clearance of 1.5 inches. The wall thickness of risers and conical tops shall be not less than that prescribed by the manufacturer's design by more than 5%. The final finished liner thickness may need to be greater than 2 inches as recommended by the liner manufacturer to withstand groundwater pressures as described in Part 2.2.A of this Section.
6. Steel reinforcement will not be required for circumferential reinforcement, joint reinforcement, or hoop reinforcement. Manufacturer shall determine the need for and type of reinforcement as it pertains to safety and lifting requirements.
7. Variations in height of two (2) opposite sides of risers and conical tops shall not be more the 5/8 inch. The under run in height of a riser or conical top shall not be more than ¼inch/foot of height with a maximum of ½ inch in any one (1) section.
8. Riser and cone section joints shall be of a flush flat edge design that on assembly with gaskets and/or butyl mastic will make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity.
 Polymer manhole riser and cone sections shall be provided in various lengths in combination to provide correct height with the fewest joints.
 Each manhole component shall be free of all defects that will detrimentally affect the strength and serviceability of the component part.
9. Epoxy coatings for bench area shall meet the requirements of the Epoxy Liner section above.



10. Minimum thickness to be applied in single application shall be no less than 250 mils and no more than 500 mils. No more than 1,000 mils shall be applied in any one (1) day of application.
11. Coordinate with the manufacturer to furnish and install product according to the manufacturer's recommendations. If manufacturer's recommendation conflicts with Specification, notify the Engineer prior to installation.

H. Manhole Frame and Cover: Comply with Section 33 05 61 – Concrete Manholes.

I. Frame and Cone Seal:

1. Applied seals shall be achieved by applying an aromatic urethane resin compound to the internal surface between the manhole frame and the cone section to stop inflow under the manhole frame. Sufficient material shall be applied to achieve a minimum thickness of 120 mils. The material shall comply with the following requirements:
 - a. Hardness per ASTM D2240: 75.
 - b. Tensile Strength per ASTM D412: 1,150 psi.
 - c. Elongation per ASTM D442: 800%.
 - d. Adhesive Strength per ASTM D903: 175 lb./l. inch.
 - e. Tear Resistance per ASTM D1004: 155 lb./l. inch.
 - 1) Flex-Seal Utility Sealant – Sealing Systems Inc.
 - 2) Or Approved Equal.

J. Inside Drop Bowl:

1. Inside manhole drops shall be installed where indicated on the drawings.
2. Inside Drop Bowl size shall be determined by incoming pipe sizes and approximate flow rates. The bowl shall be installed as per manufacturer's instructions using stainless steel fasteners.
3. The drop pipe and turn-out at the base end of the drop pipe shall be PVC SDR 35 (main lines) or Schedule 40 (service laterals). The turn-out at the base end of the drop pipe shall be accomplished with an appropriately angled pipe elbow.
4. All brackets for attaching the drop pipe to inside of manhole shall be stainless steel adjustable clamping brackets and fasteners anchored to the manhole wall.
 - a. RELINER Inside Drop Bowl – RELINER.
 - b. Or Approved Equal.

K. Concrete: Comply with Section 03 30 00 – Cast-in-Place Concrete.

L. Water: All water used on this project shall be clean and potable water.



PART 3 - EXECUTION

3.1 FLOW CONTROL AND BYPASS PUMPING

- A. Furnish, install and maintain control or bypass pump flow as necessary to accomplish the manhole repair and lining work.
- B. When force main discharges are encountered, the Contractor may fabricate an apparatus to divert flow toward the bottom of the manhole thus reducing splash. Accepted materials for the temporary apparatus include PVC pipe, bends, fittings, Fernco couplings, and lay flat discharge hoses. The Detroit Water and Sewerage Department will assist by hand operating the lift stations while the Contractor installs the flow control apparatus.
- C. If the Contractor proposes bypass pumping for this project, a detailed Bypass Pumping Plan shall be submitted, prior to installing any bypass pumping.
- D. Comply with Section 01 57 15 – Temporary Sewer Bypass Pumping.

3.2 CLEANING

- A. Comply with manhole cleaning requirements as listed in Section 33 01 30.19 – Sanitary Sewer Pipeline Cleaning.
- B. Power Washing: Equipment shall produce a minimum of 5,000 pounds per square inch (psi) water blast to remove all foreign matter, loose mortar, grease, oil residues, rust, scale and to etch the surfaces.
- C. Chipping: If large deposits exist or power washing cannot remove all deposits, then the contractor shall remove the deposits by chipping. Remove all loose, broken or softened concrete bricks/blocks to sound material. Any voids left by chipping shall be repaired in accordance with Section 2.2.
- D. Muriatic Acid: If the power washing or chipping cannot be utilized due to structural conditions in the manhole or if they do not remove all deposits, then a solution of muriatic acid (hydrochloric acid) shall be applied at a ratio of one (1) part acid to ten parts water by spraying from above the manhole. After the acid solution is applied it shall be washed off completely. The mixing, application, and removal of the acid solution shall be done in strict accordance with the manufacturer's Specification and safety procedures. The use of acid base cleaners is not permitted for polymer liners, no matter how diluted.
- E. Steel Surfaces: Solvent clean steel surfaces to be coated with the polymer lining material. The steel surfaces may also be cleaned utilizing high (> 5,000 psi) or ultra-high (> 10,000 psi) water pressure cleaning or water with sand injection and approved rust inhibitors. The surface profile shall be minimum of 2 mils.



- F. **Fiberglass Surfaces:** Only the polymer lining material is intended for use on fiberglass surfaces. Prepare fiberglass by rinsing, neutralizing, scarifying and cleaning with water or a mixture of water and solvent. Remove all dust and loose particles. The surface should be thoroughly dry before the application of the polymer material.

3.3 PATCHING HOLES OR VOIDS

- A. All loose or disintegrated material shall be removed from the area to be patched.
- B. Holes or voids around steps, joints or pipes, spalled areas, and cavities caused by missing or broken brick or mortar shall be repaired using patching material conforming to the requirements of this Specification.
- C. The patching material shall be mixed and applied in accordance with the manufacturer's requirements.

3.4 STOPPING ACTIVE LEAKS AND INFILTRATION

- A. All active leaks and infiltration shall be repaired using chemical grout conforming to the requirements of this Specification. Any areas that show evidence of leakage either active or non-active during inspection shall be injected.
- B. At each point of leakage within the manhole structure, a hole shall be carefully drilled through the wall to the exterior of the manhole. Grout ports or sealant injection devices shall be placed in these holes in a way as to provide a watertight seal between the holes and the injection device.
- C. Cementitious or hydraulic cement shall be pumped through the hole until material refusal is recorded on a pressure gauge mounted on the pumping unit. Care shall be taken during the pumping operation to ensure that excessive pressures do not develop and cause damage to the manhole structure.
- D. Dewater the exterior of the manhole with a well-point system if necessary to facilitate the repair work. The dewatering shall continue for a minimum of 8 hours following completion of the repair work.
- E. Upon completion of the injection, the ports shall be removed and the remaining holes filled with mortar and troweled flush with the surface of the manhole wall.
- F. The injected section joints, pipe connection, holes, or seams shall be sealed with patching material conforming to the requirements of this Specification and smoothed flush with the surface of the manhole wall. In order to prevent the migration of infiltration leaks, comply with the following requirements for points of injection:
 - 1. For Pre-cast Section Joint Leaks, furnish and install a minimum of four (4) injection points which shall be evenly spaced around the circumference of the manhole joint.



2. For Pipe Connection Leaks, injection points shall be furnished and installed around pipe connection by Contractor's means and methods.
3. For Pipe Invert Leaks, furnish and install a minimum of two (2) injection points, one (1) on each side of trough.
4. For Lift Holes and Voids furnish and install a minimum of one (1) injection point below the center of the lift hole or void.

3.5 REFORM/REPAIR EXISTING BENCH AND INVERT

- A. Manhole inverts and benches shall be reformed as identified in the Plans using the patching material identified in this Specification. Fast setting hydraulic cement may be used to repair the invert.
- B. The patch material shall be applied to the invert and bench at a minimum thickness of ½ inch, extending sufficiently to the wall to tie into the cementitious liner to be applied later.
- C. The finished invert and bench shall be troweled to a smooth finish free of any ridges.
- D. The bench shall be sloped a minimum of two (2) inches from the manhole wall toward the invert to prevent debris build-up on the bench.
- E. Repairs on the invert shall not compromise grade.
- F. The invert and bench shall be allowed to cure for a minimum of 30 minutes before being subject to active flow. Flow shall be bypassed by the requirements of Section 3.1 and the approved bypass plan.

3.6 BUILDING BENCH AND INVERT

- A. Inverts and benches shall be constructed in manholes with no hard bottom and no defined invert (channel of flow) if a manhole is being rehabilitated, using the patching material identified in this Specification. Fast setting hydraulic cement may be used to repair the invert.
- B. The bench shall be constructed of brick or block and finished by troweling smooth with patching material and cast-in-place concrete.
- C. The patching material shall have a minimum thickness of one (1) inch.
- D. The finished invert and bench shall be troweled to a smooth finish free of any ridges.
- E. The bench shall be sloped from the manhole wall toward the invert to prevent debris build-up on the bench. The invert and bench shall be allowed to cure for a minimum of 30 minutes before being subject to active flow.



- F. Flow shall be bypassed in accordance with the requirements of this Specification and the approved bypass plan.

3.7 CEMENTITIOUS LINER APPLICATION

A. Pre-Construction Testing:

1. Shall be in accordance with the applicable provisions of ACI Standard 506.
2. Shall be conducted by an approved testing agency.

