Agreement for the Menomonee River Levee System Accreditation

1. Parties

This intergovernmental cooperation agreement (Agreement) is between the Milwaukee Metropolitan Sewerage District (District), located at 260 West Seeboth Street, Milwaukee, Wisconsin 53204, acting through its executive director, and the City of Wauwatosa (City), located at 7725 West North Avenue, Wauwatosa, Wisconsin 53213, acting through its mayor. The District and the City (together, the Parties) make this Agreement according to Wis. Stat. § 66.0301.

2. Purpose

The purpose of this Agreement is to establish responsibilities for design, construction, ownership, long-term maintenance, and cost sharing for various elements associated with the levee system along the Menomonee River necessary to comply with Federal Emergency Management Agency (FEMA) requirements and Wisconsin Department of Natural Resources (WDNR) floodplain regulations.

3. Basis for this Agreement

A. Homes and businesses along the Menomonee River lie within the floodplain, at risk of damage if the river swells beyond its banks in times of heavy rainfall, snowmelt, or both.

B. Pursuant to its authority in Wis. Stat. § 200.35(8), the District is implementing the Menomonee River Phase II Watercourse Management Plan consisting of multiple coordinated projects focused on flood risk reduction in the Menomonee River corridor spanning from Hart Park in Wauwatosa to State Highway 175 in Milwaukee.

C. As part of this multifaceted approach, the District has begun construction of elements of a levee and floodwall system (Levee System) to fortify the Menomonee River's natural banks and better guard the community from flooding, as shown in Exhibits 1 through 3.

D. The Levee System is a flood risk reduction system that includes earthen levee embankment, reinforced concrete floodwall, and associated structures, such as closure and drainage devices, constructed and operated in accordance with sound engineering practices, as required to meet FEMA standards in 44 C.F.R. § 65.10.

E. Since 2007, the District has completed the Hart Park, 59th and State Street Pump Station, and Western Milwaukee Phase 1 and 2A projects within the corridor, which together have expanded temporary floodwater storage areas, reinforced natural embankment with earthen levee and floodwall, and naturalized and improved water conveyance infrastructure.

F. The Western Milwaukee Phase 2B project (Phase 2B) will complete the Levee System construction, and the District and the City have separately agreed to their respective

responsibilities for that project in the intergovernmental cooperation agreement effective as of February 18, 2022, and as amended July 10, 2023.

G. FEMA manages the National Flood Insurance Program (NFIP), which provides the maps and regulatory basis for local floodplain management. The NFIP is managed at the local level by a Floodplain Administrator responsible for administering the floodplain management ordinance. The City is the NFIP Floodplain Administrator for Wauwatosa.

H. FEMA accreditation of the Levee System, including those segments already constructed as well as those to be constructed under Phase 2B, constitutes official recognition of the flood risk reduction that the District's projects are anticipated to achieve and results in updated floodplain maps.

I. To attain FEMA accreditation, however, the Levee System must comply with 44 C.F.R. § 65.10, requiring improvements to the previously constructed earthen levee and floodwall freeboard, backflow closure and outfall extension storm sewer improvements, and sanitary and storm sewer rehabilitation and replacement near the Levee System (the Levee System improvements outlined in this Agreement collectively constitute the Project). The Project is anticipated to be implemented through multiple City and District capital projects and contracts.

J. Even after FEMA levee accreditation, residual flood risk remains, and this Agreement does not modify the City's obligations under Wis. Admin. Code ch. NR 116.

K. Additionally, to preserve levee accreditation for the lifespan of the infrastructure, the District and the City must cooperate closely to maintain compliance with the federal requirements.

L. The District and the City acknowledge that the North 68th Street bridge does not presently meet WDNR and FEMA freeboard requirements and intend to resolve this issue in a future agreement.

M. The District and the City desire to continue their cooperation on watercourse restoration and flood management efforts for this area, building on the Permanent Flood Water Easement recorded on February 9, 2017 (Easement). This Agreement does not in any way alter the Easement.

N. The City desires to add recreational improvements at its sole expense to the Levee System area consistent with the area's flood management use.

4. Effective Date

This Agreement becomes effective upon its execution by both the District and the City.

5. District Access to City Property and Right of Way

The City will grant the District access as requested in permits, easements, or otherwise to perform the work outlined in this Agreement. The City will waive any permit fees.

6. Levee and Floodwall Improvements

The Levee System requires freeboard improvements to comply with federal regulations, including raising five segments of levee freeboard as shown in Attachment A. The District and the City will cooperate as follows to achieve regulatory compliance.

A. The District will provide draft design documents related to the freeboard improvements to the City for review and comment prior to the District's solicitation of bids and record drawings upon completion of construction, except as to Raise 1B.

B. The City will contract for and manage the design and construction of the levee freeboard improvement at Raise 1B at its sole cost. The District will contract for and manage the design and construction of the other four levee and floodwall freeboard raises at its sole cost.

C. At Raise 1A along Hart Park Lane, upon the City's request, the District will design and remove the portion of the railroad pedestrian crossing spanning the floodwall on the south side of the railroad tracks. The City intends to remove the northern portion of the railroad pedestrian crossing between the railroad and State Street through a separate City contract. The District will invoice the City and City will reimburse the District for 100% of the design (unless the City designs it), demolition, surface restoration, and associated costs for the pedestrian crossing removal including costs for work required by the railroad.

D. At freeboard Raise 4, the District's levee freeboard design will accommodate the City's proposed recreational trail Menomonee River bridge crossing near North 63rd Street consistent with the City's Hart Park East conceptual plan and plans to improve the 63rd Street railroad crossing, which are included as Attachment B, provided that the recreational trail bridge does not negatively impact flood elevations.

7. Long-Term Levee System Responsibilities

To achieve the greatest flood risk reduction benefit, the District and the City must collaborate closely on an ongoing basis for the lifetime of the infrastructure.

A. The District will develop an operations and maintenance plan (O&M Plan) compliant with applicable regulations to address City and District long-term responsibilities for the Levee System components. The O&M Plan will include the City's obligations for embankment erosion protection, vegetation maintenance, closure maintenance, storm sewer and closure inspections, and an annual summary of the City O&M activities. The District will seek the City's input on the O&M Plan, and the City will adopt and comply with the O&M Plan pursuant to its regulatory obligations as Floodplain Administrator.

B. The District will develop an emergency preparedness plan (Emergency Preparedness Plan) compliant with applicable regulations to address responsibilities of the District, City, and other jurisdictions. The District will seek the City's input on the Emergency Preparedness Plan, and the City will adopt and comply with the Emergency Preparedness Plan pursuant to its regulatory obligations as Floodplain Administrator.

C. In the event the City needs to repair or replace a City-owned facility within the Levee Management Area (LMA), the City shall coordinate with and work collaboratively with the District during all stages of the work. Such work may require District review documented in a build-over letter to ensure it does not impact the integrity of the levee or the levee's FEMA accreditation status. The LMA is defined in the agreement for the Western Milwaukee Phase 2B project effective as of February 18, 2022, and is updated in the map included in Attachment C. The District will provide GIS datapoints delineating the LMA after completion of the project.

D. The District will annually inspect the Levee System for compliance with FEMA and WDNR requirements at its sole cost. The City and the District will be responsible for resolving deficiencies according to the O&M Plan and the Emergency Preparedness Plan.

E. For storm and sanitary sewers crossing the Levee Management Area identified in Attachment D, the District and the City will pay costs proportionally as follows:
   i. The District will conduct CCTV inspection and PACP assessment of the pipes as required by the USACE guidance EC 1110-2-6067. The District will make the CCTV video and inspection reports available to the City. The District will pay all costs for this inspection and assessment.

   ii. The District will design any structural repairs, modifications, or replacement required to maintain levee accreditation discovered through the above inspection. The District will provide design documents for City review and comment at the 30%, 60%, and 90% complete stages. The District and the City will share design costs evenly.

   iii. The District will construct required structural repairs, modifications, or replacement. The District and the City will share construction costs evenly, including construction inspection and management costs.

   iv. The District will invoice the City for the City's portion of the costs upon completion of the work.

F. The City will operate and maintain all City infrastructure impacting the Levee System to meet FEMA levee accreditation standards.

G. If the infrastructure needed to meet FEMA standards changes or if FEMA levee accreditation standards change, the District and the City will consult before implementing changes.

8. Maintenance Drive

The District will design a maintenance drive on City property for levee access along levee freeboard Raise 4 identified in Attachment E, with access points connecting on the west to River Parkway and on the east to N. 63rd Street and the District's previously constructed maintenance drive. Upon District approval and in accordance with the Easement, the City may pave the maintenance drive at its own expense to make it a recreational trail to further benefit the community.

A. The District will provide draft design documents related to the maintenance drive to the City for review and comment prior to the District's solicitation of bids and record drawings upon completion of construction.

B. The District will design and construct the maintenance drive. The District will pay for the design and pay for the gravel sub-base portion of the maintenance drive. The City will pay for the maintenance drive asphalt paving.

C. The City will maintain the paved maintenance drive, including snow removal, at its own cost in accordance with its ordinary municipal roadway procedures.

D. The City will not restrict District access to the maintenance drive.

E. The City may construct additional connections to the maintenance drive conforming to levee standards after receiving the District's approval in accordance with the Easement.

9. Storm and Sanitary Sewer Improvements

The District will install new and replacement storm sewers in the vicinity of the Levee System to improve conveyance of local stormwater to the Menomonee River and a sanitary sewer near 63rd Street as shown in Attachment F and Table 1. Sewers include all infrastructure components of sanitary sewers or storm sewers to collect and convey flows, including but not limited to inlets, manholes, pipes, and closure devices.

A. The District will construct the identified storm sewers to meet 44 C.F.R. § 65.10 requirements for FEMA levee accreditation.

B. The City will ensure any modifications it makes to the storm sewers also meet the FEMA levee accreditation requirements.

C. The City will elevate the River Parkway and North 63rd Street roadways so that the inlet manhole rims lie above the FEMA-approved conditional letter of map revision flood elevation. The City will provide its design to the District for review and comment prior to awarding a construction contract for the roadway elevation. The District will will strive to review the design documents and provide comments to meet project schedule goals.within two to four weeks or longer as approved by the City. to The City will pay for the design and construction.

D. The City will support the District's efforts to meet FEMA storm sewer closure standards with the recommendation to modify the private property storm sewer connected to the Schoonmaker Creek culvert immediate north of 6100 West State Street as shown in Attachment F (Map Location A).

E. The District will provide draft design documents related to the sanitary and storm sewers to the City for review and comment prior to the District's solicitation of bids.

F. The District will contract for and manage the design and construction of the sewer improvements required for levee standards shown in Attachment F and Table 1 at its sole cost.

G. The District will solicit City input on substantive changes to the design that may occur during construction. The City will review design changes in a reasonable time but no more than 10 working days after receipt. The City's failure to respond in 10 working days will be deemed approval by the City.

H. The District will provide record drawings to the City upon completion of construction.

I. For sewers located on Milwaukee County property that are to be owned by the City, the District will obtain an easement from Milwaukee County and transfer the easement to the City upon substantial completion of the storm sewers.

J. Upon substantial completion, the City will own, operate, and maintain the storm sewer systems shown in Attachment D and storm sewer improvements shown in Attachment F and Table 1.

K. The District will prepare all storm sewer property transfer documents for City signature prior to beginning construction. For the Schoonmaker Creek storm sewer system improvements already constructed in District contract W20027C01 Western Milwaukee Flood Management Project Phase 2A (shown in Attachment G), the District will provide the City quitclaim deeds to transfer the property prior to construction of new facilities. For new construction, the District will hold the documents in escrow, and record each upon construction substantial completion.

L. The District will provide resident inspector and construction management services for the storm sewer construction.

M. On the south side of the Menomonee River in North 68th Street, the District will design and construct portions of City storm sewer improvements connecting to the interior drainage outfall east of the 68th Street bridge. The District will invoice the City and City will reimburse the District for 100% of design, construction, surface restoration, and associated costs for these City storm sewer improvements at North 68th Street.

10. Pipe Rehabilitation

The District has inspected storm and sanitary sewers owned by the City crossing or near the Levee System to assess their condition. Based upon the condition assessment findings, rehabilitation or replacement of some sewers is recommended as shown in Attachments H and I.

A. The City will be responsible for the HPS-12 outfall repair on the south bank of Honey Creek near 72nd Street shown in Attachment H at its sole cost. The District has a future nearby project to stabilize the banks of Honey Creek. If outfall repair is added to the future Honey Creek bank stabilization project, it will be addressed through a separate agreement.

B. The District will design and construct culvert rehabilitation for City-owned portions of the Schoonmaker Creek culvert south of State Street and outside of the levee influence area included in Attachment H. The City will reimburse the District for design, construction, and construction management costs.

C. The District will provide pipe rehabilitation draft design documents to the City for review and comment prior to the District's solicitation of bids.

D. The District will contract for and manage the design and construction of the pipe rehabilitation or replacement at its sole cost.

E. The District will solicit City input on substantive changes to the design that may occur during construction. The City will review design changes in a reasonable time but no more than 10 working days after receipt. The City's failure to respond in 10 working days will be deemed approval by the City.

F. The District will provide record drawings to the City upon completion of construction.

G. The City will continue to own the rehabilitated pipes described in this section. Where the sewer condition assessment recommendations call for new or replacement infrastructure under this Agreement, the District will prepare all sewer property transfer documents for City signature prior to beginning construction of the Project, hold the documents in escrow, and record each upon construction substantial completion.

11. Wauwatosa Water Mains

Several water mains owned by the Wauwatosa Water Utility on City right of way cross the LMA.

A. By March 1, 2026, the City will provide to the District water main leak testing results completed in the last year for water mains within the LMA as shown on Attachment J.

B. The City will thereafter provide water main leak testing results to the District for review as part of the USACE condition assessment for pipes in the LMA required approximately once every five years.

C. The City will be responsible for all water main leak testing costs.

D. If such leak testing spurs more extensive pipe condition testing to comply with USACE requirements, then, if it has the appropriate technological expertise, the City will conduct the additional testing. If the City does not have the technological expertise, then the District will conduct the additional testing. In either event, the District will be responsible for all such advanced testing costs.

E. The City will cooperate with the District for any water main repair or replacement projects within the LMA to ensure that such work does not negatively impact levee accreditation. The City will pay for all water main repair and replacement project costs within the LMA as well as costs for levee restoration.

F. The City will, when possible, construct future water main replacements to cross the LMA approximately perpendicular to the levee and to minimize the length of pipe within the LMA.

12. Sidewalks and Road Pavement

Construction of the storm sewers is anticipated to impact roadway and sidewalks in the Project area.

A. The District will contract to repair and reconstruct roadway pavement and sidewalks impacted by the Project in its construction contract.

B. The District will provide the City with the design specifications for review and comment to ensure the final construction design of the sidewalks aligns with the Americans with Disabilities Act (ADA) standards.

C. The District will pay for required roadway pavement and sidewalk reconstruction.

D. The District will provide record drawings to the City upon completion of construction.

E. The District will provide construction management services for roadway pavement and sidewalk reconstruction. The District will provide the opportunity for the City's inspectors to inspect for consistency with City and ADA standards the road pavement and sidewalk construction elements.

13. FEMA Mapping and Permitting

To accomplish the purpose of lowering flood risk to hundreds of structures, the District will seek and maintain levee accreditation and the revision of floodplain maps.

A. The City will collaborate with the District on as-built drawings for work on facilities within the LMA, best practice for unavoidable work within the LMA, development of operations and maintenance plans, and emergency preparedness plans consistent with 44 C.F.R. § 65.10 requirements, as required for the letter of map revision (LOMR) submittal and Levee System accreditation.

B. The District will prepare the required LOMR submittal and Levee System accreditation documentation for FEMA. The District and the City acknowledge that documentation on Levee System accreditation must also be included as part of the LOMR submittal, such that cooperation will be necessary to submit timely applications.

C. The District will submit the Levee System accreditation application and LOMR to FEMA on behalf of the City.

D. The District will pay all FEMA application fees.

14. Hart Park East

The City desires to further develop Hart Park East for recreational and other purposes, as conceptually shown in Attachment B.

A. The City will design, construct, operate, and maintain the Hart Park East recreational and other features in accordance with the Easement and, to the extent practical, avoid penetrating the Levee System.

B. The City will be solely responsible for the cost of recreational and other features, including all FEMA requirements for inspection, CCTV, and rehabilitation costs for unavoidable pipe levee penetrations.

C. The City will provide design information for water, sanitary, and electrical services to cross under the levee near North 63rd Street and River Parkway. The City will provide utility size and elevation constraints for the utilities. The District will construct the utilities according to the City design. The City will reimburse the District for 100% of this utility construction. Upon substantial completion, the City will inspect and maintain these utilities as required to meet levee standards for accreditation.

15. Notices

A. The District will provide notices to:

David Simpson, Director of Public Works (or his successor in this role)
City of Wauwatosa
11100 West Walnut Road
Wauwatosa, WI 53226
dsimpson@wauwatosa.net
(414) 471-8422

B. The City will provide notices to:

Jennifer Wright, Watercourse Section Manager (or her successor in this role)
Milwaukee Metropolitan Sewerage District
260 West Seeboth Street
Milwaukee, Wisconsin 53204
jwright@mmsd.com
(414) 225-2097

16. Modifying this Agreement

Any modification to this Agreement will be in writing and signed by the City and the District.

17. Severability

If a court finds any part of this Agreement unenforceable, then the remainder of this Agreement continues in effect.

18. Governing Law

The laws of the state of Wisconsin govern this Agreement.

19. Resolving Disputes

If a dispute arises under this Agreement, then the parties will try to resolve it with the help of a mutually acceptable mediator in Milwaukee County. The parties will equally share any costs and fees associated with the mediation other than attorney fees. If the dispute is not resolved within 30 days after the parties refer it to a mediator, then either party may take the matter to court. Venue in any action brought under this Agreement is proper only in the Milwaukee County Circuit Court.

20. No Conflict of Interest

No officer, employee, or agent of the District or the City who has any responsibility for implementing this Agreement may have any interest in any consultant, contractor, or vendor providing services to the District or the City under this Agreement.

21. Independence of the Parties

This Agreement does not create a partnership, and neither party may enter into contracts on behalf of the other party.

22. Authority of Signatories

All signatories to this Agreement certify that they are properly authorized by their governing body to execute this Agreement.

23. Indemnification

The City and the District will be liable for their own negligent acts, errors, and omissions. If litigation requires one party to respond for the acts, errors, or omissions of the other party, then the City and the District will hold each other harmless for any losses, damages, costs, and expenses, including but not limited to reasonable attorney's fees and litigation expenses.

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

By: _____
Kevin L. Shafer, P.E.
Executive Director

Date: _____

Approved as to form

_____
Attorney for the District

CITY OF WAUWATOSA

By: _____
Dennis McBride
Mayor

Date: _____

By: _____
Steven Braatz
City Clerk

Date: _____

By: _____
John Ruggini
Finance Director

Date: _____

_____
Jennifer Tate
City Attorney

Exhibits

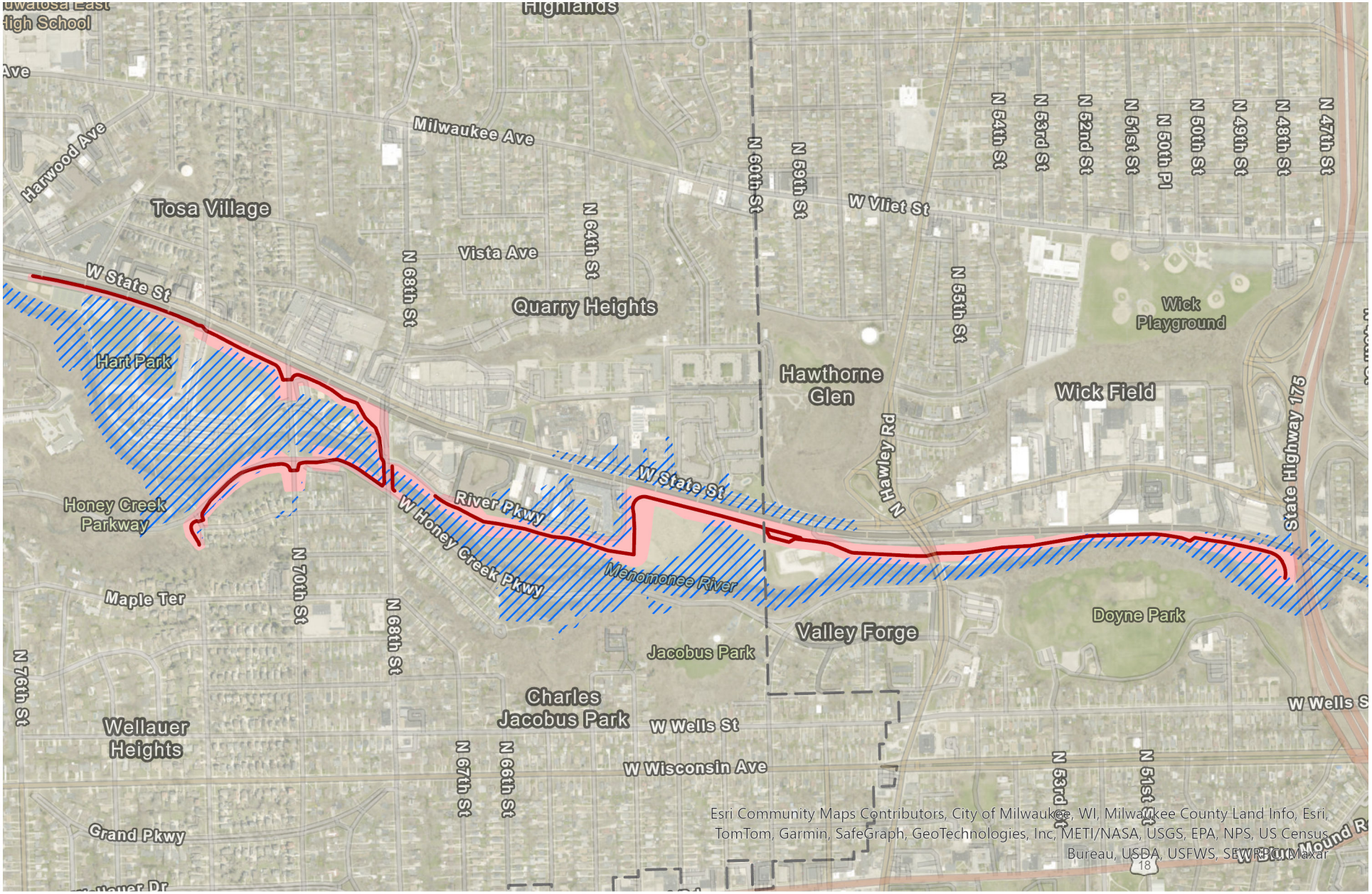


Exhibit 1: FEMA CLOMR anticipated floodplain after levee accreditation

- Levee
- Levee Management Area
- 100 Yr Floodplain - Menomonee River CLOMR
- Municipality Boundary

N

0 500 1,000 Feet

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

2023.42343

Exhibit 2: 2008 FEMA regulatory floodplain

- Levee
- Levee Management Area
- 2008 FEMA Regulatory Floodplain
- Municipality Boundary

N

0 500 1,000 Feet

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

2023.42343

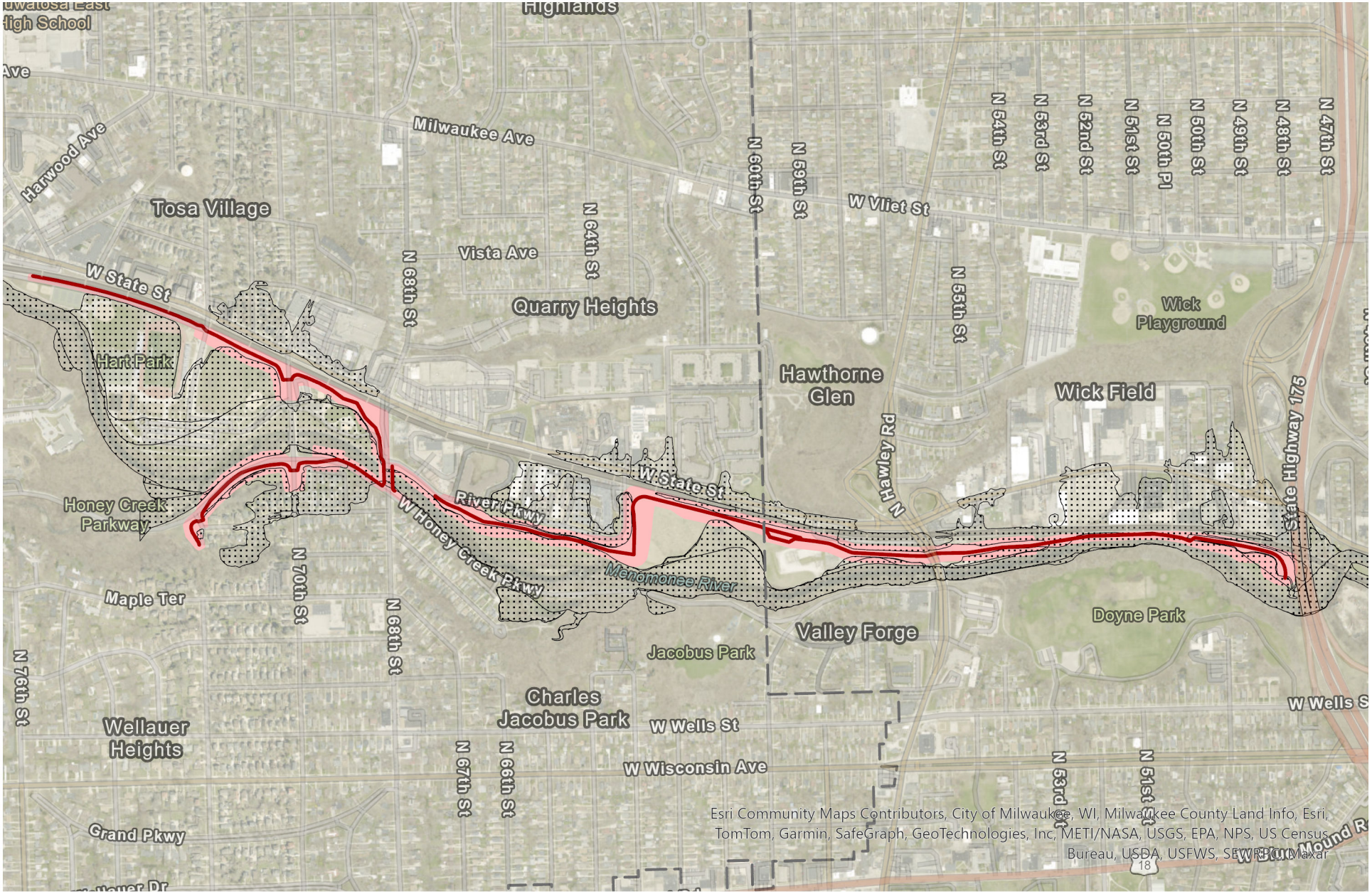


Exhibit 3: FEMA CLOMR anticipated natural valley floodplain after levee accreditation

Levee

Levee Management Area

Natural Valley Floodplain - Menomonee River CLOMR
Note: Represents the floodplain without the levee in place

Municipality Boundary

N

0 500 1,000 Feet

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

2023.42343

Table

Purpose: Summarize recommended alternatives for the storm sewer closure analysis, interior drainage, and sanitary siphon.

Map Identifier	Outfall Location	Outfall Description	Recommendations	Reference
A	Schoonmaker (Existing); Phase 2B S-Line (planned)	Schoonmaker tributary storm sewer system rerouted to the Phase 2B S-Line storm sewer system to reduce number of closures	Alternative 3. Schoonmaker tributary storm sewer system from "The Reserve" rerouted to the Phase 2B S-Line storm sewer system.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
B	Schoonmaker	Schoonmaker	Add two manholes south of the railroad to improve Schoonmaker culvert access. One manhole for each side of the Schoonmaker double box culvert.	Design access improvement recommendation
C1	WMW-24	River Parkway and 63rd Street	Alternative 3B. 72" vault with internal backflow preventer and inspection manhole.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
C2	WMW-24	River Parkway and 63rd Street	Alternative 3B. 96" diameter storm sewer outfall extension with flap gate at outfall.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
D	WMW-30	River Parkway and east of 68th Street	Alternative 1A. 30" diameter storm sewer replacement with flap gate headwall.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
E1	HPN-1 and HPN-2	River Parkway and 68th Street	Alternative 1A. New outfall with flap gate.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates,
E2	HPN-1 and HPN-2	River Parkway and 68th Street	Reroute outfall at bridge to HPN-1.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates,
F1	HPS-4 with HPS-1, HPS-2, and HPS-3	Honey Creek Parkway and 68th & 70th Streets	Alternative 1A. Reroute inlets near bridge deck to upstream of backflow preventer.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
F2	HPS-4 with HPS-1, HPS-2, and HPS-3	Honey Creek Parkway and 68th & 70th Streets	Alternative 1A. New structure with 36" internal backflow preventer.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates,
F3	HPS-4 with HPS-1, HPS-2, and HPS-3	Honey Creek Parkway and 68th & 70th Streets	Alternative 3E. Reroute 84" diameter pipe to downstream of 68th Street Bridge and add outfall capacity.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
G1	HPS-12	Honey Creek Parkway and 72nd Street	Alternative 1A and 3. Retain backflow preventer in existing structure.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates, Arcadis, February 2024
G2	HPS-12	Honey Creek Parkway and 72nd Street	Alternative 1A and 3. Reroute inlet in swale to east.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates,
G3	HPS-12	Honey Creek Parkway and 72nd Street	Reroute inlet G3 to G-1.3.	Technical Memorandum - Closure Alternative Evaluation and Conceptual Cost Estimates,
H1	West end of Hart Park Lane	Existing storm sewer system	Option 1. Install 42" internal backflow preventer near 74th Street and St. James.	Engineering Services for Hart Park North interior Drainage Closure Evaluation and 500-year Floodplain Mitigation, Arcadis, June 2023
H2	West end of Hart Park Lane	New inlet at west end of floodwall	Concept 2. New inlet with 24" storm sewer and outfall.	Engineering Services for Hart Park North interior Drainage Closure Evaluation and 500-year Floodplain Mitigation, Arcadis, June 2023
I	63rd Street Sanitary Siphon	Sanitary sewer siphon near 63rd Street	Alternative 3A. Replace sanitary siphon with gravity sewer in levee management area; add manhole.	Sanitary and Storm Pipe Condition Reassessment for the Hart Park and Western Milwaukee Levee System, Arcadis, August 2023

Attachments

Attachment A: Levee Freeboard Raise Locations

Attachment A – Freeboard Improvement Locations

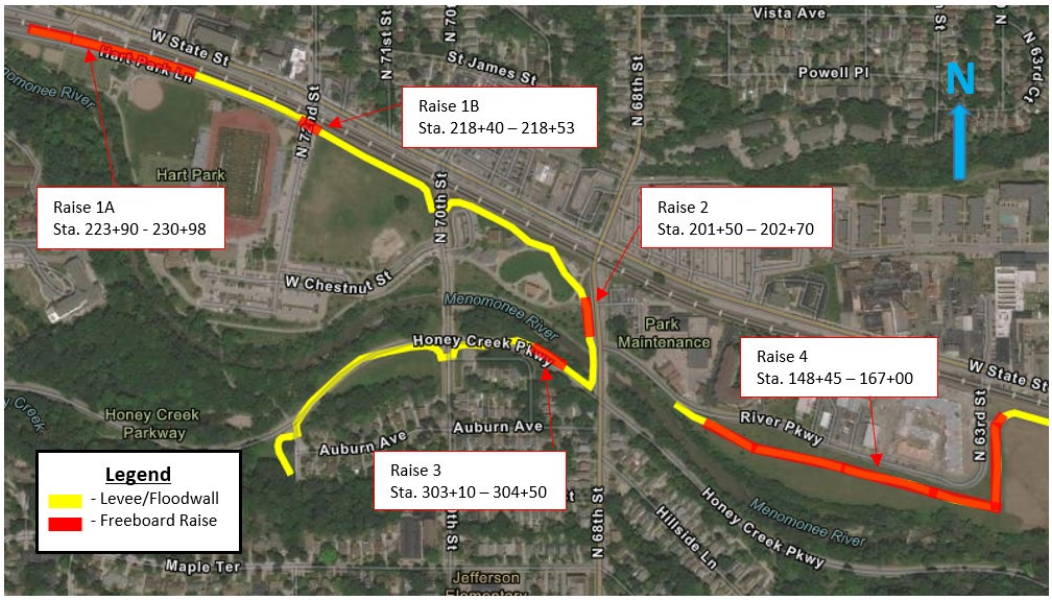


Figure ES-1 Master Plan Freeboard Deficiency Locations (modified Raise 1A and added Raise 1B) from, "Hart Park and Western Milwaukee Levee System Accreditation Master Plan", Stantec March, 2021.

Attachment B: Concept Plans - City of Wauwatosa Hart Park East and 63rd Street Realignment at the Railroad

Goals and Opportunities

- Provide a variety of passive recreation uses for a range of users
- Increase connectivity to surrounding neighborhoods; including pedestrian bridge to Jacobus Park
- Create safer crossings at 68th Street and State Street. Safety improvements to include rapid flashing beacons and bump-outs where appropriate to decrease crossing distance
- Increase accessibility; including access to the river
- Maintain and enhance native habitats through invasive removal and strategic planting of native vegetation

HART PARK - EAST *Conceptual Site Plan*

- A Picnic Area
- B Community Garden
- C Hammock Garden
- D Public Art
- E Prairie Area
- F Lawn Area
- G Natural Area
- H Low Mow Area
- I Pedestrian Bridge
- J Multi-use Trail
- K Nature Trail
- L Benches - Seating
- M Signage
- N 68th Street Crossing
- O 63rd Street Crossing
- P Mid-block Crossing

Site Features

A PICNIC AREA

- Create a plaza area that can accommodate gatherings
- Provide a range of seating option, including picnic tables and movable furniture
- Provide covered area
- Space may be rentable to provide an additional option for Wauwatosa residents

B COMMUNITY GARDEN

- Create a community garden with rentable plots
- Provide basic amenities such as access to water and composting
- Opportunities to work with volunteers and community groups

C HAMMOCK GARDEN

- Provide polls with hooks to be used to hang hammocks
- Provides a gathering space and encourages this use in a dedicated location
- Provides an additional gathering spaces for young adults

D PUBLIC ART

- Signage to be added to match existing signage throughout Hart Park
- Additional wayfinding signage to be considered along trails to highlight connections to adjacent areas and amenities
-

E PRAIRIE AREA

- Maintain prairie area that has been established by MMSD
- Limited pedestrian access to encourage establishment of native vegetation and increase ecological benefit

F LAWN AREA

- Portion of the park to be maintained as turf
- Provides opportunities for recreation
- Lawn area on the east side of park is able to accommodate two U10 soccer fields

G NATURAL AREAS

- Add to natural areas adjacent to river
- Remove invasive species
- Enhance existing vegetation with native trees, shrubs and grasses
- Convert mowed turf to native vegetation where appropriate to reduce the amount of turf

H NO MOW AREAS

- Increase the amount of turf areas that are mowed once or twice a year
- Reduces the amount of maintenance
- Creates a natural transition from wooded areas to turf

I PEDESTRIAN BRIDGE

- Install pedestrian bridge from Hart Park at 63rd Street over the Menomonee River to Jacobus Park and Honey Creek Parkway
- Improves access to between neighborhoods to the south

J MULTI-USE TRAIL

- Construct multi-use trail from 68th Street to State Street
- Trail is an extension of Oak Leaf Trail and provides safer pedestrian and bike access from State Street to all areas of Hart Park

K NATURE TRAIL

- Construct trails through and adjacent to wooded areas
- Trails to provide dedicated access points to river
- Trails to be maintained to provide access, but will not be paved

L BENCHES - SEATING

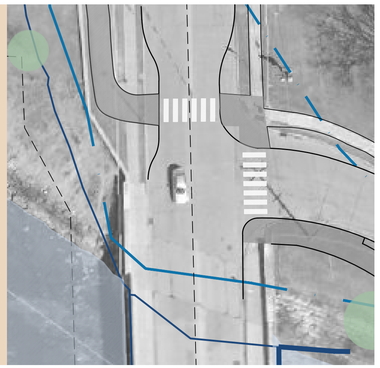
- Provide seating along all walking paths
- Create a diversity of seating types to provide gathering spaces for a variety of users and uses
- Provide seating with shade at key locations

M SIGNAGE

- Signage to be added to match existing signage throughout Hart Park
- Additional wayfinding signage to be considered along trails to highlight connections to adjacent areas and amenities

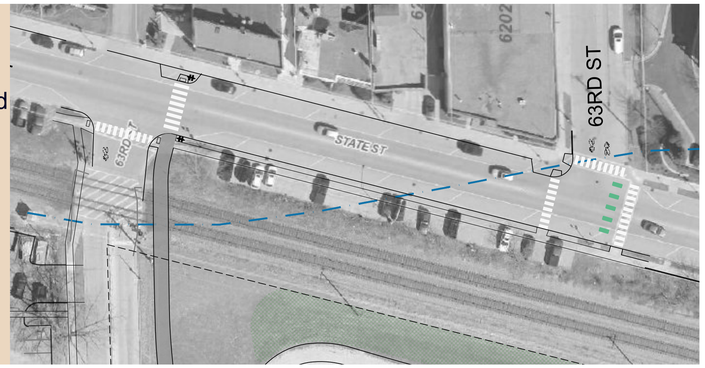
N 68th STREET CROSSING

- Add bump-out on west side of street to allow for bikes to wait to cross and to shorten the crossing distance
- Add bump-out on east side of street to better align sidewalk and path
- Add rapid flashing beacons



O 63rd STREET CROSSING

- Add crosswalk improvements and changes to pavement marking to create safer crossing from 63rd Street to River Parkway
- This is a greenway connection and will provide a safer crossing in an area with no crosswalk options
- Crossing at railroad will need further improvement



P MID-BLOCK CROSSINGS

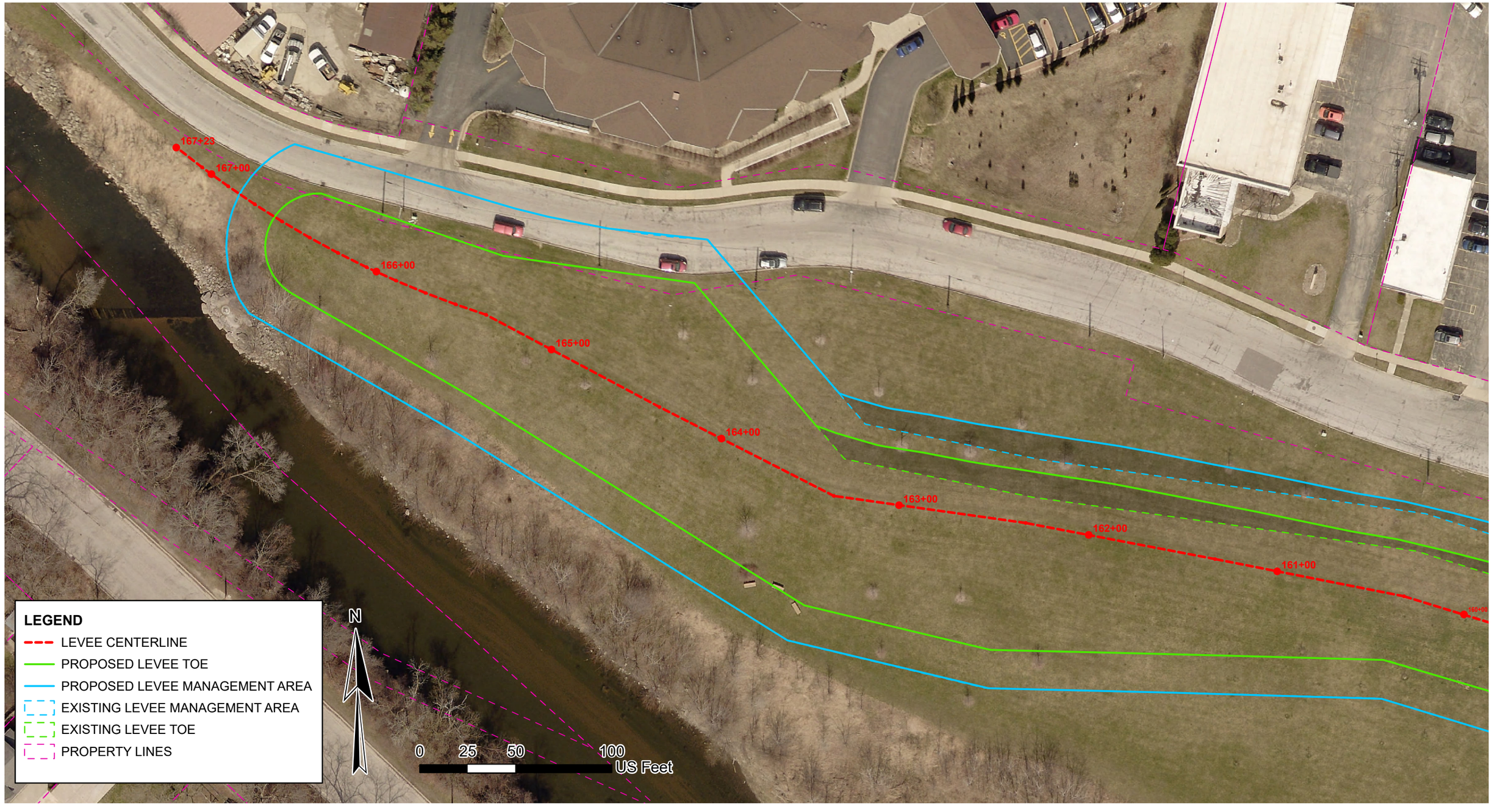
- Future mid-block crossings will provide access from developments on north side of River Parkway easier access to multi-use trail