B. Surface Preparation:

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi).
2. Loose or protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel or scraper. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface.
3. All loose cementitious liner (previously installed) shall be removed by water blasting. Deteriorated epoxy or protective coatings shall be completely removed by sandblasting.
4. Any holes or voids shall be filled in accordance with this Specification. The surface to be repaired shall be clean and free of any loose materials.
5. Active leaks and infiltration shall be stopped in accordance with Section 3.3.

- C. Step Removal: Steps in good condition shall remain; otherwise, prior to application of the cementitious liner, all steps shall be cut-off, ground flush with the manhole wall, removed, disposed off-site, and replaced.

D. Liner Application:

1. No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures exceed 90 degrees Fahrenheit, precautions shall be taken to keep the mix temperature below 90 degrees Fahrenheit.
2. For each bag of product, use the amount of water specified by the manufacturer and mix for 30 seconds to one (1) minute using equipment per manufacturer's recommendation.
3. Manhole channels are not required to be lined unless indicated otherwise on the Drawings.
4. First Application:
 - a. The surface prior to spraying shall be damp without noticeable free water, but totally saturated.
 - b. Materials shall be applied using low-pressure spray equipment from the bottom of the wall (including the bench but not invert) to the top (terminating at the frame/cone connection), to a minimum uniform thickness to ensure that all cracks, crevices, and voids are filled and a relatively smooth surface remains after light troweling.
 - c. Light troweling shall be performed to compact the material into voids and to set the bond.



5. Second Application:
 - a. A second application is applied after the first application has begun to take an initial set (disappearance of surface sheen which could be 15 minutes to one (1) hour depending upon ambient conditions) to assure a minimum total finished thickness of one (1) inch.
 - b. Application again shall be from the bottom up using low-pressure spray equipment.
 - c. The surface shall then be troweled to a smooth finish being careful not to over trowel to bring additional water to the surface and weaken it.
6. Curing:
 - a. Caution shall be taken to minimize exposure of applied product to sunlight and air movement.
 - b. If application of second coat is to be longer than 15 minutes after completion of first coat, the manhole cover shall be set back in place.
 - c. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover.
 - d. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow.
 - e. Flow shall be bypassed per the requirements of Section 3.1 and the approved bypass plan.
 - f. Traffic shall not be allowed over manholes for 12 hours after application is complete.

3.8 EPOXY LINER APPLICATION

A. Surface Preparation:

1. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface. At a minimum, this shall be achieved with a low-pressure water cleaning equipment using a 0-degree rotating nozzle at 5,000 psi and 4 gpm.
2. Other methods such as high-pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12), abrasive blasting, shot-blasting, grinding, scarifying, and/or acid etching may also be used.
3. The method(s) used shall be performed in a manner that provides a uniform, sound, clean, neutralized surface that is not excessively damaged.
4. Any holes or voids shall be filled in accordance with this Specification. The surface to be repaired shall be clean and free of any loose materials.
5. Active leaks and infiltration shall be stopped in accordance with this Specification.
6. When required on the Plans, the epoxy liner shall be applied over a back-build of cementitious surface.
 - a. Exact minimum thicknesses of cementitious back-build shall be determined after deteriorated concrete has been removed to restore the inside diameter of the manhole to its original design dimension.
 - b. The cementitious liner shall be applied in accordance with this Specification.
 - c. The epoxy lining shall take place only after the cementitious liner has cured the appropriate length of time as recommended by the manufacturer.



B. Liner Application:

1. Spray application equipment approved by the coating manufacturer shall be used.
2. Manhole channels are not required to be lined unless otherwise indicated on the Drawings.
3. Surfaces shall be coated by spray application to a minimum dry film finished thickness of at least 100 mils including bench (not including invert) and walls (terminating at top of cone/frame joint). Thickness shall be achieved using a minimum of two (2) coats.
4. Subsequent top coating or additional coats should occur no later than the recoat window for the specified products. Additional surface preparation will be required if this recoat window is exceeded.

C. Spark Test:

1. The cured epoxy lining shall be spark tested for pinholes with a spark tester set at 10,000 volts minimum (100 V per mil).
2. All pinholes identified by the spark test shall be repaired.
3. All pinholes shall be marked off on surface areas containing pinholes to a point six (6) inches beyond all pinholes and patch with epoxy to a minimum additional thickness of 30 mils.
4. Blisters and uncured lining shall be completely removed and the areas recoated with epoxy to a point six (6) inches beyond the repair areas at a minimum thickness of 100 mils.

3.9 FRP MANHOLE LINERS

- A. Take measurements of the existing manhole interior dimensions to confirm fit prior to submitting and ordering the FRP Manhole Liner.
- B. The existing manhole shall be excavated to below the bottom of concrete cone section on the existing manhole. The existing concrete cone section shall be removed and legally disposed off-site.
- C. All cuts through existing asphalt and or concrete pavement shall be saw cut with straight cuts.
- D. All existing manhole steps shall be removed flush with the existing manhole wall.
- E. FRP manhole liners shall be installed in strict conformance with the manufacturer's recommendations and these Specifications:
 1. Safely lift the manhole liner.
 2. Set the manhole liner into existing manhole. Mark the contour of the existing bench area onto the FRP liner. Remove the liner and cut along the contour mark. Restore any service connections within the manhole.



3. Set the liner into and concentric with the existing manhole. Use a non-shrinking grout to seal the area between the bottom of the liner and the existing bench area.
 4. Any holes or voids shall be filled in accordance with this Specification. The surface to be repaired shall be clean and free of any loose materials.
 5. Backfill around the excavated reducer section with stabilized sand or crushed stone. The material chosen shall be free of large lumps or clods which will not readily break down under compaction. Backfill material and compaction requirements shall be in accordance with Section 31 23 33 – Trenching and Backfill.
- F. Any required manhole wall penetrations shall be sealed with a waterproof gasket assembly approved by the Engineer.
 - G. The manhole frame and cover shall be set on concrete grade rings and into a bed of clean, fresh mortar as indicated on the standard details, in order to place the ring and cover at the required grade. Set tops of frames and covers level with finished surface of manholes that are in pavements. Set tops of frames and covers three (3) inches above finished surface in non-pavement areas (i.e., fields or open areas) if no hazards exist in leaving manholes above grade, or as directed by the Engineer. Grade rings shall be no more than six (6) inches in height.
 - H. All exposed concrete/grout surfaces within manholes including manhole inverts shall be sealed with a 60-mil spray coating.
 - I. Pavement shall be replaced in-kind to match existing pavement depth and material or as required by permits. Non-paved areas shall be replaced in-kind to match existing conditions.

3.10 POLYMER CONCRETE MANHOLE LINERS

- A. Take measurements of the existing manhole interior dimensions to confirm fit prior to submitting and ordering the Polymer-Concrete Manhole Liner.
- B. The area around the manhole shall be excavated as necessary to provide for removal of existing cone and castings while preventing soil and debris from falling into the manhole.
- C. Furnish, maintain and install equipment to maintain sewage flows without backup, overflow or spill.
- D. Repairs shall be made to the existing manhole in order to receive the polymer inserts.
- E. Remove by power wash any loose debris from wall areas. All dirt, grease, and debris shall be removed from the bench area to prepare bench surfaces for resurfacing. Debris shall not be allowed to enter the sewage system.
- F. All active leaks shall be repaired, and the bench shall be leveled and repaired to prepare for the polymer insert installation.



G. The risers shall be offloaded and lifted into place with approved manufacturer's lifting device. No other handling apparatus shall be acceptable.

H. Installation of First Polymer Riser Section:

1. The first polymer riser section shall be saw-cut if necessary to accommodate pipe entry and bench slopes.
2. Depending on invert configuration, the bench area shall be prepared by building up the bench section with a Portland cement and sand mixture to provide a clean level surface to receive the riser. This build up shall allow for a level surface above the existing top of the highest pipe.
3. If pipe inverts are offset the initial polymer sleeve shall be modified in the field to accommodate the difference in bench slopes.
4. After grout has set, lower the first riser section, clean and wipe down the polymer riser wall above the bench to allow for application of the epoxy coating. This shall be done with a wet cloth.
5. When the new bench configuration is sufficiently dry and clean, a thin shell coating of the epoxy shall be built over the bench. The epoxy shall continue six (6) inches up the polymer riser face to allow for interlink between the coating and polymer riser section.
6. All non-booted or flexible coupler pipe entry areas shall be grouted by an epoxy patch kit provided by the manufacturer.

I. Completion of Installation:

1. After the initial bottom seal has cured, the additional remaining riser sections and cone shall be installed using the appropriate wall alignment guides, gaskets and mastic.
2. Any holes or voids shall be filled in accordance with this Specification. The surface to be repaired shall be clean and free of any loose materials.

3.11 FRAME AND CHIMNEY (CONE) SEAL INSTALLATION

A. Applied Seal:

1. All foreign material, bituminous coating, rust or scale build-up, etc. shall be removed from the area to be coated by sandblasting in accordance with the manufacturer's requirements. Wire brushing will not be allowed.
2. After the area is cleaned, it shall be completely dried prior to application of the seal material.
3. The urethane resin compound shall then be applied from the bottom three (3) inches of the frame to the top three (3) inches of the cone, including the grade adjustment area, to a minimum thickness of 120 mils.
4. Application shall be in accordance with the manufacturer's instructions.



3.12 CLEANING MANHOLE

- A. Any rocks, pieces of broken pipe or any other debris discovered in the manhole or invert shall be removed and disposed off-site.
- B. The bench and invert shall be pressure washed to remove organic material and return undisturbed wastewater flow to the invert.

3.13 PLUGGING ABANDONED LINE

- A. Abandoned lines shall be filled in accordance with Section 31 23 23.33 – Flowable Fill.
- B. Grout plug shall extend at least 1.5 times the thickness of the manhole wall.
- C. Plugging abandoned lines shall be performed prior to cementitious lining.

3.14 RAISING MANHOLES

- A. If buried, whether in-road or off-road, field-locate the manhole cover.
- B. The frame shall be removed from the cone.
- C. Clean the top of the cone and bottom of the frame in accordance with SSPC-SP3 Power Tool Cleaning to remove all rust and loose material.
- D. Precast Concrete Grade Adjustment Ring:
 - 1. A pre-cast grade ring shall be inserted to raise the manhole with ample butyl rubber mastic applied between the cone and grade ring and the grade ring and the frame.
 - 2. If adjustment is made between the barrel and the cone section, butyl rubber shall be inserted between each joint.
- E. Steel Grade Adjustment Ring:
 - 1. Butyl rubber sealant or rope shall be used to seat the steel grade adjustment ring on the frame.
 - 2. The grade ring shall be secured to the existing frame by four spot welds spaced equal distance around the circumference of the frame.
 - 3. This method shall only be used to raise manholes prior to asphalt overlay of the road.
- F. Rubber Composite Adjustment Riser:
 - 1. EJ Group INFRA-RISER or approved equal.
 - 2. Adjustment risers shall be of uniform quality, free from cracks, holes, and any other surface defects.



3.15 INSTALL FLAT TOP SLAB ON EXISTING SQUARE TOP MANHOLE

- A. Existing square top slab, frame, and cover shall be removed.
- B. Brick or block courses shall be removed to allow for the installation of new flat top slab to grade.
- C. Standard approved precast concrete flat top slabs shall be used when applicable. Where standard size top slabs will not suffice, a custom precast concrete approved flat top slab shall be installed.
- D. Frames shall be bolted to the flat top using stainless steel expansion bolts and butyl rubber mastic.
- E. The finished elevation shall be level with the existing or proposed finished grade.

3.16 REALIGN AND RESET FRAME

- A. Manhole frames shall be bolted to the cone section using stainless steel expansion bolts. Frame shall have a minimum of two (2) bolts (5/8" diameter, 4" in length).
- B. Frames shall be sealed to the top of manhole with butyl rubber mastic.
- C. Grout shall then be placed, on the inside and outside to the height of the adjustment.
- D. Manholes installed in streets or roadways shall be constructed with a concrete ring (3,000 psi) six (6) inches thick and five (5) foot minimum O.D. securing the frame. The concrete ring shall lie embedded in the gravel base course and below the surface course of pavement.

3.17 MANHOLE BENCH AND CHANNEL

- A. Manhole channels and benches shall be repaired.
- B. Manhole channels and benches shall be field formed from concrete.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 2. Benches: Concrete, sloped to drain into channel.
- C. Modify the inverts to provide a smooth flow line through the manhole.
- D. Raise the bench to the top of the pipe, forming a "U" channel through the manhole and provide sufficient slope to make benches self-cleaning when benches must be modified.



3.18 GROUTING SECTION JOINTS

- A. Section joints shall be repaired with cementitious material conforming to the requirements of this Specification.
- B. Material shall be applied to fill any holes, voids, or cracks at the section joint.
- C. The material shall be applied at an even thickness around the entire circumference of the joint and smoothed flush to the surface of the manhole wall.

3.19 GROUTING CHIMNEY

- A. Manhole chimneys shall be repaired with calcium aluminate cementitious material conforming to the requirements of this Specification. Material shall be applied at a minimum thickness of one (1) inch.
- B. The cementitious material shall be applied and smoothed to an even thickness around the entire circumference of the chimney.

3.20 ACCEPTANCE

- A. Photographs:
 - 1. Provide digital photographs of the finished manhole upon completion of repair and rehabilitation work.
 - 2. The photograph shall be taken looking down into the manhole, oriented so that the effluent pipe is at the bottom of the photograph at 6 o'clock.
 - 3. Photographs shall be named by the corresponding manhole number. When there are multiple photographs per manhole, add “-#” to the end of the manhole number and number the photographs sequentially.. These photographs shall be submitted to the Engineer digitally on a USB flash drive, periodically to accompany pay applications.
 - 4. Alternatively, manhole digital scanning may be utilized for post-construction documentation.
 - 5. Final project acceptance is contingent upon receiving all manhole photographs.
- B. Portable Document Format (PDF):
 - 1. Provide a portable document format (PDF) that contains photographs of the manhole prior to repair and of the finished manhole upon completion of repair and rehabilitation work.
 - 2. The photograph shall be taken looking down into the manhole, oriented so that the effluent pipe is at the bottom of the photograph.
 - 3. Photographs should not be altered or cropped. If necessary to resize, photographs should be resized, keeping the same length/width ratio.
 - 4. Each page of the PDF should include the contract number, Manhole ID, address of repair, and a description of what the photograph is illustrating.



- a. Example: DWS-916, WWMH0000012029, 51 Taylor, Encrustation at 14.95 ft and 17.85 ft – BEFORE
 - b. Example: DWS-916, WWMH0000012029, 51 Taylor, Spot Grout Repair for Encrustation at 14.95 ft and 17.85 ft – AFTER
5. Provide raw files of the photographs included in the PDF as described in the above section.

C. GPS:

1. Use GPS receivers capable of supplying mapping grade (sub-meter) locations and provide Northing and Easting coordinates of all repaired/rehabilitated manholes.
2. A list of manholes with corresponding coordinates shall be provided to the Engineer, in digital format, upon completion of the project.
3. Final project acceptance is contingent upon receiving all manhole GPS locations.

D. Performance Testing:

1. After the Manhole Rehabilitation and repair has been completed, the Work shall be visually inspected in the presence of the Engineer for compliance with these Specifications and the manufacturer's recommendations.
2. Each manhole shall be sounded by the Contractor at seven (7) days. The Engineer will witness these soundings performed by the Contractor. Defects shall be corrected per the contract documents and manufacturer's recommendation to the satisfaction of the Owner.
3. The Engineer will also inspect the Work during the warranty period. Any leakage or defects in the Work shall be corrected by the Contractor at no additional cost to the Owner.
4. If required, a qualified independent testing and inspecting agency shall be contracted by the Contractor or by the Owner as designated in the Contract Documents.

E. Spark Testing:

1. Manholes that are completely rehabilitated using epoxy liner shall be spark tested in accordance to Section 3.7 for epoxy lining.
2. If the manhole fails the initial test, necessary repairs shall be made in accordance to Section 3.7 for epoxy lining. Retesting shall continue until the manhole satisfactorily passes the test.
3. All tests shall be performed in the presence of the Engineer.
4. Furnish all personnel, facilities, and equipment necessary to conduct the testing.

F. Material Testing:

1. Cementitious Liner:
 - a. Cementitious liner shall be tested for 24-hour and 28-day compressive strength in accordance with ASTM C-109 and shall meet the following compressive strength requirements:
 - 1) 2,000 psi at 24 hours.
 - 2) 8,000 psi at 28 days.
 - b. Three (3) samples shall be taken for every 50 bags of material used.



- c. Samples shall be sprayed from the nozzle. Use three (3) by six (6) inch diameter cylinders for testing.
 - d. Cylinders shall be labeled with date, project, manhole number, and product batch number.
 - e. Samples shall be sent to an independent testing agency for laboratory verification, results shall be provided to the Engineer.
 - f. A written log shall be maintained referencing the specific bags of cement (product batch numbers) used per manhole, for all manholes.
2. Epoxy Liner:
- a. Produce samples of epoxy liner. These samples shall be sprayed on concrete substrate (block), approx. 6 x 6 inch, approx. 60 mils thick, just prior to spraying the manholes.
 - b. Samples shall be labeled with the date, project, manhole number, and product batch number.
 - c. Samples shall be sent to an independent testing agency for laboratory verification and tested per ASTM D790 and ASTM D695 and shall meet the following flexural and compressive requirements:
 - 1) Flexural Modulus of Elasticity 30 000 psi at 2 hours.
 - 2) Compressive Strength 15 000 psi at 2 hours.

3.21 CLEAN-UP

- A. After the Work has been completed and accepted by the Engineer, clean-up the entire project area and return the ground cover to its original condition.
- B. All excess material and debris not incorporated into the permanent installation shall be legally disposed of off-site.

END OF SECTION 33 01 30.81



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MANHOLE REHABILITATION
DWSD Special Specification
March 2025

SECTION 33 31 11 - PUBLIC SANITARY SEWERAGE GRAVITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary Sewerage Piping.
2. Connection to Existing Manholes.
3. Wye Branches and Tees.
4. Sanitary Laterals.
5. Bedding and Cover Materials.

B. Related Requirements:

1. Section 31 23 33 – Trenching and Backfill.
2. Section 31 50 00 – Excavation Support Systems.
3. Section 33 01 30.16 – Sanitary Sewer Pipeline Inspection.
4. Section 33 01 30.19 – Sanitary Sewer Pipeline Cleaning.
5. Section 33 01 30.61 – Packer Injection Grouting.
6. Section 33 05 61 – Concrete Manholes.
7. Section 33 05 97 – Identification and Signage for Utilities.

1.2 DEFINITIONS

- A. Rigid Pipes: Vitrified clay pipes, reinforced concrete pipes, and ductile iron pipes shall be considered as rigid pipe materials.
- B. Non-Rigid Pipes: Pipe materials other than vitrified clay pipes, reinforced concrete pipes, and ductile iron pipes shall be considered non-rigid pipe materials.

1.3 STANDARDS

Except as modified herein, comply with the current edition of the following standards:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb.) Rammer and a 457 mm (18-in.) Drop.



B. American Water Works Association (AWWA):

1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
5. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
6. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel.
3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
8. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
11. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
12. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
18. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).



19. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 COORDINATION

- A. Comply with Section 01 30 00 - Administrative Requirements.
- B. Notify affected utility companies at least three (3) days prior to construction occurring in proximity to utility infrastructure.