Attachment C: Updated Levee Management Area

LEVEE MANAGEMENT AREA

Levee Management Area

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT



Coordinate System:

NAD 1927 State Plane
Wisconsin South
FIPS 4803

Prepared by:

ARCADIS Design & Consultancy for natural and built assets

MILWAUKEE METROPOLITAN SEWAGE DISTRICT

Freeboard Improvements - Hart Park and Western Milwaukee Levee System

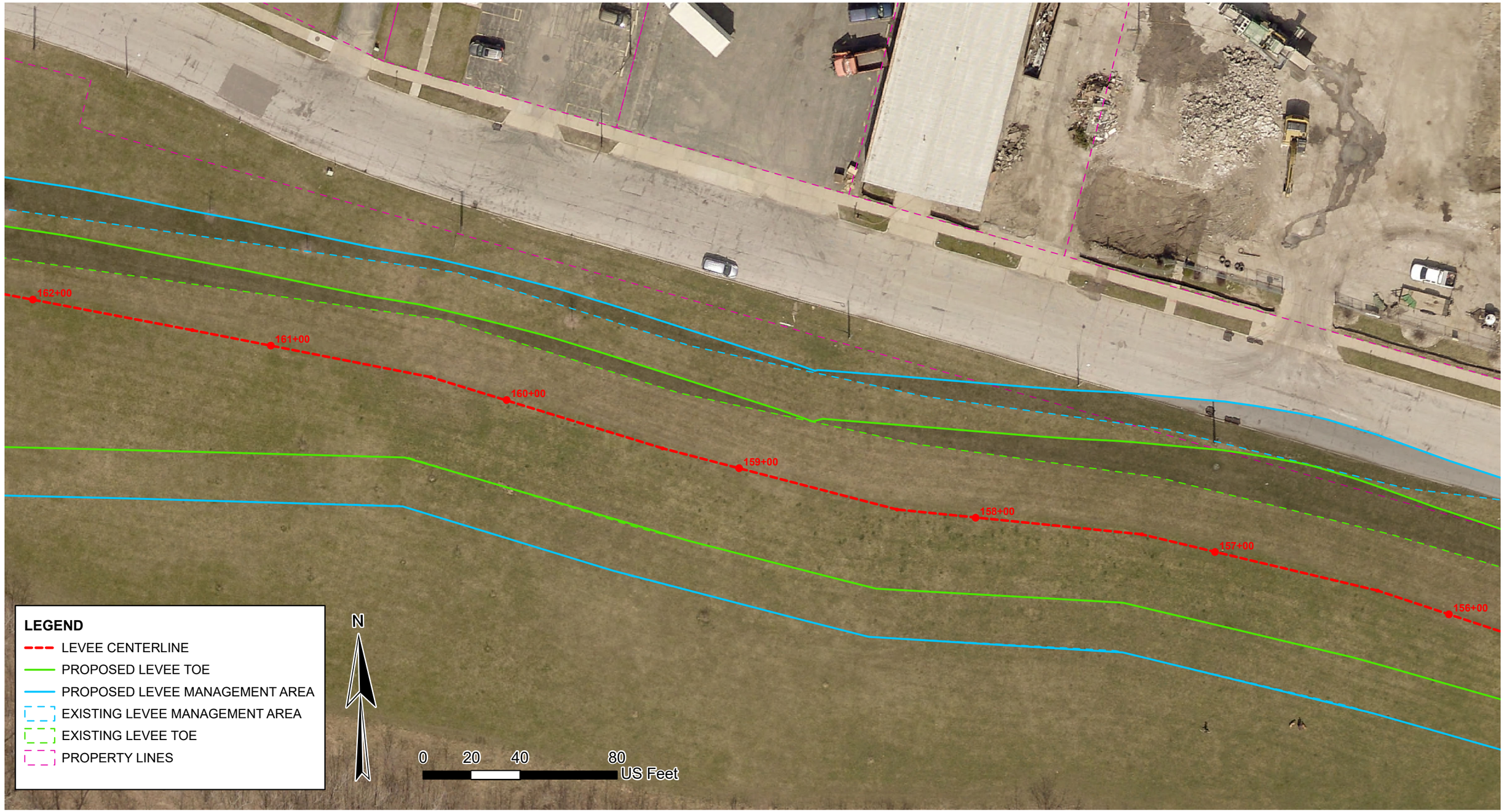
Date: April 12, 2022

MMSD PARTNERS FOR A CLEANER ENVIRONMENT

Data Sources:

1. Milwaukee County. (2020). Digital Aerial Imagery: Milwaukee County, WI 2020 . . https://geodata.wisc.edu/catalog/B7DAD270-E0C0-464A-97F7-6037BC1DAA68

2. Parcels with Property Information, MCLIO, https://www.arcgis.com/home/item.html?id=eed9d61489024802bdc89aa039abee92



Coordinate System:

NAD 1927 State Plane
Wisconsin South
FIPS 4803

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MILWAUKEE METROPOLITAN SEWAGE DISTRICT

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Data Sources:

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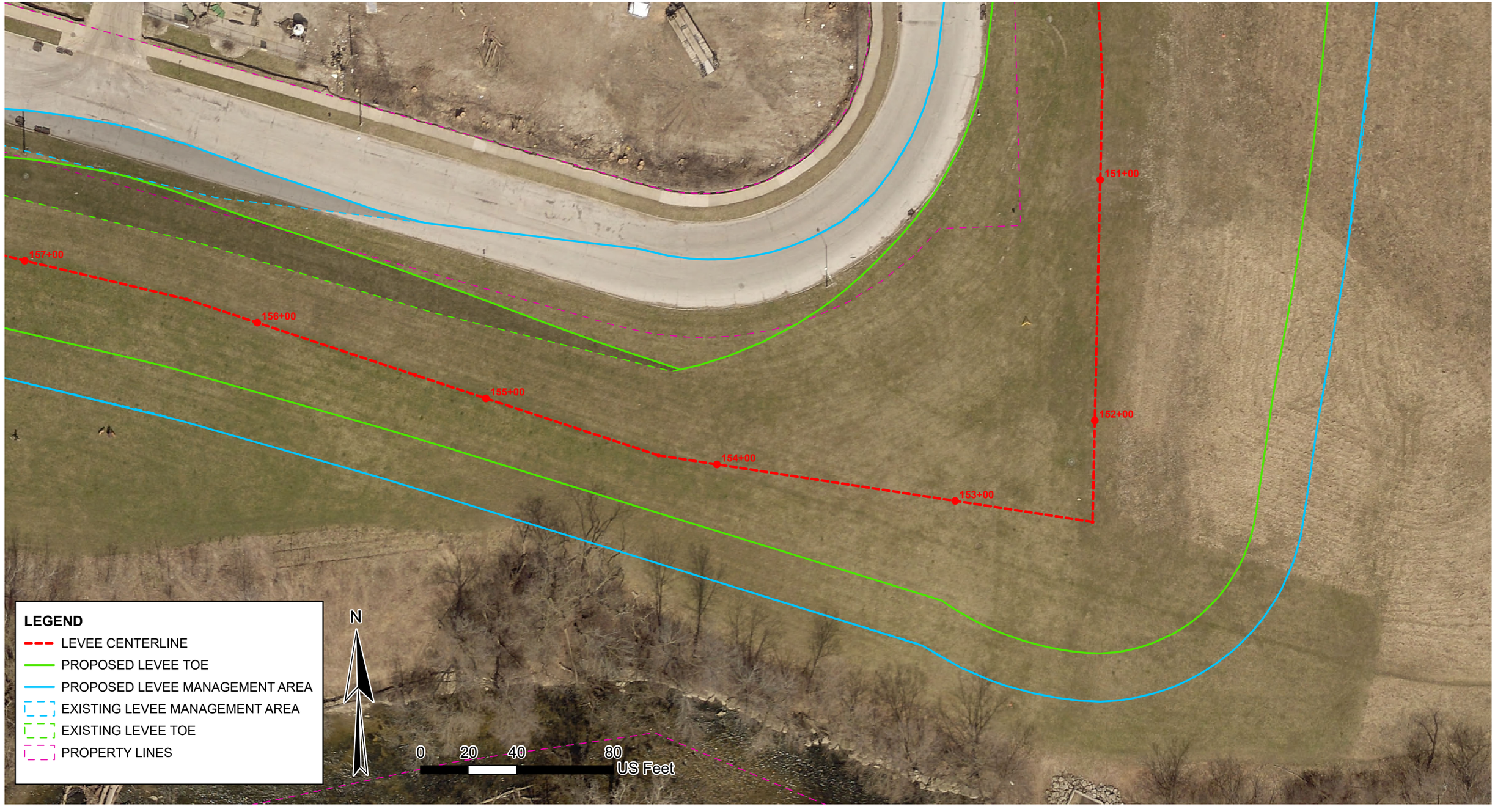

Coordinate System:

NAD 1927 State Plane
Wisconsin South
FIPS 4803

Prepared by:

ARCADIS Design & Consultancy for natural and built assets

MILWAUKEE METROPOLITAN SEWAGE DISTRICT

Freeboard Improvements - Hart Park and Western Milwaukee Levee System

Date: April 12, 2022

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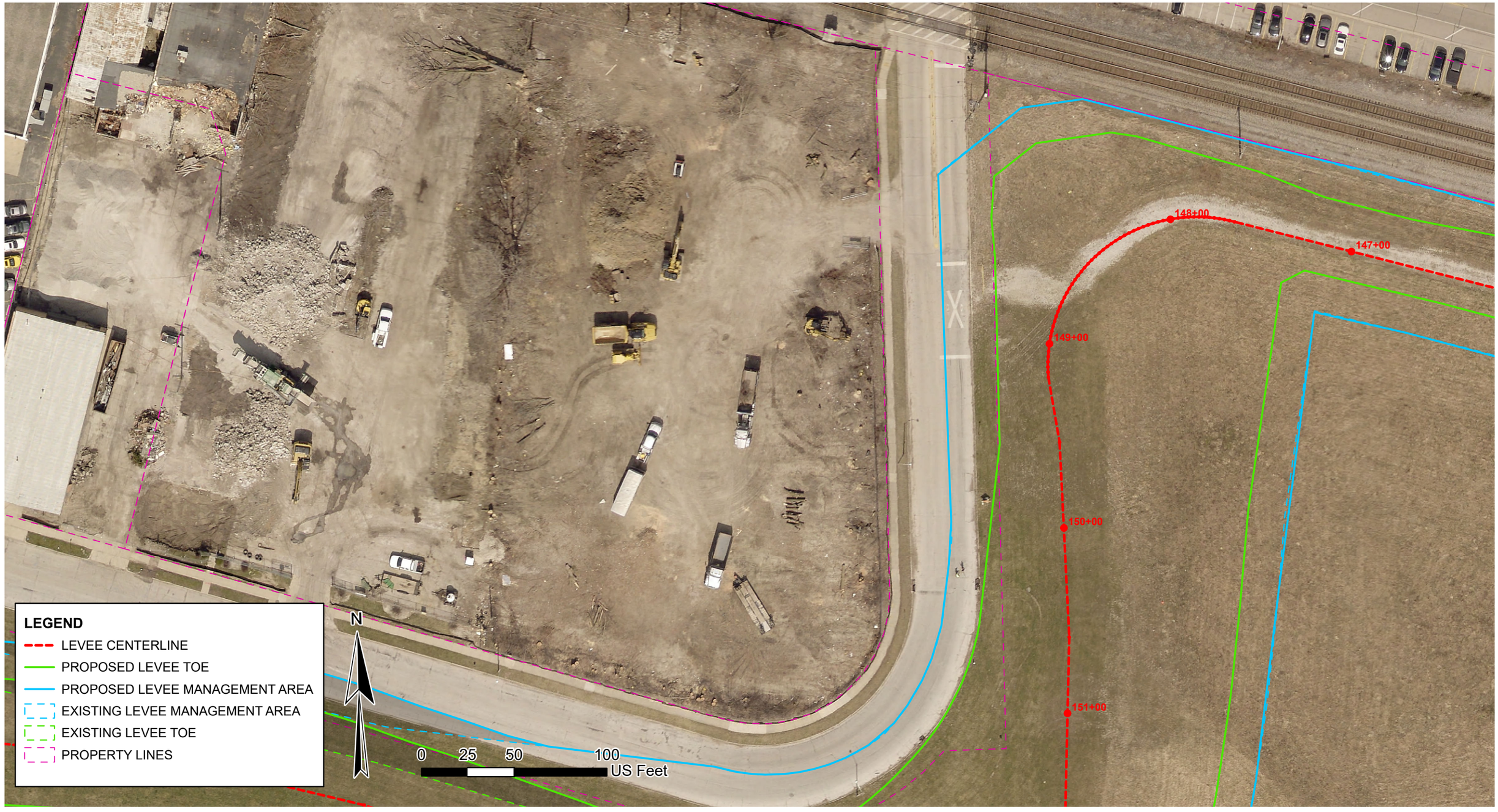
Data Sources:

1. Milwaukee County. (2020). Digital Aerial Imagery: Milwaukee County, WI 2020 . . https://geodata.wisc.edu/catalog/B7DAD270-E0C0-464A-97F7-6037BC1DAA68

2. Parcels with Property Information, MCLIO, https://www.arcgis.com/home/item.html?id=eed9d61489024802bdc89aa039abee92



Coordinate System:

NAD 1927 State Plane
Wisconsin South
FIPS 4803

Prepared by:

ARCADIS Design & Consultancy for natural and built assets

MILWAUKEE METROPOLITAN SEWAGE DISTRICT

Freeboard Improvements - Hart Park and Western Milwaukee Levee System

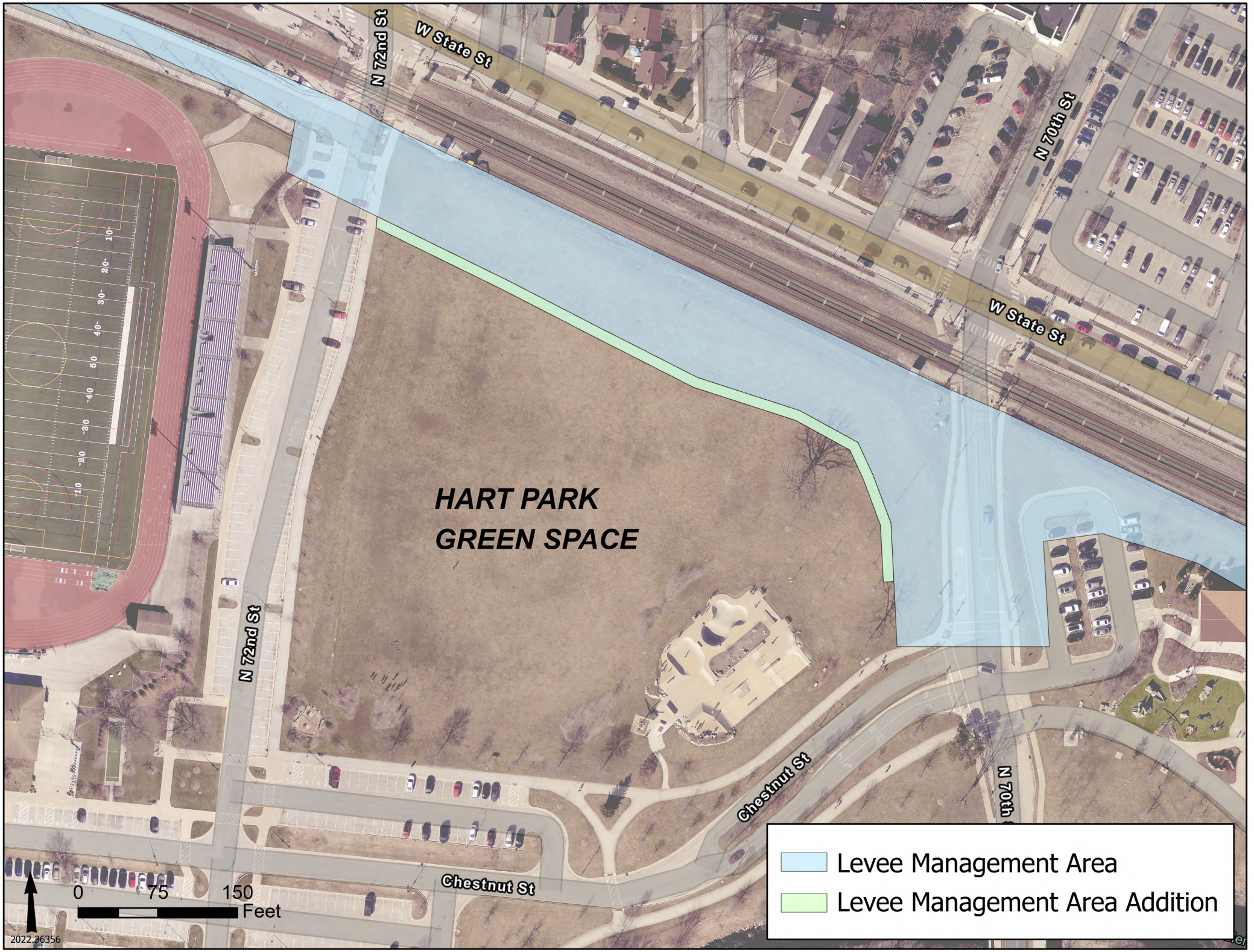
Date: April 12, 2022

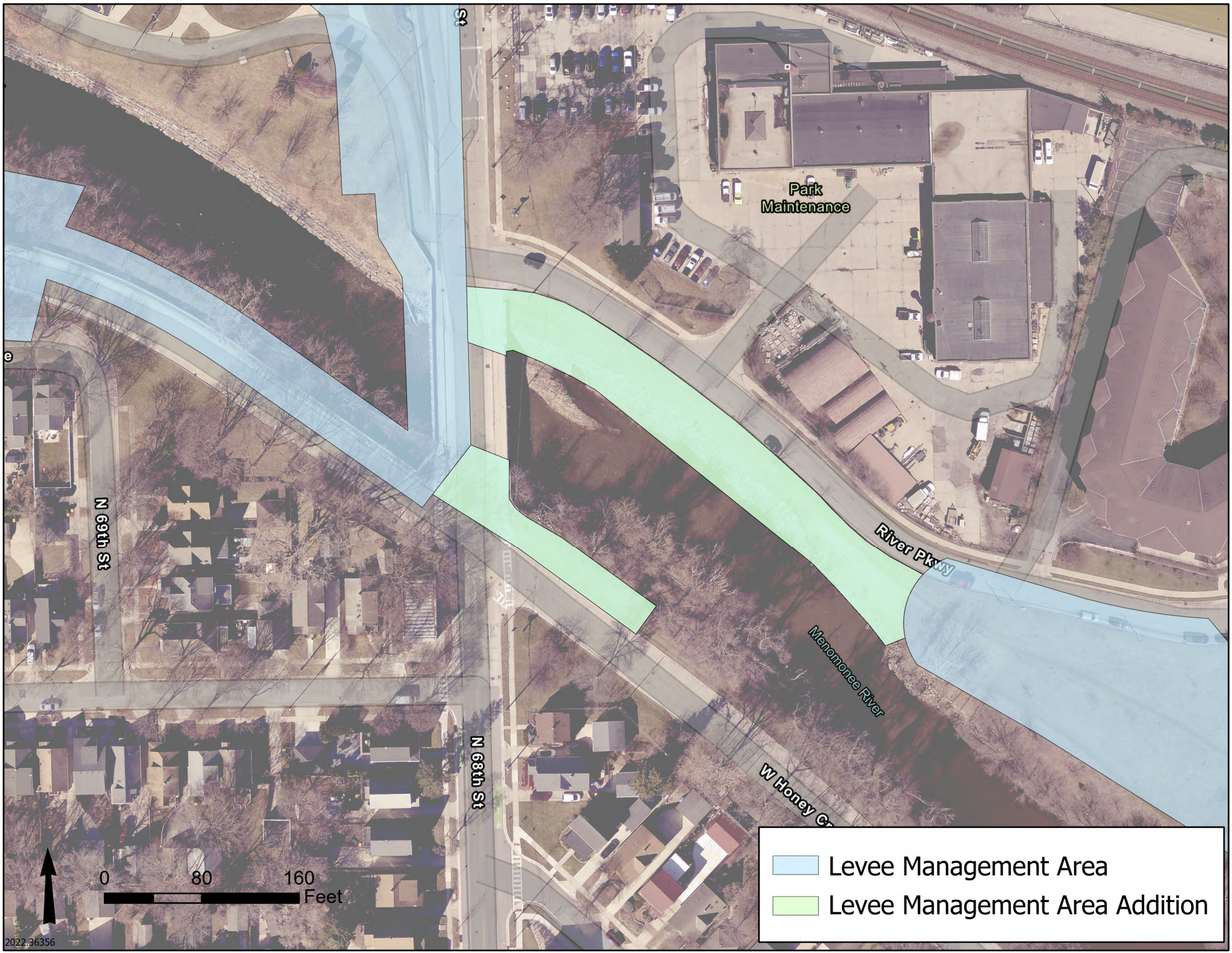
MMSD PARTNERS FOR A CLEANER ENVIRONMENT

Data Sources:

1. Milwaukee County. (2020). Digital Aerial Imagery: Milwaukee County, WI 2020 . . https://geodata.wisc.edu/catalog/B7DAD270-E0C0-464A-97F7-6037BC1DAA68

2. Parcels with Property Information, MCLIO, https://www.arcgis.com/home/item.html?id=eed9d61489024802bdc89aa039abee92


N 72nd St
W State St
N 70th St
W State St
HART PARK
GREEN SPACE
N 72nd St
Chestnut St
N 70th
Chestnut St
0
75
150
Feet
2022.36356
Levee Management Area
Levee Management Area Addition


Park
Maintenance
River Pkwy
Menomonee River
N 69th St
N 68th St
W Honey Cr
0
80
160
Feet
Levee Management Area
Levee Management Area Addition
2022.36356

Attachment D: Existing Hart Park Area Storm & Sanitary Sewers Levee Area Condition Assessment Limits

2025.50973

See "Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert" for rehabilitation and cost share limits

N

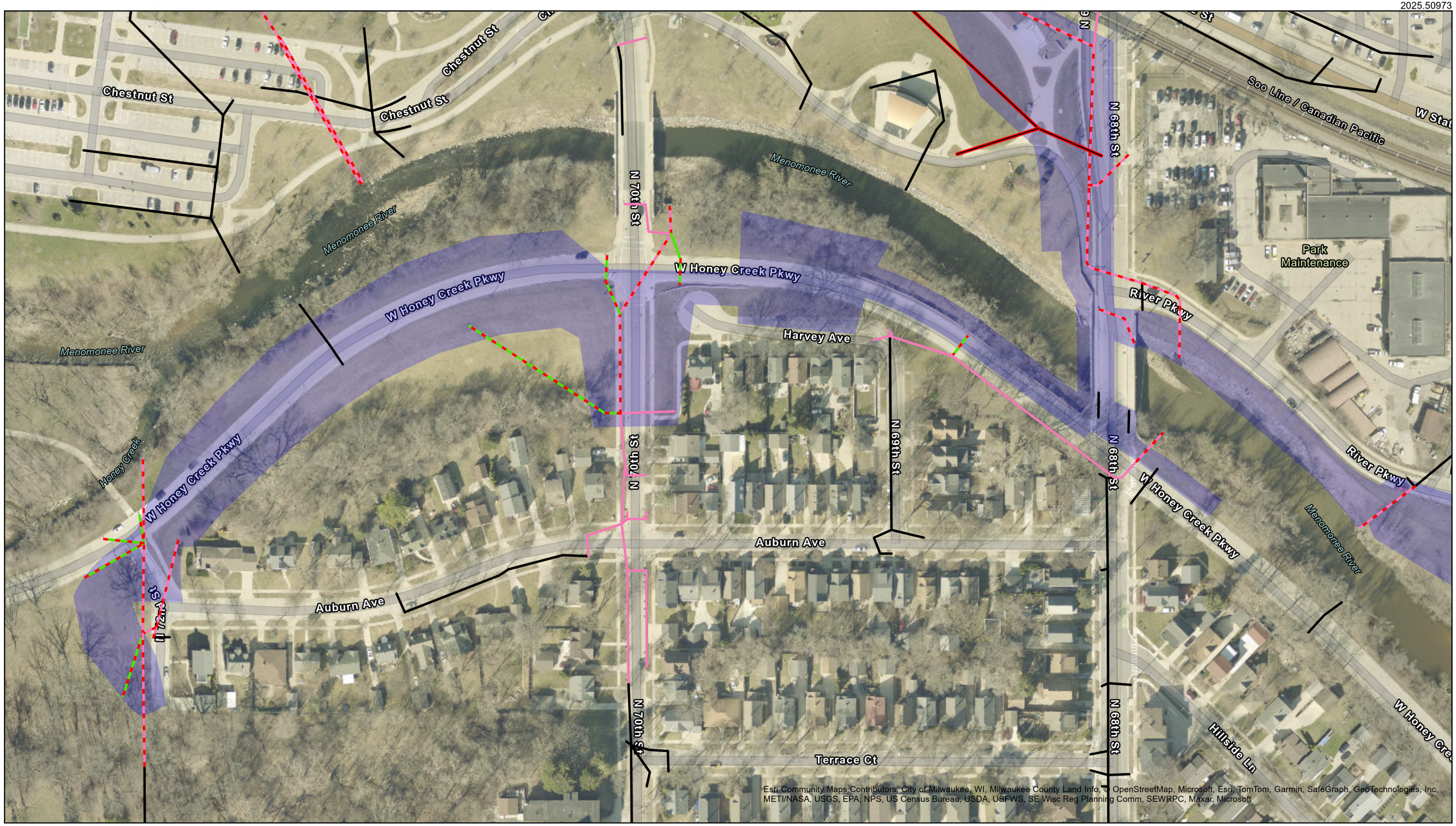
0 100 200 Feet

- Culvert, Wauwatosa Owned and MMSD Inspected
- Wauwatosa Sanitary
- Wauwatosa Sanitary, MMSD Condition Assessment and Cost Share
- Wauwatosa Storm Sewers
- Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Storm Sewers
- Levee Management Area

Existing Hart Park Levee Area Storm & Sanitary Sewers
Levee Area Condition Assessment Limits

Purpose: Identify existing sewers subject to levee area CCTV & condition assessment due to their proximity to the levee.
Day to day operations and inspections are the responsibility of the asset owner.

2025.50973



N

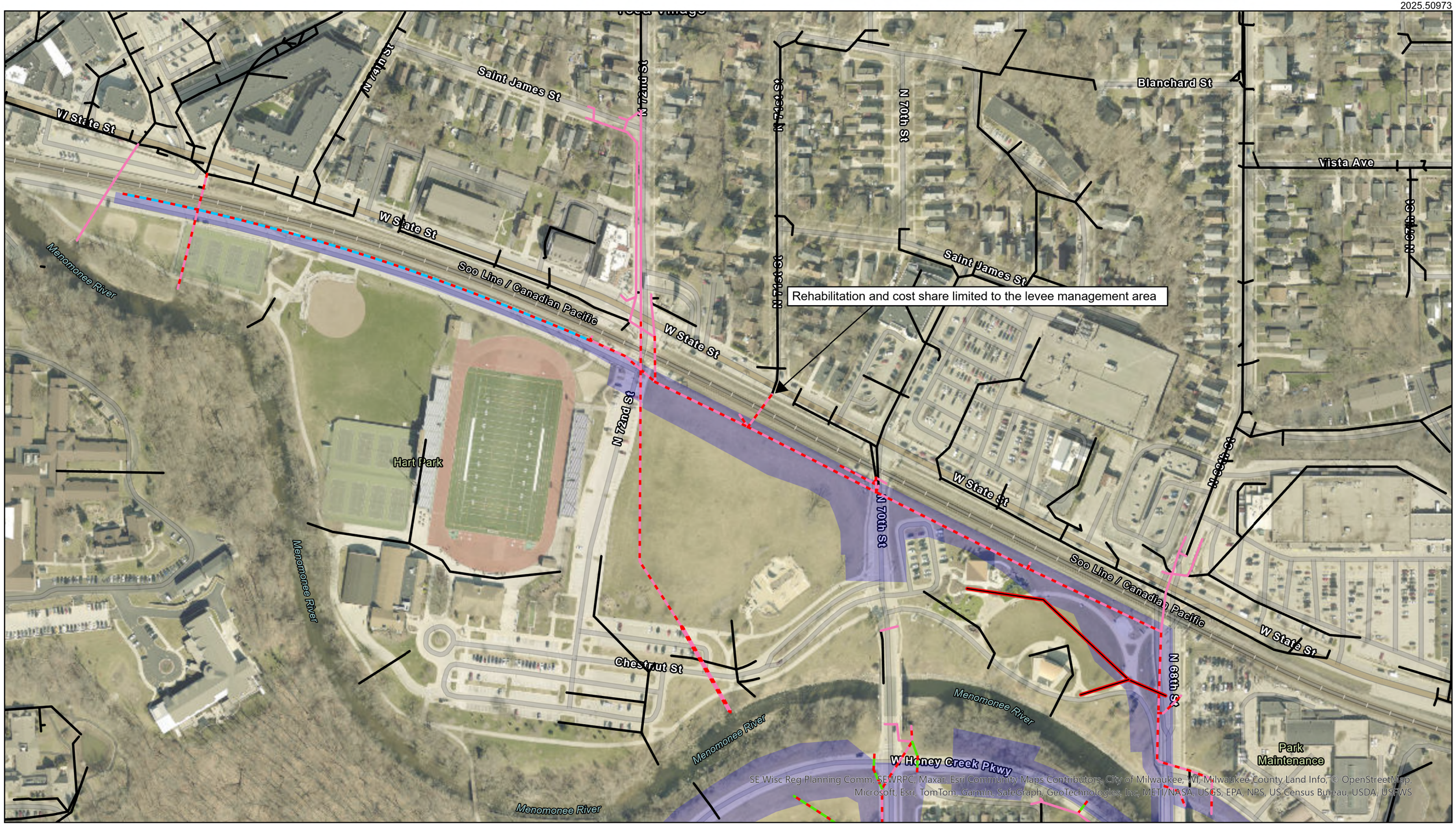
0 100 200 Feet

- Wauwatosa Sanitary, MMSD Condition Assessment and Cost Share
- County Owned Storm Sewers
- County Owned Storm Sewers, MMSD Condition Assessment and Cost Share
- Wauwatosa Storm Sewers
- Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Storm Sewers
- Levee Management Area

Existing Hart Park Levee Area Storm & Sanitary Sewers
Levee Area Condition Assessment Limits

Purpose: Identify existing sewers subject to levee area CCTV & condition assessment due to their proximity to the levee.
Day to day operations and inspections are the responsibility of the asset owner.

2025.50973



N

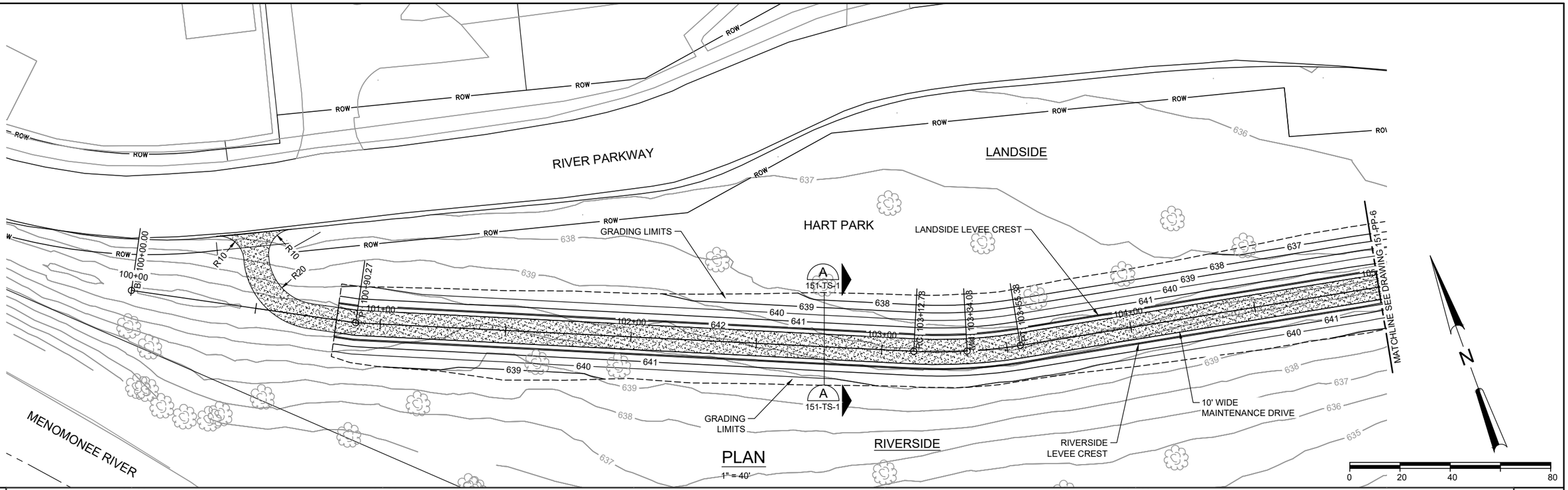
0 100 200 Feet

- Wauwatosa Sanitary, MMSD Condition Assessment and Cost Share
- County Owned Storm Sewers
- County Owned Storm Sewers, MMSD Condition Assessment and Cost Share
- Wauwatosa Storm Sewers
- Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- MMSD Storm Sewers, MMSD Condition Assessment
- Storm Sewers
- Levee Management Area

Existing Hart Park Levee Area Storm & Sanitary Sewers Levee Area Condition Assessment Limits

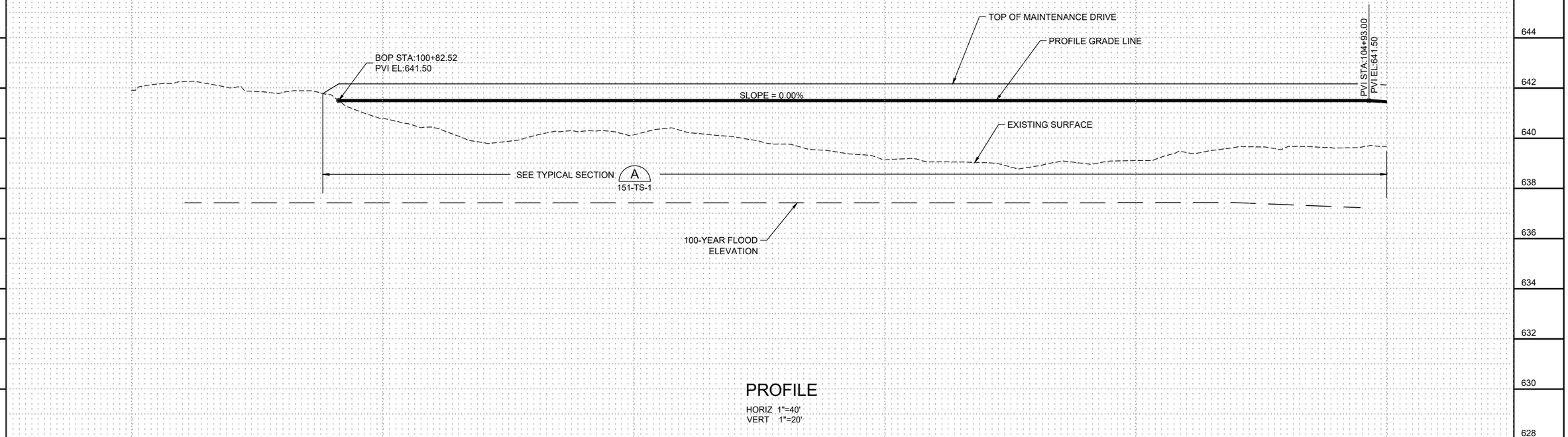
Purpose: Identify existing sewers subject to levee area CCTV & condition assessment due to their proximity to the levee.
Day to day operations and inspections are the responsibility of the asset owner.