1.5 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer information indicating proposed materials, accessories and details prior to the ordering or manufacture of the materials.
- C. Submit detailed description of procedures for connecting new sewer to existing sewer line.
- D. Submit detailed description of procedures for sewer line, directional drilling, and pipe jacking installation.
- E. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.
- F. Manufacturer Instructions: Indicate special procedures required to install specified products.
- G. Source Quality-Control Submittals: Furnish two (2) certified copies of the results of all materials tests and inspections to the Engineer.
- H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Closed-Caption Television (CCTV) Inspection:
 1. Comply with Section 33 01 30.16 – Sanitary Sewer Pipeline Inspection.



2. The CCTV inspections shall be performed by the Contractor on all sewers, manholes, inlets, and other appurtenances after completion of the sewer items, and before Substantial Completion is issued.

1.7 QUALITY ASSURANCE

- A. The Owner shall at all times have access to all places of manufacture where materials are being fabricated or tested and shall be at liberty at all times to inspect all materials and observe all tests on the materials. Any materials which, in the opinion of the Engineer, are not in conformity with the specifications herein stated, or the drawings submitted to the Engineer as herein required, will be rejected and shall be removed from the site immediately.
- B. Unless otherwise specified herein, materials shall be manufactured, tested and inspected by the manufacturer in the manner required by the latest version of ASTM specifications and AWWA/ANSI standards. Such tests shall be at the Contractor's expense. Furnish to the Engineer two certified copies of the results of all materials tests and inspections.
- C. Ductile Iron Pipe Epoxy Lining: The lining shall be applied by a firm with a successful history of applied linings to the interior of ductile iron pipe and fittings.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage. Any materials which, in the opinion of the Engineer, are not in conformity with the specifications or the Drawings will be rejected and shall be removed from the site immediately.
- B. Storage:
 1. Store materials according to manufacturer instructions.
 2. Store valves in shipping containers with labeling in place.
 3. Non-rigid pipe shall be stored to prevent bowing. Pipe and fittings with visible cracks, breakage or other defects shall not be used, or repaired and used, unless specifically accepted by Engineer in writing.
- C. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Plastic pipe shall be kept covered to prevent exposure to ultra-violet exposure from the sun.



3. Block individual and stockpiled pipe lengths to prevent moving.
4. Provide additional protection according to manufacturer instructions.
5. Lined pipe and fittings shall be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

A. Ductile-Iron Pipe:

1. Comply with AWWA C151.
2. Minimum Special Thickness Class: 52.
3. End Connections: Bell and spigot.
4. Outside Coating:
 - a. Type: Asphaltic.
 - b. Minimum Uniform Thickness: 1 mil.
 - c. Comply with AWWA C151.
5. Lining:
 - a. Type: Ceramic Epoxy Lining.
 - b. "Protecto 401 Ceramic Epoxy" or approved equal.
6. PE Encasement: Comply with AWWA C105.
7. Fittings:
 - a. Material: Ductile iron, Pressure Class 250 or greater.
 - b. Comply with AWWA C110.
8. Joints:
 - a. Rubber gasket joint devices.
 - b. Comply with AWWA C111.
 - c. Wrap MJ fittings, flanges, and couplings with wax tape per AWWA C217, then overwrap in accordance with AWWA Standard C105.

B. Reinforced Concrete Pipe:



1. Comply with ASTM C76, Class IV, with Wall Type B minimum.
2. All reinforced concrete pipe shall be manufactured using Type II Cement unless otherwise approved by the Engineer.
3. Reinforcement: Steel Wire Mesh.
4. End Connections: Bell and spigot.
5. Fittings: Reinforced concrete.
6. Joints:
 - a. Rubber compression gasket.
 - b. Comply with ASTM C443.

C. Plastic Pipe Inside Nominal Diameter: 4 to 15 inches:

1. Material: PVC.
2. Comply with ASTM D3034; SDR-26 minimum, unless shown otherwise on the Drawings.
3. End Connections: Bell-and-spigot style, with rubber-ring-sealed gasket joint.
4. Fittings: PVC.
5. Joints:
 - a. Elastomeric gaskets.
 - b. Comply with ASTM F477.

D. Plastic Pipe Inside Nominal Diameter: 18 to 48 inches:

1. Material: PVC.
2. Comply with ASTM F679, SDR 26.
3. End Connections: Bell-and-spigot style, with rubber-ring-sealed gasket joint.
4. Fittings: PVC.
5. Joints:
 - a. Elastomeric gaskets.
 - b. Comply with ASTM F477.

E. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe (CCFRPMP) or Fiberglass Reinforced Polymer Mortar Pipe (FRPMP):

1. Manufacture and testing shall be in accordance with ASTM D3262. Strain Corrosion Resistance shall be determined in accordance with Appendix X1.2 for a 4% long-term limiting deflection. The method for determining glass content shall be in accordance with Appendix X3.1.1.
2. Open cut portions of sewer pipe shall have a minimum stiffness class of 72-psi when tested in accordance with ASTM D2412. Sewer pipe that is to be installed by pipe jacking shall have a design factor of safety of 2.5 and an allowable safe jacking load per manufacturer's recommendation.



3. Liner:
 - a. The internal liner shall be suitable for service in a sewer pipe and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases.
 - b. Comply with ASTM D3681.
4. End Connections:
 - a. The pipe shall be field connected with glass reinforced plastic sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness.
 - b. Comply with ASTM D4161.
5. Joints:
 - a. Elastomeric Gaskets.
 - b. Comply with ASTM F477 and ASTM D4161.

2.2 MANHOLES

- A. As specified in Section 33 05 61 - Concrete Manholes.

2.3 MATERIALS

- A. Bedding and Cover:
 1. Bedding: Fill Type as specified in Section 31 23 33 – Trenching and Backfill.
 2. Cover: Fill Type as specified in Section 31 23 33 – Trenching and Backfill.

2.4 MIXES

- A. Grout: As specified in Section 03 60 00 - Grouting.

2.5 SOURCE QUALITY CONTROL

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Provide shop inspection and testing of pipe.
- C. Certificate of Compliance: Submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Verify that trench cut is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are as indicated in Contract Documents.
- D. Verify excavation for manholes to proper depth and proper placement of bedding material.

3.2 PREPARATION

- A. Correct over-excavation with bedding material as specified in Section 31 23 33 – Trenching and Backfill.
- B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- C. Protect and support existing sewer lines, utilities, and appurtenances.
- D. Utilities:
 - 1. Maintain profiles of utilities.
 - 2. Coordinate with other utilities to eliminate interference.
 - 3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 31 23 33 – Trenching and Backfill.
 - 2. Excavate to lines and grades as indicated in Contract Documents, or as required to accommodate installation of encasement.
 - 3. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
 - 4. Provide sheeting and shoring as specified in Section 31 50 00 – Excavation Support Systems.
 - 5. Pile Support Systems:
 - a. Install pile support systems as specified in Section 31 50 00 – Excavation Support Systems.
 - b. Install utilities on pile support systems as indicated in Contract Documents.



6. Placement: Place bedding material at trench bottom as specified in Section 31 23 33 – Trenching and Backfill.

B. Piping:

1. Install PVC pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
2. Install ductile iron pipe, fittings, and accessories according to AWWA C600 unless otherwise noted on Contract Documents.
3. Install reinforced concrete pipe, fittings, and accessories according to ASTM C1479 unless otherwise noted on Contract Documents.
4. Install CCFRPM pipe according to manufacturer recommendations unless otherwise indicated on the Contract Documents.
5. Lay pipe to slope gradients as indicated in Contract Documents.
6. Begin pipe laying at downstream end of system and progress upstream.
7. Bedding: As indicated on the Drawings.
8. Lay bell-and-spigot pipe with bells upstream.
9. PE Pipe Encasement: Comply with AWWA C105, Method A. Seal all joints with polyethylene tape to prevent ingress of water.
10. Backfill and compact as specified in Section 31 23 33 – Trenching and Backfill.
11. Backfill each section of pipe as it is laid and as indicated at least up to centerline before next joint is made.
12. Do not displace or damage pipe when compacting.
13. Keep trenches and other excavations free of water until final inspection. Do not lay pipe or construct masonry work in water. Do not allow water to rise over the work until concrete or mortar has had ample time to set.
14. All lifting holes in reinforced concrete circular pipe shall be grouted with cement mortar or other approved material after the pipe has been placed. Repair lining following placement.
15. Connections to pipes of dissimilar size and/or material shall be made using a flexible coupling as shown in the Contract Documents.

C. Manholes: As specified in Section 33 05 61 - Concrete Manholes.

D. Connections to Existing Manholes:

1. Drilling:
 - a. Core drill existing manhole to clean opening.
 - b. Use of pneumatic hammers, chipping guns, sledge hammers will not be permitted.
2. Install watertight neoprene gasket and seal with non-shrink concrete grout.
3. Prevent construction debris from entering existing sewer line when making connection.

E. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated in the Contract Documents.



2. Use standard fittings of the same material and joint type as sewer main.
3. Maintain minimum five (5) foot separation distance between wye connection and manhole.
4. Use a saddle, wye or tee with stainless-steel clamps for taps into existing piping.
5. Mount saddles with solvent cement or gasket and secure with metal bands.
6. Lay out holes with an accurate template and cut holes with a mechanical cutter.

F. Sanitary Laterals and Services:

1. Construct laterals from wye branch to terminal point where connection to structurally sound existing lateral is achieved.
2. Where depth of main pipeline warrants, construct riser-type laterals from wye branch.
3. Minimum Depth of Cover over Piping: 2 feet.
4. Minimum Separation Distance between Laterals: 5 feet.
5. If constructing new laterals connecting to existing sewers:
 - a. Encase sewer lateral with Grade "C" concrete to center line of pipe.
 - b. Install magnetically locatable watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral.

G. Backfilling: As specified in Section 31 23 33 – Trenching and Backfill.

3.4 TOLERANCES

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Maximum Variation from Indicated Slope: 1/8-inch in 10 feet.

3.5 FIELD QUALITY CONTROL

- A. Comply with Section 01 40 00 - Quality Requirements.
- B. Request inspection by Engineer prior to and immediately after placing bedding.
- C. Testing:
 1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
 2. Pipe Testing:
 - a. Pressure Testing: The air test shall, as a minimum, conform to the test procedure described in ASTM C828 clay pipe, ASTM C924 for concrete pipe and ductile iron pipe, ASTM F1417 for plastic pipe, and ASTM3212 for PVC pipe.
 - b. Infiltration and Exfiltration Testing: The leakage infiltration or exfiltration shall not exceed 100 gallons per inch of pipe diameter per mile per day for any section of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of two (2) feet of water.



- c. Deflection Testing: Deflection tests shall be performed on all non-rigid pipe. The tests shall be conducted after the final backfill has been in place at least 30 days in order to permit stabilization of the soil-pipe system. No pipe shall exceed a deflection of five (5) percent of the inside diameter. If deflection exceeds five (5) percent, the pipe shall be excavated, replaced and retested. For piping 48-inch diameter or smaller, a rigid ball or mandrel shall be used for the deflection test which shall have a diameter not less than 95 percent of the base inside diameter. The tests shall be performed without mechanical pulling devices. All non-rigid pipe larger than 48-inch diameter shall have deflection measurements performed directly using extension rulers, tape measures, etc. at 10-foot increments, using the same criteria used for the mandrel device.

3.6 PROTECTION

- A. Comply with Section 01 70 00 - Execution and Closeout Requirements.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
- C. Cap open ends of piping during periods of Work stoppage.
- D. Repair linings, coatings, and coverings damaged during construction with accepted materials equal to and compatible with original lining, coating or covering. Repair damaged galvanizing with zinc-rich paint.
- E. Repair any existing utilities/structures or features damaged during installation of sanitary sewerage utilities to Owner's satisfaction, and at no cost to Owner.

- 3.7 Closed-Caption Television (CCTV) Inspection: Visually and CCTV inspect all installed piping in accordance with Specification Section 33 01 30.16 – Sanitary Sewer Pipeline Inspection.

END OF SECTION 33 31 11



Information for Page 1 of the COA PDF Document

Project Address: City wide

Historic District:

Description of Work:

The Project may include the following Work as issued by DWSD on an as-needed basis:

1. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
2. Replacement of sewer services and installation of new cleanout at the property line.
3. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.
4. Performing site cleanup and restoration including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
5. CCTV of the lateral after installation from newly installed cleanout to the point of connection to the private structure.
6. All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

With the Conditions That: To be completed by HRD.

Information for Page 2 of the COA PDF Document

Description of Work: Refer to the description provided above.

With the Conditions That: To be completed by HRD

Information for Page 3 of the COA PDF Document

Address: N/A

Historic District: N/A

Scope of Work: Others including site restoration

Brief Project Description:

- A. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
- B. Replacement of sewer services and installation of new cleanout at the property line.
- C. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.
- D. Performing site cleanup and restoration including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
- E. CCTV of the lateral after installation from newly installed cleanout to the point of connection to the private structure.
- F. All labor, equipment, and material for the entirety of the Contract shall be provided by the

Applicant Identification: To be completed by HRD

I Agree to and Affirm the Following: To be completed by HRD

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ePlans Permit Number: To be completed by HRD

Description of Existing Condition: The work will be performed in the public ROW and mostly in alleyways. The condition of the sewer services will be determined through the CCTV inspection of sewers.

Photographs: Photos of the sewers and services will be available after each sewer and service is inspected.

Description of Project: The Project is intended to replace cave-ins caused by failed/collapsed sewer services in the public ROW.

Detailed Scope of Work:

- 7. Sewer cleaning and inspection of the public sewer by means of closed-circuit television (CCTV) and reporting of condition of sewer services (laterals).
- 8. Replacement of sewer services and installation of new cleanout at the property line.
- 9. Point repairs of circular and non-circular public sewers associated with sewer service replacement by open-cut method of excavating the portion of the pipeline and replacing it with new connections.
- 10. Performing site cleanup and restoration, including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.

11. CCTV of the lateral after installation from newly installed cleanout to the point of connection to the private structure.
12. All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

Brochures/Cut Sheets: DWSD's specifications require the awarded contractor to submit brochures/cut sheets for the products to be used on the project. However, here are some descriptions of the resiliency of the products to be used on the project.

DWSD shall incorporate resilient design techniques and material performance into construction projects to increase a structure's ability to withstand adverse weather and changing natural hazards. To achieve this standard, the use of corrosion-resistant, stronger, and durable materials has been specified in project specifications.

The project's scope of work involves construction for external spot repairs and sewer lateral connections, both of which utilize resilient materials. Below is a summary:

- **PVC SDR26 Pipe:** This non-rigid pipe is resilient due to its flexibility, which allows it to withstand ground movement from freeze-thaw cycles and settling without cracking. It is also corrosion-resistant, preventing degradation from chemicals in sewage and ensuring a long service life.
- **Flexible Couplings:** The use of flexible couplings, which conform to ASTM C1173, accommodates movement at joints, maintaining a watertight seal. This is crucial for preventing stormwater infiltration, which can overload the system during heavy rain events.
- **Saddles and Metal Parts:** **Saddles** for connecting sewer laterals, along with associated metal components like bands, are made of corrosion-resistant materials such as stainless steel to ensure long-term integrity in the sewer environment.
- **Grouting:** The project specifies hydraulic cement and chemical grouts to seal holes and joints as needed, and it effectively eliminates infiltration thereby contributing to climate resilience.
- **Repair Mortars:** The specifications include specialized repair mortars that are non-shrinking, impermeable, and resistant to hydrogen sulfide, a common cause of deterioration in sewer infrastructure.

The combination of these materials and techniques creates a resilient system designed to withstand both internal chemical degradation and external environmental stress, aligning with the project's goal of resisting adverse weather and changing natural hazards

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Additional Details: Additional details for specific questions can be made available

Other: N/A

Information for Page 6 of the COA PDF Document

Background/Description of Environment: To be completed by HRD. Note that the work will generally be performed in City of Detroit

Information for Page 7 of the COA PDF Document

Services to be Performed:

- Cleaning and inspection of public sewers to determine the condition of services.
- Replacement of failed/collapsed sewer services and public sewer segments associated with the replacement of the service.
- Performing site cleanup and restoration, including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
- CCTV of the lateral after installation from the newly installed cleanout to the point of connection to the private structure.
- All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

Inside Work Only: N/A

Inside Work and Outside Work:

- Cleaning and inspection of public sewers to determine the condition of services.
- Replacement of failed/collapsed sewer services and public sewer segments associated with the replacement of the service.

- Performing site cleanup and restoration, including surface restoration of pavement, curbs, sidewalks, driveways, and lawns.
- CCTV of the lateral after installation from the newly installed cleanout to the point of connection to the private structure.
- All labor, equipment, and material for the entirety of the Contract shall be provided by the Contractor unless otherwise stated in the measurement and payment description.

Information for Pages 8 through 22 of the COA PDF Document

Exhibit H Price and Payment Procedure

1.11 UNIT PRICE SCHEDULE

The measurement and payment descriptions of this section provide a summary of the pay items. Please refer to the individual technical specifications for additional details on general requirements, materials, and execution.

Mobilizations/Demobilization

- a. The Contractor shall furnish all necessary personnel, equipment, labor, and materials for movement of equipment and personnel to the project site.
- b. The lump sum unit price bid for Mobilization/Demobilization will not be more than 5% of the total of all other bid items of the original proposal excluding any provisional allowance and will include submittal of construction quality plan, insurance and bonds, schedule of values with proposed payment schedule including a project breakdown of all Lump Sum items, shop drawings, progress schedule, Site cleaning, dust control, field office, staging area, construction layout and staking, erosion and sediment control, and Demobilization costs including punch list completion, removal of equipment and final site clean-up.
- c. Items included in the lump sum Schedule of Values including Site cleaning, field office, staging area and others listed above must adhere to the requirements of the specifications when performed in order to be accepted for payment.
- d. Contractor to submit schedule of values for Mobilization/Demobilization item subject to approval by the Owner.
- e. Contractor shall include all costs of mobilization and demobilization for any scheduled winter

shutdown or other planned work stoppage as listed in the Contract Documents in the cost of this bid item.

- f. Combined payment for Mobilization and the corresponding schedule of values will equal two-thirds (67%) of the pay items for Mobilization/Demobilization. Combined payment for Demobilization and the corresponding schedule of values shall equal one-third (33%) of the pay items for Mobilization/Demobilization.
- g. Payment for Demobilization costs will be made in conjunction with the demobilization of the Site including punch list completion, removal of equipment and final site clean-up, subject to the Contractor's compliance with the requirements specified in the Contract Documents.

Traffic Control

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for traffic control including furnishing, installing, maintaining, relocating, replacing defective items and removal of the following: traffic control devices, temporary hot-mix asphalt, temporary stone, plating, and temporary pavement marking for the purposes of traffic control and restoring public access shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price "Traffic Control...LS" complete in place.
- c. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Safety Program

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the submittal of the Contractor Safety Program as described in the technical specifications including but not limited to the Project Specific Safety Plan, Emergency Response Plan, and personnel training shall be included in the cost of the pay item.
- b. This item shall include the Project Specific Safety Plan preparation, submittal, and all coordination and resubmittals associated with the reviews until final approval.
- c. The accepted quantities for this work will be paid for at the contract unit price "Safety Program...LS" complete in place.
- d. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Pre-Construction Site Documentation

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for pre-construction site documentation as described in the technical specifications including resident notifications, photographic documentation, and site video shall be included in the cost of the pay item.