Attachment E: MMSD Levee Maintenance Drive Location



PLAN

1" = 40'



PROFILE

HORIZ 1"=40'
VERT 1"=20'

ESSENTIALLY COMPLETE, JUNE 2022

HORIZONTAL DATUM
NAD27 WISCONSIN STATE PLANE SOUTH ZONE COORDINATE SYSTEM

VERTICAL DATUM
NGVD29 NATIONAL GEODETIC VERTICAL DATUM OF 1929

DSGN G. KELLER
DR. M. POLINSKE
CHK S. BREEN
APVD S. BREEN

This Design Prepared For MMSD By:
ARCADIS
In Association With:
ONEIDA Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD

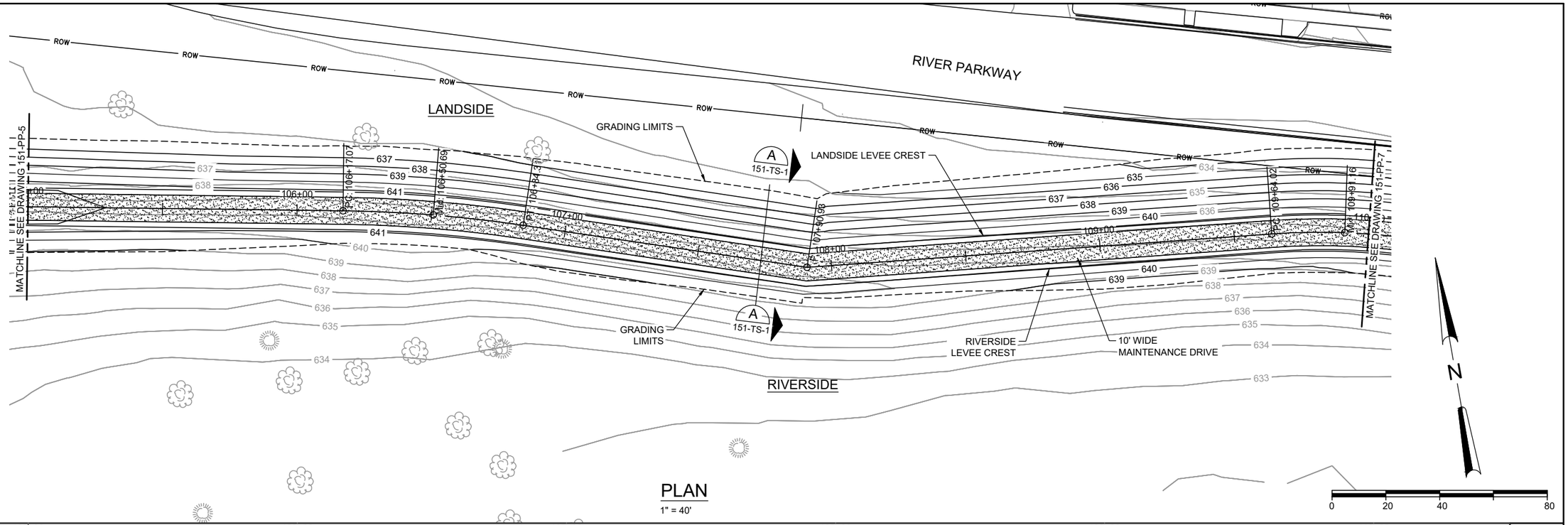
MMSD PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
MENOMONEE RIVER LEVEE SYSTEM ACCREDITATION

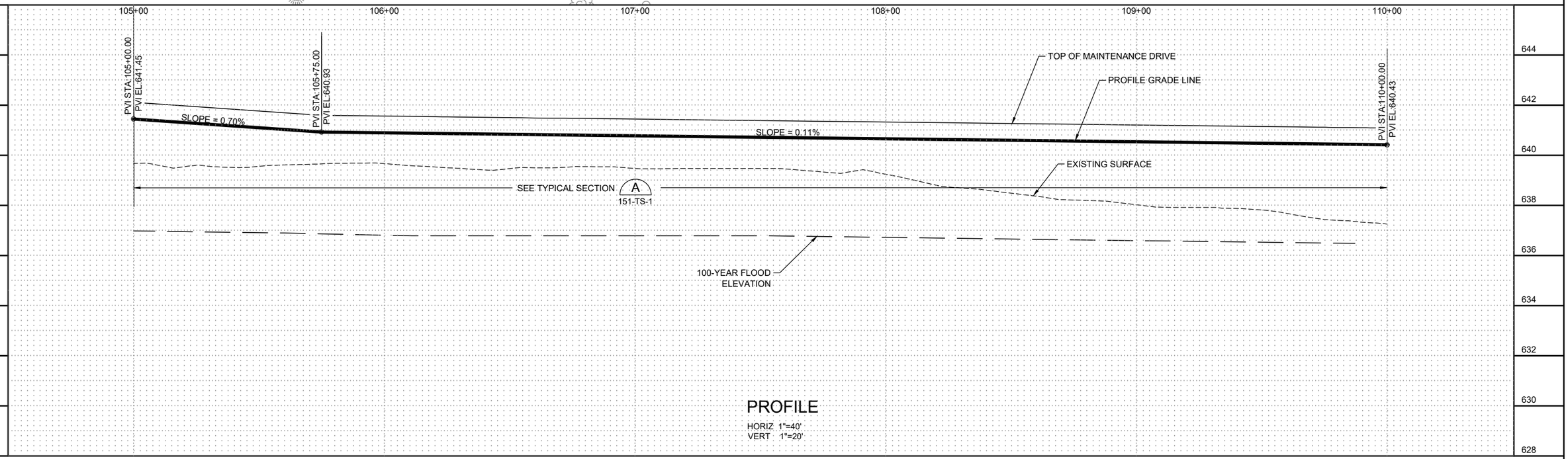
PLAN & PROFILE
STA. 100+00 - STA. 105+00

DRAWING NO.:	151-PP-6
SHEET:	32
DATE:	XXXX, 2022
CONTRACT:	W20033
MMSD FILE:	151-1491.dwg



PLAN

1" = 40'



PROFILE

HORIZ 1"=40'
VERT 1"=20'

ESSENTIALLY COMPLETE, JUNE 2022

HORIZONTAL DATUM
NAD27 WISCONSIN STATE PLANE SOUTH ZONE COORDINATE SYSTEM

VERTICAL DATUM
NGVD29 NATIONAL GEODETIC VERTICAL DATUM OF 1929

DSGN	G. KELLER
DR	M. POLINSKE
CHK	S. BREEN
APVD	S. BREEN

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ONEIDA Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD

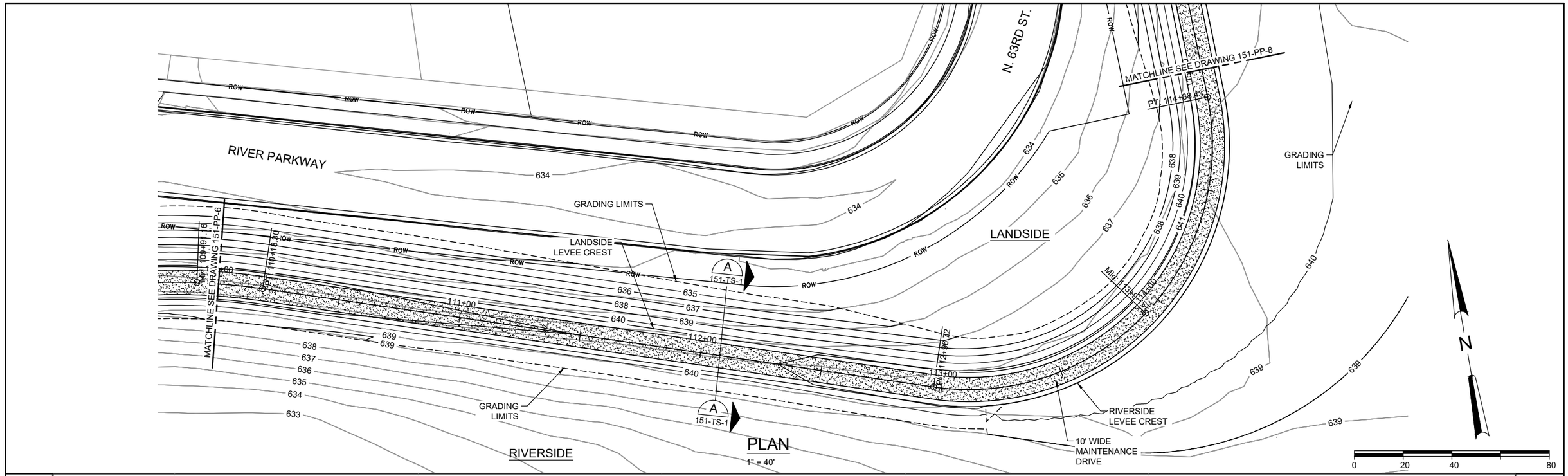
MMSD PARTNERS FOR A CLEANER ENVIRONMENT

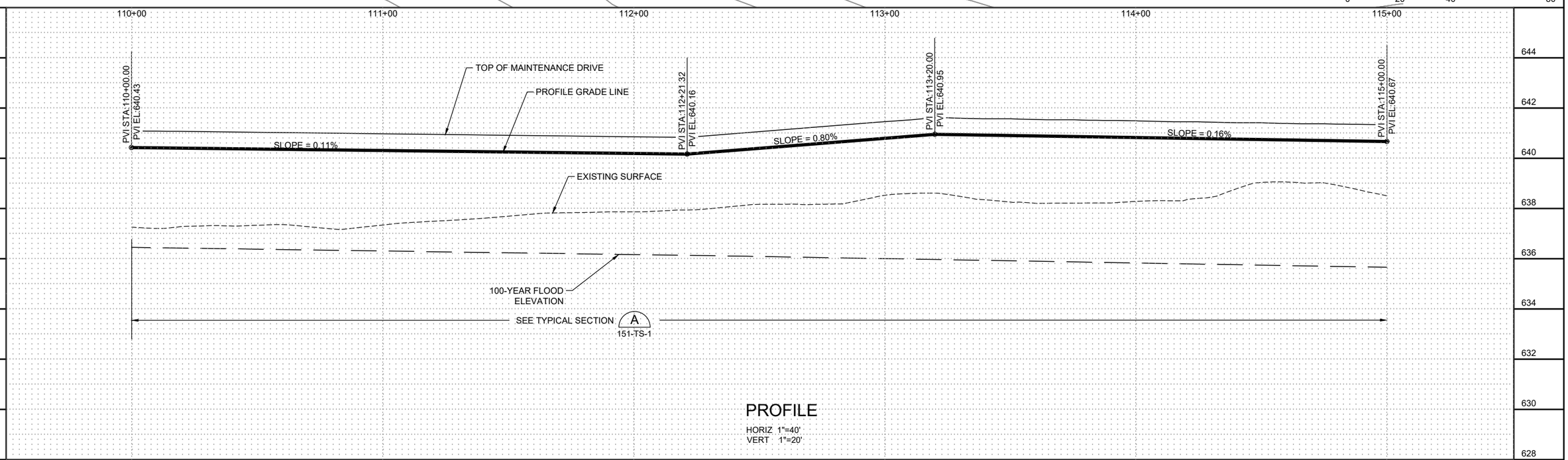
MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
MENOMONEE RIVER LEVEE SYSTEM ACCREDITATION

PLAN & PROFILE
STA. 105+00 - STA. 110+00

DRAWING NO.:	151-PP-7
SHEET:	33
DATE:	XXXX, 2022
CONTRACT:	W20033
MMSD FILE:	151-1492.dwg





PROFILE

HORIZ 1"=40'
VERT 1"=20'

ESSENTIALLY COMPLETE, JUNE 2022

HORIZONTAL DATUM
NAD27 WISCONSIN STATE PLANE SOUTH ZONE COORDINATE SYSTEM

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DSGN G. KELLER
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REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD

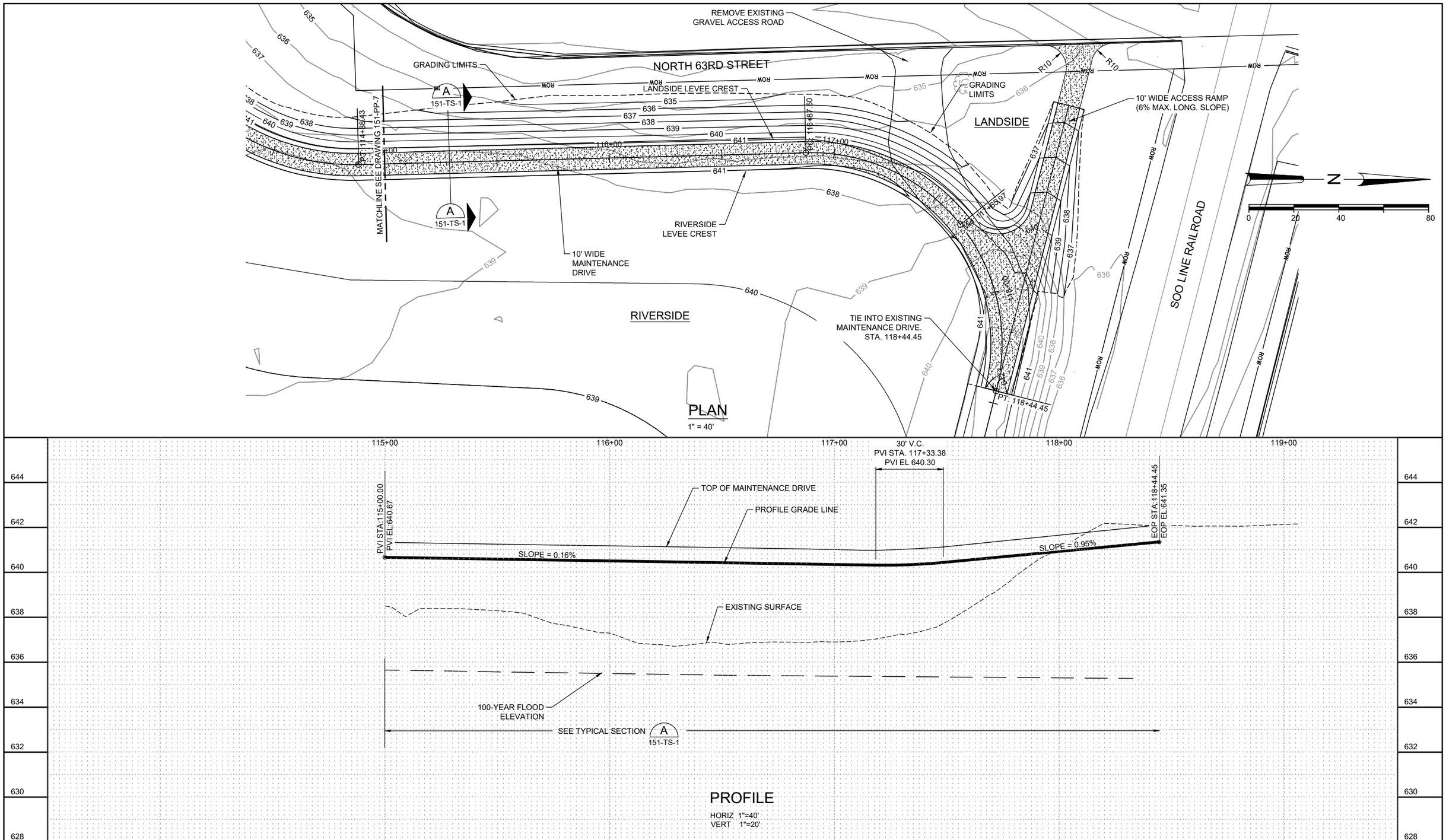
MMSD PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
MENOMONEE RIVER LEVEE SYSTEM ACCREDITATION

PLAN & PROFILE
STA. 110+00 - STA. 115+00

DRAWING NO.:	151-PP-8
SHEET:	34
DATE:	XXXX, 2022
CONTRACT:	W20033
MMSD FILE:	151-1493.dwg



ESSENTIALLY COMPLETE, JUNE 2022

HORIZONTAL DATUM
NAD27 WISCONSIN STATE PLANE SOUTH ZONE COORDINATE SYSTEM

VERTICAL DATUM
NGVD29 NATIONAL GEODETIC VERTICAL DATUM OF 1929

DSGN	G. KELLER
DR	M. POLINSKE
CHK	S. BREEN
APVD	S. BREEN

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ARCADIS
In Association With:
ONEIDA Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD

MMSD PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

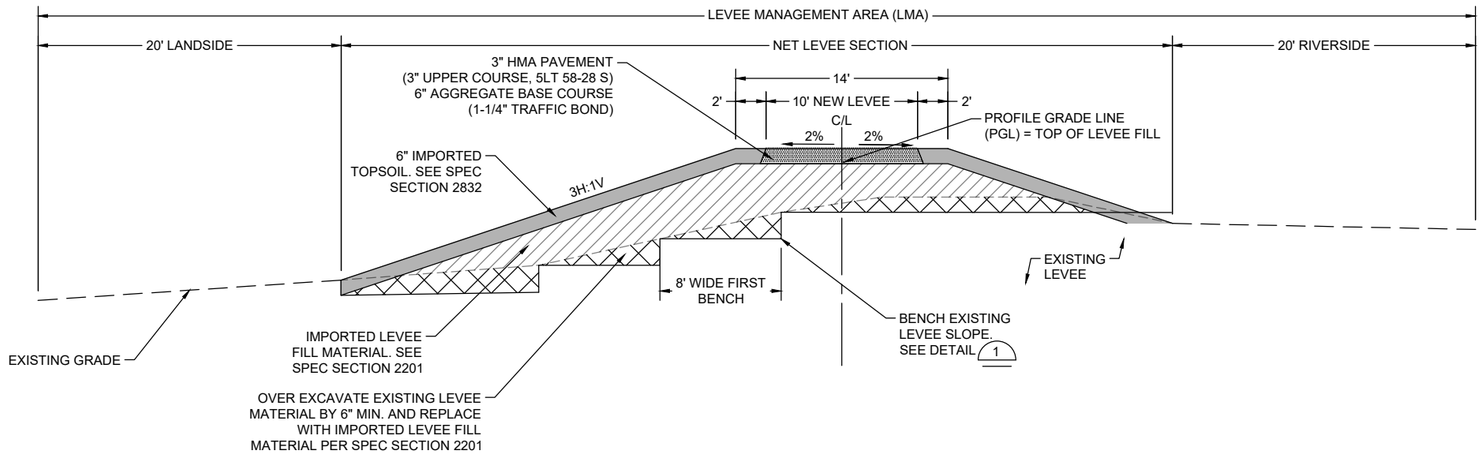
WATERCOURSE
MENOMONEE RIVER LEVEE SYSTEM ACCREDITATION

PLAN & PROFILE
STA. 115+00 - STA. 119+00

DRAWING NO.:	151-PP-9
SHEET:	35
DATE:	XXXX, 2022
CONTRACT:	W20033
MMSD FILE:	151-1494.dwg

CONSTRUCTION NOTES:

1. CONTRACTOR SHALL VERIFY SUBSURFACE, OVERHEAD UTILITIES, AND OBSTRUCTIONS PRIOR TO CONSTRUCTION.
2. THE EXISTING FILL SLOPE SHALL BE STRIPPED TO A DEPTH OF 6" TO REMOVE TOPSOIL. AT LOCATIONS WHERE STONE RIPRAP IS PRESENT, REMOVE AND DISPOSE OF EXISTING RIPRAP PRIOR TO STRIPPING 6" OF LEVEE SLOPE.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SEEDING AND MULCHING IN ACCORDANCE TO THE PLANS.

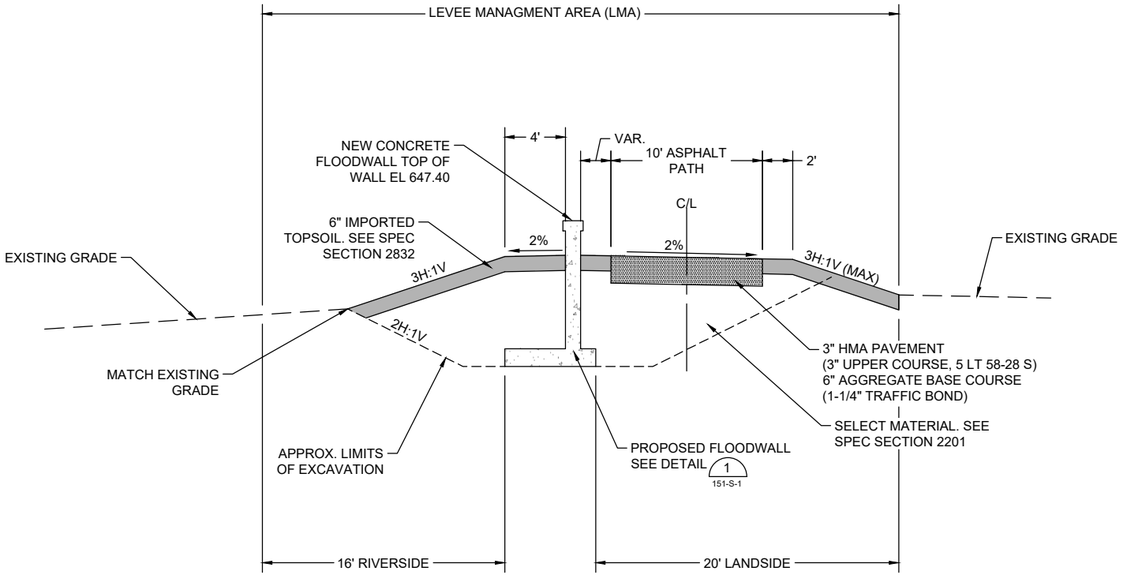


TYPICAL LEVEE SECTION - STA. 100+82.50 TO 118+44.45

A

NOT TO SCALE

151-PP-3, 151-PP-5, 151-PP-6, 151-PP-7, 151-PP-8

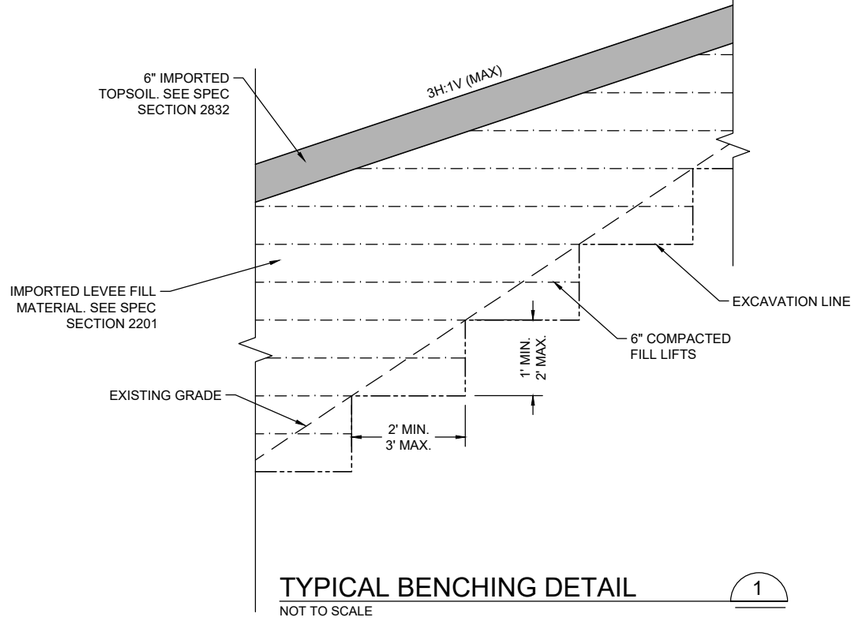


TYPICAL FLOODWALL SECTION AT N. 68TH ST. & PATH - STA. 0+36.84 TO 1+45.00

B

NOT TO SCALE

151-PP-3



TYPICAL BENCHING DETAIL

1

NOT TO SCALE

ESSENTIALLY COMPLETE JUNE, 2022

HORIZONTAL DATUM
NAD27 WISCONSIN STATE PLANE SOUTH ZONE COORDINATE SYSTEM

VERTICAL DATUM
NGVD29 NATIONAL GEODETIC VERTICAL DATUM OF 1929

DSGN G. KELLER
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ARCADIS
ONEIDA Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD

MMSD PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
FREEBOARD IMPROVEMENTS - HART PARK AND WESTERN MILWAUKEE LEVEE SYSYTEM

TYPICAL SECTIONS
LEVEE SECTIONS

DRAWING NO.:	151-TS-1
SHEET NO.:	36
DATE:	XXXX, 2022
CONTRACT:	W20033C01
MMSD FILE:	151-1495.dwg

Attachment F: Changes to Hart Park Area Storm & Sanitary Sewers Levee Area Showing Condition Assessment Limits

2025.50973

See ICA Table 1 for a summary of planned changes.

See "Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert" for rehabilitation and cost share limits

See A

See B

See C1

See C2

See D

See I

W State St

Soo Line / Canadian Pacific

River Pkwy

N 62nd St

N 63rd St

W Honey Creek Pkwy

Hillside Ln

Menomonee River

Park Maintenance

N

0 100 200 Feet

- Culvert, Wauwatosa Owned and MMSD Inspected
- Wauwatosa Sanitary
- Wauwatosa Sanitary, MMSD Condition Assessment and Cost Share
- Planned Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Wauwatosa Storm Sewers
- Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Private, No Inspection
- Demo
- Storm Sewers
- Flap Gate
- Manhole
- Vault
- Levee Management Area

Changes to Hart Park Levee Area Storm & Sanitary Sewers Showing Condition Assessment Limits

Purpose: Identify conceptual locations of planned sewers subject to levee area CCTV & condition assessment due to their proximity to the levee. Day to day operations and inspections are the responsibility of the asset owner.

2025.50973

See ICA Table 1 for a summary of planned changes.

Chestnut St
Menomonee River
W Honey Creek Pkwy
N 70th St
N 68th St
Soo Line / Canadian Pacific
Park Maintenance
River Pkwy
Harvey Ave
N 69th St
Honey Creek
Auburn Ave
Terrace Ct
Hillside Dr
W Honey Creek Pkwy

See E1
See E2
See F1
See F2
See F3
See G1
See G2
See G3

Esri Community Maps Contributors, City of Milwaukee, WI, Milwaukee County, Land Info, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, SE Wisc Reg Planning Comm, SEWRPC, Maxar, Microsoft

N

0 100 200 Feet

- Wauwatosa Sanitary, MMSD Condition Assessment and Cost Share
- County Owned Storm Sewers
- County Owned Storm Sewers, MMSD Condition Assessment and Cost Share
- Planned Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Wauwatosa Storm Sewers
- Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Demo
- Storm Sewers
- Flap Gate
- Backflow Preventor
- Levee Management Area

Changes to Hart Park Levee Area Storm & Sanitary Sewers Showing Condition Assessment Limits

Purpose: Identify conceptual locations of planned sewers subject to levee area CCTV & condition assessment due to their proximity to the levee. Day to day operations and inspections are the responsibility of the asset owner.

2025.50973

See ICA Table 1 for a summary of planned changes.

See H1

See H2

Rehabilitation and cost share limited to the levee management area

Saint James St
W State St
Soo Line / Canadian Pacific
N 72nd St
N 74th St
N 70th St
Blanchard St
Vista Ave
N 67th St
N 68th St
Menomonee River
Hart Park
Chestnut St
W Honey Creek Pkwy
Park Maintenance

N

0 100 200 Feet

- Wauwatosa Sanitary, MMSD Condition Assessment and Cost Share
- County Owned Storm Sewers
- County Owned Storm Sewers, MMSD Condition Assessment and Cost Share
- Planned Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- Wauwatosa Storm Sewers
- Wauwatosa Storm Sewers, MMSD Condition Assessment and Cost Share
- MMSD Storm Sewers, MMSD Condition Assessment
- Demo
- Storm Sewers
- Flap Gate
- Backflow Preventor
- Levee Management Area

Changes to Hart Park Levee Area Storm & Sanitary Sewers Showing Condition Assessment Limits

Purpose: Identify conceptual locations of planned sewers subject to levee area CCTV & condition assessment due to their proximity to the levee. Day to day operations and inspections are the responsibility of the asset owner.

Attachment G: Select Record Drawings W20027C01
Western Milwaukee Flood Management Project Phase 2A

Contract Documents

Milwaukee Metropolitan
Sewerage District

WATERCOURSE
Western Milwaukee
Flood Management Project
Phase 2A

Contract W20027C01

Plans

For information regarding this project call: Ms. Jennifer Wright, P.E., MMSD Sr. Project Manager : Tel. 414-225-2097

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

Record Drawings - March 2016
Bid - November 2014

Record Drawings

MMSD FILE NO. 151-696.dgn

The following circled drawings are included.

INDEX TO DRAWINGS

SHEET NO.	DRAWING NO.	MMSD FILE NO.	DRAWING TITLE
			GENERAL
1	G-1	151-696.dgn	COVER SHEET
2	G-2	151-697.dgn	INDEX TO DRAWINGS
3	G-3	151-698.dgn	SITE LOCATION AND VICINITY MAP
4	G-4	151-699.dgn	LEGEND
5	G-5	151-700.dgn	ABBREVIATIONS AND SECTION DESIGNATIONS
6	G-6	151-701.dgn	PROJECT LAYOUT AND CONTROL DATA
7	G-7	151-702.dgn	PROJECT ALIGNMENT PLAN
8	G-8	151-703.dgn	SOIL BORING LOCATIONS
			SITE PLANS
9	SP-1	151-704.dgn	EXISTING SITE CONDITIONS/TOPOGRAPHY
10	SP-2	151-705.dgn	PROPOSED PLAN/PROJECT OVERVIEW
11	SP-3	151-706.dgn	PROPERTY AND EASEMENT PLAN
12	SP-4	151-707.dgn	CONTRACTOR ACCESS AND STAGING PLAN
13	SP-5	151-708.dgn	REMOVALS AND ABANDONMENT PLAN
			GRADING
14	GP-1	151-709.dgn	GRADING PLAN
15	GP-2	151-710.dgn	MENOMONEE RIVER STREAM BANK GRADING
16	GP-3	151-711.dgn	MENOMONEE RIVER STREAM BANK GRADING
17	GP-4	151-712.dgn	SCHOONMAKER CREEK STREAM BANK GRADING
18	GP-5	151-713.dgn	SCHOONMAKER CREEK PROFILE
19	GP-6	151-714.dgn	TYPICAL SECTIONS OF MENOMONEE RIVER STREAM BANK
20	GP-7	151-715.dgn	TYPICAL FINISHED SECTION OF EARTHEN LEVEE & SERVICE ROAD
			EROSION CONTROL
21	EC-1	151-716.dgn	EROSION CONTROL NOTES
22	EC-2	151-717.dgn	SUGGESTED EROSION CONTROL PLAN
			STREAM & STREAM BANK IMPROVEMENTS
23	SB-1	151-718.dgn	SCHOONMAKER CREEK RIP RAP STILLING BASIN DETAILS
24	SB-2	151-719.dgn	SCHOONMAKER CREEK STILLING BASIN SIDE SLOPE DRAIN DETAILS
25	SB-3	151-720.dgn	UPPER SCHOONMAKER CREEK STREAM CONSTRUCTION DETAILS
26	SB-4	151-721.dgn	LOWER SCHOONMAKER CREEK STREAM CONSTRUCTION DETAILS
27	SB-5	151-722.dgn	SCHOONMAKER CREEK STONE APRON DETAILS
28	SB-6	151-723.dgn	STREAM BANK DETAILS
29	SB-7	151-724.dgn	STEAMBANK FES DETAILS
30	SB-8	151-725.dgn	STREAM BANK CONSTRUCTION DETAILS
31	SB-9	151-726.dgn	COIR FABRIC DETAILS
			REMEDIATION PLANS
32	RP-1	151-727.dgn	WDNR CASES AND PROPERTIES
33	RP-2	151-728.dgn	TCLP - LEAD REMEDIATION PLAN
34	RP-3	151-729.dgn	CONFIRMATION SOIL SAMPLES LAYOUT
35	RP-4	151-730.dgn	CONFIRMATION SOIL SAMPLE COORDINATES
36	RP-5	151-731.dgn	REMEDIATION CAPPING PLAN
			WATERCOURSE PLANTING & SEEDING
37	WC-1	151-733.dgn	SEEDING PLAN
38	WC-2	151-734.dgn	PLANTING PLAN
39	WC-3	151-735.dgn	MASTER PLANT LIST AND PLANING DETAILS
			STRUCTURAL
40	S-1	151-736.dgn	STRUCTURAL NOTES
41	S-2	151-737.dgn	REMOVALS AND PROTECTION (1 OF 2)
42	S-3	151-738.dgn	REMOVALS AND PROTECTION (2 OF 2)
43	S-4	151-739.dgn	PLANS AND SECTIONS
44	S-5	151-740.dgn	SECTIONS (1 OF 3)
45	S-6	151-741.dgn	SECTIONS (2 OF 3)
46	S-7	151-742.dgn	SECTIONS (3 OF 3)
47	S-8	151-743.dgn	SCHOOMAKER CREEK BOX CULVERT MODIFICATION DETAILS
			DETAILS
48	D-1	151-744.dgn	MISCELLANEOUS DETAILS
49	D-2	151-744a.dgn	PIPE GATE DETAILS (1 OF 2)
50	D-3	151-744b.dgn	PIPE GATE DETAILS (2 OF 2)
			CROSS SECTIONS
51	XS-1	151-745.dgn	SITE GRADING CROSS SECTIONS
52	XS-2	151-746.dgn	SITE GRADING CROSS SECTIONS
53	XS-3	151-747.dgn	SITE GRADING CROSS SECTIONS
54	XS-4	151-748.dgn	SITE GRADING CROSS SECTIONS
55	XS-5	151-749.dgn	SITE GRADING SCHOONMAKER CREEK CROSS SECTIONS
56	XS-6	151-750.dgn	SITE GRADING SCHOONMAKER CREEK CROSS SECTIONS
57	XS-7	151-751.dgn	SITE GRADING SCHOONMAKER CREEK CROSS SECTIONS
58	XS-8	151-752.dgn	SITE GRADING SCHOONMAKER CREEK CROSS SECTIONS
59	XS-9	151-753.dgn	SITE GRADING SCHOONMAKER CREEK CROSS SECTIONS
60	XS-10	151-754.dgn	EARTHEN LEVEE CROSS SECTIONS
61	XS-11	151-755.dgn	EARTHEN LEVEE CROSS SECTIONS
62	XS-12	151-756.dgn	EARTHEN LEVEE CROSS SECTIONS
63	XS-13	151-757.dgn	EARTHEN LEVEE CROSS SECTIONS

RECORD DRAWING

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0" ——— 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DSGN J. MARSHALL
DR M. POLINSKE
CHK P. SHEDIVY
APVD T. DEIBERT

This Design Prepared For MMSD By:
HNTB
In Association With:
OTIE
Oneida Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - NO REDLINE CHANGES	MJP	JCM

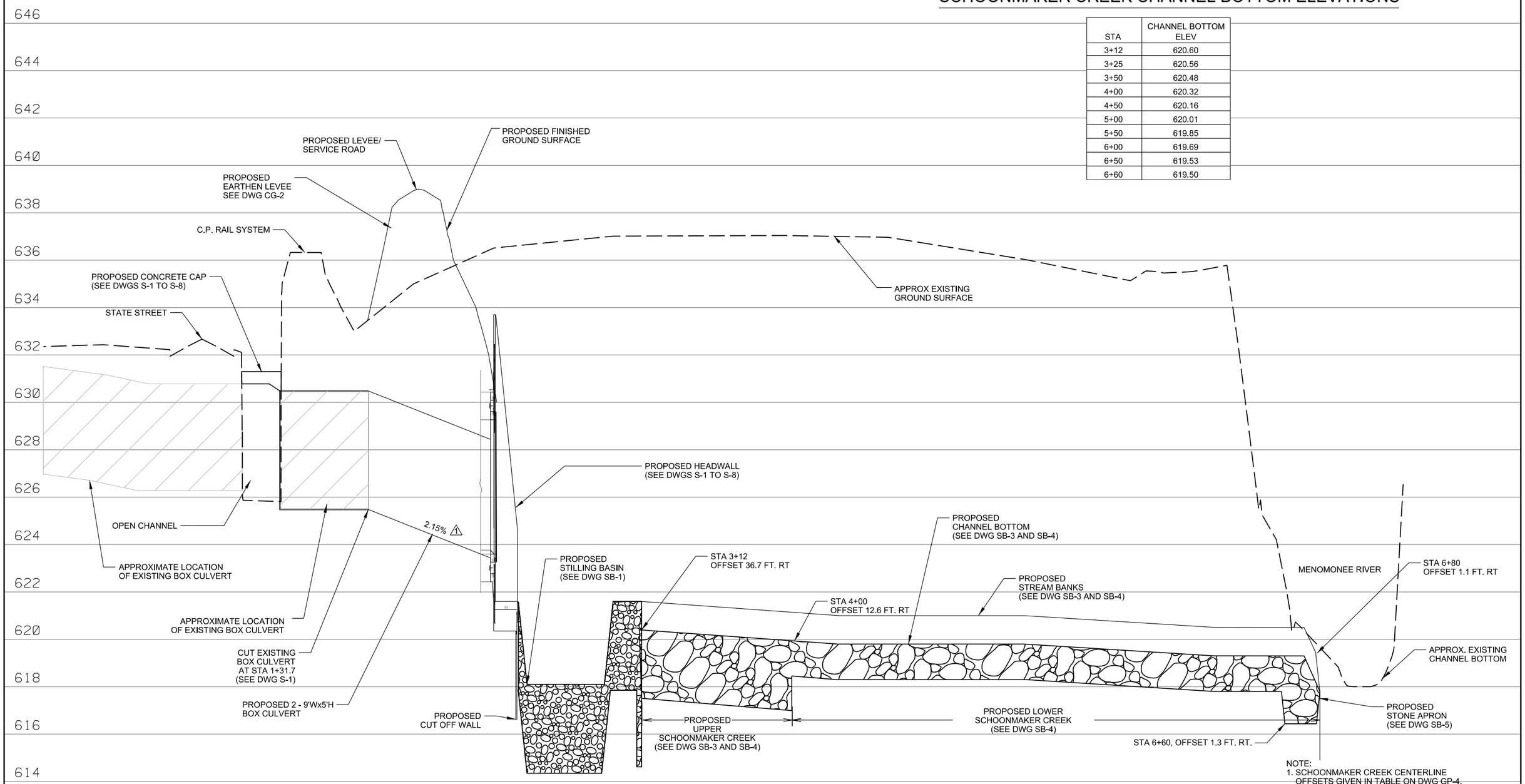
MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT
WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
GENERAL
INDEX TO DRAWINGS

DRAWING NO.:	G-2
SHEET:	2
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-697.dgn

SCHOONMAKER CREEK CHANNEL BOTTOM ELEVATIONS

STA	CHANNEL BOTTOM ELEV
3+12	620.60
3+25	620.56
3+50	620.48
4+00	620.32
4+50	620.16
5+00	620.01
5+50	619.85
6+00	619.69
6+50	619.53
6+60	619.50



NOTE:
1. SCHOONMAKER CREEK CENTERLINE OFFSETS GIVEN IN TABLE ON DWG GP-4.

2. SLOPE IS APPROX. 0.32% ALONG ALIGNMENT, THEREFORE ACTUAL SLOPE WILL BE LESS DUE TO THE MEANDERING OF THE LOW FLOW CHANNEL.

SCHOONMAKER CREEK PROFILE - LOOKING EAST (ALONG CHANNEL CENTERLINE)

HORIZ 1" = 30'
VERT 1" = 2"

SEE DWG GP-4

RECORD DRAWING

VERIFY SCALES
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0" 1"
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DR	M. POLINSKE
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REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - PER REDLINE CHANGES	MJP	JCM

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MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A

GRADING
SCHOONMAKER CREEK PROFILE

DRAWING NO.:	GP-5
SHEET:	18
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-713.dgn

DRAWING NOTES

GENERAL STRUCTURAL NOTES

THE DRAWINGS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MEASURES SHALL INCLUDE, BUT NOT BE LIMITED TO, BRACING, SHORING FOR LOADS DUE TO CONSTRUCTION EQUIPMENT, BERMS FOR FLOOD PROTECTION, ETC. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S MEANS, METHODS, TECHNIQUES SEQUENCES OR PROCEDURES OF CONSTRUCTION, OR THE SAFETY PRECAUTIONS AND THE PROGRAMS INCIDENT THERETO.

THE INFORMATION SHOWN ON THE DRAWINGS CONCERNING TYPE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OR HER OWN DETERMINATION AS TO THE TYPE AND LOCATION OF UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO.

REMOVE EXISTING BOX CULVERT AS SHOWN AND BACKFILL PER SPECIFICATION SECTIONS 02210 AND 02228.

CHAMFER THE EXPOSED EDGES OF CONCRETE 3/4" UNLESS NOTED OTHERWISE.

CONSTRUCTION JOINTS SHOWN ARE OPTIONAL. CONSTRUCTION JOINTS MAY BE OMITTED AT THE CONTRACTOR'S OPTION, AND MAY BE RELOCATED OR ADDED ONLY IF APPROVED BY THE ENGINEER.

A 12" THICK MINIMUM SECTION OF GRANULAR BACKFILL IS REQUIRED BEHIND WING WALLS.

THE CONCRETE IN THE CUTOFF WALL MAY BE PLACED UNDERWATER IF THE EXCAVATION CAN NOT BE DEWATERED.

DESIGN DATA

REINFORCED CONCRETE f'c = 4,000 PSI
REINFORCEMENT ASTM A 615 GRADE 60 OR ASTM A617 GRADE 60

BOX CULVERT IS DESIGNED FOR 13.2 FEET OF BACKFILL PLUS 240 PSF LIVE LOAD SURCHARGE.

DESIGN CODES

USACE EM 1110-2-2104 STRENGTH DESIGN FOR REINFORCED CONCRETE HYDRAULIC STRUCTURES

ACI 318-11 BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE

REINFORCING DETAILS

UNLESS OTHERWISE SHOWN, CONC. WALLS AND SLABS SHALL BE REINFORCED AS FOLLOWS:
- #4@12" EW CENTER OF 6" SECTIONS;
- #5@12" EW CENTER OF 8" SECTIONS;
- #4@12" EW EF OF 10" SECTIONS;
- #5@12" EW EF OF 12" SECTIONS.

SINGLE MAT REINF. SHALL BE AT CENTER OF SECTION.

UNLESS OTHERWISE SHOWN, MIN CLR FOR REINF BARS SHALL BE AS FOLLOWS:
- UNFORMED SURFACES IN CONTACT WITH FOUNDATION ____ 4"
- FORMED AND SCREEDED SURFACES
  - EQUAL TO OR GREATER THAN 24 INCHES IN THICKNESS ____ 4"
  - GREATER THAN 12 INCHES AND LESS THAN 24 INCHES IN THICKNESS ____ 3"
  - EQUAL TO OR LESS THAN 12 INCHES IN THICKNESS ____ 2"

TERMINATE BARS WITH STANDARD 90° HOOKS WHERE SHOWN IN THE PLANS.

REINF. BENDS AND LAPS SHALL SATISFY THE FOLLOWING MINIMUM REQUIREMENT:

LAP SPLICE	#3	#4	#5	#6	#7	#8
TOP BARS	1'-7"	2'-1"	2'-7"	3'-2"	4'-7"	5'-3"
OTHER BARS	2'-1"	2'-9"	3'-5"	4'-1"	5'-11"	6'-9"

90° HOOK	#3	#4	#5	#6	#7	#8
STD. HOOKS	6"	8"	10"	1'-0"	1'-2"	1'-4"

RECORD DRAWING

VERIFY SCALES
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0" ——— 1"
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DSGN	M. MATHU
DR	M. MATHU
CHK	B. JELENIK
APVD	T. DEIBERT

This Design Prepared For MMSD By:
HNTB
In Association With:
OTIE
Oneida Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - NO REDLINE CHANGES	MJP	JCM

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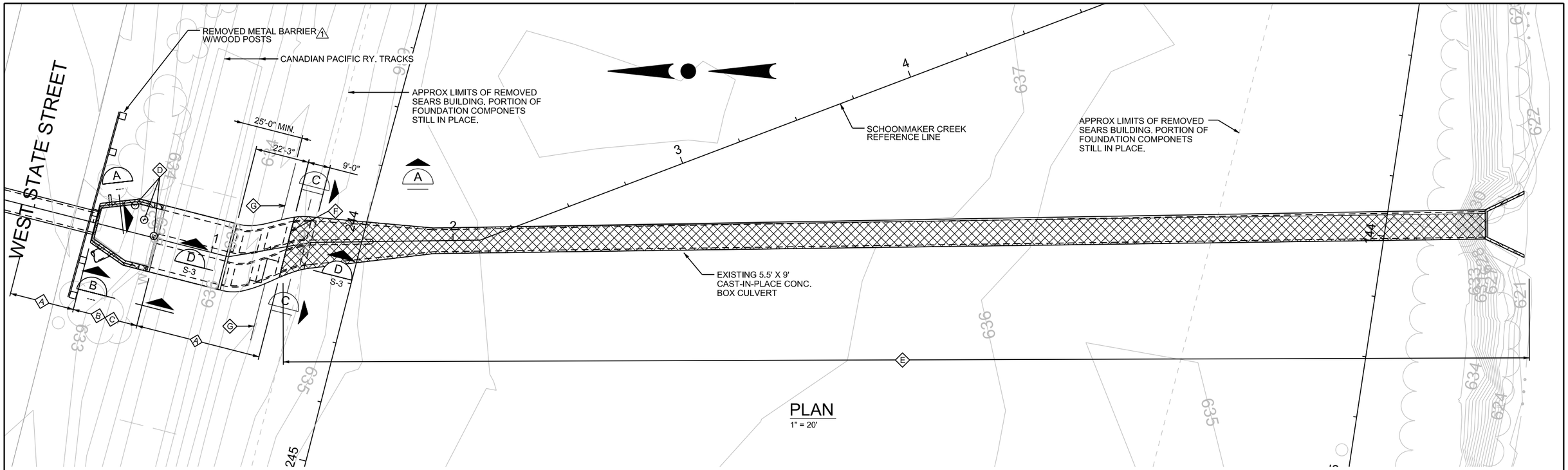
PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
SCHOONMAKER CREEK BOX CULVERT
STRUCTURAL
STRUCTURAL NOTES

DRAWING NO.:	S-1
SHEET:	40
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-736.dgn



DRAWING NOTES

A. SEE DWG. SP-4 FOR ACCESS AND STAGING PLAN.

B. SEE DWG. SP-5 FOR REMOVALS AND ABANDONMENT PLAN.

PLAN NOTES

(A) NO REMOVAL IN THIS AREA.