- b. The accepted quantities for this work will be paid for at the contract unit price “Pre-Construction Site Documentation...LS” complete in place.
- c. Contractor to submit schedule of values for all Lump Sum items subject to approval by the Owner.

Sidewalk, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sidewalk removal including saw cutting, removing, hauling, and disposal of existing subgrade, sidewalk base material and sidewalk shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. Payment under this item will include sidewalk removal to full depth of existing sidewalk and ADA ramps regardless of depth of existing sidewalk.
- d. The accepted quantities for this work will be paid for at the contract unit price “Sidewalk, Rem...SYD” complete in place.

Sidewalk, Conc, 4 inch

Sidewalk, Conc, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sidewalk installation including preparation of subgrade; furnishing and compacting sidewalk base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete sidewalk shall be included in the cost of the pay item. Removal of existing sidewalk shall be paid for separately.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Sidewalk, Conc...SYD” complete in place.

ADA Ramp, w/Curb

- a. The costs of materials, labor, equipment, and all other incidental materials including preparation of subgrade; furnishing and compacting sidewalk base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing,

sealing concrete sidewalk, and detectable warning tiles necessary for the installation of ADA ramp shall be included in the cost of the pay item.

- b. Payment under this item will include all ADA sidewalk, ramps, and attached curb.
- c. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- d. The accepted quantities for this work will be paid for at the contract unit price “ADA Ramp, w/ Curb...SYD” complete in place.

Curb, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of curb removal including saw cutting, removing, hauling, and disposal of curb shall be included in the cost of the pay item.
- b. Removal of integral curbs including all saw cutting will be included in the payment of this item.
- c. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- d. The accepted quantities for this work will be paid for at the contract unit price “Curb, Rem...LFT” complete in place.

Curb, Conc

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of Concrete Curb including preparation of subgrade; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete curb shall be included in the cost of the pay item. Removal of existing curb shall be paid for separately.
- b. Integral curb, when poured with roadway pavement or sidewalk will be included in the cost of this pay item and will be paid for on a linear foot basis for curb installed. ADA, ramp with integral curb will be paid for separately.
- c. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- d. The accepted quantities for this work will be paid for at the contract unit price “Curb, Concrete...LFT” complete in place.

Curb and Gutter, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of curb and gutter removal including saw cutting, removing, hauling, and disposal of curb and gutter shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. The accepted quantities for this work will be paid for at the contract unit price “Curb and Gutter, Rem...LFT” complete in place.

Curb and Gutter, Conc

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of Concrete Curb and Gutter including preparation of subgrade; furnishing and compacting aggregate base; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete curb shall be included in the cost of the pay item. Removal of existing curb shall be paid for separately.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Curb and Gutter, Conc...LFT” complete in place.

Driveway, Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of driveway removal of various thicknesses including saw cutting, removing, hauling, and disposal of existing subgrade, aggregate base and pavement shall be included in the cost of the pay item.
- b. Payment under this item will only be made for additional removals located outside any water main and sewer approved trench limits. Surface, base, and trench removals will be included in applicable water main and sewer structure and pipe items as listed in the measurement and payment descriptions.
- c. Payment under this item will apply to full depth of existing driveway for both residential and commercial driveways.
- d. The accepted quantities for this work will be paid for at the contract unit price “Driveway, Rem...SYD” complete in place.

Driveway, Conc, 4 inch

Driveway, Conc. 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of residential driveway installation including preparation of subgrade; furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete driveway shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The accepted quantities for this work will be paid for at the contract unit price “Driveway, Conc...SYD” complete in place.

Pavement Rem

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of alley, roadway or any other quantifiable pavement removal of various thicknesses to full depth of pavement including saw cutting, removing, hauling, and disposal of existing aggregate base, concrete base, and pavement with or without reinforcement outside of approved water and sewer structure and pipe trench limits shall be included in the cost of the pay item.
- b. Trench limits are as defined in the Pavement Restoration Standard Detail as the maximum trench width excavation plus additional width to extend to existing concrete base joint limits.
- c. Payment under this item will only be made for additional pavement removals located outside any approved water main and sewer trench limits as defined in this pay item and in the Pavement Restoration Detail. Surface, base, and trench removals to the full depth and width required to replace the concrete base from existing roadway joint to joint will be included in applicable structure and pipe items for water main and sewer as listed in the measurement and payment descriptions.
- d. No extra payment will be made under this item for removal of pavement due to the expansion of trench width by the Contractor for the purpose of benching or sloping beyond the acceptable trench limits.
- e. This item will include removal of concrete paved alley and concrete paved roadway outside the approved trench limits or as directed by the Engineer.
- f. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- g. The accepted quantities for this work will be paid for at the contract unit price “Pavement, Removal...SYD” complete in place.

Aggregate Base, No. 22A, 6 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the

furnishing, placing and compacting of aggregate base shall be included in the cost of the pay item.

- b. The accepted quantities for this work will be paid for at the contract unit price “Aggregate Base, No. 22A, 6 inch...SYD” complete in place.

Concrete Base, 8 inch

Concrete Base, 10 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of concrete base installation including furnishing reinforcement bars, dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete base shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. When restoring within Detroit DPW right of way, the pavement removal outside of the approved trench will be measured to comply with DPW pavement requirements which state that the removal and replacement of concrete base must be from existing joint to joint.
- d. The accepted quantities for this work will be paid for at the contract unit price “Concrete Base...SYD” complete in place.

HMA Pavement, Rem, Milling, 2 inch Depth up to 4 inch Depth

- a. The costs of materials, labor, equipment and all other incidental materials necessary for the removal of HMA pavement materials including milling, hauling, and disposal shall be included in the cost of the pay item.
- b. Milling shall be performed in accordance with Detroit DPW requirements which state to mill HMA pavement beyond the area of the trench pavement removal in order to determine location of underlying concrete base pavement joints and shall be a minimum width of one lane, full roadway, or as shown on the plans.
- c. Milling within the trench limit is included in the cost of water main pipe and shall not be paid for separately.
- d. Payment for HMA Pavement removal via milling will only be made for actual pavement milled beyond the trench limits of any excavated trench.
- e. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, Removal, Milling...SYD” complete in place.

HMA Pavement, 36A, 1.5 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing tack coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. Permanent pavement markings are to be furnished and installed following the acceptance of HMA Pavement installation and are to be in accordance with Michigan Manual on Uniform Traffic Control Devices and MDOT Pavement and Standard Marking Plans and MDOT Standard Specifications Section 811. A survey of existing pavement markings prior to the Work shall be taken with final placement to be in-kind or as stated in the standards listed herein. The cost of all permanent pavement markings will be included in the cost of this pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 36A, 1.5 inch...SYD” complete in place.

HMA Pavement, 13A, 2 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing prime coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 13A, 2 inch...SYD” complete in place.

HMA Pavement, 5E3, 1.5 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing tack coat; furnishing, placing, compacting HMA pavement; and furnishing and placing permanent pavement markings shall be included in the cost of the pay item.
- b. Permanent pavement markings are to be furnished and installed following the acceptance of HMA Pavement installation and are to be in accordance with Michigan Manual on Uniform Traffic Control Devices and MDOT Pavement and Standard Marking Plans and MDOT Standard Specifications Section 811. A survey of existing pavement markings prior to the Work shall be taken with final placement to be in-kind or as stated in the standards listed herein. The cost of all permanent pavement markings will be included in the cost of this pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 5E3...SYD” complete in place.

HMA Pavement, 4E3, 2 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the installation of HMA pavement materials including cleaning and preparing concrete base; furnishing and placing prime coat; furnishing, placing, compacting HMA pavement shall be included in the cost of the pay item.
- b. The accepted quantities for this work will be paid for at the contract unit price “HMA Pavement, 4E3, 2 inch...SYD” complete in place.

Concrete Paving, 9 inch

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of concrete paving installation including preparation of subgrade; furnishing dowels, tie bars, joint filler, sealant and accessories; furnishing, forming, finishing, curing, and sealing concrete paving shall be included in the cost of the pay item.
- b. The concrete mixes and procedures included in the cost of this pay item shall be performed to the standards and requirements of the local jurisdiction or permitting agency with authority in the right of way where the work is performed.
- c. The costs of material testing as described in the technical specifications including but not limited to concrete testing, compaction testing, and any associated field tests, lab tests or fees shall be included in the cost of the pay item.
- d. The accepted quantities for this work will be paid for at the contract unit price “Concrete Paving...SYD” complete in place.

Structure, Adjust Existing Casting to Grade

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the adjustment of existing structure casting to grade including removal and disposal of existing surface and furnishing, placing and compacting backfill shall be included in the cost of the pay item.
- b. In addition to structure adjustments indicated in the restoration drawings, all ‘replace adjusters’ and ‘frame/cover adjustments’ indicated in the drawings shall be paid for under this pay item.
- c. Payment under this item will include up to two (2) vertical feet of casting adjustment. Adjustment greater than this depth will be paid for under applicable chimney repair or replacement items.
- d. Adjustment of casting to finished grade of newly installed structures or existing structures within the sewer or manhole replacement alignment will not be paid for under this item and will be included in the cost of applicable manhole installation items. Structure, adjust existing

casting to grade will only be paid for under this item as indicated on the plans or when the existing frame and cover are to be adjusted outside the boundaries of trench excavation for proposed or existing structure work.

- e. Adjustment of existing casting to finished grade shall be made with adjustment rings per the manhole rehabilitation specification.
- f. Locating and exposing of buried manholes beneath six (6) inches or greater of pavement or hard surfaces will be paid for separately under Manhole, Locate and Raise to Grade.
- g. The accepted quantities for this work will be paid for at the contract unit price for "Structure, Adjust Existing Casting to Grade...EA" complete in place.

Mulched Seeding

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of mulched seeding installation including furnishing, placing, grading and watering topsoil and seed shall be included in the cost of the pay item.
- b. Costs associated with the maintenance of mulched seeding as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price "Mulched Seeding...SYD" complete in place.

Sodding

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of sod installation including furnishing, placing, grading and watering topsoil and seed shall be included in the cost of the pay item.
- b. Costs associated with the maintenance of sod as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price "Sodding...SYD" complete in place.

Wood Fence, Remove and Replace, 4 foot Wood Fence, Remove and Replace, 6 foot

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the

specifications shall be included in the cost of the pay item.

- c. The accepted quantities for this work will be paid for at the contract unit price “Wood Fence, Remove and Replace...LFT” complete in place.

**Chain Link Fence, Remove and Replace, 4 footChain
Link Fence, Remove and Replace, 6 foot**

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Chain Link Fence, Remove and Replace...LFT” complete in place.

**Vinyl Fence, Remove and Replace, 4 footVinyl
Fence, Remove and Replace, 6 foot**

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of fence removal and replacement in kind including but not limited to clearing, excavation, removal and hauling of roots, removal and replacement of all posts, rails, gates, braces, and footings and placing backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal and replacement of fence in kind as prescribed in the specifications shall be included in the cost of the pay item.
- c. The accepted quantities for this work will be paid for at the contract unit price “Vinyl Fence, Remove and Replace...LFT” complete in place.

Tree, Install

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of tree installation including but not limited to furnishing trees, clearing, excavation, removal of existing roots, preparation of subsoil, placing and preparing topsoil, planting, backfill, landscape edging, trimming, watering, fertilizing, applying herbicides and pesticides, installing erosion control measures during installation, tree stabilization, maintenance of trees, and warranty shall be included in the cost of the pay item.
- b. All trees greater than 6 inches in diameter that were removed due to work shall be replaced on a 1:1 basis. Plant new trees as close to the original location as possible. Contractor shall choose which tree species to plant in each replacement tree location, making sure that planting conditions comply with the notes stated in the planting schedule and the specifications.

- c. Location of tree installation shall be as directed by the Engineer. Trees shall only be installed on private property or city ROW. Trees shall not be installed above existing sewers or within sewer easements.
- d. Costs associated with the installation and maintenance of trees as prescribed in the specifications shall be included in the cost of the pay item.
- e. The accepted quantities for this work will be paid for at the contract unit price “Tree, Install...EA” complete in place.

Tree. Remove, 6 inch to 18 inch Diameter Tree.
Remove, Greater than 18 inch Diameter

- a. The costs of materials, labor, equipment, and all other incidental materials necessary for the completion of tree removal of trees 6 inch or greater in diameter including but not limited to clearing, excavation, hauling, removal of existing roots and backfill shall be included in the cost of the pay item.
- b. Costs associated with the removal of trees 6 inch or greater as prescribed in the specifications shall be included in the cost of the pay item. No payment will be made under this item for trees under 6 inches in diameter. All payment for trees removed under 6 inches in diameter will be included in the clearing and grubbing of applicable sewer, water or other installation and removal items.
- c. The approved method of tree diameter measurement will be the diameter at breast height (DBH), in which the tree diameter measurement is taken 4.5 feet above the ground for measurement and payment purposes.
- d. The accepted quantities for this work will be paid for at the contract unit price “Tree, Remove...EA” complete in place.

Sewer, Video Inspection, Circular and Non-Circular, Less than 18 inch Height

Sewer, Video Inspection, Circular and Non-Circular, Greater than 18 inch to 24 inch Height

- a. The costs of all equipment, labor, products, materials, cleaning, digital video recordings, and inspection reports will be included in the cost of sewer video inspection.
- b. Any flow control to remove standing water and debris shall be incidental to the contract.
- c. Contractor shall be responsible for fully cleaning the sewer segment within the manhole to manhole segment. This may require multiple passes and the use of any equipment necessary to fully clean the sewer to acceptable standards and remove any debris, obstructions, roots, root balls, grease, and settled deposits. No additional payment will be made for multiple passes or the use of alternate equipment which may be required to fully clean the sewer.
- d. Correction and re-submission of non-compliant submissions will be at Contractors own expense.
- e. No extra payment will be made for video inspection performed more than once on the same section of pipe.
- f. The height of non-circular sewers will be taken as the largest dimension.
- g. The Contractor is responsible for quality control review and final quality of the deliverable for all sewer reports. All deliverables to the Engineer will include all requirements and be delivered to the minimum standard as identified in the specifications. Payment will not be made until the required report submissions are accepted by the Engineer.
- h. The deliverable for this item is a report describing the following:
 - Inspection Detail Information
 - Date and Time of Inspection
 - Pipe Segment Reference Asset ID
 - Start Node
 - End Node
 - Start Location with Description
 - Service Connection Information for All Services Found on a Segment
 - Picture of service connection
 - Footage counter measurement in linear feet
 - The address of the service connection
 - Size of service connection
 - PACP code of largest observable defect, if service connection is defective
 - Percentage values of obstruction of lateral
- i. Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.

- j. Payment under this item will include all reverse setups required in order to obtain a complete inspection.
- k. Sewer inspections will be measured on a length basis for each size and type of sewer and paid for at the Contract Unit Price for “Sewer, Video Inspection...LFT”. Length to be paid for will be the total length of sewer inspected in accordance with this specification, accepted and measured by the Engineer.
- l. Measurement will be made horizontally at grade above the center line of the sewer from start manhole and sewer pipe interface to sewer pipe interface and finish manhole or from start manhole and sewer pipe interface to the point of abandoned inspection as confirmed by the steel tape or calibrated footage counter measurement.

Sewer, Video Inspection, Lateral

- a. The costs of all equipment, labor, and materials to conduct and deliver digital video recordings of private sewer laterals will be included in the cost of sewer video inspection.
- b. Inspections for this item will be conducted only on sewer laterals which have been replaced, during or after they have been replaced.
- c. Inspections for this item shall capture the condition of the private side of sewer lateral, from newly installed cleanout to the point of connection of the structure.
- d. The deliverable for this item is a .mp4 video in the following format:
 - [P/O Number]_[Address]_[Direction]_[YYYYMMDD]_[HHMMSS – 24 hour format].mp4
- e. Any flow control to remove standing water and debris shall be incidental to the contract.
- f. Correction and re-submission of non-compliant submissions will be at Contractors own expense.
- g. No extra payment will be made for video inspection performed more than once on the same section of pipe.
- h. The Contractor is responsible for quality control review and final quality of the deliverable for all sewer reports. All deliverables to the Engineer will include all requirements and be delivered to the minimum standard as identified in the specifications. Payment will not be made until the required report submissions are accepted by the Engineer.
- i. Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.
- j. Payment under this item will include all reverse setups required in order to obtain a complete inspection.

- k. Payment under this item will only be made once inspections have been received and approved by the Engineer.
- l. Sewer inspections will be measured by each inspection completed at the Contract Unit Price for "Sewer, Video Inspection...EA".

Sewer, External Point Repair, 6 inch Sewer,
External Point Repair, 10 inch Sewer,
External Point Repair, 12 inch Sewer,
External Point Repair, 15 inch Sewer,
External Point Repair, 18 inch
Sewer, External Point Repair, 20, 21, 22, & 24 inch

- a. The costs of all equipment, labor, materials, saw cutting, pavement removal, driveway removal, sidewalk removal, curb removal, excavation, excavation support, dewatering excavation, cleaning of existing sewer prior to and following open cut replacement, removal of existing sewer, temporary bulkheads, flow control, bypass pumping, hauling, disposal, grubbing, clearing of brush and trees less than 6 inches in diameter, bedding, backfill, compaction, pipe, pipe gaskets, pipe sleeves, pipe couplings, pre and post open cut replacement CCTV inspection video in accordance with the specifications, and incidentals shall be included in the cost of this item.
- b. This item shall be used to replace portions of public sewers connected to lateral replacements.
- c. Reconnection of sewer laterals within the accepted linear footage of open cut replacement will not be paid for under this item and will be included in the cost of other items
- d. The costs of material testing as described in the technical specifications including but not limited to compaction testing and any associated field tests, lab tests or fees shall be included in the cost of this pay item. The Engineer reserves the right to verify in-situ or lab testing results by enlisting a third-party to perform quality assurance at their discretion.
- e. Maximum payment for surface restoration items to restore open cut replacement trench shall be paid for at trench width as listed in the trench and pavement details in the DWSD standard drawings. No payment for aggregate base, concrete base course, asphalt, or other restoration items will be paid for outside of maximum payment width for the trench unless otherwise approved by the Engineer.
- f. Contractor shall perform CCTV prior to open cut replacement to verify location and length of repair required and to determine if deterioration of the pipe requiring additional repairs are required. CCTV shall take place prior to excavation activities and shall be delivered to the Engineer for approval on repair length and locations within the segment. Post repair CCTV in accordance with the specifications will be required and included in this item for the acceptance of work.

- g. Following open cut replacement, contractor shall be responsible for fully cleaning the sewer segment within the manhole to manhole segment. This may require multiple passes and the use of any equipment necessary to fully clean the sewer to acceptable standards and remove any debris, obstructions, roots, root balls, asphalt, concrete, grease, settled deposits, ingress deposits, encrustation, and vermin. No additional payment will be made for multiple passes or the use of alternate equipment which may be required to fully clean the sewer.
- h. All removals within the trench limits will be included in the cost of this item. Local agencies and permitting authorities may require additional removal and replacement in order to meet local surface roadway restoration requirements. All removals in order to adhere to these requirements will be included in the cost of this item. Installation of restoration items will not be paid for under this item and will be included in the cost of applicable restoration items.
- i. Surface, base, and trench removals to the full depth and width required to replace the concrete and aggregate base in existing concrete base from joint to joint will be included in this pay item.
- j. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- k. The accepted quantities for this work will be paid for at the contract unit price for "Sewer, Open Cut Replacement...LFT" of actual length of repair complete in place. Measurement shall be along the centerline of the sewer.