(B) REMOVE RAILINGS AND ROUGHEN THE TOP SURFACE OF CHANNEL WALL TO 1/4" MIN. AMPLITUDE IN THIS AREA.

(C) REMOVE SEDIMENT AND VEGETATION FROM CHANNEL.

(D) REMOVE STEEL ANGLES ATTACHED TO THE CHANNEL WALLS AND H-PILE IN THE CHANNEL. THE PORTION OF THE H-PILE EMBEDDED IN THE FLOOR MAY BE LEFT IN PLACE.

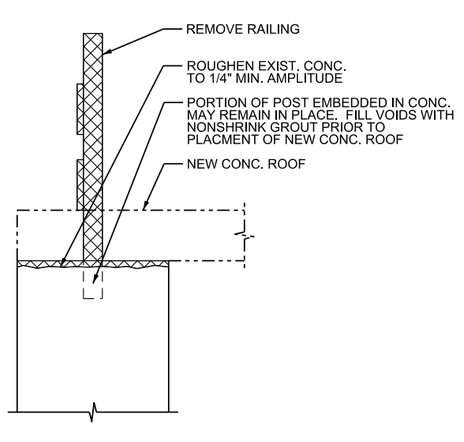
(E) REMOVE THE ENTIRE BOX CULVERT AND HEAD WALL IN THIS AREA.

(F) SAW CUT ENTIRELY THROUGH THE CONCRETE OR GRIND SMOOTH AT LOCATIONS WHERE NEW EXPANSION JOINT FILLER ABUTS THE EXISTING STRUCTURE.

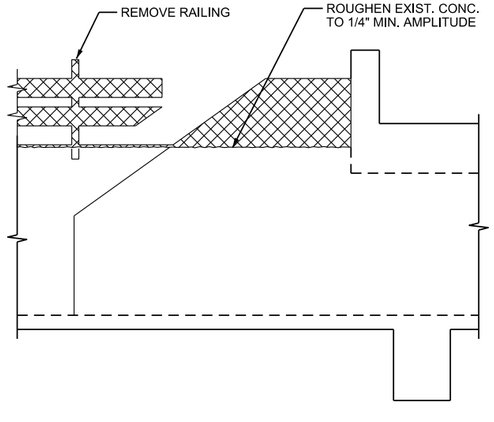
(G) TEMPORARY SHORING ALONGSIDE CANADIAN PACIFIC RAILWAY TRACKS FOR EXCAVATION AND REMOVAL OF BOX CULVERT. THE SHORING SHALL BE CAPABLE OF WITHSTANDING COOPER E-80 LIVE LOAD SURCHARGE AND IN COMPLIANCE WITH OSHA REQUIREMENTS. REFER TO THE SPECIFICATIONS REGARDING THE SUBMITTAL OF SHOP DRAWINGS, DETAILED PLANS, AND COMPUTATIONS FOR TEMPORARY CONSTRUCTION NEAR THE TRACKS. INCLUDE IN THE SUBMITTAL THE PROPOSED METHOD OF INSTALLATION AND REMOVAL OF THE SHORING.

LEGEND

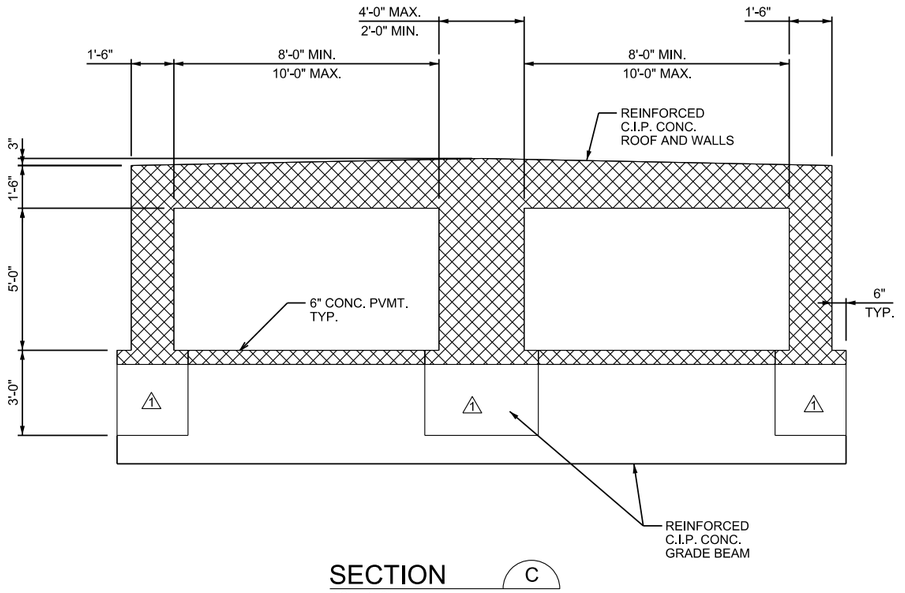
EXIST. STRUCTURE TO BE REMOVED.



SECTION A
1" = 1'-0"



SECTION B
3/8" = 1'-0"



SECTION C
3/8" = 1'-0"

RECORD DRAWING

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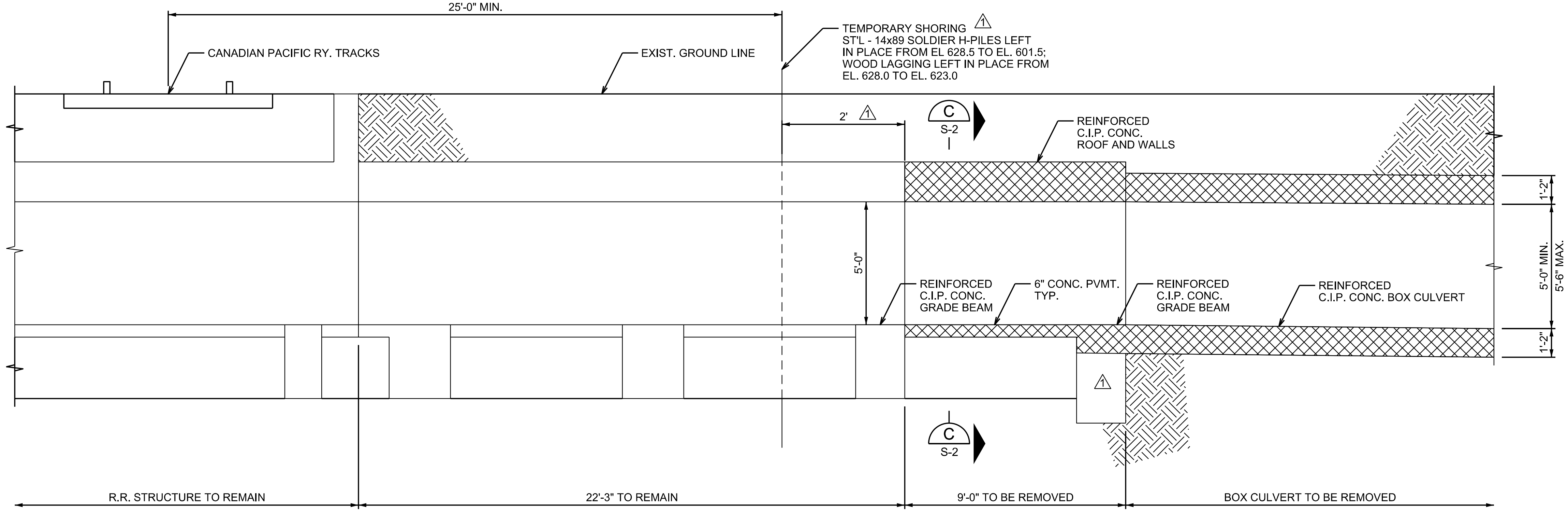
				REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD

MMSD PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
SCHOONMAKER CREEK BOX CULVERT
STRUCTURAL
REMOVALS AND PROTECTION (1 OF 2)

DRAWING NO.:	S-2
SHEET:	41
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-737.dgn



SECTION D
S-2
3/8" = 1'-0"

RECORD DRAWING

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DSGN M. MATHU
DR M. MATHU
CHK B. JELENIK
APVD T. DEIBERT

This Design Prepared For MMSD By:
HNTB
In Association With:
OTIE
Oneida Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - PER REDLINE CHANGES	MJP	JCM

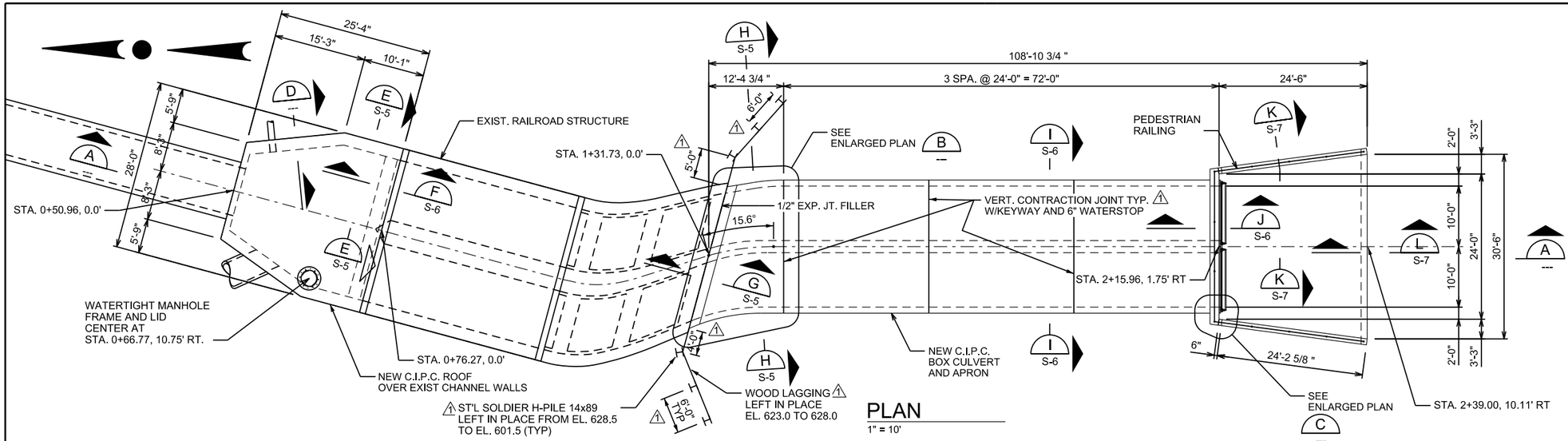
MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT
WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
SCHOONMAKER CREEK BOX CULVERT
STRUCTURAL
REMOVALS AND PROTECTION (2 OF 2)

DRAWING NO.:	S-3
SHEET:	42
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-738.dgn

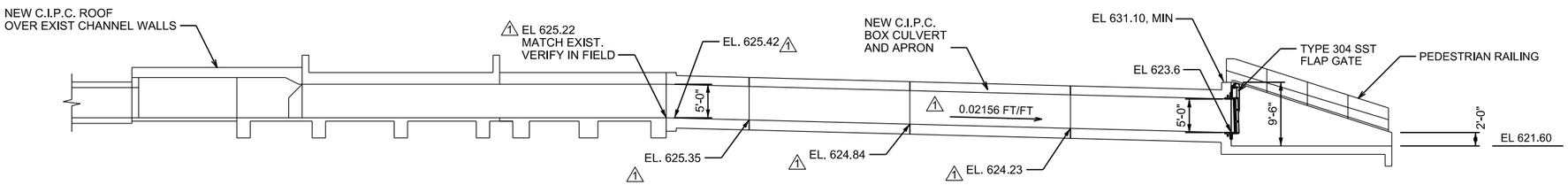
DRAWING NOTES

STATION OFFSET IN PLAN VIEW IS MEASURED TO C/L OF STRUCTURE.



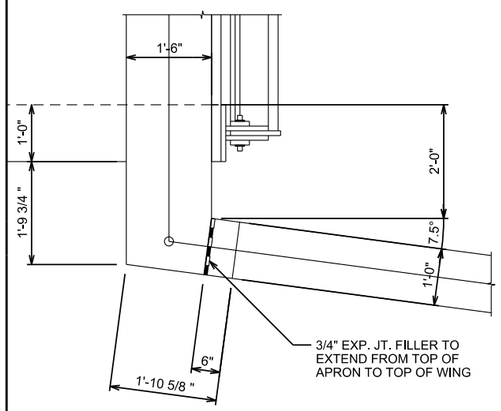
PLAN

1" = 10'



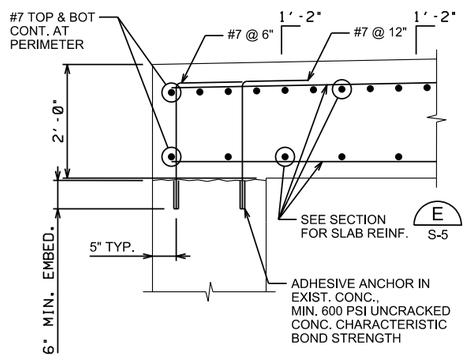
SECTION A

1" = 10'



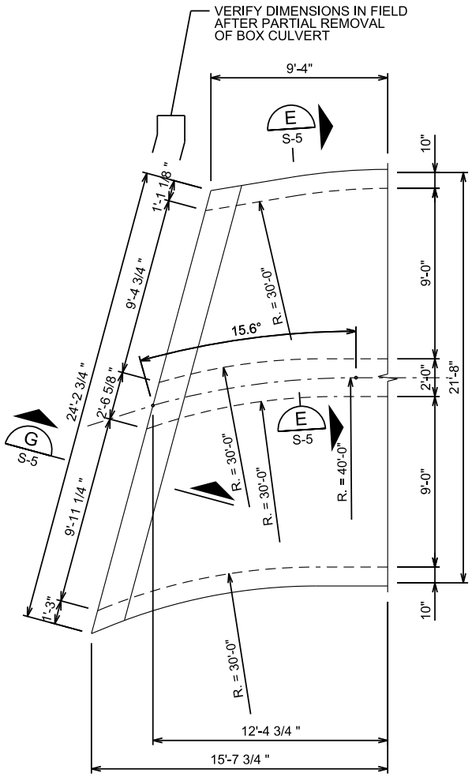
ENLARGED PLAN C

3/4" = 1'-0"



SECTION D

3/4" = 1'-0"



ENLARGED PLAN B

1/4" = 1'-0"

RECORD DRAWING

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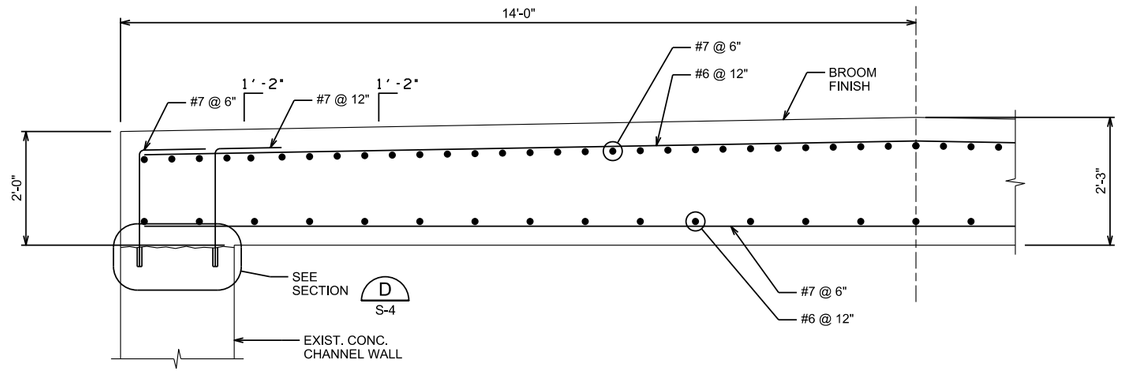
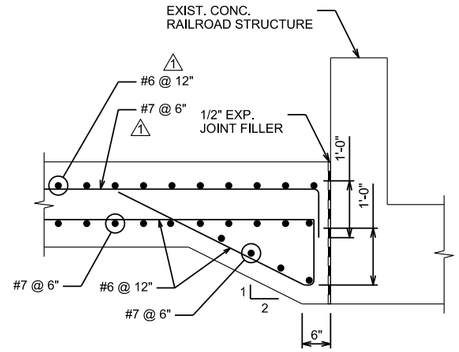
				REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD			



SECTION E
3/4" = 1'-0" S-4



SECTION F
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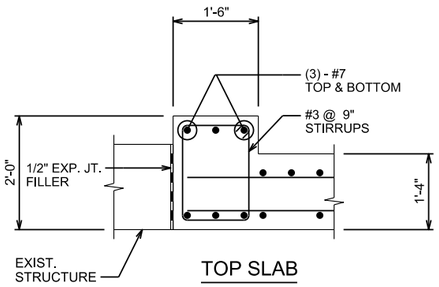
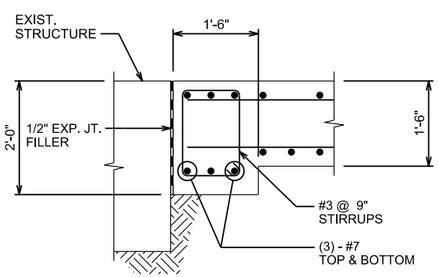
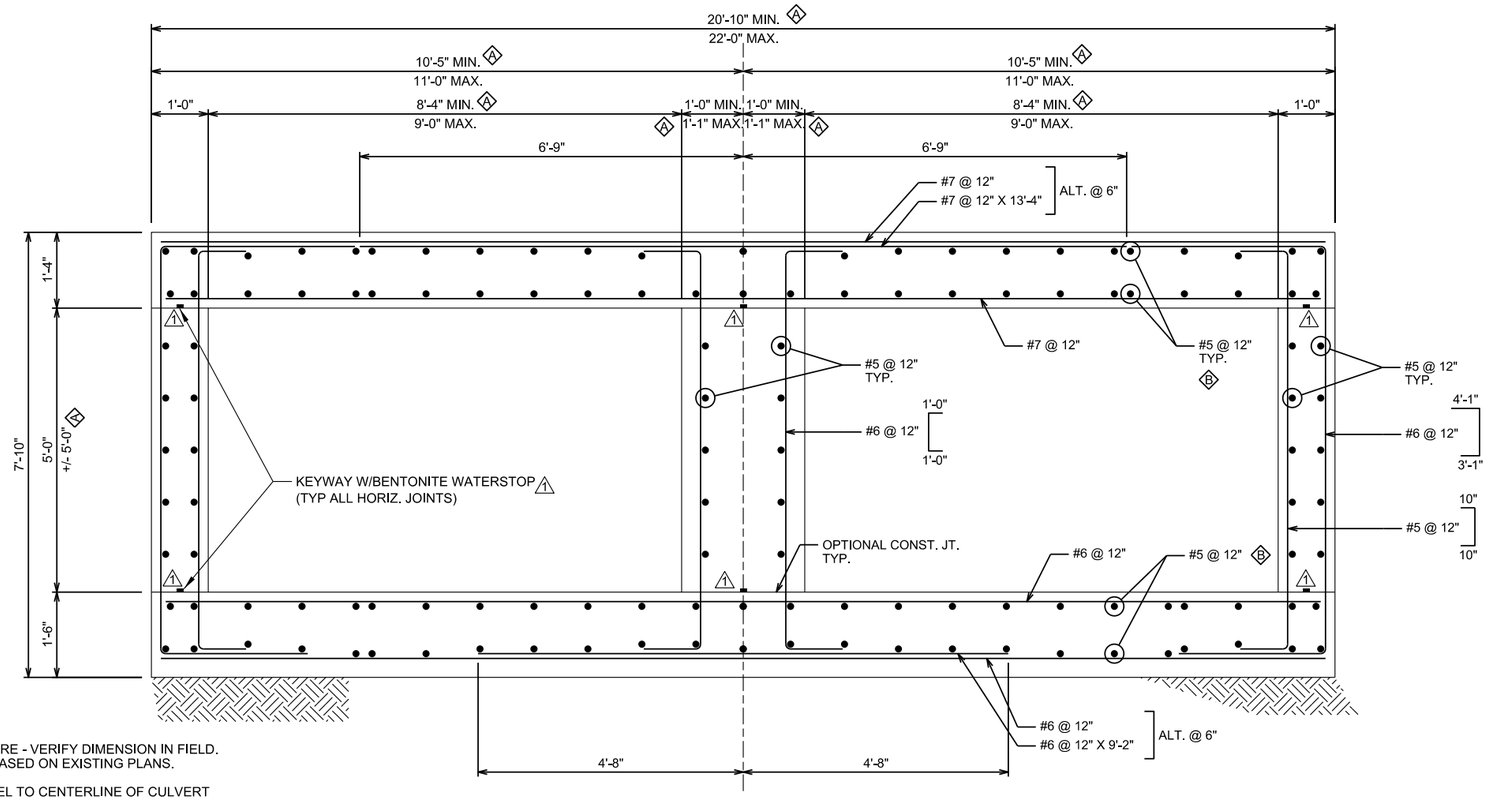


TOP SLAB



BOTTOM SLAB

SECTION G
3/4" = 1'-0" S-4



A MATCH EXIST. STRUCTURE - VERIFY DIMENSION IN FIELD. DIMENSION SHOWN IS BASED ON EXISTING PLANS.

B PLACE #5 BARS PARALLEL TO CENTERLINE OF CULVERT

SECTION H
3/4" = 1'-0" S-4

RECORD DRAWING

VERIFY SCALES
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0" 1"
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DSGN M. MATHU
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APVD T. DEIBERT

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REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - PER REDLINE CHANGES	MJP	JCM

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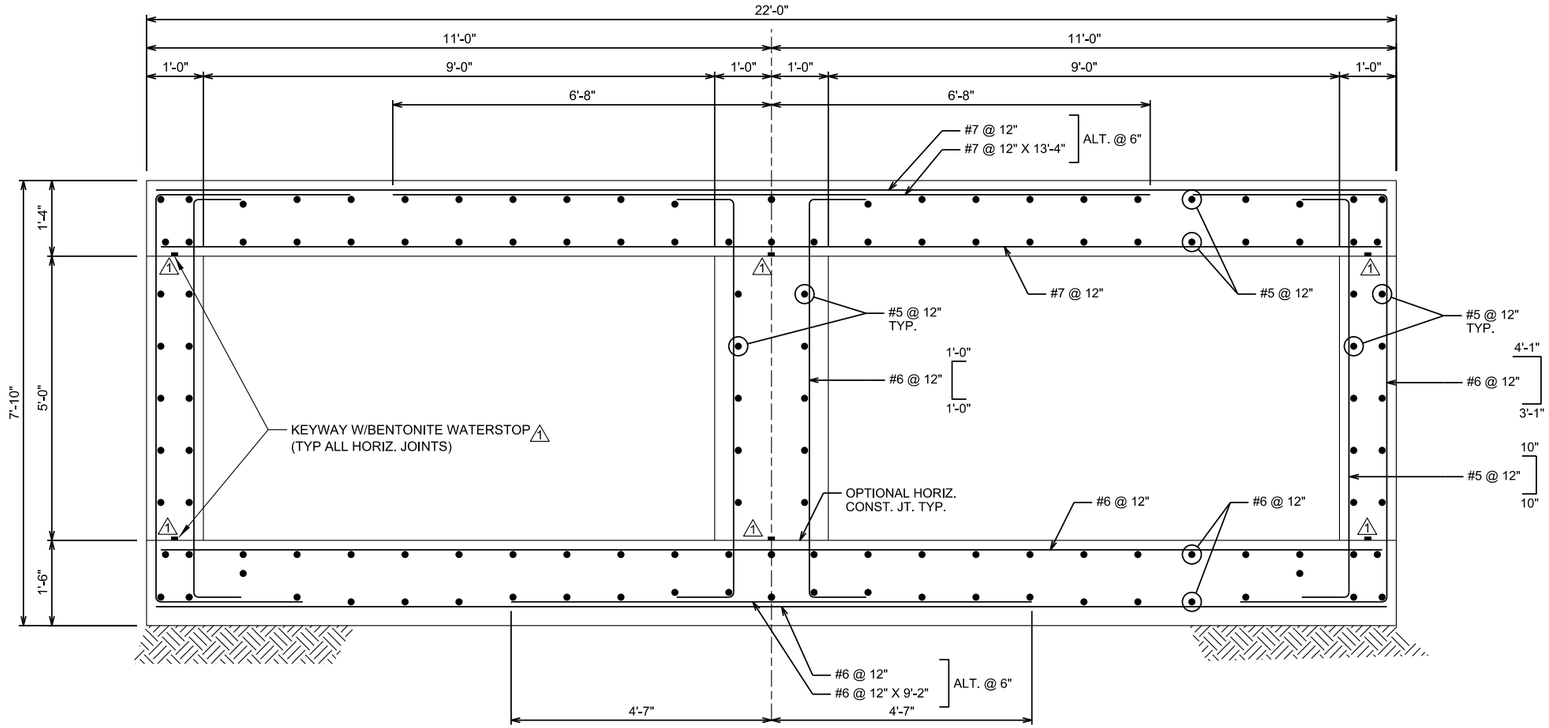
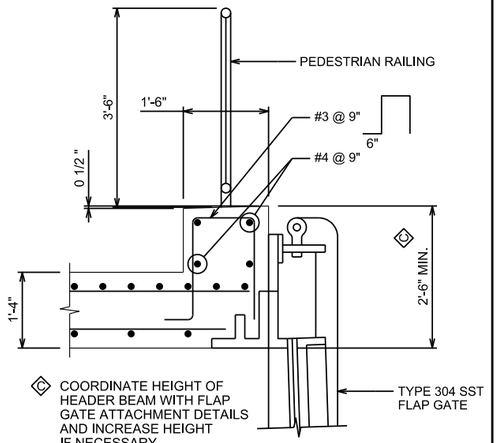
PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT
WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
SCHOONMAKER CREEK BOX CULVERT
STRUCTURAL
SECTIONS (1 OF 3)

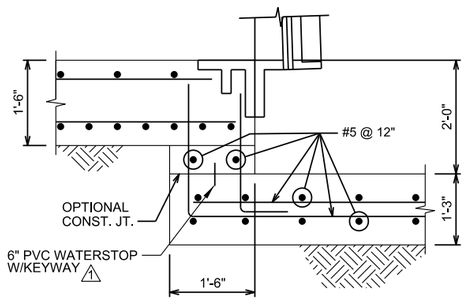
DRAWING NO.:	S-5
SHEET:	44
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-740.dgn



SECTION I
3/4" = 1'-0" S-4



TOP SLAB



BOTTOM SLAB

SECTION J
3/4" = 1'-0" S-4

RECORD DRAWING

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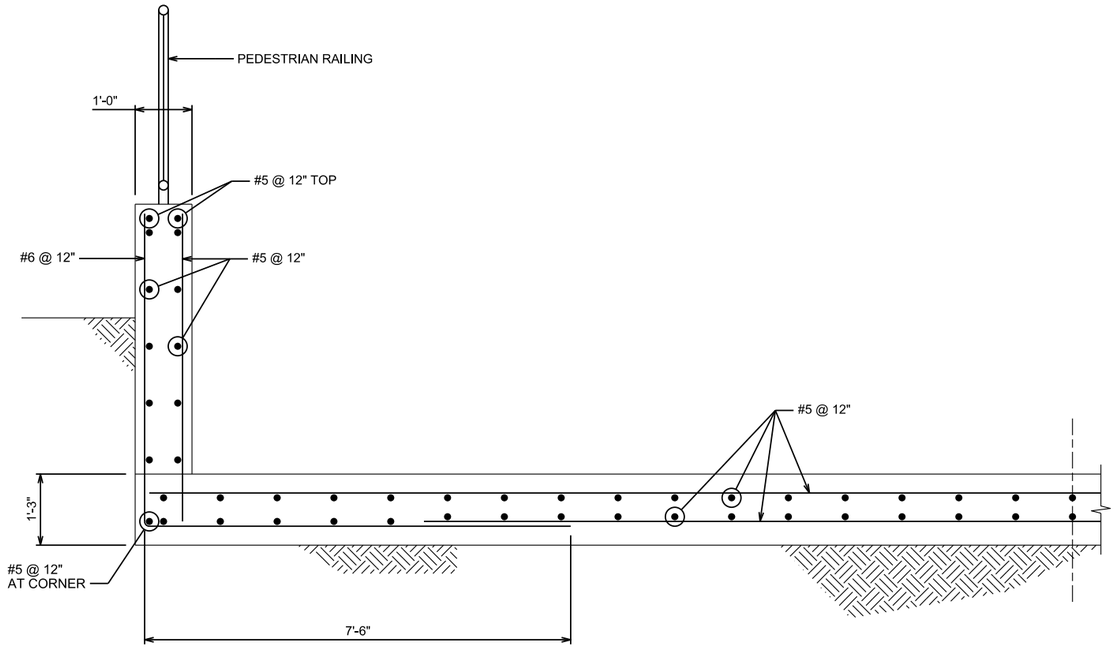
				REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD	

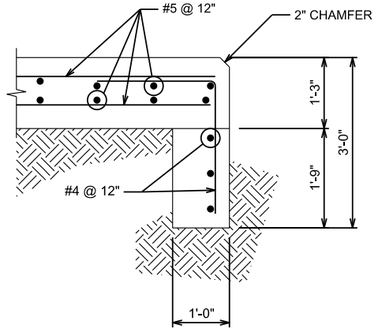
MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
SCHOONMAKER CREEK BOX CULVERT
STRUCTURAL
SECTIONS (2 OF 3)

DRAWING NO.:	S-6
SHEET:	45
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-741.dgn



SECTION K
3/4" = 1'-0" S-5



SECTION L
3/4" = 1'-0" S-4

RECORD DRAWING

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0" 1"
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DSGN	M. MATHU
DR	M. MATHU
CHK	B. JELENIK
APVD	T. DEIBERT

This Design Prepared For MMSD By:
HNTB
In Association With:
OTIE
Oneida Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - NO REDLINE CHANGES	MJP	JCM

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
SCHOONMAKER CREEK BOX CULVERT
STRUCTURAL
SECTIONS (3 OF 3)

DRAWING NO.:	S-7
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CONTRACT:	W20027C01
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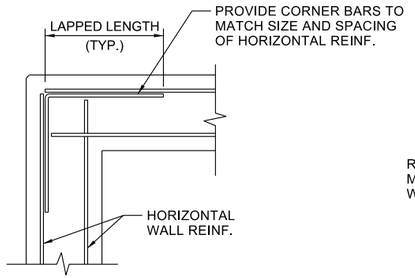

SECTION PLAN OF WALL DETAIL
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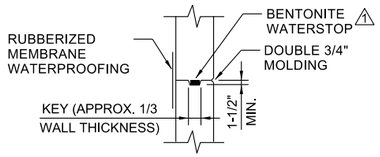

CONSTRUCTION JOINT DETAIL
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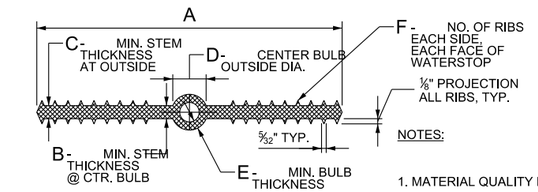
1 DETAIL REMOVED

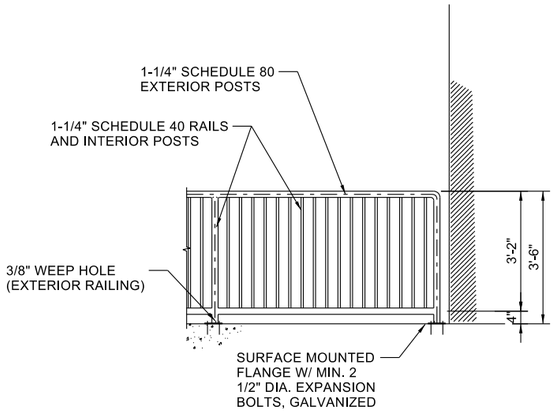


SIZE	A	B	C	D	E	F
6" x ⅜"	6"	⅜"	⅜"	⅞"	¼"	6

NOTES:

1. MATERIAL QUALITY PER SPECIFICATIONS.
2. DIM. REQUIREMENTS INDICATED SHOULD BE GIVEN TO SUPPLIERS PRIOR TO PLACING ORDER.
3. NON-ROUND CENTER BULBS SHALL HAVE A MIN. OUTSIDE DIM. OF D.

PLASTIC WATERSTOP
NTS



TYP. PEDESTRIAN RAILING DETAIL
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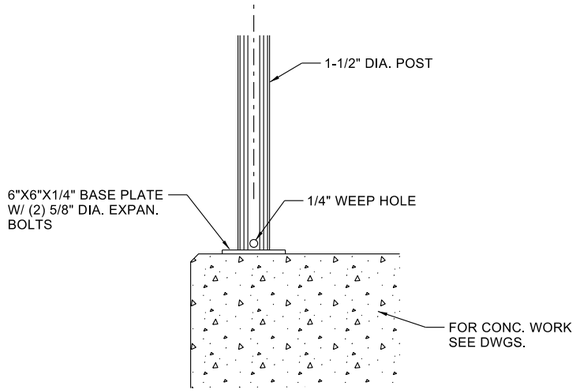

SURFACE MOUNTED PEDESTRIAN RAILING DETAIL
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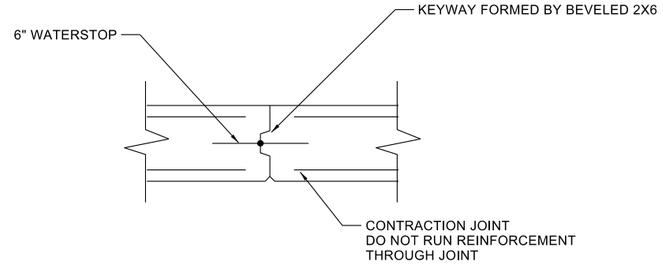

CONTRACTION JOINT DETAIL
NTS

RECORD DRAWING

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DR M. MATHU
CHK B. JELENIK
APVD T. DEIBERT

This Design Prepared For MMSD By:
HNTB
In Association With:
OTIE
Oneida Total Integrated Enterprises

REV. NO.	DATE	REVISION DESCRIPTION	BY	APVD
1	03/2016	RECORD DRAWING - PER REDLINE CHANGES	MJP	JCM

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT
WATERCOURSE
WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT PHASE 2A
STRUCTURAL
SCHOONMAKER CREEK BOX CULVERT MODIFICATION DETAILS

DRAWING NO.:	S-8
SHEET:	47
DATE:	MARCH, 2016
CONTRACT:	W20027C01
MMSD FILE:	151-743.dgn

Attachment H: Pipe Rehabilitation/Replacement for Levee Standards (Sanitary and Storm Pipe Condition Reassessment for the Hart Park and Western Milwaukee Levee System (MMSD Project No. W20034) – Final, Arcadis August 2023

ARCADIS

Milwaukee Metropolitan Sewage District

Sanitary and Storm Pipe Condition Reassessment for the Hart Park and Western Milwaukee Levee System (MMSD Project No. W20034) – Final

August 2023

Levee System at WI-175

Sanitary and Storm Pipe Condition Reassessment for the Hart Park and Western Milwaukee Levee System (MMSD Project No. W20034) - Final

Levee Engineering and Accreditation On-Call Services, Contract TS-2683

August 2023

Prepared By:
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Prepared For:
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Our Ref:
30109039

Contents

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Acronyms and Abbreviations

Arcadis	Arcadis U.S., Inc.
CCTV	Closed Circuit Television Video
CFR	Code of Federal Regulations
CIPP	Cured in Place Pipe
EM	Engineering Manual
FEMA	Federal Emergency Management Agency
JOS	Joint Offset Small
JSS	Joint Separated Small
LMA	Levee Management Area
Master Plan	Hart Park and Western Milwaukee Levee System Accreditation Master Plan
MH	Manhole
Michels	Michels Trenchless, Inc
NFA	No Further Action
District	Milwaukee Metropolitan Sewerage District
NASSCO	National Association of Sewer Service Companies
PACP	Pipeline Assessment and Certification Program
TREKK	TREKK Design Group, LLC
US	United States
USACE	United States Army Corps of Engineers

1 Introduction

This report evaluates known sanitary and storm sewer pipes located within the Hart Park and Western Milwaukee Levee System. The pipes reviewed within the context of this report were previously inspected by other consultants for the Milwaukee Metropolitan Sewerage District (District). Arcadis was tasked with reviewing the inspection records of the stormwater and sanitary sewer pipes and providing alternative corrective action recommendations where different from the original recommendations. Arcadis was also tasked with inspecting any sanitary or storm sewer pipes where information did not exist or previously collected information was not sufficient to make a condition assessment.

This report follows the same general procedural and regulatory standards (Title 44 Code of Federal Regulations Part 65.10 (CFR 65.10) [1] as used in the Hart Park and Western Milwaukee Levee System Accreditation Master Plan (Master Plan)[2].[2] Detailed evaluation criteria are not listed in 44 CFR 65.10; hence, evaluation methods presented in United States Army Corps of Engineers (USACE) Engineer Manual (EM) 1110-2-1913 Design and Construction of Levees[3] and USACE EM 1110-2-2902 Conduits, Pipes, and Culverts Associated with Dams and Levee Systems[4] dated 31 December 2020 were used.

It is our understanding that the Master Plan Pipe Penetration Evaluation was in part based on guidance from EM 1110-2-2902 Conduits, Culverts and Pipes originally dated 31 October 1997. Significant changes occurred from EM 1110-2-2902 dated in 1997 to the revised EM 1110-2-2902 dated December 2020 used as guidance for this evaluation. Some notable changes in the current EM 1110-2-2902 were regarding inspection limits related to structural integrity and operation adequacy, evaluating risk, guidance on nonessential pipes and inspection frequency.

USACE EM 1110-2-1913 requires that existing pipes through or in the foundation of levees meet the following requirements:

- Be in good condition
- Have adequate strength to withstand levee loading
- Have sufficient flexibility in joints to adjust under expected settlement
- Have provisions for emergency closure in the event of inoperable flap gate, backflow from river, leakage, or rupture
- Be backfilled with pervious material for a third of the levee width on the landside where soil materials are susceptible to piping
- Abandoned pipes are removed or sealed, preferably by completely filling with concrete/grout
- Have no seepage or settlement issues associated with pipes if abandoned in-place

EM 1110-2-2902 requires that all storm and sanitary pipe penetrations meet the following requirements:

- Be assessed using the Pipeline Assessment and Certification Program (PACP) guidelines published by the National Association of Sewer Service Companies (NASSCO).
- Although EM 1110-2-2902 defines these storm and sanitary pipes as nonessential pipes in Section 6.10.2 (i.e. pipes that are not necessary for the operation of the dam or levee which typically consist of utility crossings), MMSD has indicated they would like to utilize the same inspection frequency specified for essential pipes because it is important to understand the condition of these pipes within the levee since if are

compromised they could impact the levee, which requires them to be inspected at recurring intervals based on the pipe PACP ratings:
  - If pipe was not inspected before (or there is no record of inspection), inspect now
  - If post-installation inspection was performed but the follow up inspection was not performed within 5 years, inspect now
  - Pipes rated a 1 or 2 using the PACP coding system, inspect at least every 10 years
  - Pipes rated a 3 using the PACP coding system, inspect at least every 5 years
  - Pipes rated a 4 or 5 using the PACP coding system, inspect at least every 5 years until mitigated (including repair, rehabilitation, removal [with or without replacement] or decommissioning)
- Pipes larger than 48 inches and in a safe condition are expected to be inspected using a walk-through method.
- Pipes less than 48 inches in diameter are inspected using remote cameras or another video technology, depending on the pipe submergence factors.
- Be inspected with the following methods:
  - When no water is present inside the pipe, a closed-circuit television video (CCTV) or walk-through inspection should be performed
  - When pipe is partially submerged, a hybrid method with CCTV above water and sonar below water inspection should be performed
  - When pipe is submerged, a sonar inspection should be performed
- Pipes rated a 4 or 5 using the PACP coding system, are suggested to be replaced or repaired. PACP defect codes for pipes associated with dams and levees are generally coded with higher numerical ratings than other pipes. However, engineering judgment may be used to justify whether the pipe is in an acceptable or unacceptable condition.

1.1 Background

As shown in Figure 1-1, the Hart Park and Western Milwaukee Levee System extends from the upstream end on the left descending bank of the Menomonee River at the west end of Hark Park, near the west end of Hart Park Lane, and ends downstream with a hanging levee at the intersection of the left descending bank of the Menomonee River and State Highway 175 (STH 175). The system also includes a levee and floodwall on the right descending bank of the Menomonee River. The Hart Park and Western Milwaukee Levee System was built under five separate construction contracts known as (from upstream to downstream):

1. Hart Park
2. Phase 2A
3. 59th and State Pump Station
4. Phase 2B
5. Phase 1

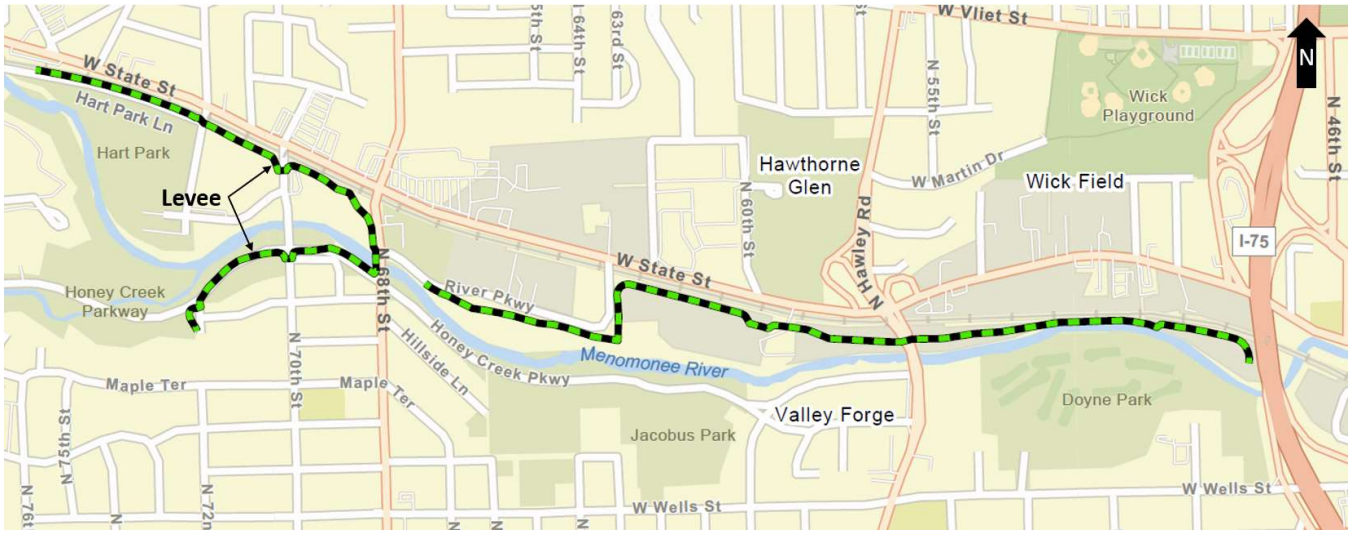

Figure 1-1 Hart Park and Western Milwaukee Levee System

The pipe penetrations were previously inspected by Stantec Consulting Service Inc. on behalf of the District as part of the Master Plan. The CCTV inspections were performed by TREKK Design Group, LLC (as a subcontractor to Stantec) between October 13, 2020 and October 22, 2020.

The District retained Arcadis to provide an independent review of the recommended pipe replacements and repairs outlined in the Master Plan (because the Master Plan recommendations were thought to be overly conservative), perform outstanding or missing inspections, and evaluate additional available pipe inspections near the levee management area for rehabilitation considerations.

1.2 Objective

The objective of the study described herein is to:

- Review/verify the previously-performed assessments of the stormwater and sanitary sewer pipe penetrations into the Hart Park and Western Milwaukee Levee System per CFR 65.10, EM 1110-2-1913, and EM 1110-2-2902 updated standards published in December 2020
- Fill in any data collection gaps of stormwater and sanitary pipe penetrations by performing CCTV or man-entry inspections
- Where appropriate, recommend alternative corrective actions for the pipes under review

2 Pipe Penetrations

The following sections describe Arcadis's efforts to review/verify the previously-performed assessments of the stormwater and sanitary sewer pipe penetrations for the Hart Park and Western Milwaukee Levee System.

2.1 Pipe Penetration Inventory

Arcadis reviewed the video inspections and other materials developed during the Master Plan condition assessment as well as inspections of additional pipes in the vicinity of Hart Park provided by the District. A

modified version of the Master Plan pipe penetration inventory that shows only the sanitary and storm sewer assets is provided as Appendix A; maps are provided in Appendix C. For the purposes of this study, Arcadis focused only on the stormwater and sanitary pipe penetrations, totaling 129 pipes (a pipe means a pipe reach from one access point to another access point) from the Master Plan, plus 21 additional pipes added by MMSD (it was later determined that one of the original master plan pipes does not exist, one pipe was split into two records since it was parallel pipes, and four of the additional pipes were already in the original Master Plan list, so a total of 146 pipes are included in this report). Pipes that were identified as requiring no further action in the Master Plan are included in the inventory reported but were not re-evaluated under this study. Gas, potable water, electric, telecommunications, and other ducts/asset lines were not reviewed as part of this study but recommendations for future monitoring are included in Section 2.5.2.

2.2 CCTV Inspection

Standard CCTV video inspection techniques were used to document the existing condition of the pipe penetration. Inspection videos from various years between 2011 and 2020 were provided by the District for incorporation into this evaluation. The following additional inspections were performed by Michels in 2022 as part of the Arcadis task order for this report (See Appendix B):

- MIS 07010 (P2543, asset 136939): 335 LF 24-inch VCP. Crosses river south of Hart Park stadium.
- MIS 07002 (P1438, asset 136932): 207 LF 36-inch monolithic (1924). Crosses river east of 68th Street.
- MIS 32406 (P2708, asset 137246) and 32406B (P10222, asset 137248): 176 + 35 LF 96-inch monolithic (1972). South of W. State Street at pump station site.
- City of Wauwatosa parallel 6-inch sanitary siphons (asset 151412, 258 LF each) crossing the river at North 63rd Street. Push-camera inspection was performed on the downstream portion of each of these pipes (~85 LF) within the levee management area.

2.3 Abandonment Investigation

A stormwater box culvert located under the North Hawley Rd Bridge contains many connections that were identified in the Master Plan to be abandoned. MMSD requested that Arcadis review the connections shown in Figure 2-1 to determine if there was evidence indicating whether they were active. The information included in the Master Plan was generally inconclusive, so the Arcadis team retained Michels Trenchless, Inc. (Michels) and Mid City Corporation (Mid City) to perform field investigations to gather additional evidence to support a determination as to whether certain pipes were active or could be abandoned.

Michels Investigation: On September 2, 2022, Michels attempted to flush with water a pipe connected to a drain from the overhead bridge of North Hawley Road to determine where it connects to the box culvert. The actual inlet on the bridge was clogged, so Michels flushed water around the pipe as it went below ground (See Figure 2-2 and Figure 2-3), but the volume of water entering the drain pipe was limited. No infiltration was observed in the box culvert; therefore, the point of connection from the bridge drain into the box culvert was not determined. Because this bridge deck drain is likely connected to an underground pipe that is clogged or collapsed (based on the 2020 TREKK CCTV inspections of the box culvert connections in this area) and based on discussions with the District, Arcadis recommends managing the drainage from the bridge deck at this location by reconfiguring the bridge deck drains to discharge to an appropriate location at grade and abandoning the below grade pipe.

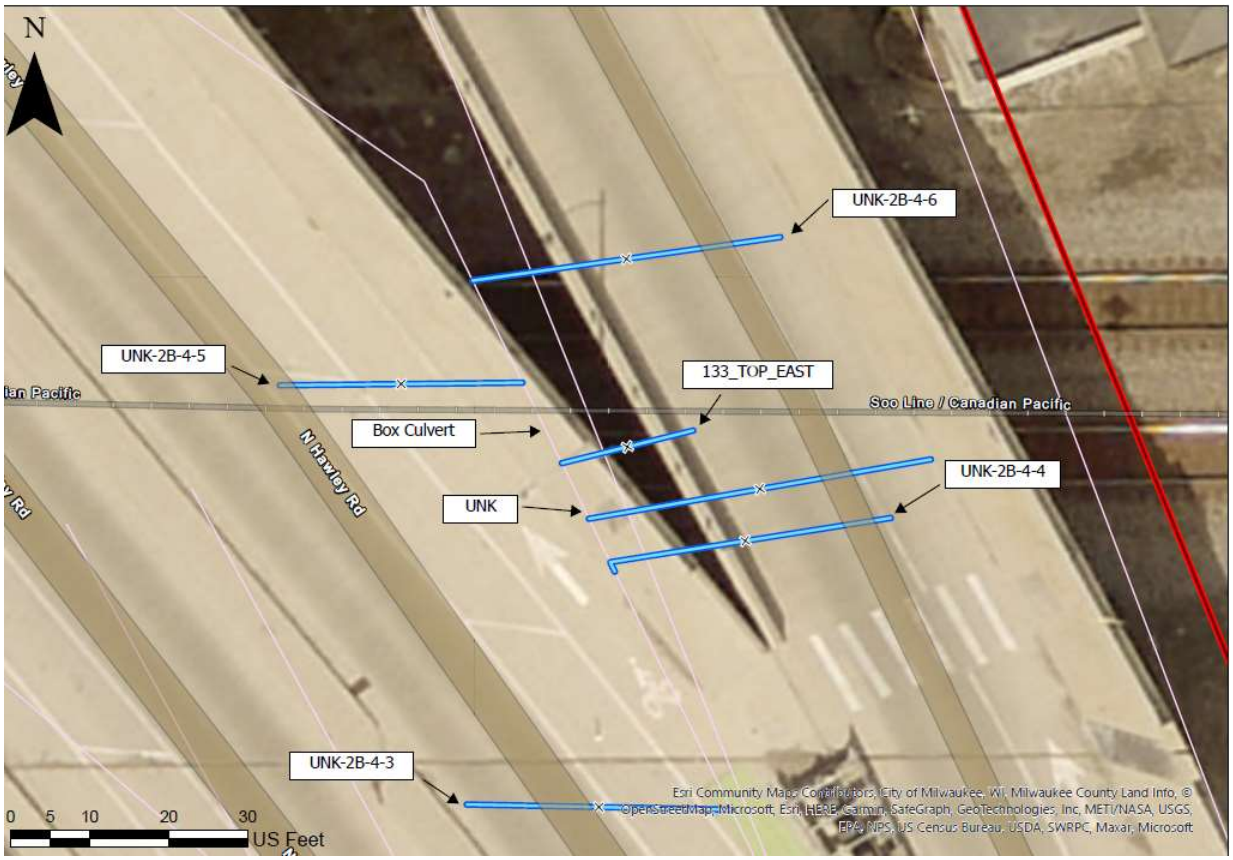

Figure 2-1 Box Culvert Tap Locations

Figure 2-2 Box Culvert Flush Test Location for North Hawley Road Bridge Inlet Drain

Figure 2-3 Box Culvert Flush Test Location Showing Flushing Hose

In addition to the flush testing, Michels inspected the following connections in the box culvert to determine if they can be abandoned:

- UNK-2B-4-3 (aka 152015), STA 75.7 (Michels STA 70.7 on Box Culvert inspection report) – Michels video inspection shows blockage. Recommendation: Abandon.
- STA 129.9 (Unknown asset ID) (Michels STA 142.9) – Michels photograph shows blocked connection. Recommendation: Abandon.
- 133_TOP_EAST, STA 133.1 (Michels STA 144.8) – Michels video inspection showed the pipe was75 percent full of debris, but evidence of flow lines above debris. This was later subject to smoke testing by Mid City (discussed below), which did not confirm any active connection. Recommendation: Based on discussions with the District, Arcadis recommends that this line be abandoned as no potential active connection has been identified.
- UNK-2B-4-5 (aka 152018), STA 148.6 (Michels STA 152.2) – Michels video inspection shows pipe full of rocks. Recommendation: Abandon.
- UNK-2-B-4-6 (aka 152019), STA 168.4 (Michels STA 172.7) – Michels video inspection shows open pipe until pipe goes vertical and inspection camera cannot pass. Mid City performed smoke testing (discussed below) and confirmed this is an active drain connected to the bridge deck drains. Based on the survey information provided by MMSD which shows the ground surface elevation at this location to be 3.54 feet above the base flood elevation, this connection does not require a closure device. Recommendation: No further action.

Note that UNK-2B-4-4 was not inspected because the Master Plan video showed it was blocked with brick or concrete block and referred to it as capped; Arcadis recommends it be abandoned. With the exception of the pipes listed above, Arcadis did not review any pipe penetrations designated in the Master Plan as “abandoned” as part of this study.

Mid City Investigation: On December 12, 2022, Mid City (accompanied by the District and the Arcadis team) performed smoke testing of two connections to the box culvert that were considered potentially active. Smoke testing the 133_TOP_EAST connection did not result in any observed smoke emissions at grade, in nearby Saz's restaurant, or on the North Hawley Road bridge deck. As shown in Figure 2-4, smoke testing UNK-2-B-4-6 (aka 152019) resulted in smoke emissions observed on the overhead bridge deck drain, thereby confirming this is an active connection.

Figure 2-4 Smoke Emissions from Box Culvert Connection UNK-2-B-4-6 (aka 152019)

2.4 Ratings

The Master Plan condition assessment utilized the NASSCO's PACP rating system for condition assessment and defect logging. Both structural as well as operation and maintenance defects were rated on a 1 to 5 scale, with 1 being the least severe defect and 5 being the most severe defect. Arcadis did not rescore the pipes' penetrations or reevaluate their "pass" or "fail" status. Instead, Arcadis focused on the overall condition of the pipes and the recommended work plan consistent with NASSCO's written PACP program that indicates "…it will be the engineer who must take the documented visual observations of the pipe's current condition, put them into their proper context with respect to the need for renewal/repair…" Arcadis reviewed and revised the pipe rehabilitation and replacement recommendations in the Master Plan which were based in some cases upon mischaracterization of defects. The following sections describe some examples of how the pipe evaluation recommendations in this report differ from the Master Plan. Although this report's reassessment does in some cases revise Master Plan recommendations, Arcadis believes that the recommendations of this report will still meet FEMA levee

accreditation with regard to the sanitary sewer and storm pipes provided the recommendations herein are completed and ongoing inspections continue.

2.4.1 Example 1 – Joint Separated Small (JSS)

According to the PACP definition of joint separations, small separations are not coded in sanitary or stormwater sewers and are only used in a dam or levee system where there is “noticeable separation between pipe segments, but no gap is visible.” The PACP condition score for a JSS associated with a dam or levee is 5, which is the most severe rating. According to EM 1110-2-2902, a condition rating of 5 would require mitigation. Figure 2-5 shows examples of joints coded as JSS in the Master Plan that received condition grades of 5. However, because these joints show no evidence of infiltration or root intrusion, Arcadis believes they appear to be sound joints that do not require mitigation.

Figure 2-5 Examples of JSS from Master Plan

2.4.2 Example 2 – Joint Offset Small (JOS)

The Master Plan identified the pipes shown in Figure 2-6 as having small offset joints, which is a PACP condition grade of 4, which requires mitigation per EM 1110-2-2902. Arcadis believes these joints do not reflect an offset condition that warrants mitigation.

Figure 2-6 Examples of JOS from Master Plan

2.4.3 Example 3 – Reinforcement Projecting

The Master Plan incorrectly identified the conditions shown in Figure 2-7 as reinforcement projecting with a PACP condition grade of 4, which requires mitigation per EM 1110-2-2902. The reinforcement in these pipes is not visible or projecting. Therefore, Arcadis believes these appear to be sound pipes that do not require mitigation.

Figure 2-7 Examples of Reinforcement Projecting from Master Plan

2.5 Recommendations

The results of the Arcadis evaluation are summarized in Table 2-1. Specific recommendations for each evaluated pipe are included in the table provided in Appendix A and shown on the maps provided in Appendix C.

Table 2-1 Summary of Pipe Rehabilitation Recommendations

Recommended Rehabilitation	# Segments
No Further Action (includes abandoned pipes)	94
Abandon (includes Phase 2B)	24
Concrete Repairs	2
Cured-in-Place Pipe Lining	11
Grout Defects	8
Outfall Repair	1
Replace (includes partial replacement)	2
Test and Seal	4
Total	146

2.5.1 Sanitary Siphons

Asset 151412 consists of two parallel 6-inch cement-lined ductile iron sanitary siphons owned by the City of Wauwatosa (see Appendix D for as-built drawing of the siphons). These siphons cross the Menomonee River and terminate at a manhole located within the levee. All flow normally goes through the east siphon barrel. The west siphon barrel receives flow during wet weather or other high flow conditions. The CCTV inspection performed by Michels on October 7, 2022, included only the portions of the siphons downstream of the final 22.5-degree bends on the north side of the river (see Appendix E for Inspection Procedure for Siphon Pipes Downstream of Riser). On August 25, 2022, Michels attempted to dewater the siphons for a full CCTV inspection using a foam pig, but the 22.5-degree bends in the siphon resulted in loss of seal between the pig and the pipe resulting in the limited inspection peformed. The east siphon barrel showed spalling of the cement coating and corrosion of the iron pipe wall. The west siphon barrel showed very minimal evidence of pipe corrosion and the cement coating was largely intact. Arcadis evaluated several alternatives for rehabilitation of the portion of siphon that lays in the levee management area, as indicated in Table 2-2.

Table 2-2 Siphons Rehabilitation Alternatives

#	Alternative	Considerations
1a	CIPP line east barrel within Levee Management Area (LMA), ~60–70ft	• No excavation • Rehabilitation limited to LMA • Blindshot liner.
1b	CIPP line east barrel up to just beyond 22.5-deg bend, ~90 ft	• No excavation • Liner extent covers entire observed area of deterioration including 22.5-degree fitting that was not cement-lined and corroding • Longer blindshot liner through a bend is higher risk of lining defects (e.g., wrinkles, resin slug, etc.) than Option 1a

#	Alternative	Considerations
2	CIPP line east barrel up to a new MH installed downstream of 22.5-deg bend (just past concrete encasement), ~70–80 ft	• CIPP lining between manholes is lower risk than blindshot CIPP • Extra cost of new MH, which will need watertight lid • Location of nearby water main and limits of concrete encasement will need to be confirmed
3a	Replace both barrels with single 8-inch pipe up to a new MH installed at boundary of LMA, ~60–70 ft	• New pipe is less likely to have defects than CIPP liner • Rehabilitation limited to LMA • Location of nearby water main and limits of concrete encasement will need to be confirmed
3b	Replace both barrels with 6-inch PVC within LMA (no new MH), ~60–70 ft	• New pipe is less likely to have defects than CIPP liner • No manhole installation reduces potential for conflict with water main • Rehabilitation limited to LMA

Arcadis recommends Alternative 3a, as presented in Table 2-1, Appendices A and B and Figure 2-8. This alternative includes open-cut replacement of the portion of the siphons within the levee management area and installing a new manhole with a watertight lid at the levee management area boundary. Appropriate levee reconstruction measures will need to be taken for any excavation within the levee. There is a nearby water main that could potentially interfere with the installation of a new manhole at the levee management area boundary. Furthermore, portions of the water main and siphons were installed with concrete encasement, but the exact terminus of the concrete encasement is unknown. Therefore, as part of the design for replacement of the siphons, Arcadis recommends a pothole excavation be performed at the planned location of the new manhole to confirm existing conditions and the feasibility of installing a manhole at this location.

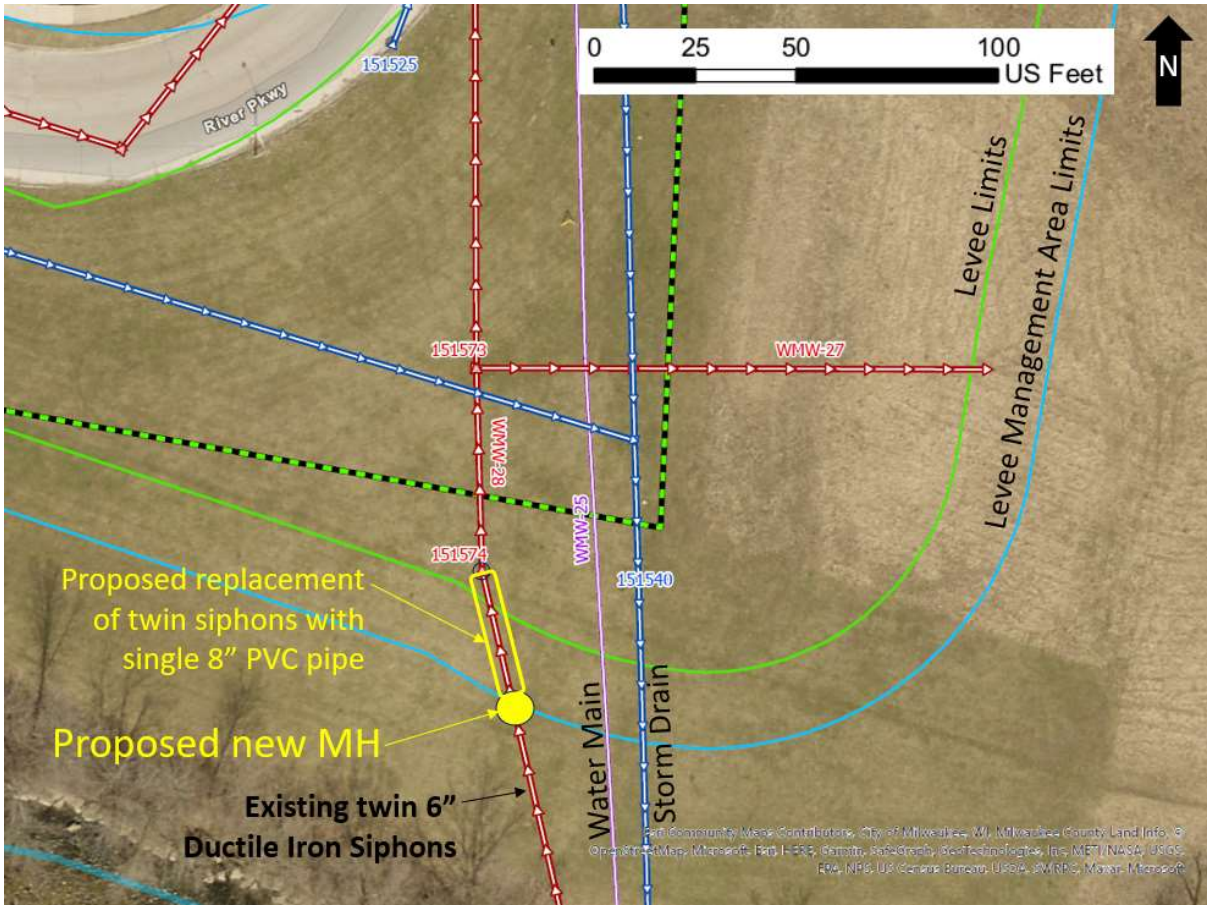

Figure 2-8 Siphons Replacement

2.5.2 Other Utilities

Gas, potable water, electric, telecommunications, and other ducts/asset utility lines were not reviewed as part of this study. It is recommended that MMSD prepare as part of an operations and maintenance manual for the Hart Park and Western Milwaukee system a section that includes periodic site visits to the levee locations where non storm and sewer utilities (e.g. water, electric, telecommunication and gas utilities) cross the levee. These site visits should look for evidence of utility pipe failures such as water leaks, natural gas odors, and/or the formation of surface voids/sink holes. Any potential concerns should be communicated to the utility owner for coordination on any further investigations and repairs needed to resolve the concern. It is also recommended during the annual inspection of the levee system that utility owners be contacted about their condition assessment of the utility crossing and in the case of water lines if they employ any leak detection practices.

2.5.3 Next Steps

Prior to moving to final design, MMSD should:

- Define how the work will be packaged and bid.

- Define responsibilities for permitting and agency coordination for the outfall repair and work affecting the river, as well as the siphons replacement and associated levee reconstruction.
- Coordinate final design requirements with the closure and abandonment recommendations in the Technical Memorandum: Engineering Services for Conceptual Study Closure Alternative Evaluation and Conceptual Cost Estimates, prepared by Arcadis.

2.6 Monitoring

Arcadis did not perform any monitoring efforts as part of this study.

2.7 Limitations

The evaluation reflected in this report was limited to evaluation of available visual condition of the interior of the pipes.

2.8 Cost Estimate

A preliminary project cost estimate for the recommended rehabilitation work identified in Appendices A and C is provided in Table 2-3 below with additional details provided in Appendix F. This estimate does not include repairs to the Schoonmaker Creek Culvert or the storm sewer/outfall on Honey Creek Parkway between 70th and 72nd Streets, which are addressed in the Design Report - Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert, dated March 2022 (rev. 2/10/23). This estimate does not include the costs associated with pipe abandonments because those costs are included in Technical Memorandum: Engineering Services for Conceptual Study Closure Alternative Evaluation and Conceptual Cost Estimates, prepared by Arcadis. The cost estimates include the following allowances:

Contractor Mobilization/Demobilization: 3%

Contingency: 15%

Engineering Design: 10%

Construction Inspection: 10%

Administration and Legal: 5%

Table 2-3 Pipe Rehabilitation Preliminary Project Cost Estimate

Rehabilitations Method	Cost
Cured-in-Place Pipe Lining (includes install of 1 new manhole)	$810,000
Outfall Repair/Stream Bank Restoration	$150,000
Open Cut Replacement per Figure 2-8 (includes levee reconstruction)	$75,000
Test and Seal (includes grouting defects)	$230,000
Total	$1,265,000

References

1. U.S. Government Printing Office (2010). Code of Federal Regulations, Title 44, Part 65.10. November.

2. Stantec, Consulting Services Inc. (2021). Hart Park and Western Milwaukee Levee System Accreditation Master Plan. March.

3. U.S. Army Corps of Engineers (USACE) (2000). Design and Construction of Levees. EM 1110-2-1913. August.

4. U.S. Army Corps of Engineers (USACE) (2020). Conduits, Pipes, and Culverts Associated with Dams and Levee Systems. EM 1110-2-2902. December.

5. MMSD Memo on Hart Park Storm sewers

Appendix A

Pipes Evaluation Table

STANTEC ID	STANTEC STATION	PIPE_ID	MMSD ASSET ID	OLD ASSET ID	OWNER	DIA/ WIDTH	HEIGHT	MATERIAL	SYSTEM	GIS LENGTH	MASTER PLAN WORK PLAN	REVISED WORK PLAN	NEXT INSPECTION (YRS)
WMW-2	109+44	48303	151409		CITY OF MILWAUKEE	24		VCP	STORM	191	PRIMARY AND SECONDARY CLOSURE (BEING INSTALLED WITH	No Further Action (NFA)	5
WMW-3	109+44	P7386	145535		MMSD	192		LIMESTONE	SANITARY TUNNEL	4029	NONE	NFA	NA
WMW-5	124+37	P7553	145560		MMSD	108		Lined Monolithic	SANITARY TUNNEL	387	NONE	NFA	NA
	124+37	P7554	145560		MMSD	108		Lined Monolithic	SANITARY TUNNEL	55	NONE	NFA	NA
WMW-6	126+17	UNK-2B-2	152012		PRIVATE	6		CI	SANITARY	107	REMOVE OR FILL WITH GROUT.	Phase 2B Abandon	NA
WMW-6	129+87	UNK-33-1_UNK-26- 1	152020		PRIVATE	6		UNK	SANITARY	564	REMOVE OR FILL WITH GROUT.	Phase 2B Abandon	NA
WMW-6	126+17	97906	151469		CITY OF MILWAUKEE	15		VCP	SANITARY	268	REMOVE OR PLUG AND FILL PIPE WITH GROUT SOUTH OF RR TRACKS. ABANDON MANHOLES 151580; 151579; 151578.	NFA	5
WMW-7	126+27		UNK			8		UNK	SANITARY	264	NONE	Abandoned	NA
WMW-8	126+74	P6775	150891	150851	MMSD	102	60	RCP	SANITARY	139	PORTION THAT WILL REMAIN ACTIVE.	NFA	5
WMW-8	126+74	P9309	150160	150120	MMSD	102	60	RCP	SANITARY	201	GROUT AND SHOTCRETE LINE	NFA	5
WMW-8	126+74	151510:151510- a/26 West Top	UNK		UNKNOWN	8		VCP	STORM	6	PIPE SHOULD BE REMOVED OR FILLED WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	UNK-2B-4-1	152017		UNKNOWN	6		VCP	STORM	100	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	UNK-M6314- D_M6314	152013		UNKNOWN	8		VCP	STORM	71	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	151511:151511a/150 Top East 10inch	UNK		UNKNOWN	10		CI	STORM	12	PIPE SHOULD BE REMOVED OR FILLED WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	170east	UNK		UNKNOWN	3		UNK	STORM		PIPE SHOULD BE REMOVED OR FILLED WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	151512:151512-a/ 175 Top East 8Inch	UNK		UNKNOWN	8		VCP	STORM	5	INLET AND PIPE SHOULD BE ABANDONED BY REMOVAL OR FILLING WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	151513:151513a/ 195 Top East	UNK		UNKNOWN	8		VCP	STORM	4	INLET AND PIPE SHOULD BE ABANDONED BY REMOVAL OR FILLING WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	UNK-2B-4-2	152014		UNKNOWN	8		CI	STORM	100	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Phase 2B Abandon	NA
WMW-8	126+74	UNK-2B-4-3	152015		UNKNOWN	8		VCP	STORM	100	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Abandon	NA
WMW-8	126+74	UNK-2B-4-4	152016		UNKNOWN	8		RCP	STORM	100	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Abandon	NA
WMW-8	126+74	133_TOP_EAST	UNK		UNKNOWN	6		UNK	STORM		ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Abandon (per MMSD direction)	NA
WMW-8	126+74	UNK-2B-4-5	152018		UNKNOWN	8		RCP	STORM	100	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	Abandon	NA
WMW-8	126+74	UNK-2B-4-6	152019		UNKNOWN	6		CI	STORM	100	ABANDON PIPE BY REMOVAL OR FILLING WITH GROUT	NFA	10
WMW-8	129+87	UNK-M6314- B1_UNK-M6314-B	152010		UNKNOWN	8		VCP	STORM	92	ABANDON BY REMOVAL OR FILL WITH GROUT.	Phase 2B Abandon	NA

STANTEC ID	STANTEC STATION	PIPE_ID	MMSD ASSET ID	OLD ASSET ID	OWNER	DIA/ WIDTH	HEIGHT	MATERIAL	SYSTEM	GIS LENGTH	MASTER PLAN WORK PLAN	REVISED WORK PLAN	NEXT INSPECTION (YRS)
WMW-11	126+67	P7545	145557		MMSD	108		LINED MONOLITHIC	SANITARY	417	NONE	NFA	NA
WMW-11	126+67	P7546	145557		MMSD	108		LINED MONOLITHIC	SANITARY	173	NONE	NFA	NA
WMW-14	126+87	UNK	UNK		UNKNOWN	8		VCP	STORM	100	ABANDON BY REMOVAL OR FILL WITH GROUT.	Abandon	NA
WMW-16	135+07	P2708	137246		MMSD	96		MONOLITHIC CONCRETE	SANITARY	212	NONE	NFA	5
WMW-16	135+07	P9968	137198		MMSD	96		MONOLITHIC CONCRETE	SANITARY	59	NONE	NFA	NA
WMW-16	135+07	P10222	137248		MMSD	96		MONOLITHIC CONCRETE	SANITARY	62	LINE WITH SHOTCRETE	NFA	NA
WMW-16	135+07	P10221	137247		MMSD	96		MONOLITHIC CONCRETE	SANITARY	55	NONE	Grout leaking joint, patch surface damage at DS pipe end.	5
WMW-16	135+07	92709	137197		MMSD	96		MONOLITHIC CONCRETE	SANITARY	39	NONE	NFA	NA
WMW-16	135+07	P2710	137196		MMSD	72		MONOLITHIC CONCRETE	SANITARY	119	NONE	NFA	NA
WMW-16	135+07	BS0405	151606		MMSD	4		PVC	SANITARY	284	NONE	NFA	10
WMW-16	135+07	BS0405-1	151604		MMSD	8		DIP	SANITARY	240	NONE	NFA	10
WMW-16	135+07	P10224	140906		MMSD	120		RCP	SANITARY	207	NONE	NFA	10
WMW-16	135+07	P10223	140904		MMSD	120		RCP	SANITARY	194	GROUT JOINT.	Grout all joints.	5
WMW-18	136+72	UNK-35-1_UNK-37-1	151605		MMSD	12		RCP	STORM	168	GROUT JOINTS AND CIPP LINE	NFA	5
WMW-19	136+72	P10225	140905		MMSD	96	96	RCP	SANITARY	227	NONE	NFA	10
WMW-20	142+12	UNK-42-1_UNK-42-2	151602		MMSD	18		RCP	STORM	101	ABANDOND PIPE BY REMOVAL OR FILLING WITH GROUT WITH PHASE 2B.	Phase 2B Abandon	NA
WMW-21	142+72	ST9A-366_ST9A-365E	151491		MMSD	56	108	RCP	STORM	104	NONE	NFA	10
WMW-21	142+72	ST9A-366_ST9A-365W	151603		MMSD	56	108	RCP	STORM	104	NONE	NFA	10
WMW-21	142+72	ST9A-367_ST9A-366	151599		MMSD	56	108	RCP	STORM	33	GROUT HOLES AND SHOTCRETE. REPAIR BASE SLAB.	Concrete Repairs. See Design Report for Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert.	5
WMW-21	142+72	ST9A-368_ST9A-366	151600		MMSD	56	108	RCP	STORM	33	GROUT HOLES AND SHOTCRETE. REPAIR BASE SLAB.	Concrete Repairs. See Design Report for Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert.	5
WMW-21	142+72	UNK-2A-2	152011		UNKNOWN	12		CMP	STORM	100	ABANDON BY FILLING WITH GROUT	Abandon	NA
WMW-23	145+22		UNK		UNKNOWN	-		UNK	SANITARY	81	ABANDON BY FILLING WITH GROUT	Abandoned	NA
WMW-24	152+73	ST9B-004_ST9B-003	151416		MMSD	72		RCP	STORM	339	GROUT LIFT HOLES AND JOINTS.	NFA	5
WMW-24	152+73	ST9B-003_ST9B-002	151428		MMSD	72		RCP	STORM	184	GROUT JOINTS	NFA	5
WMW-24	152+73	ST9B-002_ST9B-001	151429		MMSD	96		RCP	STORM	150	GROUT JOINTS	NFA	5

STANTEC ID	STANTEC STATION	PIPE_ID	MMSD ASSET ID	OLD ASSET ID	OWNER	DIA/ WIDTH	HEIGHT	MATERIAL	SYSTEM	GIS LENGTH	MASTER PLAN WORK PLAN	REVISED WORK PLAN	NEXT INSPECTION (YRS)
WMW-24	152+73	151416a	UNK		PRIVATE	21		RCP	STORM		PIPE INSPECTION	NFA	TBD by MMSD
WMW-24	152+73	ST9B-018_ST9B-002	151430		MMSD	48		RCP	STORM	449	GROUT LIFT HOLES.	Grout lift holes (person-entry polyurethane)	5
WMW-24	152+73	ST9B-003A_ST9B-003	151431		MMSD	21		RCP	STORM	27	GROUT LIFT HOLES.	Grout lift holes (acrylamide with latex and glycol additives). Pipe appears to have ~8' cover.	5
WMW-24	152+73	ST9B-003C_ST9B-003A	151432		MMSD	18		RCP	STORM	35	NONE	NFA	10
WMW-24	152+73	ST9B-003B_ST9B- 003A	151442		MMSD	12		RCP	STORM	90	REPLACE PIPE	NFA	5
WMW-24	152+73	ST9B-019_ST9B-018	151443		MMSD	48		RCP	STORM	20	NONE	NFA	5
WMW-24	152+73	ST9B-019A_ST9B-019	151485		MMSD	21		RCP	STORM	10	GROUT HOLE.	Grout hole 1' from access structure (manual polyurethane injection)	5
WMW-27	153+14	WA4004-017_WA4004-016	UNK		WAUWATOSA	8		UNK	SANITARY	135	PER CCTV, NO CONNECTION INTO MANHOLE - NONE	Abandoned	NA
WMW-28	153+14	WA4004-020_WA4004-018	151412		WAUWATOSA	6		UNK	SANITARY	258	PIPE NEEDS TO BE DEWATERED AND RE-INSPECTED OR INSPECTED USING ALTERNATIVE METHOD. APPEARS TO NEED REPAIR FROM LIMITED INSPECTION.	Replace siphons in Levee Management Area with single 8" pipe. New MH at edge of LMA with watertight lid.	5
WMW-28	153+14	WA4004-018_WA4004-016	151413		WAUWATOSA	8		UNK	SANITARY	53	NONE	NFA	5
WMW-28	153+14	WA4004-016_WA4004-012	151414		WAUWATOSA	8		UNK	SANITARY	175	REPLACE PIPE AND REMOVE OR FILL ABANDONED PIPES	CIPPL, cut roots	5
WMW-28	153+14	WA4004-012_WA4004-010	151415		WAUWATOSA	8		UNK	SANITARY	174	REPLACE PIPE AND REMOVE OR FILL ABANDONED PIPES	CIPPL, pregrout IR@167	5
WMW-28	153+14	UNK-WA-4004-010A_WA-4004-010	151426		WAUWATOSA	8		UNK	SANITARY	27	PIPE IS ABANDONED FROM CCTV VIDEO, NO CONNECTION AT MANHOLE 151571.	Abandoned	NA
WMW-28	153+14	UNK-WA-404- 012A_WA-404-012	151427		WAUWATOSA	8		UNK	SANITARY	29	PIPE IS ABANDONED FROM CCTV VIDEO, NO CONNECTION AT MANHOLE 151572.	Abandoned	NA
WMW-29	166+42	7001	136928		MMSD	36		MONOLITHIC CONCRETE	SANITARY	329	NO REPAIR REQUIRE, DEFECTIVE CONNECTION IS OUTSIDE OF LEVEE ZONE. EMERGENCY CLOSURE IS REQUIRED PER FEMA GUIDELINES, RECOMMENDING FREQUENT INSPECTION OF RIVER CROSSING IN LIEU OF CLOSURE. River bottom elev 627.5, pipe top is 1' below creek bottom. Rock elev. approx. 612.	NFA	5
WMW-29	166+42	P2544	137015	151483	MMSD	36		MONOLITHIC CONCRETE	SANITARY	5	NONE	Abandoned	NA
WMW-29	166+42	P1442	137016	151484	MMSD	36		MONOLITHIC CONCRETE	SANITARY	8	NONE	Abandoned	NA
WMW-30	166+72	ST9B-028_ST9B-027	151410		WAUWATOSA	12		VCP	STORM	87	REPLACE PIPE OR ABANDON AND RE-ROUTE 170' TO THE EAST ALONG RIVER PKWY. TO DOWNSTREAM SYSTEM.	Abandon	NA
WMW-30	166+72	ST9B-029_ST9B-028	151411		MILWAUKEE CO	12		VCP	STORM	19	REPLACE PIPE	NFA	5

STANTEC ID	STANTEC STATION	PIPE_ID	MMSD ASSET ID	OLD ASSET ID	OWNER	DIA/ WIDTH	HEIGHT	MATERIAL	SYSTEM	GIS LENGTH	MASTER PLAN WORK PLAN	REVISED WORK PLAN	NEXT INSPECTION (YRS)
HPN-1	170+62	ST8A-203_ST8A-202	151449		MMSD	84		RCP	STORM	87	STRAP OR ABANDON EXISTING OUTFALL AND RELOCATE 260' DOWNSTREAM TO AVOID CLOSURE INSTALLATION.	NFA	5
HPN-1	170+92	ST8A-204_ST8A-203	151448		MMSD	84		RCP	STORM	50	NONE	NFA	10
HPN-1	201+26	ST8A-205_ST8A-204	151417		MMSD	84		RCP	STORM	83	NONE	NFA	5
HPN-1	202+76	ST8A-208_ST8A-205	151418		MMSD	84		RCP	STORM	299	NONE	NFA	5
HPN-1	202+46	ST8A-206A_ST8A- 206T	151454		MMSD	12		RCP	STORM	12	NONE	NFA	10
HPN-1	205+78	ST8A-209_ST8A-208	151419		MMSD	72		RCP	STORM	348	NONE	NFA	5
HPN-1	207+29	ST8A-209A_ST8A- 209	151441		MMSD	12		RCP	STORM	14	NONE	NFA	10
HPN-1	208+80	ST8A-210_ST8A-209	151439		MMSD	60		RCP	STORM	400	GROUT JOINTS	NFA	5
HPN-1	211+10	ST8A-037B_ST8A- 037	151474		MMSD	12		RCP	STORM	14	NONE	NFA	5
HPN-1	211+10	ST8A-037A_ST8A- 037	151475		MMSD	12		RCP	STORM	28	GROUT JOINTS	NFA (pipe determined to be outside levee management area and no evidence of defective joints)	5
HPN-1	211+10	ST8A-037_ST8A-210	151476		WAUWATOSA	21		CIPP	STORM	34	NONE	NFA	10
HPN-1	211+10	ST8A-201_ST8A-210	151477		MMSD	36		RCP	STORM	16	NONE	NFA	10
HPN-1	211+10	ST8A-200_ST8A-201	151478		WAUWATOSA	36		RCP-CIPP	STORM	91	NONE	NFA	5
HPN-1	211+86	ST8A-037C_ST8A- 037B	151440		MMSD	12		RCP	STORM	89	GROUT JOINTS AND LINE	NFA	5
HPN-1	213+86	ST8A-211_ST8A-210	151438		MMSD	48		RCP	STORM	341	GROUT JOINTS	NFA	5
HPN-1	215+36	ST8A-043_ST8A-211	151437		WAUWATOSA	36		CIPP	STORM	96	NONE	NFA	10
HPN-1	215+36	ST8A-211A_ST8A-211	151436		MMSD	12		RCP	STORM	34	GROUT JOINTS AND FRACTURES AND CIPP LINE	NFA	5
HPN-1	216+86	ST8A-212_ST8A-211	151435		MMSD	48		RCP	STORM	243	NONE	NFA	5
HPN-1	217+86	ST8A-213_ST8A-212	151434		MMSD	48		RCP	STORM	106	NONE	NFA	5
HPN-1	218+86	ST8A-212A_ST8A-212	151433		MMSD	6		PVC	STORM	185	NONE	NFA	10
HPN-2	200+71	ST8A-358A_ST8A- 358	151450		WAUWATOSA	12		RCP	STORM	36	GROUT JOINTS AND FRACTURES AND CIPP LINE OR ABANDON EXISTING PIPE, INSTALL 55' OF NEW PIPE TO REROUTE EXISTING INLET TO THE NORTH TO AVOID CLOSURE INSTALLATION.	Abandon	NA
HPN-2	200+71	ST8A-358_ST8A-357	151451		WAUWATOSA	36		RCP	STORM	37	GROUT JOINTS AND FRACTURES AND CIPP LINE OR ABANDON EXISTING OUTFALL AND REROUTE UPSTREAM INLET TO SEWER TO THE	Abandon	NA
HPN-3	201+96	WA4003-013_WA4003-012	UNK		WAUWATOSA	12		UNK	SANITARY	179	NONE	Abandoned	NA
HPN-3	202+76	WA4003-015_WA4003-014	UNK		WAUWATOSA	15		UNK	SANITARY	245	NONE	Abandoned	NA
HPN-3	202+76	WA4003-014_WA4003-012	UNK		WAUWATOSA	15		UNK	SANITARY	33	NONE	Abandoned	NA
HPN-5	202+82	WA4003-486_WA4003-485	151470		WAUWATOSA	8		PVC	SANITARY	182	NONE	NFA	10
HPN-5	202+82	WA4003-485_WA4003-484	151471		WAUWATOSA	8		PVC	SANITARY	281	NONE	NFA	10
HPN-5	202+82	WA4003-487_WA4003-484	151472		WAUWATOSA	6		PVC	SANITARY	123	NONE	NFA	10
HPN-5	202+82	WA4003-484_WA4003-483	151479		WAUWATOSA	8		PVC	SANITARY	62	NONE	NFA	10

STANTEC ID	STANTEC STATION	PIPE_ID	MMSD ASSET ID	OLD ASSET ID	OWNER	DIA/ WIDTH	HEIGHT	MATERIAL	SYSTEM	GIS LENGTH	MASTER PLAN WORK PLAN	REVISED WORK PLAN	NEXT INSPECTION (YRS)
HPN-5	202+82	WA4003-483_WA4003-012	151480		WAUWATOSA	3		DIP	SANITARY	28	DISCHARGE TO THE PROTECTED SIDE IS LIMITED BY THE CAPACITY OF THE PUMP STATION, NO CLOSURE NEEDED.	NFA	10
HPN-8	211+00	WA4003-018_WA4003-017	UNK		WAUWATOSA	8		UNK	SANITARY	127	NONE	Abandoned	NA
HPN-8	211+00	WA4003-448_WA4003-018	UNK		WAUWATOSA	8		UNK	SANITARY	93	NONE	Abandoned	NA
HPN-12	218+36	ST8-176_ST8-175	151444		MMSD	43	68	RCP	STORM	224	GROUT JOINTS AND LINE	NFA	5
HPN-12	218+36	ST8-176A_ST8-175A	151445		MMSD	43	68	RCP	STORM	225	NONE	NFA	5
HPN-12	218+36	ST8-177_ST8-176	151446		MMSD	63	98	RCP	STORM	185	NONE	NFA	5
HPN-12	218+36	ST8-178_ST8-177	151447		MMSD	72		RCP	STORM	564	GROUT HOLE.	Grout hole (person-entry polyurethane)	5
HPN-14	229+46	ST7A-501_ST7A-009	151468		WAUWATOSA	30		CIPP	STORM	279	NONE	NFA	5
HPS-1	301+03	ST11-010_ST11-009	151458		MMSD	60		RCP	STORM	93	GROUT JOINTS OR ABANDON EXISTING SEWER AND REROUTE 120' DOWNSTREAM TO AVOID CLOSURE INSTALLATION.	NFA	5
HPS-1	303+23	ST11-100A_ST11- 100	151457		MILWAUKEE CO	12		RCP	STORM	34	GROUT JOINTS, CIPP LINE	NFA	5
HPS-2	301+03	ST11-006_ST11-005	151453		WAUWATOSA	12		RCP	STORM	30	REPLACE PIPE OR ABANDON AND RE-ROUTE.	Abandon	NA
HPS-3	301+03	ST11-004_ST11-003	151452		WAUWATOSA	12		CMP	STORM	34	REPLACE PIPE OR ABANDON AND RE-ROUTE.	Abandon	NA
HPS-4	307+46	ST11-129B_ST11- 129A	151425		MILWAUKEE CO	12		RCP	STORM	34	GROUT JOINTS AND CIPP LINE.	NFA	5
HPS-4	307+46	ST11-129_ST11-128	151455		MMSD	84		RCP	STORM	46	GROUT JOINTS AND LIFT HOLES.	NFA	5
HPS-4	308+96	ST11-132_ST11-131	151420		MMSD	84		RCP	STORM	138	NONE	NFA	10
HPS-4	308+96	ST11-131_ST11-129	151421		MMSD	84		RCP	STORM	131	NONE	NFA	10
HPS-4	308+96	ST11-131A_ST11- 131	151422		MILWAUKEE CO	12		RCP	STORM	49	GROUT JOINTS AND CIPP LINE.	NFA	5
HPS-4	308+96	ST11-131B_ST11- 131A	151423		MILWAUKEE CO	12		RCP	STORM	34	CIPP LINE	NFA	5
HPS-4	311+14	ST11-132C_ST11- 132B	151456		MILWAUKEE CO	15		RCP	STORM	223	GROUT JOINTS AND FRACTURE AND CIPP LINE	NFA	5
HPS-6	307+75	WA4004-176_WA4004-344	UNK		WAUWATOSA	-		UNK	SANITARY	80	ABANDON BY FILLING WITH GROUT	Abandoned	NA
HPS-9	312+88	ST11-002A_ST11- 002	151466		MILWAUKEE CO	12		RCP	STORM	35	GROUT JOINTS	NFA	5
HPS-9	312+88	ST11-002_ST11-001	151467		MILWAUKEE CO	8		NCP	STORM	68	REPLACE PIPE	Replace	5
HPS-12	317+01	ST12-012A_ST12-012	151461		MMSD	12		RCP	STORM	123	REPLACE CHECK VALVE (WILL BECOME SECONDARY CLOSURE) GROUT JOINTS, CIPP LINE.	NFA	5
HPS-12	317+41	ST12-013_ST12-011	151459		WAUWATOSA	30		RCP	STORM	125	NONE	NFA	5
HPS-12	317+41	ST12-011_ST12-010	151460		WAUWATOSA	30		UNK	STORM	123	REPLACE DOWNSTREAM 2 SEGMENTS (12') AND CIPP LINE.	Outfall repair	5
HPS-12	317+41	ST12-011A_ST12- 011	151463		MILWAUKEE CO	12		RCP	STORM	94	GROUT JOINTS AND CIPP LINE	NFA	5
HPS-12	317+41	ST12-011B_ST12- 011	151464		MILWAUKEE CO	12		RCP	STORM	55	CIPP LINE	CIPPL	5
HPS-12	317+41	ST12-011C_ST12- 011	151465		MILWAUKEE CO	12		RCP	STORM	40	GROUT JOINTS AND CIPP LINE	CIPPL	5
HPS-12	318+50	ST12-013C_ST12-013	151481		MILWAUKEE CO	12		RCP	STORM	91	GROUT JOINTS AND CIPP LINE	Abandon	NA
HPS-12	318+71	ST12-014_ST12-013	151462		WAUWATOSA	30		RCP	STORM	183	GROUT JOINTS	NFA	5
VIDEO 2		~~07108~~ 07103 (P1305)	137031		MMSD	24		TC	SANITARY	274.5		Grout all joints.	5

STANTEC ID	STANTEC STATION	PIPE_ID	MMSD ASSET ID	OLD ASSET ID	OWNER	DIA/ WIDTH	HEIGHT	MATERIAL	SYSTEM	GIS LENGTH	MASTER PLAN WORK PLAN	REVISED WORK PLAN	NEXT INSPECTION (YRS)
VIDEO 3		07104 (P1304)	137032		MMSD	24		TC	SANITARY	200.4		Grout all joints.	5
VIDEO 4		07105 (P1303)	137033		MMSD	24		TC	SANITARY	287.8		Grout all joints.	5
VIDEO 5		08801 (P1323)	136942		MMSD	24		VCP	SANITARY	332.5		CRT, CIPPL, inspect outside drop connection at MH	5
VIDEO 6		08802 (P1322)	136943		MMSD	24		VCP	SANITARY	344.4		CIPPL	5
VIDEO 7, Michels 7002		07002 (P1438)	136932		MMSD	36		CP	SANITARY	207.6		NFA	5
VIDEO 8		07003 (P1437)	136933		MMSD	36		CP	SANITARY	127.7		NFA	5
VIDEO 9		07004 (P1319)	136934		MMSD	36		CP	SANITARY	36.5		Man entry grout the IR@10.8.	5
VIDEO 10		07005 (P1320)	136935		MMSD	36		CP	SANITARY	294.2		NFA	5
VIDEO 11		07006 (P1317)	136936		MMSD	36		CP	SANITARY	342.2		Man entry grout the IR@10.3 from DS MH.	5
VIDEO 12		07007 (P1316)	136937		MMSD	36		CP	SANITARY	356.2		Man entry grout the TFD (IR) @53.5 from DS MH.	5
VIDEO 13		07008 (P1314)	136938		MMSD	36		CP	SANITARY	333.2	PIPE REPAIR, RECOMMEND - CHEMECAL GROUT AND CIPP LINE. REPAIRING BOTH PIPES EVEN THOUGH ONLY THE UPSTREAM PIPE IS REQUIRED. H2S DAMAGE IS EVIDENT. Emergency Closure is FEMA's requirement - basements would back up if there is a falure on the riverside. Top of pipe is approx. 6' below the river bottom. DS invert - 626.24, creek bottom - 635; rock elev. from boring #5 @ 214+00 is 604.3. However; since river rises rapidly it is unlikely closure would prevent damage and would require large pumping operation. Recomend frequent pipe inspection and repair.	NFA	5
VIDEO 14		07009 (P1313)	136939		MMSD	36		CP	SANITARY	306.9	NONE	NFA	5
VIDEO 15, Michels 7010		07010 (P2543)	137027		MMSD	24		TC	SANITARY	334.8		CIPPL	5
VIDEO 16		07011 (P2542)	137028		MMSD	24		TC	SANITARY	307.3		CIPPL	5
VIDEO 17		07101 (P1307)	137029		MMSD	24		TC	SANITARY	356.3		CIPPL	5
VIDEO 18		07102 (P1306)	137030		MMSD	24		TC	SANITARY	347.5		CIPPL	5
VIDEO 19		07106 (P1302)	137034		MMSD	24		TC	SANITARY	380.1		Install MH, heavy clean, CIPPL	5
Purple Line		ST8-200_ST8-179	155500		MMSD	72		RCP	STORM	328		NFA	5

Notes:

1. Where "NA" is reported for the "Next Inspection" it is because the pipe is either abandoned or will be abandoned, does not fall within the levee management area, or is a deep tunnel per the Master Plan.

Appendix B

Michels Inspection Reports

Michels Pipe Services
W964 WI-49
Lomira, WI 53048

Main Inspections Large Photos and Scoring

Mainline ID:	City:	Street:	Project name:
1	**Milwaukee**	**North 70th Street**	**Inspection**
Start date/time:	Total length:	Weather:	Surveyed by:
4/27/2022 8:36 AM		**1**	**KRIS KOLTZ**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
7010		**7009**	
Shape:	Material:	Height:	Width:
C	**VCP**	**24 in.**	**24 in.**
Additional info:			

Scores

Calculated at: **4/27/2022 8:52:59 AM**

Grade	Structural:				O&M:				Overall:	
	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Pipe Rating	Pipe Rating Index
1	0	0	0000	0.0	0	12	5131	3.0	12	3.0
2	0				4					
3	0				3					
4	0				0					
5	0				5					

Observations

Distance	Dir.	ForDista	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**USMH 7010**
0.0 ft.	**D**		**/**	**MWL**			
5.6 ft.	**D**		**5 /**	**IG**		**5**	
179.1 ft.	**D**		**12 /**	**DAE**		**3**	
182.8 ft.	**D**		**12 /**	**DAE**		**2**	
190.2 ft.	**D**		**12 /**	**DAE**		**2**	
330.7 ft.	**D**		**/**	**AMH**			**INSIDE DROP, END OF VIDEO**

Main Inspections Large Photos and Scoring

Mainline ID:	City:	Street:	Project name:
2	**Milwaukee**	**Honey Creek Pkwy**	**Inspection**
Start date/time:	Total length:	Weather:	Surveyed by:
4/27/2022 9:11 AM		**1**	**KRIS KOLTZ**
Upstream MH No:	Depth US:	Downstream MH No:	Depth DS:
7002		**80003**	
Shape:	Material:	Height:	Width:
C	**CP**	**36 in.**	**36 in.**
Additional info:			

Scores

Calculated at: **4/27/2022 9:30:54 AM**

Grade	Structural:				O&M:				Overall:	
	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Pipe Rating	Pipe Rating Index
1	1	12	3124	2.0	0	5	3121	2.5	17	2.1
2	8				2					
3	3				3					
4	0				0					
5	0				0					

Observations

Distance	Dir.	ForDista	From/To	Code	Modifier	Rating	Remarks
0.0 ft.	**D**		**/**	**AMH**			**7002**
0.0 ft.	**D**		**/**	**MWL**			
29.1 ft.	**D**		**3 /**	**SRI**		**1**	**WALL OF PIPE IS DETERIORATED ON BOTH SIDES, GOES DOWN PIPE FURTHER**
144.6 ft.	**D**		**1 / 4**	**DAE**		**3**	
148.6 ft.	**D**		**12 /**	**CL**		**2**	**DEPOSIT GROWING OUT OF CRACK STARTS HERE**
160.6 ft.	**D**		**12 /**	**DAE**		**2**	
162.4 ft.	**D**		**12 /**	**CL**		**2**	**CRACK ENDS HERE**
172.1 ft.	**D**		**9 /**	**SCP**		**3**	

Observations

Distance	Dir.	ForDista	From/To	Code	Modifier	Rating	Remarks
189.9 ft.	D		12 /	CL		2	STARTS HERE
201.1 ft.	D		12 /	CL		2	ENDS HERE
207.4 ft.	D		/	AMH			DSMH 80003, END OF VIDEO

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Fax: 407-425-1569

PACP v7.0 Inspections and Scoring

General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
CAM				Michels	

P/O number:	Work order no.:	Media label:	Project name:	Start date/time:
			22260800 MMSD	20220902 09:11

Sheet number:	Weather:	Pre-cleaning:	Date cleaned:	Flow control:	Purpose:
		N			

Direction:	Technology used:	Inspection Status:	Consequence of failure:	Pressure value:
D				

Location:

Drainage area:	Pipe segment ref.:	Street:
	4: 32406 to 32406B	96 Inch

City:	Location code:	Location details:
Milwaukee		

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
SS	96 in.	96 in.	C	RCP	

Coating method:	Pipe joint length:	Total length:	Length surveyed:	Year laid:	Year renewed:
			260.0 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
DC0403						

Downstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
Overflow						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

Grade	Structural: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	O&M: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Overall: Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	2nd	%	Joint	Circumferential Location At/From	To	Rating	Image Ref.	Remarks
0.0		AMH					☐	/				DC0403
0.0		MWL				15	☐	/				
52.9 ft.	00:02:21	DAE					☒	1:00 /	3:00			Deposit Encrustation at Joint
183.6 ft.	00:04:23	AOC										MMSD Overflow Weir Structure
215.6 ft.	00:05:33	AMH										Weir Structure Manhole
260.0 ft.	00:06:44	AOC										Center of MMSD Gate Structure

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General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
KRIS				Michels	
P/O number:	**Work order no.:**	**Media label:**	**Project name:**		**Start date/time:**
22260800	22260800		22260800 MMSD		20221007 11:18
Sheet number:	**Weather:**	**Pre-cleaning:**	**Date cleaned:**	**Flow control:**	**Purpose:**
	1	N			A
Direction:	**Technology used:**		**Inspection Status:**	**Consequence of failure:**	**Pressure value:**
U					

Location:

Drainage area:	Pipe segment ref.:		Street:
	Item 5 - East Siphon		River Pkwy
City:		**Location code:**	**Location details:**
Milwaukee			

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
S	6 in.	6 in.	C	DIP - oncrete Lined	
Coating method:	**Pipe joint length:**	**Total length:**	**Length surveyed:**	**Year laid:**	**Year renewed:**
			85.0 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
WA4004-020						
Downstream MH No:	**Rim to invert:**	**Rim to grade:**	**Grade to invert:**	**Northing:**	**Easting:**	**Elevation:**
WA4004-018						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

Grade	Structural: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	O&M: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Overall: Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	2nd	%	Joint	Circumfrential Location At / From	To	Rating	Image Ref.	Remarks
0.0 ft.		AMH						/				MH WA4004-018
0.0 ft.		MWL				5		/				
0.0 ft.		SSC	S1					5	7			
16.0 ft.		DAE						/				
34.5 ft.		DAE	S2					/				
45.1 ft.		DAE	E2					/				
52.8 ft.		DAE	S3					/				
58.1 ft.		DAE	E3					/				
61.8 ft.		SAV						8	/			
83.9 ft.		DAE					x	8	/			
83.9 ft.		SSC	E1					5	7			
83.9 ft.		MMC						/				Material Change to CI
83.9 ft.		SCP	S4					/				
85.1 ft.		SCP	E4					/				
85.1 ft.		LD						/				
85.1 ft.		MWL				100		/				
85.1 ft.		MCU						/				
85.1 ft.		MSA						/				Start of Siphon

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General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
KRIS				Michels	
P/O number:	**Work order no.:**	**Media label:**	**Project name:**		**Start date/time:**
22260800	22260800		22260800 MMSD		20221007 11:26
Sheet number:	**Weather:**	**Pre-cleaning:**	**Date cleaned:**	**Flow control:**	**Purpose:**
	1	N			A
Direction:	**Technology used:**		**Inspection Status:**	**Consequence of failure:**	**Pressure value:**
U					

Location:

Drainage area:	Pipe segment ref.:		Street:
	Item 5 - West Siphon		River Pkwy
City:		**Location code:**	**Location details:**
Milwaukee			

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
S	6 in.	6 in.	C	DIP - Concrete Lined	
Coating method:	**Pipe joint length:**	**Total length:**	**Length surveyed:**	**Year laid:**	**Year renewed:**
			88.2 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
WA4004-020						
Downstream MH No:	**Rim to invert:**	**Rim to grade:**	**Grade to invert:**	**Northing:**	**Easting:**	**Elevation:**
WA4004-018						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

Grade	Structural: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	O&M: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Overall: Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	2nd	%	Joint	Circumfrential Location At / From	To	Rating	Image Ref.	Remarks
0.0 ft.		AMH						/				MH WA4004-018
0.0 ft.		MWL				5		/				
8.3 ft.		DAE					X	1 /				
17.1 ft.		DAE					X	7 /	5			
17.1 ft.		SRI	S1					/				
38.1 ft.		DAE	S2					7 /	5			
45.3 ft.		DAE	E2					7 /	5			
46.1 ft.		DAE					X	8 /				
86.7 ft.		MMC						/				Material Change to CI
86.7 ft.		SRI	E1					/				
86.7 ft.		SCP	S3					/				
87.5 ft.		LD						/				
87.5 ft.		MWL						/				
87.5 ft.		MSA				100		/				Start of Siphon

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General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
CAM				Michels	
P/O number:	**Work order no.:**	**Media label:**	**Project name:**		**Start date/time:**
22260800	22260800		22260800 MMSD		20220902 11:16
Sheet number:	**Weather:**	**Pre-cleaning:**	**Date cleaned:**	**Flow control:**	**Purpose:**
		N			A
Direction:	**Technology used:**		**Inspection Status:**	**Consequence of failure:**	**Pressure value:**
U					

Location:

Drainage area:	Pipe segment ref.:	Street:
	Storm Box Culvert P9309/P6775	Bridge under Hawley Rd
City:	**Location code:**	**Location details:**
Milwaukee		

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
SW	60 in.	102 in.	R	RCP	
Coating method:	**Pipe joint length:**	**Total length:**	**Length surveyed:**	**Year laid:**	**Year renewed:**
			173.0 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
96 inch						
Downstream MH No:	**Rim to invert:**	**Rim to grade:**	**Grade to invert:**	**Northing:**	**Easting:**	**Elevation:**
C18401						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

Grade	Structural: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	O&M: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Overall: Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	2nd	%	Joint	Circumferential Location At/From	To	Rating	Image Ref.	Remarks
0.0 ft.		AMH					☐	/				C18401
0.0 ft.		MWL				10	☐	/				
31.1 ft.	00:03:01	TF		12.000			☐	9 /				
31.1 ft.	00:03:42	TF		12.000			☐	1 /				
52.6 ft.	00:04:48	TF		12.000			☐	1 /				
70.7 ft.	00:23:06	TF		10.000			☐	10 /				Scope Item 1: Unable to confirm if active
81.6 ft.	00:06:22	TFC		10.000			☐	1 /				
129.2 ft.	00:07:59	TF		12.000			☐	2 /				
142.9 ft.	00:09:41	TFC		12.000			☐	2 /				Scope Item 2: Confirmed Collapsed
144.8 ft.	00:10:37	TF		4.000			☐	1 /				Scope Item 3: Settled Debris, Unable to continue
151.6 ft.	00:11:35	TFC		10.000			☐	12 /				
152.2 ft.	00:12:38	TF		10.000			☐	10 /				
172.7 ft.	00:13:58	TF		6.000			☐	2 /				Scope Item 4: Confirmed no cap.
173.0 ft.	00:24:56	MSA					☐	/				done with inspection

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General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
KRIS				Michels	

P/O number:	Work order no.:	Media label:	Project name:	Start date/time:
22260800	22260800		22260800 MMSD	2022**0902** **02:19**

Sheet number:	Weather:	Pre-cleaning:	Date cleaned:	Flow control:	Purpose:
		N			A

Direction:	Technology used:	Inspection Status:	Consequence of failure:	Pressure value:
D				

Location:

Drainage area:	Pipe segment ref.:	Street:
	Storm Box Culvert P6775/P9309	**Box Culvert Service at 142.9 LF upstream of access MH under bridge**

City:	Location code:	Location details:
Milwaukee		

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
XX	**12** in.	**12** in.	C	**RCP**	

Coating method:	Pipe joint length:	Total length:	Length surveyed:	Year laid:	Year renewed:
			22.8 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:

Downstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
Box Culvert						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

Grade	Structural: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	O&M: Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Overall: Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	2nd	%	Joint	Circumfrential Location At / From	To	Rating	Image Ref.	Remarks
0.0 ft.		ADP						/				142.9 LF Service Start
0.0 ft.		MWL				0		/				
2.9 ft.		HVV						10 /				
3.0 ft.		CM						/				
6.2 ft.		MMC						/				RCP to VCP
14.8 ft.		JOM						/				
22.8 ft.		MSA						/				Debris in Pipe

MICHELS®
TRENCHLESS, INC.

CUES, Inc.
3600 Rio Vista Avenue
Orlando, FL 32805
Phone: 407-849-0190
Fax: 407-425-1569

PACP v7.0 Inspections and Scoring

General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
KRIS				Michels	

P/O number:	Work order no.:	Media label:	Project name:	Start date/time:
22260800	22260800		22260800 MMSD	2022**1007** **12:18**

Sheet number:	Weather:	Pre-cleaning:	Date cleaned:	Flow control:	Purpose:
		N			A

Direction:	Technology used:	Inspection Status:	Consequence of failure:	Pressure value:
D				

Location:

Drainage area:	Pipe segment ref.:	Street:
	Storm Box Culvert P6775/P9309	**Box Culvert Service at 144.8 LF upstream of access MH under bridge**

City:	Location code:	Location details:
Milwaukee		

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
XX	**4** in.	**4** in.	C	**V**CP	

Coating method:	Pipe joint length:	Total length:	Length surveyed:	Year laid:	Year renewed:
			16.4 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:

Downstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
Box Culvert						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

Grade	Structural:					O&M:					Overall:			
	Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	Value Inches (mm) 2nd	%	Joint	Circumfrential Location At / From	Circumfrential Location To	Rating	Image Ref.	Remarks
0.0 ft.		ADP						/				144.8 LF Service Start
0.0 ft.		MWL				0		/				
0.5 ft.		LR						/				
0.5 ft.		MMC						/				From VCP to RPM
0.5 ft.		DNF	S1					/				
14.2 ft.		DNF	E1					/				
14.2 ft.		DSC	S2					/				
16.4 ft.		DSC	E2					/				
16.4 ft.		MSA						/				Cannot Pass Debris

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Orlando, FL 32805
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Fax: 407-425-1569

PACP v7.0 Inspections and Scoring

General Information:

Surveyed by:	Certificate number:	Reviewed by:	Reviewer certificate no.	Owner:	Customer:
KRIS				Michels	

P/O number:	Work order no.:	Media label:	Project name:	Start date/time:
22260800	22260800		22260800 MMSD	2022**0902** **02:22**

Sheet number:	Weather:	Pre-cleaning:	Date cleaned:	Flow control:	Purpose:
		N			A

Direction:	Technology used:	Inspection Status:	Consequence of failure:	Pressure value:
D				

Location:

Drainage area:	Pipe segment ref.:	Street:
	Storm Box Culvert P6775/P9309	**Box Culvert Service at 172.7 LF upstream of access MH under bridge**

City:	Location code:	Location details:
Milwaukee		

Pipe:

Sewer use:	Height:	Width:	Shape:	Material:	Lining method:
XX	**6** in.	**6** in.	C	**RCP**	

Coating method:	Pipe joint length:	Total length:	Length surveyed:	Year laid:	Year renewed:
			18 ft.		

Measurements:

Upstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:

Downstream MH No:	Rim to invert:	Rim to grade:	Grade to invert:	Northing:	Easting:	Elevation:
Box Culvert						

Coordinate system:	Vertical datum:	GPS accuracy:

Additional Information:

Pipe Ratings

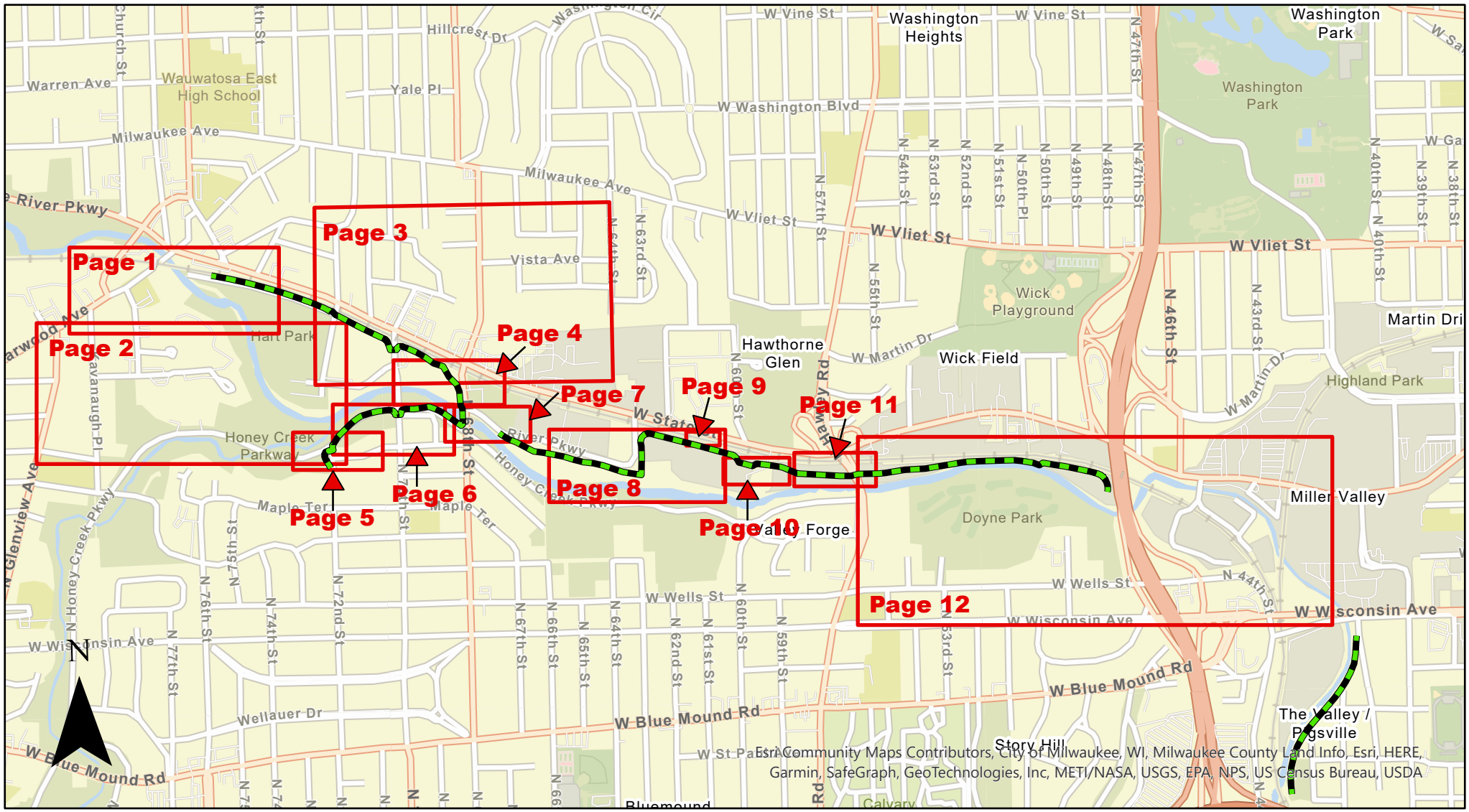
Grade	Structural:					O&M:					Overall:			
	Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Amount of Defects	Segment Grade	Pipe Rating	Quick Rating	Pipe Rating Index	Pipe Rating	Pipe Rating Index	LoF	Risk
1	0	0	0	0000	0.00	0	0	0	0000	0.00	0	0.00		
2	0	0				0	0							
3	0	0				0	0							
4	0	0				0	0							
5	0	0				0	0							

Observations

Distance	Video Ref.	PACP Code	Continuous	Value Inches (mm) 1st	2nd	%	Joint	Circumfrential Location At / From	To	Rating	Image Ref.	Remarks
0.0 ft.		ADP						/				172.7 LF Service Start
0.0 ft.		MWL				0		/				
4.0 ft.		LLD						/				
16.5 ft.		LU						/				
18.0 ft.		MSA						/				Cannot Contiune Past Bend

Appendix C

Pipe Evaluations Maps



LEGEND

Levee Centerline

PREPARED BY:

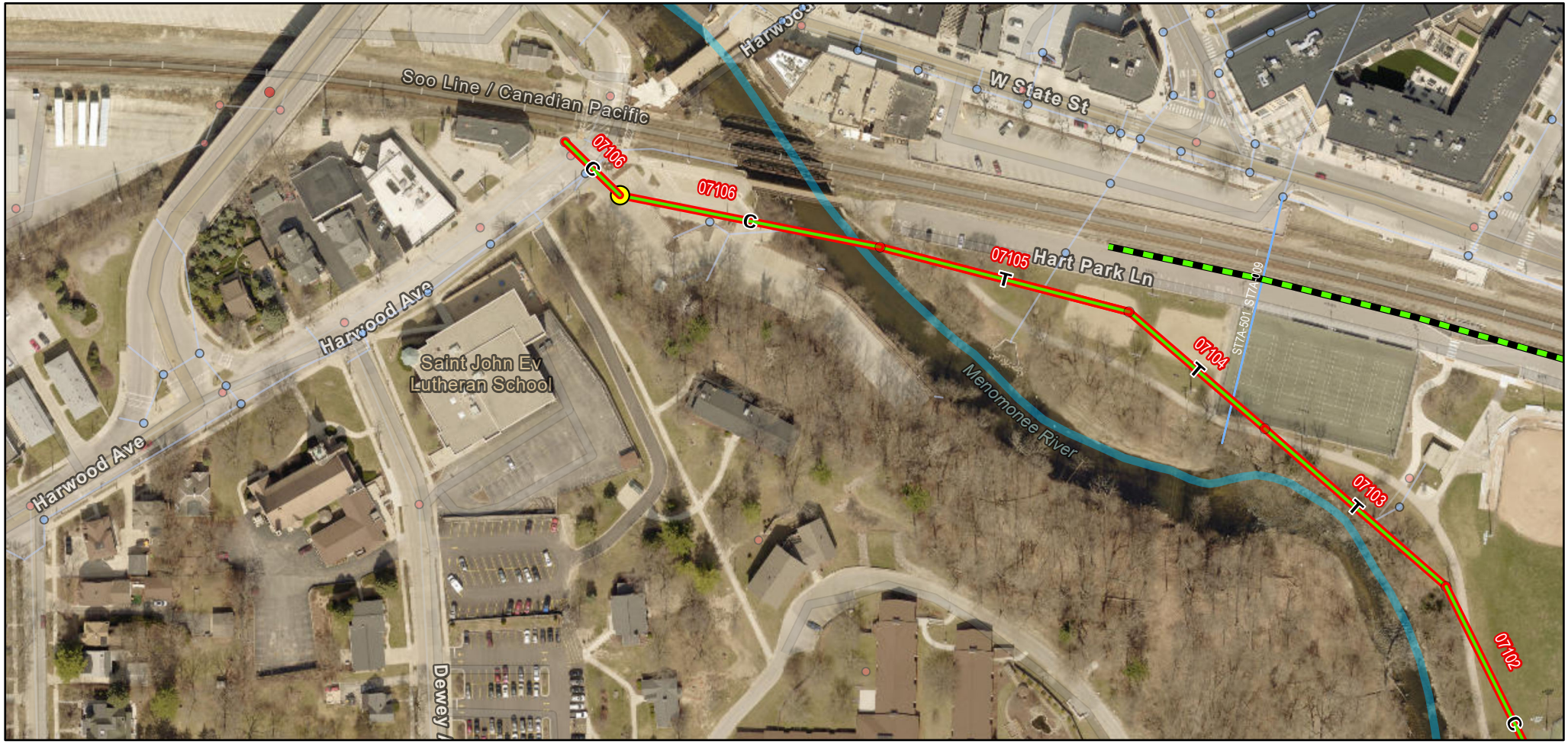
ARCADIS Design & Consultancy for natural and built assets

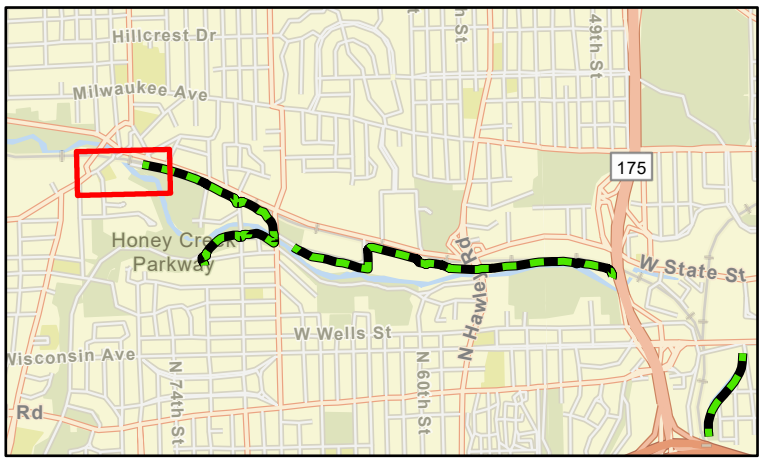
HART PARK & MILWAUKEE LEVEE SYSTEM
INDEX SHEET: PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)
May 01, 2023

0.0 0.1 0.3 0.5
Miles





CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 70 140 280 420
Feet

LEGEND

- Levee Centerline
- Menomonee River
- New Manhole
- C — Sanitary CIPPL - MMSD
- T — Sanitary T&S - MMSD
- Storm NFA

N

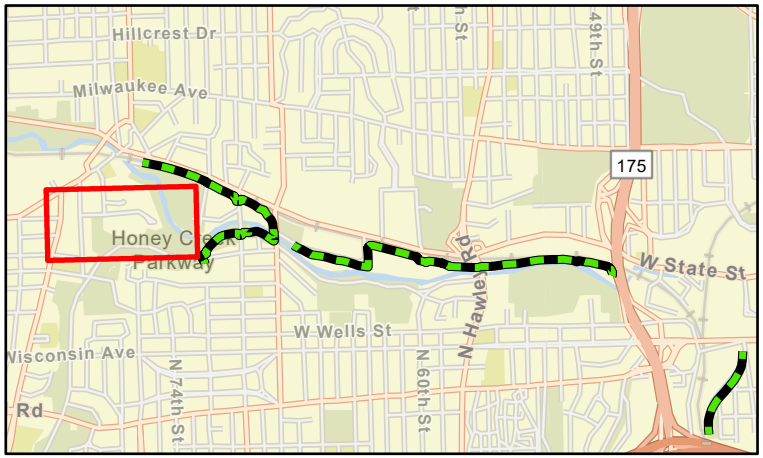
HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)

Source: Esri Community Maps Contributors, City of Milwaukee, WI, Milwaukee County Land Info, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, SWRPC, Maxar, City of Milwaukee, WI, Milwaukee County Land Info, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA



LEGEND

- Menomonee River
- Sanitary CIPPL - MMSD
- Sanitary NFA

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 120 240 480 720 Feet

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

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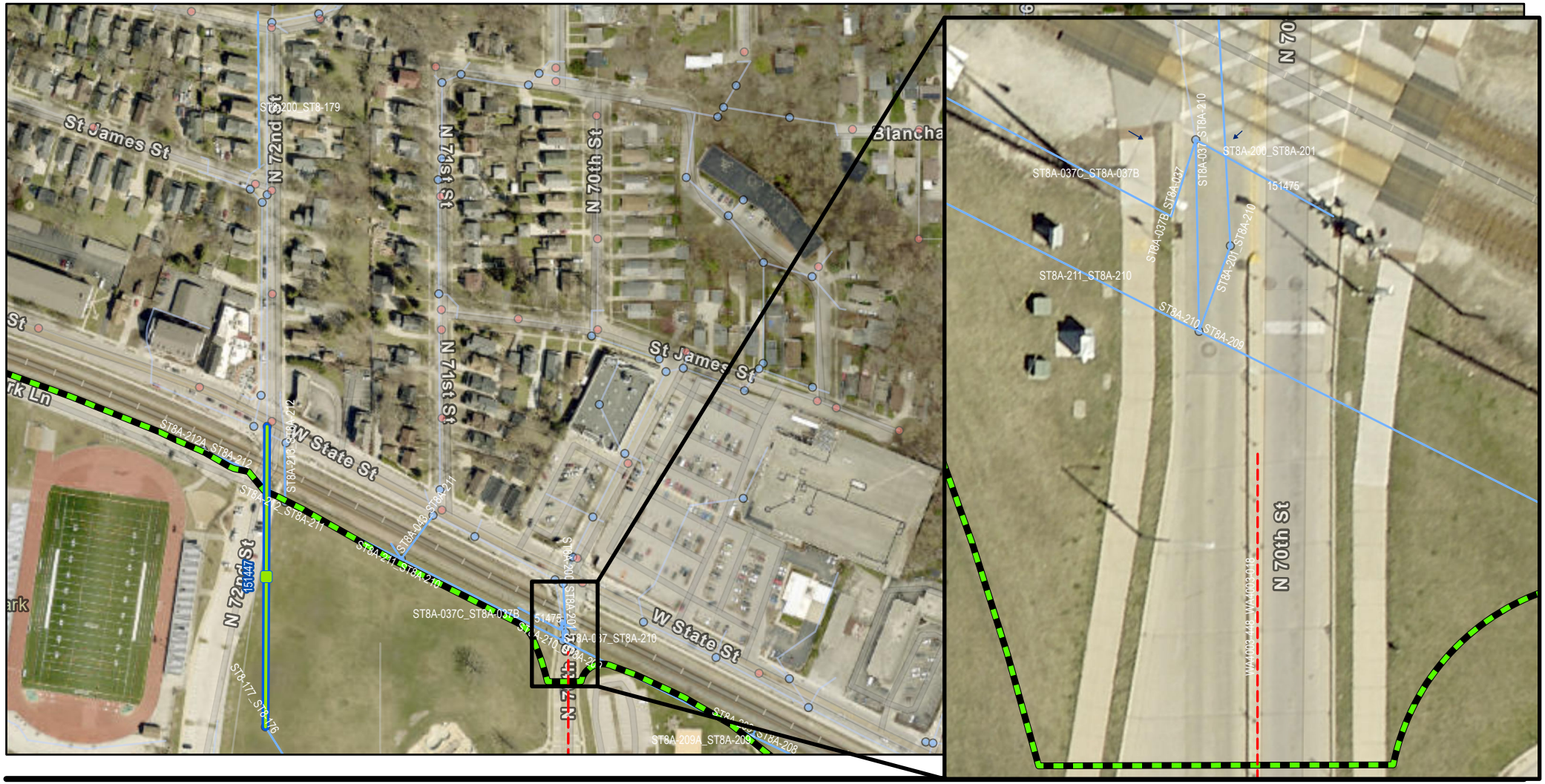
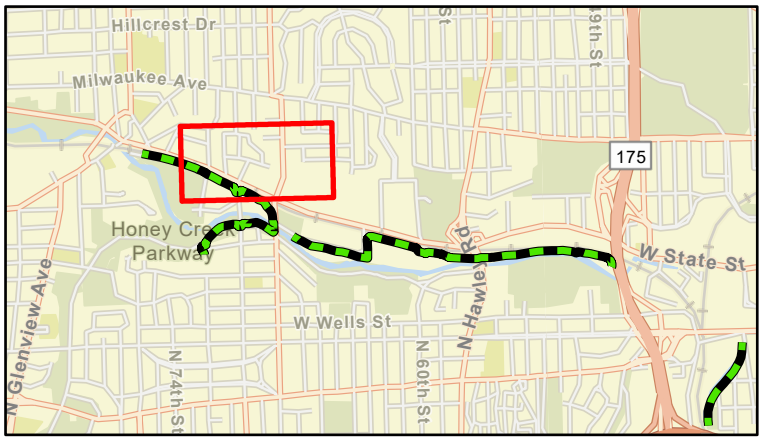




CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 100 200 400 600
Feet

LEGEND

- Levee Centerline
- Storm Grout Defects - MMSD
- Storm NFA
- Sanitary NFA -Abandoned

N

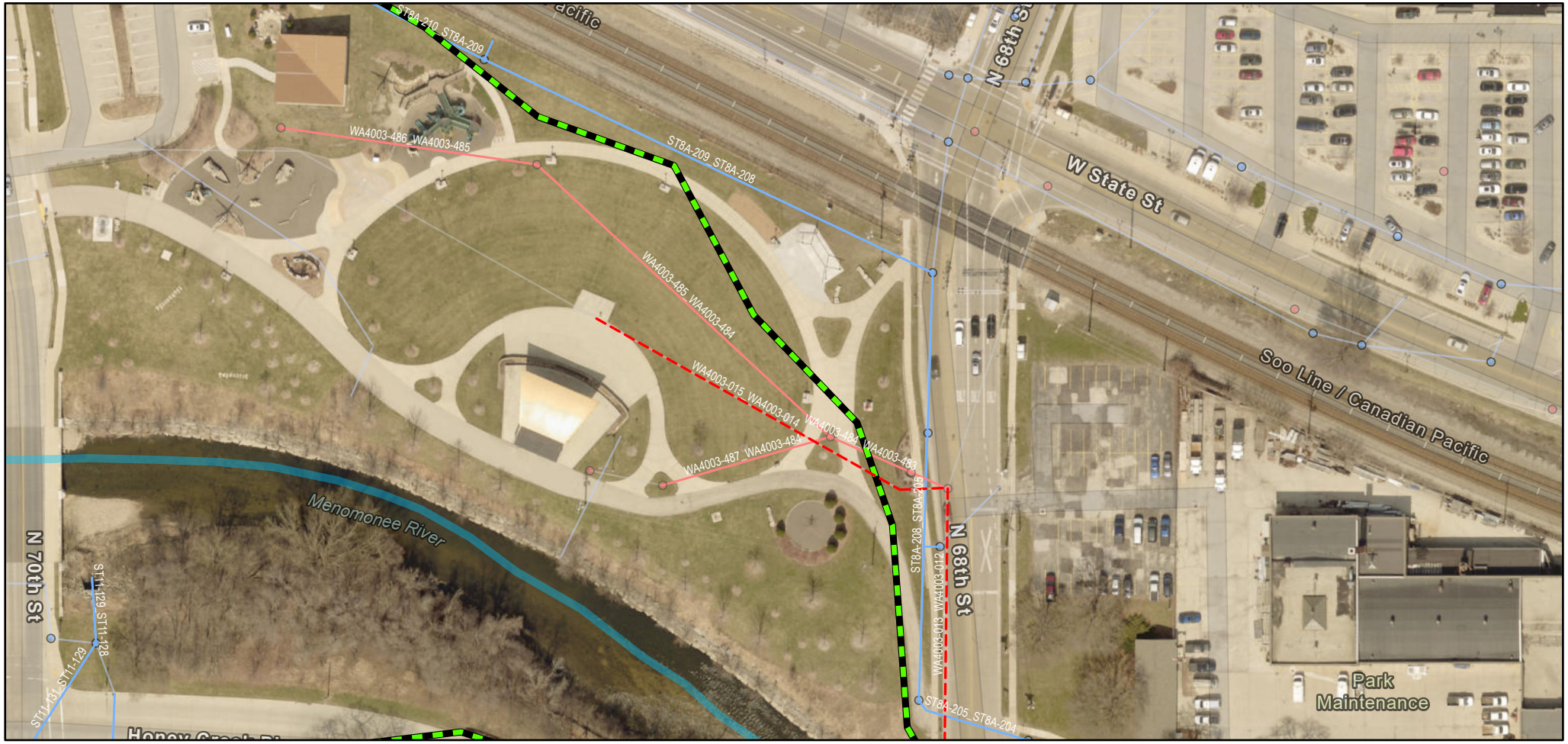
HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

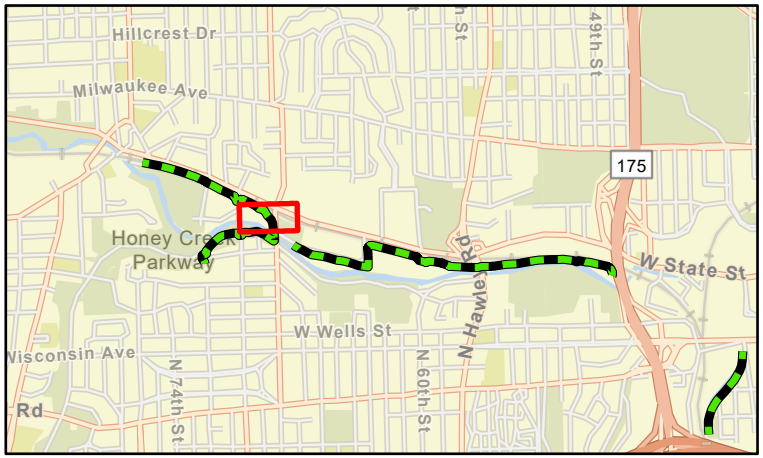
CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)
Date: November 3rd 2022

Source: SEWRPC, Maxar, Microsoft, SEWRPC, Maxar, Esri Community Maps Contributors, City of Milwaukee, WI, Milwaukee County Land Info, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, City of Milwaukee, WI, Milwaukee County Land Info, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA





CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 45 90 180 270
Feet

LEGEND

- Levee Centerline
- Menomonee River
- Sanitary NFA -Abandoned
- Sanitary NFA
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

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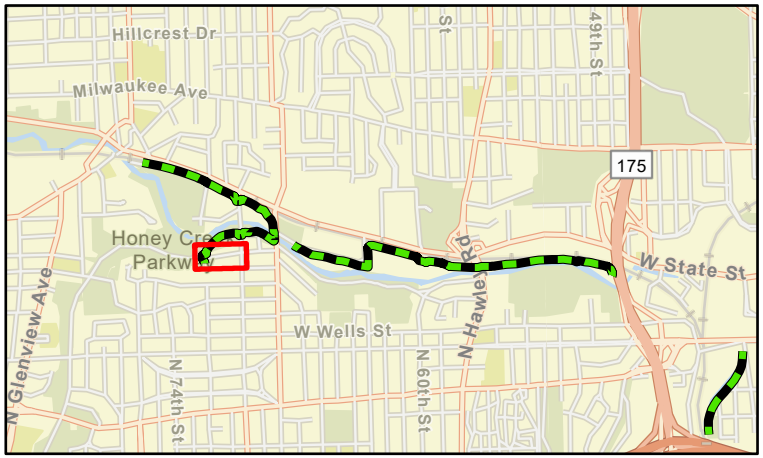

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 40 80 160 240
Feet

LEGEND

- Levee Centerline
- Storm Outfall Repair - Wauwatosa
- Storm CIPPL - Milwaukee County
- Sanitary Grout Defects - MMSD
- Storm Abandonment- Milwaukee County
- Sanitary NFA
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)
Date: November 3rd 2022

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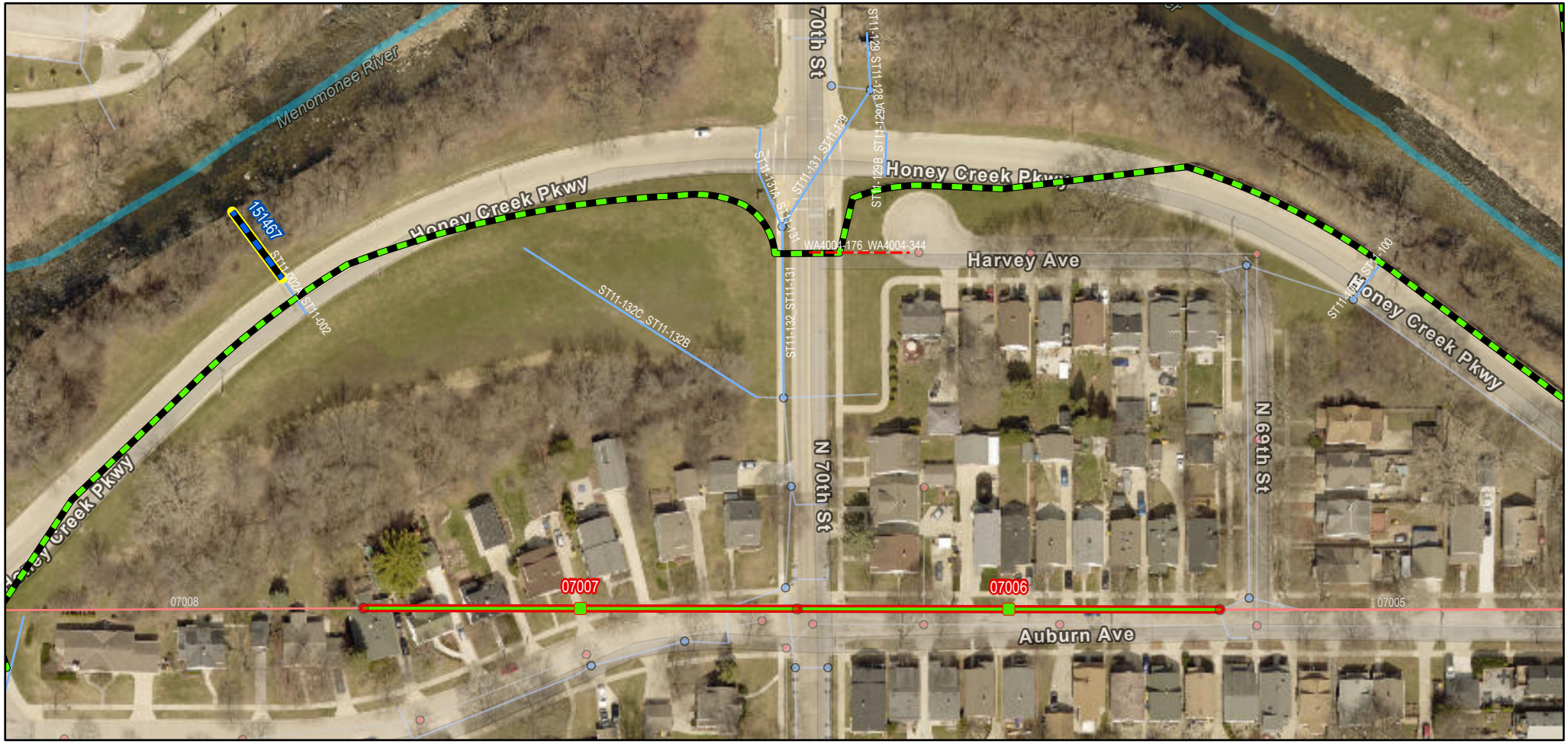

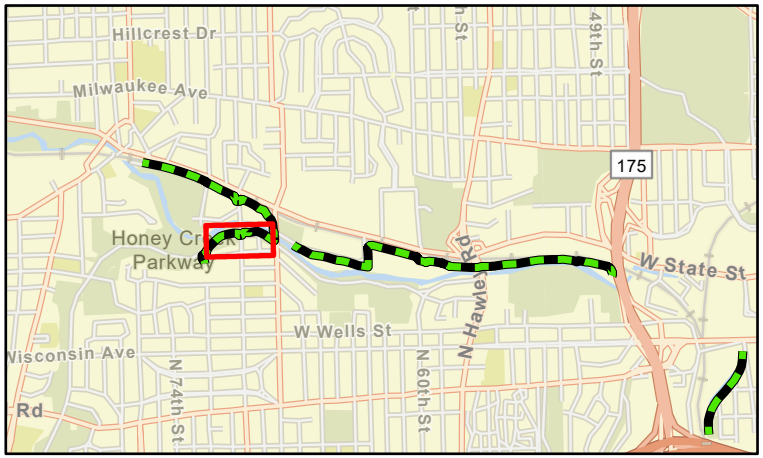

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 50 100 200 300 Feet

LEGEND

- Levee Centerline
- Menomonee River
- Storm Replacement - Milwaukee County
- Sanitary Grout Defects - MMSD
- Sanitary NFA -Abandoned
- Sanitary NFA
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

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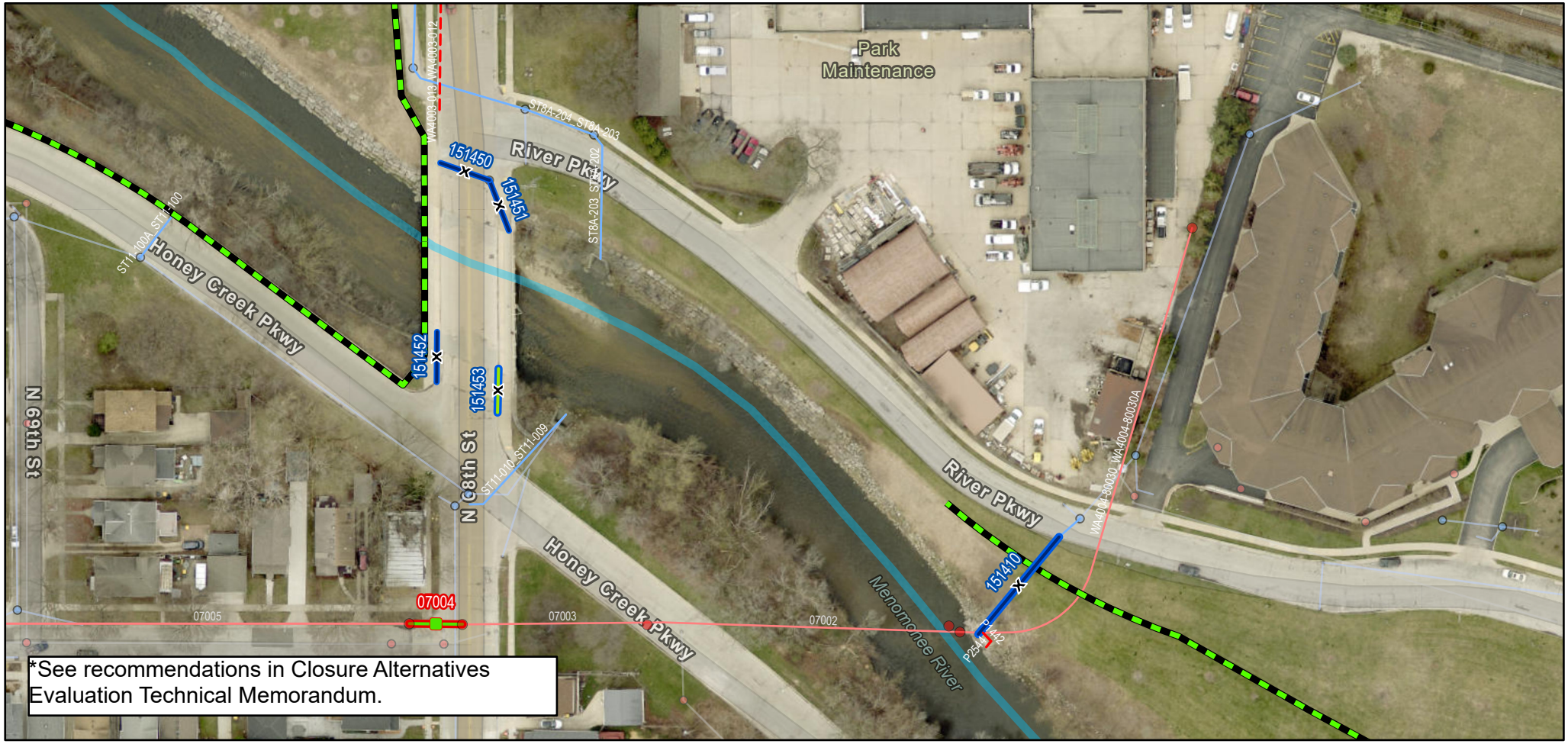

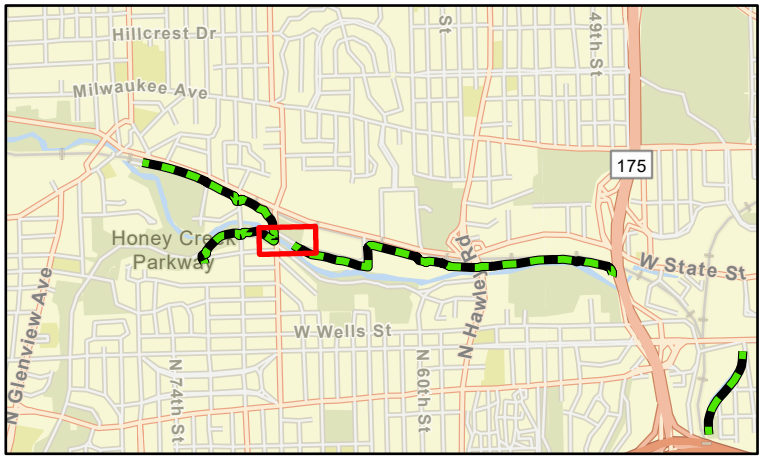

LEGEND

- Levee Centerline
- Menomonee River
- Storm Abandonment - MMSD
- Storm Abandonment - Wauwatosa
- Sanitary Grout Defects - MMSD
- Sanitary NFA -Abandoned
- Sanitary NFA
- Storm NFA

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 45 90 180 270 Feet

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)
Date: November 3rd 2022

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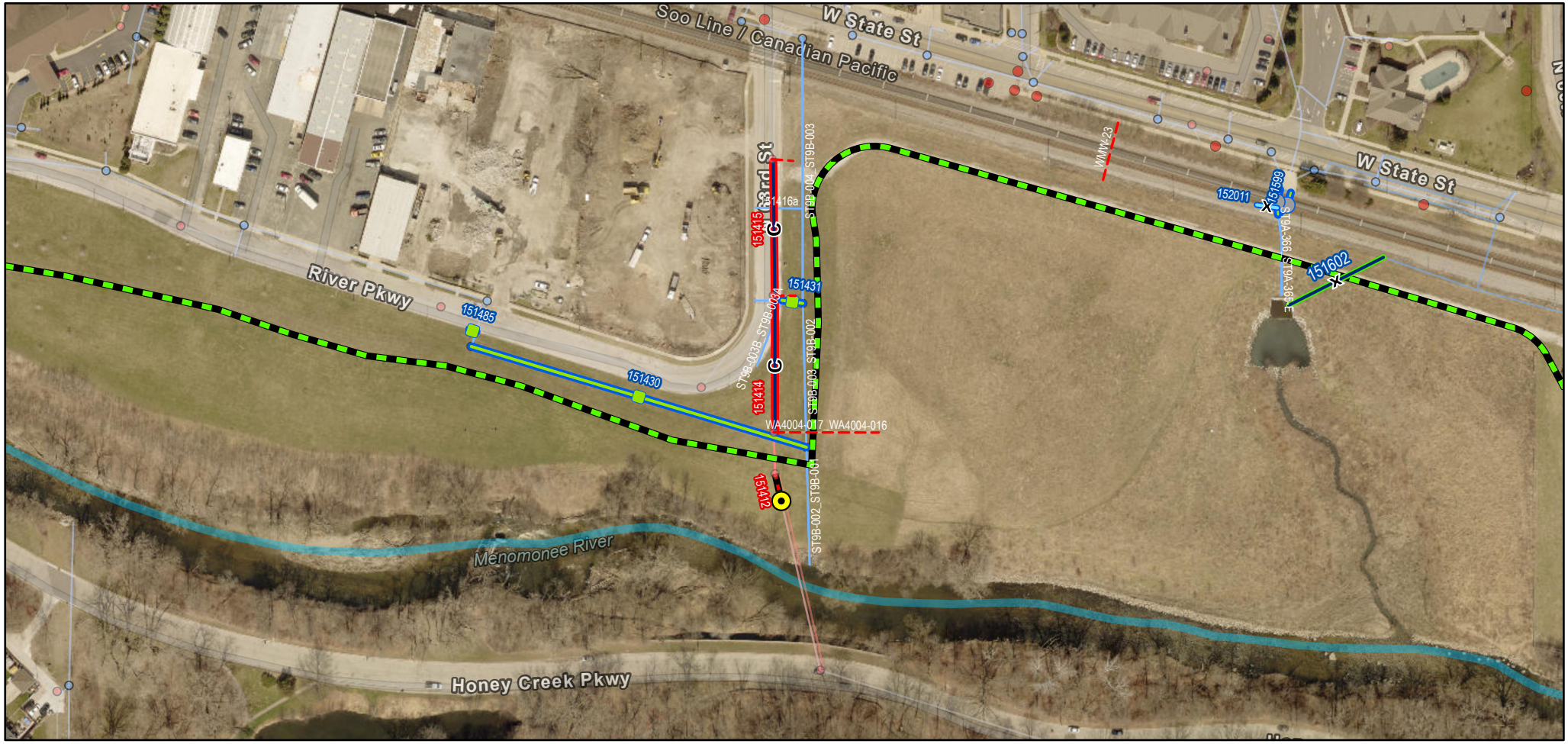

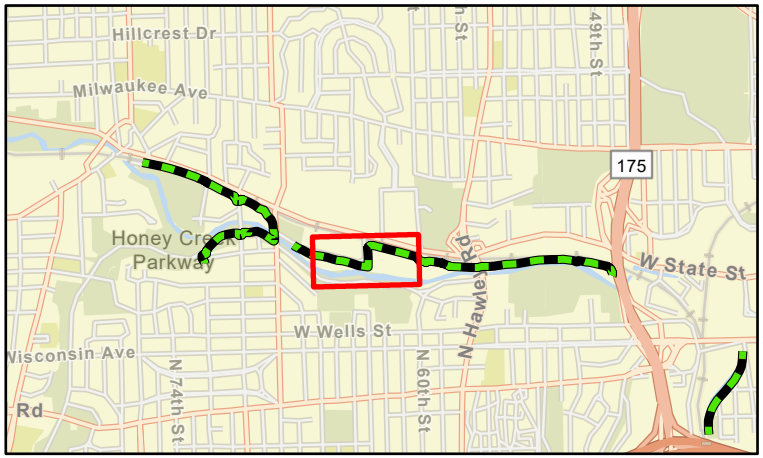

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 80 160 320 480 Feet

LEGEND

- Levee Centerline
- Menomonee River
- New Manhole
- Storm Grout Defects - MMSD
- Sanitary Replace - Wauwatosa
- Sanitary CIPPL - Wauwatosa
- Storm Concrete Repairs - MMSD
- Storm Phase 2B Abandon- MMSD
- Storm Abandonment- Unknown
- Sanitary NFA -Abandoned
- Sanitary NFA
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)

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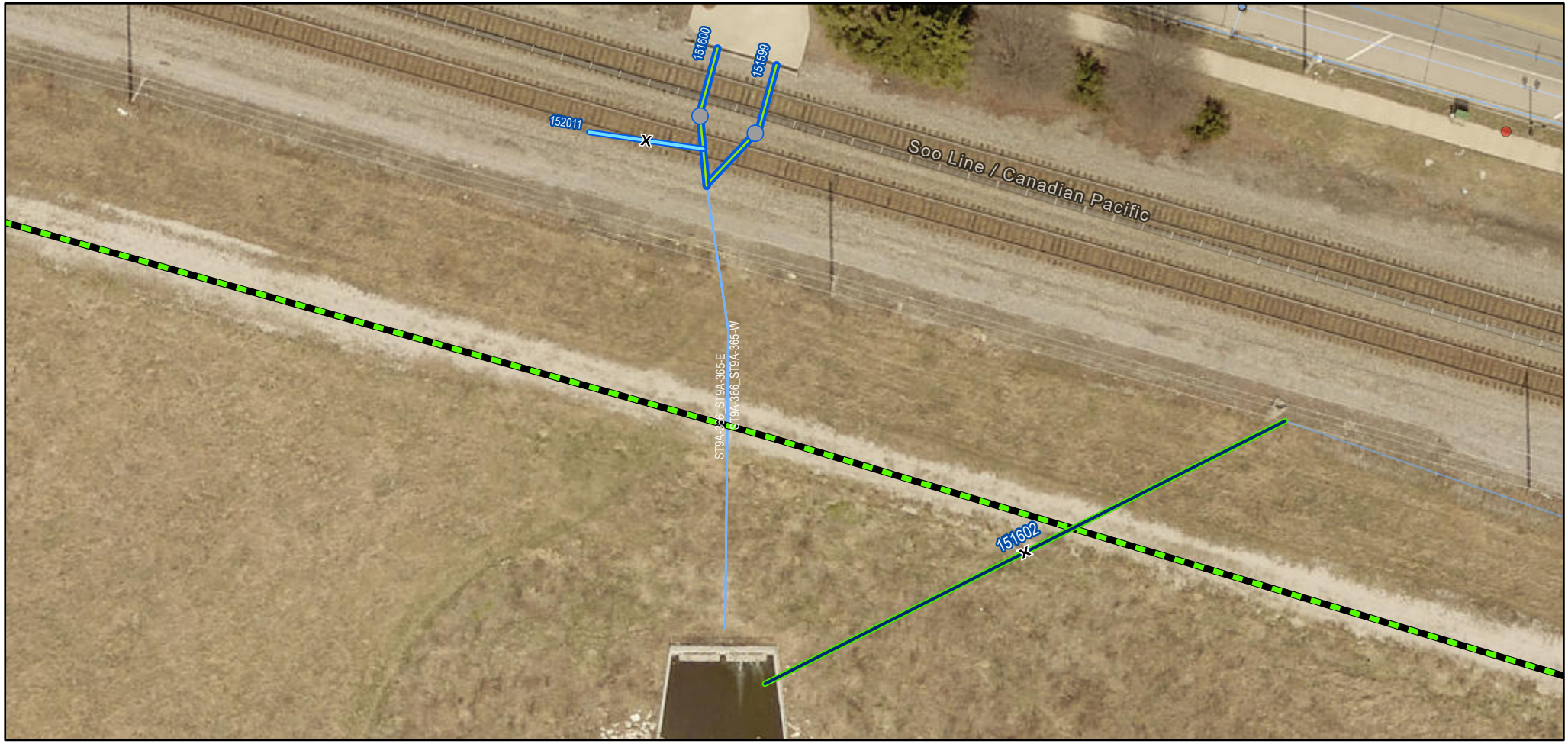

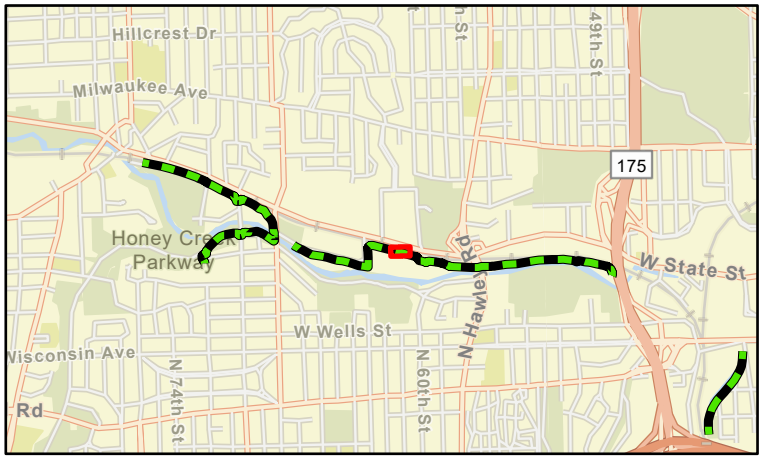

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 15 30 60 90
Feet

LEGEND

- Levee Centerline
- Storm Concrete Repairs - MMSD
- Storm Phase 2B Abandon- MMSD
- Storm Abandonment- Unknown
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)

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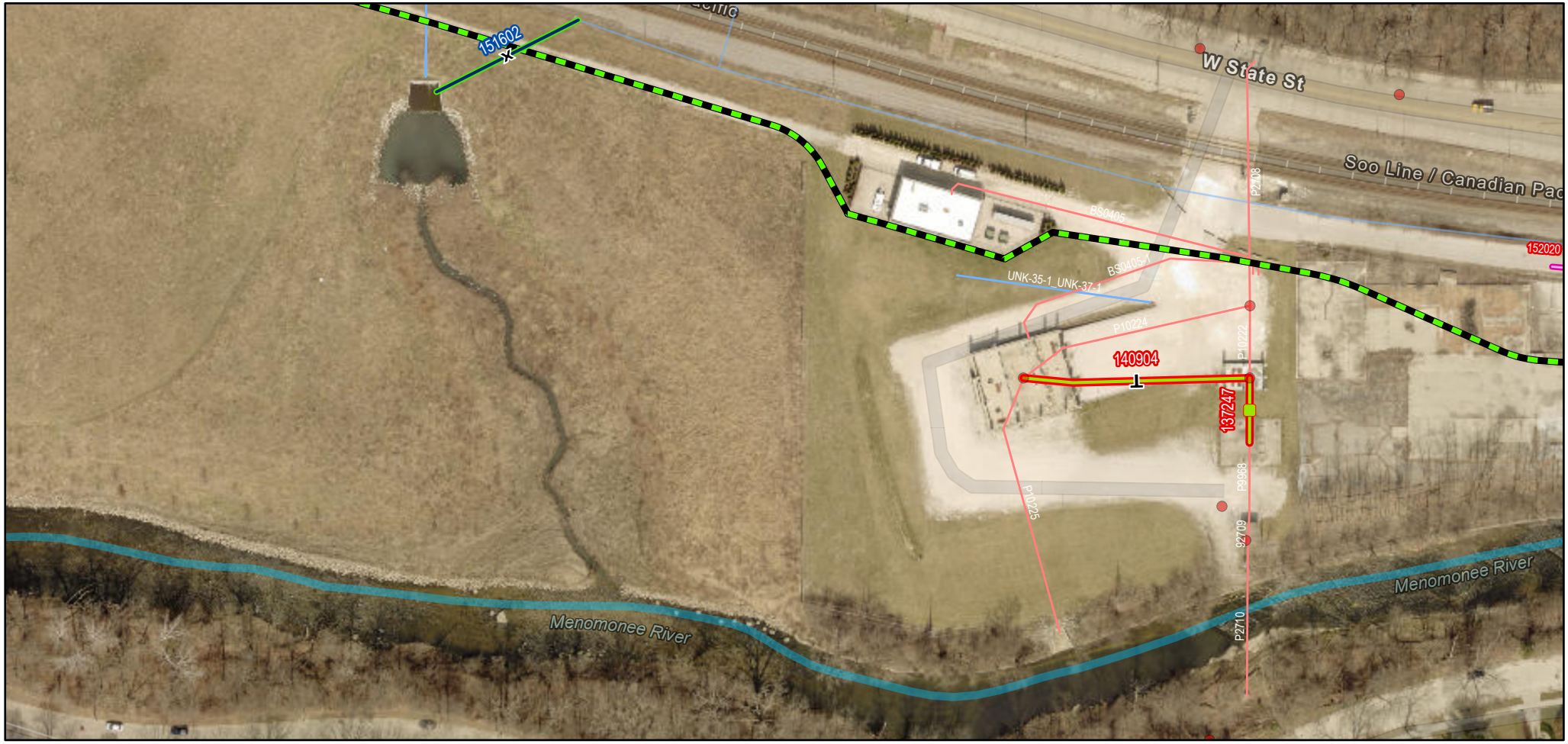

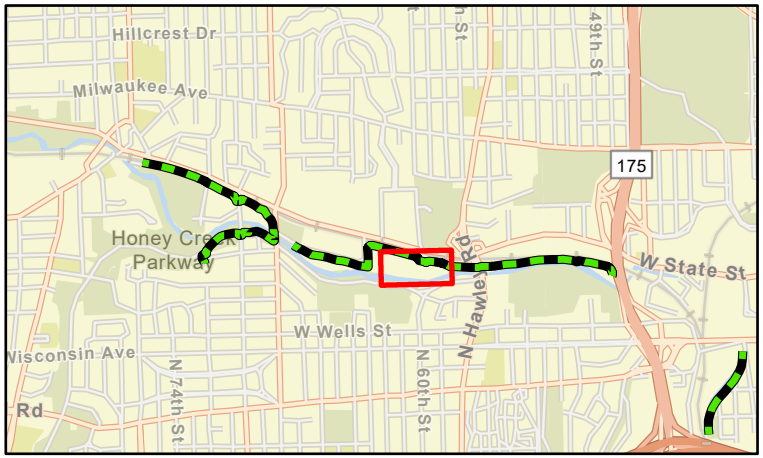

CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 55 110 220 330
Feet

LEGEND

- Levee Centerline
- Menomonee River
- Sanitary T&S - MMSD
- Sanitary Grout Defects - MMSD
- Storm Phase 2B Abandon - Private
- Storm Phase 2B Abandon- MMSD
- Sanitary NFA
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)

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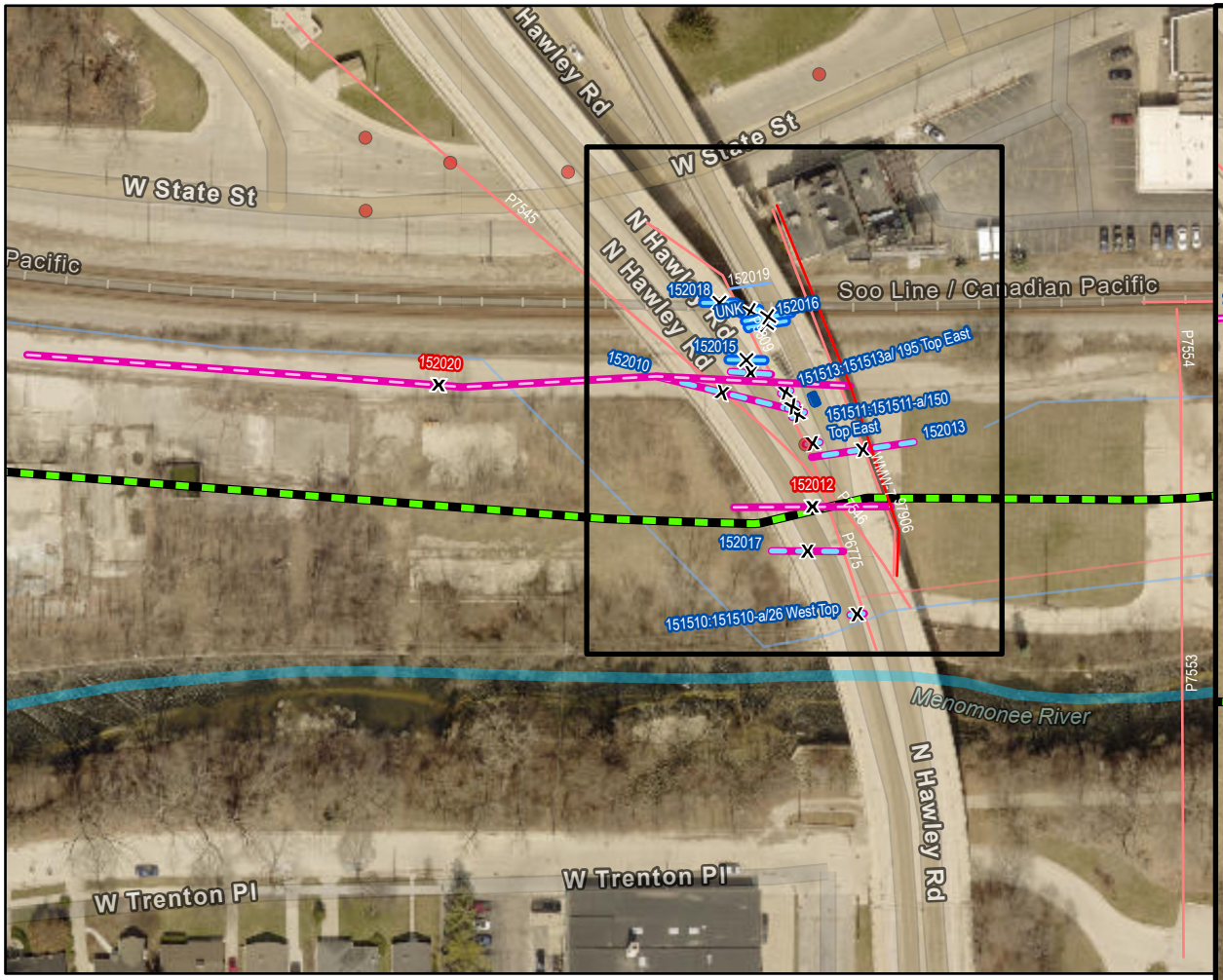
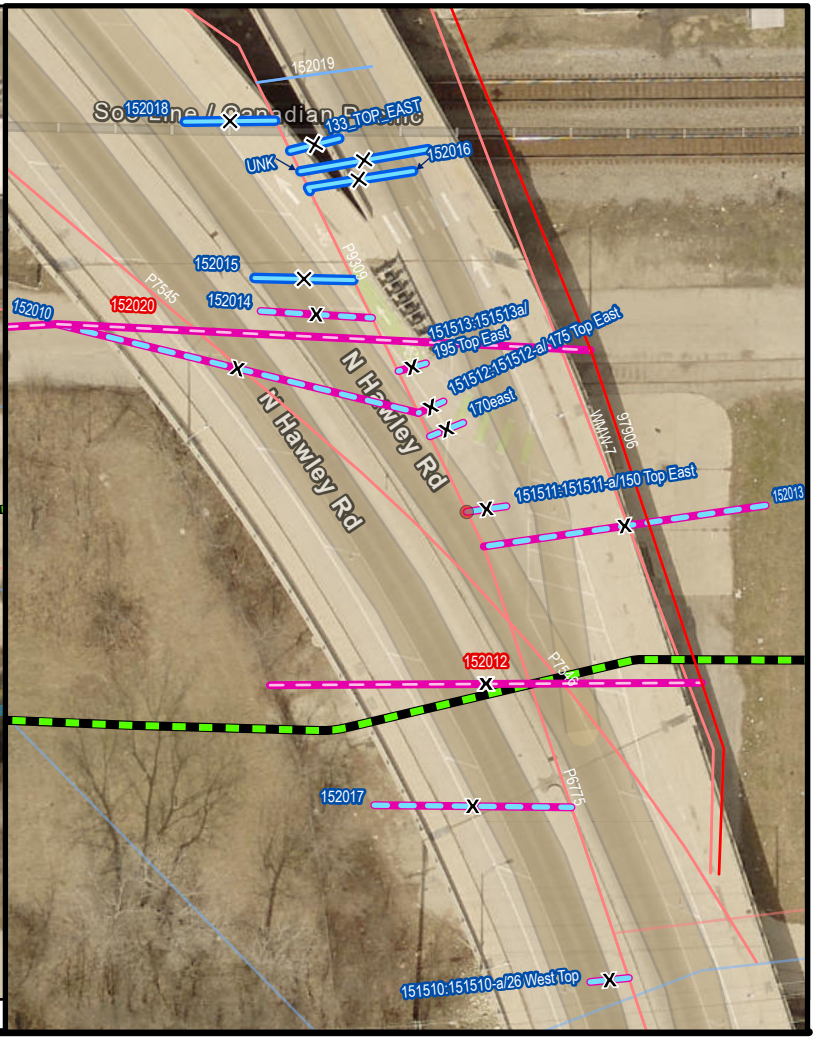
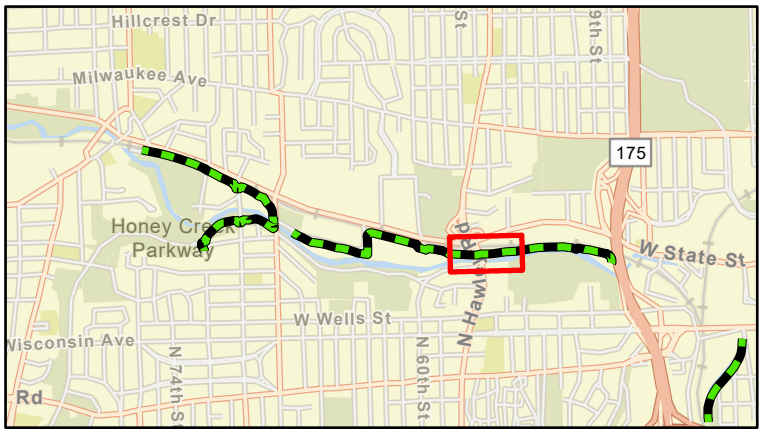






CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 45 90 180 270
Feet

LEGEND

- Levee Centerline
- Menomonee River
- Storm Abandonment - Unknown
- Storm Phase 2B Abandon - Private
- Storm Phase 2B Abandon - Unknown
- Sanitary NFA -Abandoned

N

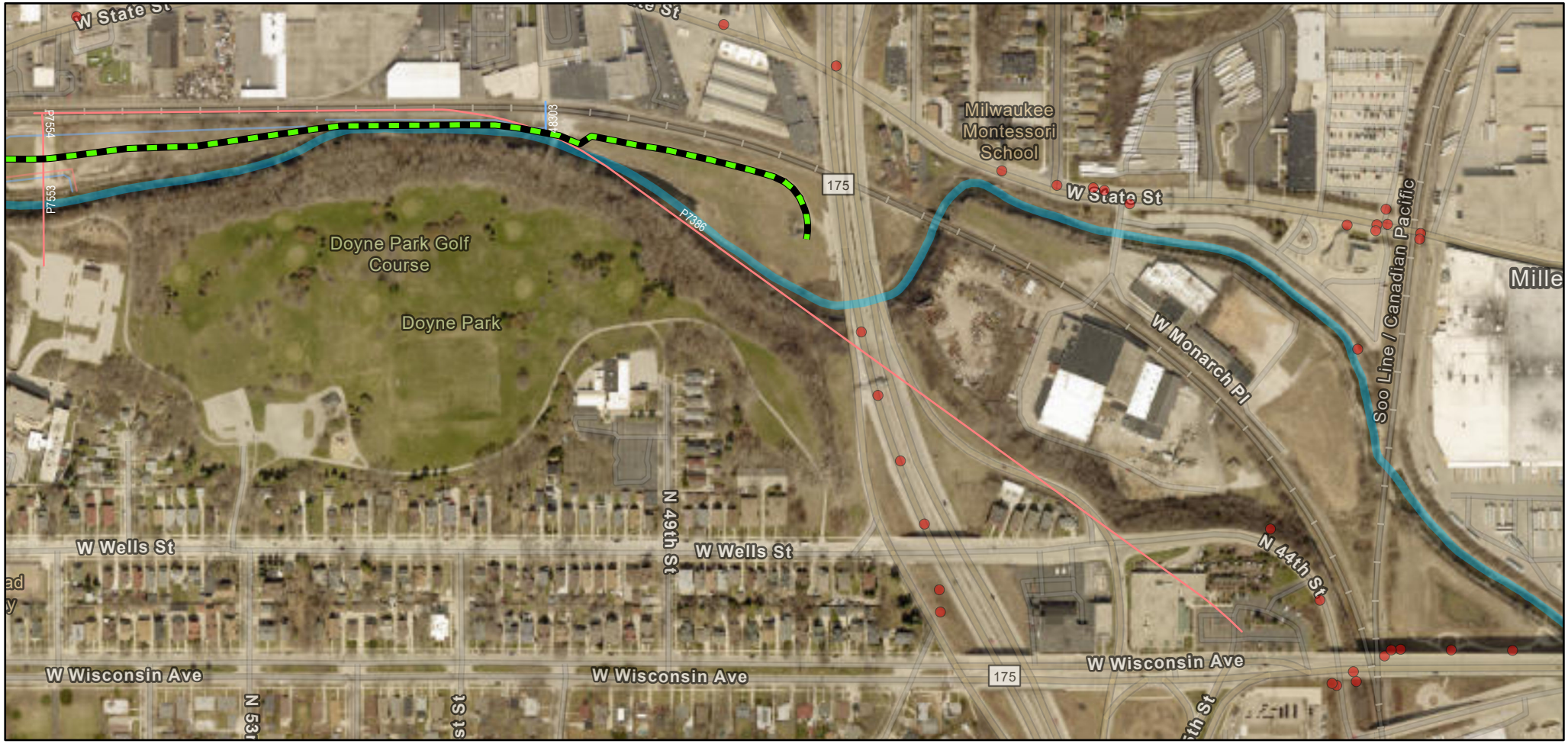
HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

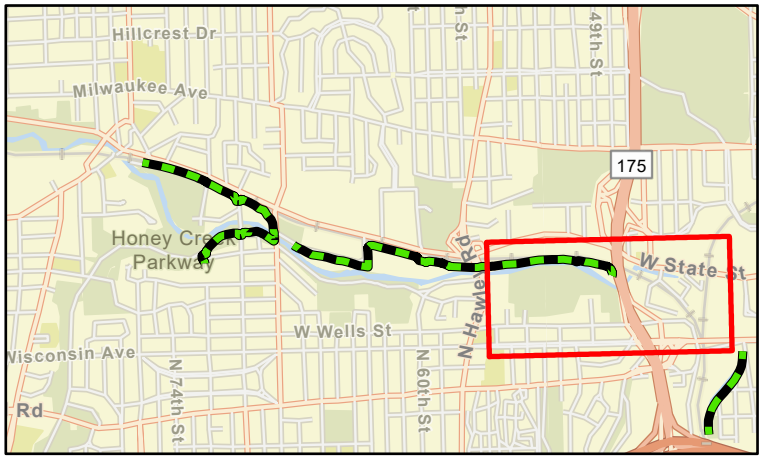
CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)

Source: Esri Community Maps Contributors, City of Milwaukee, WI, Milwaukee County Land Info, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, City of Milwaukee, WI, Milwaukee County Land Info, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, SWRPC, Maxar, Microsoft





CIPPL - Cured-In-Place Pipe Lining
T&S - Test & Seal
NFA - No Further Action

0 190 380 760 1,140
Feet

LEGEND

- Levee Centerline
- Menomonee River
- Sanitary NFA
- Storm NFA

N

HART PARK & MILWAUKEE LEVEE SYSTEM PIPE REHABILITATION & REPAIR

CLIENT/PROJECT:
MILWAUKEE METROPOLITAN SEWAGE DISTRICT HART PARK & MILWAUKEE LEVEE SYSTEM

PREPARED BY: ARCADIS Design & Consultancy for natural and built assets

Coordinate System: WGS 1984 Web Mercator (auxiliary sphere)

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Appendix D

Siphon As-Builts


AS-BUILT INFORMATION BY THE SEWERAGE COMMISSION OF THE CITY OF MILWAUKEE
Construction Plan Approved 2-23-78
File No. 175-118
I hereby certify that the Sanitary Sewer shown on this plan has been constructed in accordance with the approved plan and specifications.
Chief Engineer and General Manager
Date MAY 30, 1978
(F) Indicates Field Measurement
I-Leakage test by LOW PRESSURE AIR
As-Built entered by T. J. P., 5-19-78
Inspectors: V. TOELLNER, W. BRAUN
Checked by: E.K.
Notes in Envelope 7679
Contractor: GLOBE CONTRACTORS INC.
Date Accepted: 5-1978
C.L. N. 63RD ST. EXTENDED
SEE AS-BUILT 34-40
EXIST. 6" WATER
EXIST. 8" SAN.
EXIST. 36" STORM
M.H. 1
EXIST. GATE
2" AIR VENT BY WAUWATOSA WATER DEPT.
ABANDON
BULKHEADS
PROP. 8" P.V.C. SEWER PIPE ASTM D-3034 SDR 35
M.H. 2
6" X 12" REDUCER
12" X 11¼° BEND
12" X 22½° BEND (TIPPED)
BULKHEAD
4-6" X 22½° BENDS
2-12" X 22½° BENDS
PROP. 12" CLASS VI DUCTILE IRON WATER MAIN
PROP. TWIN 6" CL. IV DUCTILE IRON SAN. SEWER
ROEBUCK & CO.
MILWAUKEE CO.
PROPOSED 90' PAVED CHANNEL
FENCE
RIVER
MENOMONEE
SEARS
HONEY CREEK PARKWAY
EXISTING 6" C.I.
EXIST. GATE
24" OFFSET
12 X 45° BEND (TIPPED)
TEMPORARY TAPPED PLUG REQ'D.
6" X 12" REDUCER
12" X 22½° BEND
M.H. 3
8" S.E. 46.39 (F)
TWIN 6" N.W. 46.30 (F) W/S
6" N.W. 46.33 (F) E/S
EXISTING WALL
EXISTING PARKWAY ROADWAY
CONCRETE CURBS AND ASPHALT PAVEMENT
PROP. 8" P.V.C. SEWER PIPE ASTM D-3034 SDR 35
M.H. 4
8" S. 48.13 (F)
8" S.E. 48.14 (F)
8" N.W. 47.99 (F) (PROP. & EXIST.)
EXIST. 8" SAN. SEWER
SEE AS-BUILT 35-150
SEE AS-BUILT 35-147
BENCH MARKS
STD. N. 62ND ST. & W. NORTH AVE. 53.22
HYD. N. 63RD ST. & RIVER PKWY. 56.17
NOTE:
CONTRACTOR SHALL EXCAVATE AND REMOVE EXIST. 8" SAN. SEWER BETWEEN M.H. 3 & M.H. 4 AND FROM EXIST. M.H. AT APPROX. STA. 3+22 SOUTH APPROX. 20 FEET. HE SHALL THEN BACKFILL BENEATH THE NEW SEWER WITH COMPACTED ROAD GRAVEL.
BOTTOM M.H. "2"
BOTTOM M.H. "3"
PROP. 6" SAN. SEWER
PROP. 8" SAN. SEWER
SECTION X-X M.H. "2" & "3"
CONCRETE ENCASEMENT DETAIL
STA. 3+30 TO STA. 4+82
0.00 WAUWATOSA DATUM - 581.22 ABOVE SEA LEVEL
GRADE 0.0053 (F)
PROP. 8" P.V.C. SAN. SEWER
PROP. TWIN 6"
GRADE 0.0067 (F)
12" DUCTILE IRON
DUCTILE SAN. SEWER
PROP. 8" P.V.C. SAN. SEWER
GRADE 0.004
WATERMAIN
EXIST. 8" SAN. SEWER
PIPE ENCASED IN CONC. BTWN. THESE LIMITS (F)
53.1 (F)
177' (F)
333.4 (F)
2+00
3+00
4+00
5+00
6+00
7+00
8+00
APPROVED BY THE BOARD OF PUBLIC WORKS OF THE CITY OF WAUWATOSA, WISCONSIN, BY A RESOLUTION ADOPTED: 11-14-1977
APPROVED BY THE COMMON COUNCIL OF THE CITY OF WAUWATOSA, WISCONSIN, BY A RESOLUTION ADOPTED: 11-15-1977
SUBMITTED FOR APPROVAL: 11-14-1977
CITY OF WAUWATOSA, WISCONSIN
ENGINEERING DIVISION
SAN. SEWER & WATER MAIN – RELAY
MENOMONEE RIVER CROSSING AT N. 63RD ST. EXT.
HONEY CREEK PARKWAY FROM N. 63RD. ST. EXT. TO 334' E
SCALE: HORIZ.: 1"=30' VERT.: 1"=3'
DRAWN BY: L.B.
CHECKED BY: RDH
DATE: NOV. 11, 1977
FILE NO. 16-531
SEWERAGE COMMISSION AS-BUILT FILE NO. 35-6672

Appendix E

Inspection Procedure for Siphon Pipes Downstream of Riser

Appendix E: Inspection Procedure for Siphon Pipes Downstream of Riser

Scope: Inspect the portions of the twin 6” cast iron siphons downstream of the riser (i.e. final 22.5 degree bends).

Personnel:

- Confined Space Entrant
- Confined Space Attendant
- Foreman/support personnel

Equipment:

- Rigid SeeSnake push camera
- Dewatering submersible pump
- Generator
- Hose
- Extension cords
- Vac/Jet Truck
- Confined space entry equipment
- Harnesses
- Air monitors
- PPE
- Plug and flow through hose for diversion
- Air compressor w/ hose
- Manhole protection (rail/guards)
- Ventilator
- Landscape protection (tire boards)

Procedure:

1. Block off worksite at downstream manhole (WA MH4004-018).
2. Send jet up overflow and main siphon pipes.
3. Use dewatering pump to remove excess water from behind weir wall (overflow pipe).
4. Send in confined space entrant.
5. Send push camera into overflow siphon – stop at riser section end.
6. Pull back slowly while recording.
7. Depending on flow, divert main siphon pipe flow into overflow siphon at upstream manhole (WA MH4004-020).
8. Send push camera into main siphon pipe – stop at riser section end.
9. Pull back slowly while recording.
10. Remove push camera and confined space entrant.
11. Break down project site.

Lessons Learned:
The siphon section cannot be dewatered with either using a jetter or pig to draw down the water level. Any further televising of the siphon section would require specialized equipment or alternative methods. The orientation and small size of the pipes presented both a high difficulty level to complete televising and a higher risk of having equipment damaged or get stuck.

Appendix F

Project Cost Estimates

Appendix F - MMSD Sanitary and Storm Pipe Project Cost Estimate Backup

Cured-in-Place Pipe Lining ~ $810,000

2,847 LF of 8", 12" and 24" CIPPL, including pre-clean/CCTV, bypass pumping, pre-grouting, and installation of 1 new manhole.

Baseline Construction Costs

- Pipeline Cleaning and CCTV $36,000
- Pre-Grouting Defects $3,500
- 8" CIPPL Installation, 349 LF $31,000
- 12" CIPPL Installation, 95 LF $7,000
- 24" CIPPL Installation, 2,403 LF $324,000
- 5' Diameter MH Install $20,000
- 8" Pipe Bypass Pumping $4,000
- 24" Pipe Bypass Pumping $122,000

Contingencies

- Contingency 15% $82,000
- Mobilization 3% $19,000
- Engineering Design 10% $65,000
- Construction Inspection 10% $65,000
- Administration and Legal 5% $32,000

Outfall Repair/Stream Bank Restoration ~ $150,000

Estimate was based on 2 similar projects in Virginia.

Open Cut Replacement per Figure 2-8 (includes levee reconstruction) ~ $75,000

Replace twin 6" cast iron siphons with one 8" PVC sewer and install one new access manhole. Includes levee reconstruction.

Baseline Construction Costs

- 8" Siphon Replacement $25,000
- 5' Diameter Manhole Install $20,000
- Vac Truck Bypass Pump and Dump $4,500

Contingencies

- Contingency 15% $7,400
- Mobilization 3% $1,700
- Engineering Design 10% $6,000
- Construction Inspection 10% $6,000

- Administration and Legal 5% $3,000

Test and Seal (includes grouting defects) ~ $230,000

Test and seal 763 LF of 24" pipe, preclean and TV, and seal defects and joints in multiple pipes ranging from 21" to 120".

Baseline Construction Costs

- Clean and CCTV Inspection $18,000
- 24" Pipe Joint Test and Seal $62,300
- 96" Defect Grouting $16,400
- 120" Pipe Test and Seal $36,400
- 21", 36", 48", & 72" Defect Grouting $21,000

Contingencies

- Contingency 15% $23,000
- Mobilization 3% $5,300
- Engineering Design 10% $18,200
- Construction Inspection 10% $18,200
- Administration and Legal 5% $9,100

Note: Totals rounded to nearest $5,000.

Arcadis U.S., Inc.
126 North Jefferson Street, Suite 400
Milwaukee, WI 53202
www.arcadis.com

Attachment I: Pipe Rehabilitation/Replacement for Levee Standards (*Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert,* Arcadis March 2022 rev. 2/10/23)

Milwaukee Metropolitan Sewerage District

Contract TS-2683 Task Order 02

Project W20034 – Sewer Rehabilitation for FEMA Levee Accreditation

Design Report

Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert

March 2022 (rev. 2/10/23)

Milwaukee Metropolitan Sewerage District
Contract TS-2683 Task Order 02
Project W20034 – Sewer Rehabilitation for FEMA Levee Accreditation

Design Report

Replacement of the Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets and Rehabilitation of the Schoonmaker Creek Culvert

March 2022 (rev. 2/10/23)

Prepared By:
Arcadis U.S., Inc.
126 North Jefferson Street, Suite 400
Milwaukee, Wisconsin 53202
Phone: 414 276 7742
Fax: 414 276 7603

Prepared For:
Keith Kalinger
Senior Project Manager
Milwaukee Metropolitan Sewerage District
260 West Seeboth Street
Milwaukee, WI 53204

Our Ref:
30109039

Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

CCTV	Closed circuit television
CF	Cubic feet
CIPP	Cured in place pipe
CP	Canadian Pacific Railway
ESDC	Engineering services for design and construction
HPS	Hart Park South
LF	Linear feet
LS	Lump sum
Master Plan	Hart Park and Western Milwaukee Levee System Accreditation Master Plan
RCP	Reinforced concrete pipe
SF	Square feet
TO	Task order
VCP	Vitrified clay pipe
WDNR	Wisconsin Department of Natural Resources
WPA	Works Progress Administration

1 Introduction

The Arcadis team, including OTIE and HNTB, reviewed the Hart Park and Western Milwaukee Levee System Accreditation Master Plan ("Master Plan") report provided by Stantec dated March 31, 2021, as part of Task Order 1 (TO-1) for Project W20033. The Master Plan Pipe Penetration Analysis (Attachment E of the Master Plan) identified pipes for rehabilitation or replacement. The Master Plan identified the 8-inch storm sewer and outfall on Honey Creek Parkway between 70th and 72nd streets (HPS-9) for replacement due to poor condition of the existing pipe (see Figure 1-1).

The Master Plan also identified the Schoonmaker Creek Culvert for repairs due to deterioration in the concrete and stone walls and portions of the culvert floor that are missing or eroded. The Schoonmaker Creek Culvert pass below railroad tracks owned by the Canadian Pacific Railway (CP).

The purpose of this report is to evaluate alternative solutions and identify recommended improvements for the repair and/or replacement of the HPS-9 storm sewer and outfall and the Schoonmaker Creek Culvert.

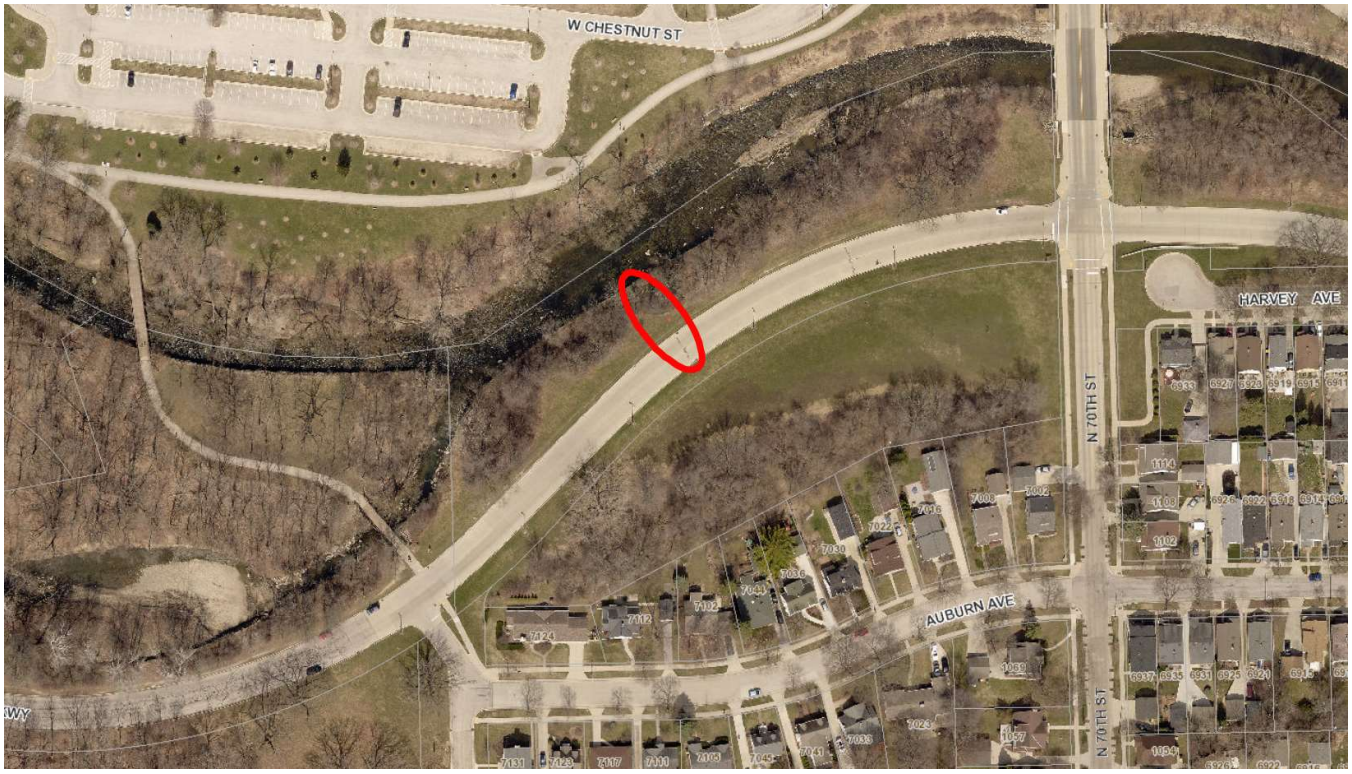


Figure 1-1. Location of Storm Sewer on Honey Creek Parkway between 70th and 72nd Streets

OTIE conducted a site visit on January 13, 2022 to verify existing surface conditions and the condition of the Works Progress Administration (WPA) wall, including the wall penetration at the outfall to the Menomonee River (HPS-9). OTIE also reviewed Trekk Design Group, LLC's 2020 closed-circuit television (CCTV) inspection of the HPS-9 storm sewer. Results of the condition assessment, analysis, and review of the HPS-9 storm sewer and outfall are provided in Section 2.

In December 2021, Arcadis conducted a site visit and internal inspection of the Schoonmaker Creek Culvert structure to collect photographs and measurements of defects for evaluation by HNTB. Results of the condition assessment, descriptions of culvert repair types and associated costs, and additional construction and planning considerations for the Schoonmaker Creek Culvert are provided in Section 3.

An overall summary of recommendations for both the Honey Creek Parkway HPS-9 storm sewer/outfall and the Schoonmaker Creek Culvert are presented in Section 4.

2 Evaluations and Recommendations for the HPS-9 Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets

2.1 Condition of Existing Sewer and WPA Wall

OTIE reviewed Trekk Design Group's 2020 CCTV inspection of this approximately 68-foot long, 8-inch diameter storm sewer pipe run and noted that the inspection was truncated because of a large offset joint at 48.7 feet from Honey Creek Parkway and because of a large joint separation at 2.8 feet from the Menomonee River WPA wall, leaving about 16 feet of the pipe uninspected. The existing sewer material is reinforced concrete pipe (RCP) from the Honey Creek Parkway end and transitions to vitrified clay pipe (VCP) at 30.8 feet. During the January 13, 2022 site visit, the OTIE field staff also observed VCP at the outfall (see Figure 2-1). The CCTV inspection identified numerous longitudinal cracks and joint separations along the portions of the pipe that were accessible by the CCTV crawler. The pipe material change suggests earlier repairs to the sewer. The Milwaukee Metropolitan Sewerage District (MMSD) was unable to provide plans for the sewer, so its age and the date of the apparent repairs are unknown. Given its location, the sewer apparently is owned by Milwaukee County Parks.

Figure 2-1. Existing VCP Penetration of WPA Wall

OTIE also visually inspected the WPA wall section at the at the HPS-9 storm sewer outfall for structural issues/concerns associated the sewer replacement during its January 13, 2022 site visit. Although existing drawings of the wall section were not available at the time of this report, previous reports indicated that this is a

WPA-era limestone block wall. Based on other WPA-era walls that have been replaced, OTIE assumes that this wall is of similar construction.

As shown in **Error! Reference source not found.**, the wall section at the HPS-9 storm sewer outfall shows considerable deterioration. Many of the face stones directly below the outfall and at the waterline are missing, exposing the rubble/hearting between the face stones. At the time of the inspection, OTIE was unable to determine the extent of the deterioration at or below the waterline due to the frozen water surface; however, given the age of the wall, OTIE assumes that the entire wall has some degree of deterioration.

Figure 2-2. WPA-era wall at HPS-9 storm sewer outfall (July 2021)

2.2 Description and Evaluation of Improvement Alternatives

Several improvement alternatives can be considered for mitigating this damaged run of storm sewer:

1. Cured in place pipe (CIPP) lining existing piping
2. Remove RCP/VCP and replace with SDR-35 PVC piping (same alignment)
3. Relay with new SDR-35 PVC piping (new alignment)
4. Do nothing

These alternatives are discussed below.

Storm Sewer Alternative #1: CIPP Lining Existing Piping: Although CIPP lining of existing piping is an option, it would not be a practical alternative here because of the significant structural deficiencies in this pipe run, primarily a large offset near the downstream end. Structural deficiencies include significantly sized gaps between joints, significantly offset joints, and lengthy longitudinal and radial fractures. CIPP liners can handle minor deficiencies

of these types; however, even if CIPP lining of this pipe could be completed, it would result in unacceptable wrinkles and deformations in the liner that would obstruct flow.

Storm Sewer Alternative #2: Remove RCP/VCP and Replace with SDR-35 PVC Piping (same alignment): Another option is to remove the existing RCP/VCP piping and replace it with new SDR-35 PVC piping along the current alignment. This has the advantage of only disturbing the original trenching that was done to install the original piping. However, this alternative also has some disadvantages: clearing and disposal of trees and overgrowth, and management of the stone and mortar WPA wall and penetration. The contractor would need a minimum 25 feet of clearing width to allow room for the excavator and to give the excavator swing room. About eight trees in this area with a diameter exceeding 12 inches would require felling and a few of their root balls would require removal to allow for trenching. Alternatives for managing the WPA wall and penetration are discussed later in this section. Since this is an active storm sewer, the work would have to be scheduled for a dry period or alternative arrangements would need to be made to convey roadway drainage to the river.

Storm Sewer Alternative #3: Relay with New SDR-35 PVC Piping (new alignment): A third option is to relay new piping along a new alignment that is different than the existing alignment and then abandon the existing sewer. This option faces the same disadvantages as the prior remove-and-replace alternative with regard to clearing vegetation, felling trees, removing root balls, and managing the stone and mortar WPA wall and penetration. Additionally, this alternative has the disadvantage of lengthening the sewer run and trenching in previously virgin, undisturbed soils. It also involves more work at the WPA wall to cut in a new outfall penetration and abandon the existing.

Storm Sewer Alternative #4: Do Nothing: A final option is to do nothing. This option would allow continued deterioration and erosion of the separated and offset pipe joints. Storm water would continue to exfiltrate into surrounding soils, saturating them and increasing pressures behind the WPA wall.

There are also several alternatives for repairing the WPA wall at the outfall pipe penetration. These alternatives are:

1. Using the existing penetration as-is
2. Improving the existing penetration
3. Demolishing and creating a new penetration

These alternatives are discussed below.

WPA Wall Penetration Alternative #1: Using the Existing Penetration As-is: The existing penetration is an 8-inch diameter VCP embedded in the stone and mortar wall. The VCP is damaged and partly eroded away. Using the existing penetration as-is has the disadvantage of allowing the Menomonee River to continue to deteriorate the penetration.

WPA Wall Penetration Alternative #2: Improving the Existing Penetration: The existing penetration could be improved. For example, the WPA wall beneath the penetration would undergo masonry repair (See “WPA Wall Alternative #1: Stone Masonry Repair” below). The existing 8-inch diameter fractured VCP, which has an outer diameter of approximately 9.9 inches, would be removed along with the mortar bed surrounding it. A Kor-N-Seal (or equal) rubber boot (see Appendix C) would need a 10.5-inch diameter penetration opening for expansion ring installation to accommodate an 8-inch diameter SDR-35 PVC piping with an outer diameter of 8.4 inches. Therefore, the penetration would need to be formed with mortar to accommodate the boot, and the boot would

then be installed with a galvanized or stainless steel expansion ring. Then the 8-inch diameter SDR-35 PVC pipe could be inserted into the penetration and connected to the boot with a galvanized or stainless steel compression ring. The pipe behind the wall could then be encased in a flowable Portland cement concrete having a shape in which a key several feet behind the wall would transfer some of the weight loading of the concrete away from the stone and mortar WPA wall.

WPA Wall Penetration Alternative #3: Demolishing and Creating a New Penetration: Another option would be to entirely demolish a section of the stone and mortar WPA wall (See Section **Error! Reference source not found.** Alternatives #2 and #3). In this option, a new 10.5-inch diameter penetration opening would be formed. The Kor-N-Seal (or equal) boot and SDR-35 PVC pipe would then be installed as previously discussed in WPA Wall Penetration Alternative #2: Improving the Existing Penetration.

Alternatives to repair the wall damage at the sewer outfall are:

1. Stone masonry repair
2. Cast-in-place wall around piping penetration
3. Cast-in-place wall

These alternatives are described below.

WPA Wall Alternative #1: Stone Masonry Repair: Replace damaged face stones to an extent below outfall and below the waterline and pressure inject mortar behind new face stones. Replacement work would be performed by a stone mason. This repair would not be a long-term solution and it will only address the area below and adjacent to the outfall.

WPA Wall Alternative #2: Cast-in-place Wall around Piping Penetration: Remove the existing WPA-era wall to an extent on both sides of the outfall and construct a new reinforced cast-in-place concrete retaining wall. The new section of cast-in-place wall would tie into the existing limestone wall, meaning that this solution is also a short-term fix.

WPA Wall Alternative #3: Cast-in-place Wall: Replace a large section of the wall with a new concrete retaining wall. The existing structurally compromised wall would be removed until sound sections of wall are reached on each side. This option is similar to option 2, except the wall replacement would be made over a larger distance.

All three of these options have cost and aesthetic qualities that would need to be investigated as well as incorporated into the Master Plan for the WPA system.

2.3 Recommended Improvement Alternatives

The Arcadis team recommends the following improvement alternatives:

1. Storm Sewer Alternative #2: Removing and replacing the existing piping (using the existing alignment) (See Section 2.2 “Storm Sewer Alternative #2: Remove RCP/VCP and Replace with SDR-35 PVC Piping [same alignment]”)
2. WPA Wall Penetration Alternative #2: Improving the existing WPA wall penetration (See Section 2.2 “WPA Wall Penetration, Alternative #2: Improving the Existing Penetration”)
3. WPA Wall Alternative #1: Stone Masonry Repair of the existing WPA wall (See Section 2.2 “WPA Wall Alternative #1: Stone Masonry Repair”)

This would allow for a good and consistent sewer run using modern materials and would minimize disturbance to the stone and mortar WPA wall and project costs.

2.4 HPS-9 Storm Sewer Replacement Preliminary Opinion of Probable Cost

Table 2-1 presents a list of critical construction cost items along with estimated costs for removing and replacing the existing piping and improving the existing WPA wall penetration. Table 2-2 presents estimated costs for engineering services for design and construction (ESDC), assuming bidding performed by MMSD.

Table 2-1. Preliminary Opinion of Probable Construction Cost – HPS-9 Storm Sewer Replacement on Honey Creek Parkway between 70th and 72nd Streets

Construction Item Description	Quantity	Unit	Unit Price	Estimated Cost
Mobilization/Demobilization, Erosion Control and Traffic Control	1	LS	$7,500	$7,500
Clearing and Disposal of Vegetation	1	LS	$5,000	$5,000
Removing and Disposal of Existing Storm Sewer Piping	1	LS	$7,500	$7,500
Installing New Storm Sewer Piping	1	LS	$7,500	$7,500
WPA Wall Stone Masonry Repair and Improving Existing Penetration	50	CF	$900	$45,000
Coffer Dam	1	LS	$20,000	$20,000
Surface Restoration	1	LS	$2,000	$2,000
			Subtotal	**$94,500**
			Contingency (10%)	$9,450
			Total Estimated Replacement Cost	**$103,950**

Table 2-2. Preliminary Opinion of Probable ESDC Cost – HPS-9 Storm Sewer Replacement on Honey Creek Parkway between 70th and 72nd Streets

ESDC Item Description	Quantity	Unit	Unit Price	Estimated Cost
Drawings, Specifications, and Design Report	1	LS	$35,500	$35,500
Permitting	1	LS	$5,000	$5,000
Construction Inspection	1	LS	$10,000	$10,000
			Total Estimated ESDC Cost	**$50,500**

2.5 Impacts on Operations and Maintenance

The project is located in open space along Honey Creek Parkway. Therefore, there are no anticipated impacts to any facility operations and maintenance. The only impact to Honey Creek Parkway would be temporary lane closures, which would be managed by traffic control devices such as barrels and/or barricades and signs.

2.6 Potential Environmental or Private Property Issues

The project is located along the banks of the Menomonee River. Therefore, erosion control measures need to be implemented to prevent sediments from entering the river. The use of silt fence and wattles during construction and biodegradable/photodegradable matting after construction would effectively achieve this objective.

The Menomonee River water level fluctuates with rain events. Therefore, work on and adjacent to the WPA wall should be avoided when intense or extended rainfalls are predicted.

There are not any private property issues since the project is located on Milwaukee County Parks property. However, a park access permit for construction will be required. The design will need to be submitted to Milwaukee County Parks for review and approval.

2.7 Constraints Related to Utilities and Regulatory and Governmental Agencies

Grading and utility work along streambanks and within the river channel typically requires a Chapter 30 permit with the Wisconsin Department of Natural Resources (WDNR), which is anticipated to take 30 to 90 days. The permit could include all work within the park or sites could be permitted separately. The decision on permitting approach will be made based on final timing and packaging of the design work as well as the extent of other excavation required. The City of Wauwatosa will also require an erosion control permit.

The WPA wall may inherently have historical significance. Therefore, the City of Wauwatosa's Historic Preservation Commission, Milwaukee County, and the State Historic Preservation Office should be consulted to see if the WPA wall falls under their jurisdiction and what their permitting requirements would be if it does.

2.8 Engineering Issues and Assumptions

Today's COVID-19 induced labor and material supply shortages have resulted in project schedule delays and cost increases across the construction industry. Extending timeframes for completing tasks and adding contingency funds are good tools for mitigating these impacts to projects.

3 Evaluations and Recommendations for the Schoonmaker Creek Culvert

Schoonmaker Creek drains water from land extending north generally from West State Street to Center Street, west to North 78th Street, and east to North 60th Street in the City of Wauwatosa. Schoonmaker Creek outfalls to the Menomonee River through a box culvert located approximately 350 feet east of North 62nd Street.

The most recent modifications to the Schoonmaker Creek Culvert were made in 2015 as part of the Western Milwaukee Flood Management Project, Phase 2A under MMSD Contract W20027C01 (Figure 3-1). The Schoonmaker Creek Culvert has the following three segments as shown in Figure 3-2 and

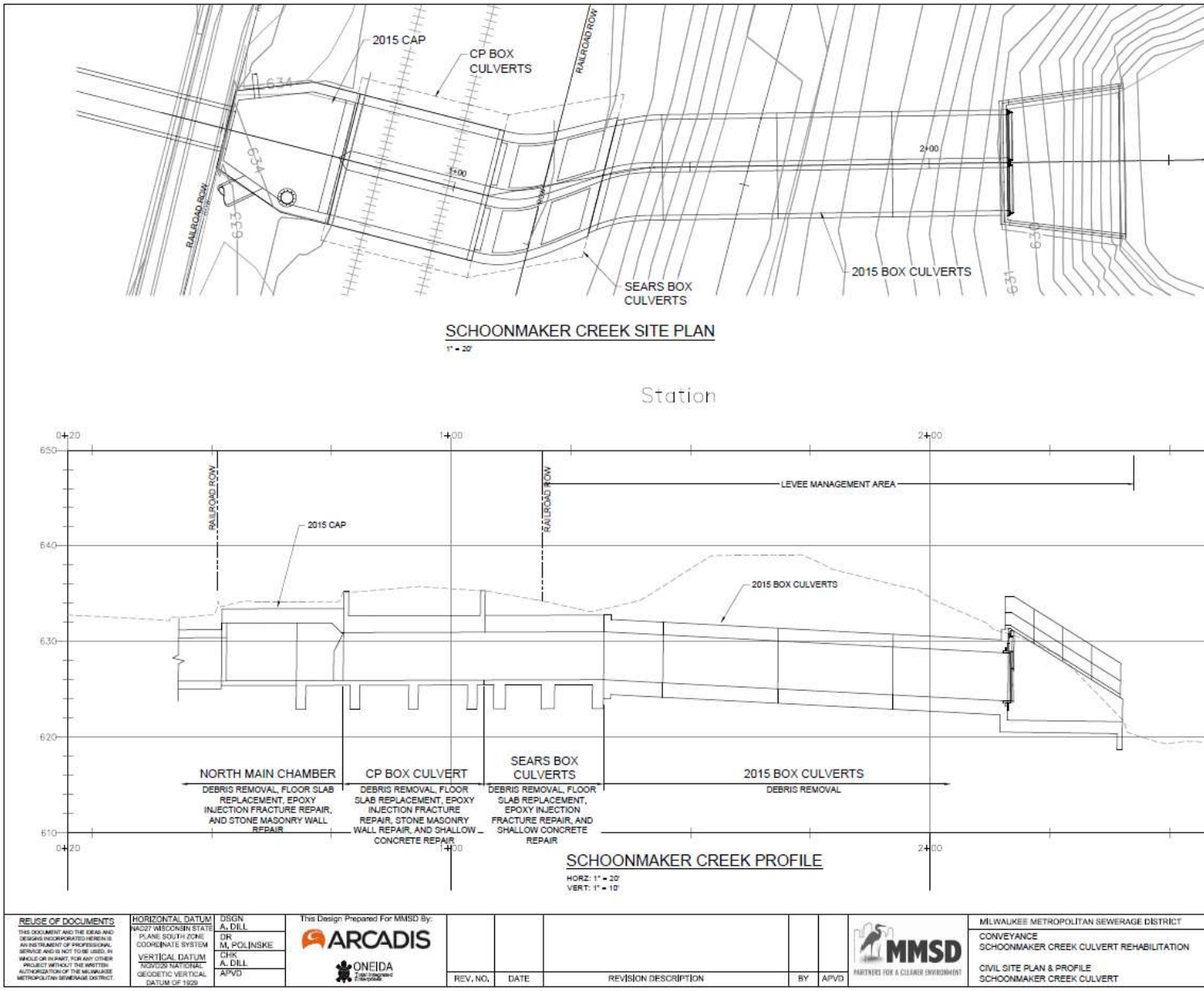


Figure 3-3:

1. A varying width (up to 24') by 6-foot-high by 25-foot-long box culvert that was enclosed as part of the 2015 project (Schoonmaker Creek Enclosure on Figure 3-1). This segment is located south (downstream) of West State Street and is referred to as the North Main Chamber between Joint 0 (J0) and Joint 2 (J2) in the Schoonmaker Creek Culvert 2021 inspection documentation (Appendix A).
2. Two 9-foot-wide by 5-foot-high box culverts approximately 56 feet long that go under the CP tracks. This segment was not modified during the 2015 project. It spans between Joint 2 and Joint 5 on the east channel and between Join 2 and Joint 6 on the west channel (see Figure 3-2).
3. Two 9-foot-wide by 5-foot-high box culverts approximately 85 feet long that exit through a headwall with a dual flap gate, apron, and flared wing walls approximately 500 feet upstream of the Menomonee River. A 9-foot-wide by 5.5-foot-tall single-cell box culvert originally constructed by Sears was removed and replaced with the double-cell concrete box culvert as part of the 2015 project. This segment spans between Joint 4 (J4; east channel)/Joint 5 (J5; west channel) and the flap gates in the 2021 