Sewer, Open Cut, Lateral Replacement, Up to 10 foot Depth **Sewer, Open Cut, Lateral Replacement, Greater than 11 foot Depth**

- a. The costs of all equipment, labor, materials, saw cutting, pavement removal, driveway removal, sidewalk removal, curb removal, excavation, excavation support, dewatering excavation, removal of existing lateral, temporary bulkheads, flow control, bypass pumping, hauling, disposal, grubbing, clearing of brush and trees less than 6 inches in diameter, bedding, backfill, compaction, pipe, pipe gaskets, pipe sleeves, cleanout, pipe couplings and incidentals shall be included in the cost of this item.
- b. Reconnection of sewer laterals will be paid for under this item.
- c. The costs of material testing as described in the technical specifications including but not limited to compaction testing and any associated field tests, lab tests or fees shall be included in the cost of this pay item. The Engineer reserves the right to verify in-situ or lab testing results by enlisting a third-party to perform quality assurance at their discretion.
- d. Maximum payment for surface restoration items to restore open cut replacement trench shall be paid for at the trench width of 5 feet. No payment for aggregate base, concrete base course, asphalt, or other restoration items will be paid for outside of maximum payment width for the trench unless otherwise approved by the Engineer.
- e. All removals within the trench limits will be included in the cost of this item. Local agencies

and permitting authorities may require additional removal and replacement in order to meet local surface roadway restoration requirements. All removals in order to adhere to these requirements will be included in the cost of this item. Installation of restoration items will not be paid for under this item and will be included in the cost of applicable restoration items.

- f. Surface, base, and trench removals to the full depth and width required to replace the concrete and aggregate base in existing concrete base from joint to joint will be included in this pay item.
- g. Milling of HMA pavement will not be paid for under this item and will be included in the HMA Pavement, Removal, Milling items.
- h. The accepted quantities for this work will be paid for at the contract unit price for "Sewer, Open Cut, Lateral Replacement...LF" of replacement complete in place.

ALLOWANCES

Permit Allowance

Contaminated Material Allowance

Provisional Allowance

PART 2 - PRODUCTS - Not

Used PART 3 - EXECUTION -

Not Used

END OF SECTION 01 20 00

Information for Page 23 of the COA PDF Document

Required Material Specs: The awarded contractor is required to provide submittals for materials to be used on the project before work begins. However, a sample list of specifications for materials is provided below.

- 03 30 00 Cast-in-Place Concrete
- 03 20 00 Cast-in-Place Concrete
- 31 23 23.33 Flowable Fill
- 32 31 13 Chain Link Fences and Gates

- 32 31 29 Wood Fences and Gates
- 32 11 23 Aggregate Base Coarse
- 32 12 16 Asphalt Paving
- 32 13 13 Concrete Paving
- 32 92 19 Seeding
- 32 93 00 Plants
- 33 01 30.18 Security Clearances and Communications
- 33 01 30.30 Sanitary Sewer Pipeline Inspection (Replaces 33 01 30.23)
- 33 01 30.31 Manhole Inspection (Replaces 33 01 30.17)
- 33 01 30.32 Sanitary Sewer Pipeline Cleaning (Replaces 33 01 30.19)
- 33 01 30.81 Manhole Rehabilitation

Information for Page 24 of the COA PDF Document

Historic District Commission Project Review Request

Completed Building Permit Application: N/A

Refer to **Information for Page 4 of the COA PDF Document** above for the rest.

Information for Page 25 of the COA PDF Document

Property Information: N/A. HRD shall provide input if required.

Information for Page 26 of the COA PDF Document

Identification: N/A. HRD shall provide input if required.

Information for Page 27 of the COA PDF Document

Historic District Commission Review and Permit Process: FYI per HRD.

Information for Page 28 of the COA PDF Document

DWSD Fix It Letter: This letter may not be required since the work will be in the public ROW.

Information for Pages 29 through 31 of the COA Document

List of Items of Work from Bid Schedule:



Item No.	Description
1	Mobilization/Demob
2	Traffic Control
3	Safety Program
4	Pre-Construction Site Documentation
5	Sidewalk, Rem
6	Sidewalk, Conc, 4 inch
7	Sidewalk, Conc, 6 inch
8	ADA Ramp, w/ Curb
9	Curb, Rem
10	Curb, Conc
11	Curb and Gutter, Rem
12	Curb and Gutter, Conc
13	Driveway, Rem
14	Driveway, Conc, 4 inch
15	Driveway, Conc, 6 inch
16	Pavement, Rem
17	Aggregate Base, No. 22A, 6 inch
18	Concrete Base, 8 inch
19	Concrete Base, 10 inch
20	HMA Pavement, Rem, Milling, 2 inch Depth up to 4 inch Depth
21	HMA Pavement, 36A, 1.5 inch
22	HMA Pavement, 13A, 2 inch
23	HMA Pavement, 5E3, 1.5 inch
24	HMA Pavement, 4E3, 2 inch
25	Concrete Paving, 9 inch
26	Structure, Adjust Existing Casting to Grade
27	Mulched Seeding

28	Sodding
29	Wood Fence, Remove and Replace, 4 foot
30	Wood Fence, Remove and Replace, 6 foot
31	Chain Link Fence, Remove and Replace, 4 foot
32	Chain Link Fence, Remove and Replace, 6 foot
33	Vinyl Fence, Remove and Replace, 4 foot
34	Vinyl Fence, Remove and Replace, 6 foot
35	Tree, Install
36	Tree, Remove, 6 inch to 18 inch Diameter
37	Tree, Remove, Greater than 18 inch Diameter
38	Sewer Video Inspection, Less than 18 inch Height
39	Sewer Video Inspection, 18 inch to 24 inch Height
40	Sewer, Video Inspection, Lateral
41	Sewer, External Point Repair, 6 inch
42	Sewer, External Point Repair, 10 inch
43	Sewer, External Point Repair, 12 inch
44	Sewer, External Point Repair, 15 inch
45	Sewer, External Point Repair, 18 inch
46	Sewer, External Point Repair, 20, 21, 22 & 24 inch
47	Sewer Lateral Replacement, Greater than 5' to 10' in Depth
48	Sewer Lateral Replacement, Greater than 10' to 20' in Depth
49	Permit Allowance
50	Contaminated Material Allowance
51	Provisional Allowance

Information for Pages 32 through 38 of the COA PDF Document

Alley Sinkhole Project Billing: The billings will be submitted by the contractor(s) through eBuilder for review and processing by DWSD and shall be based on the Schedule of Values.

Information for Pages 39 through 40 of the COA PDF Document

Invoice Requirements:

- Project Name, Number, Invoice Period, and Invoice Number
- Billing submitted by SOV line items
- Construction Progress Schedule revised and current
- Monthly Safety Reports
- Certified Payroll
- Vendors and Subcontractor(s) Partial Waivers

- Completed work quantities with appropriate unit of measure

Invoice Support Documentation:

- CCTV files
- Detail Quantity Sheet signed by contractor field representative and DWSD Inspection Team Leader and/or inspector.
- DWSD Daily Inspection Reports
- Photos
- Valid Certificate of Insurance (COI)

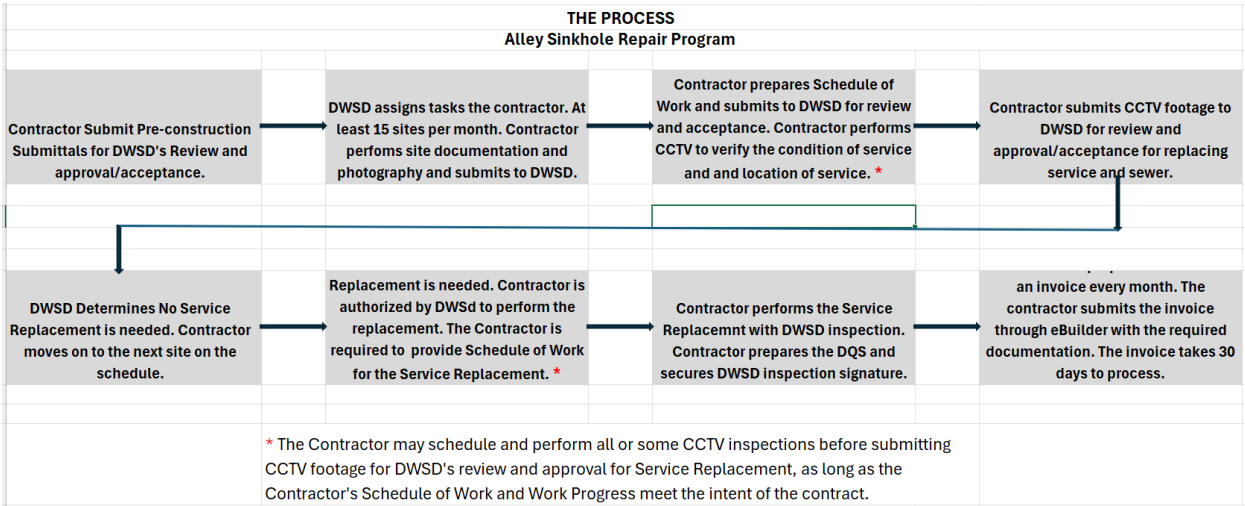
Reference: N/A. This project will use eBuilder for invoicing and general project management, and documentation. No Smartsheet shall be used.

Information for Page 41 of the COA PDF Document

Environmental Concern Fix It Letter: N/A

Information for Page 42 of the COA PDF Document

The Process: Refer to the insert below.



Information for Page 43 of the COA PDF Document

Work Acceptance Form: The work acceptance will be done through the daily inspection/field verification of work, validating post sewer and service replacement by means of CCTV submittals.

Information for Pages 44 through 50 of the COA PDF Document

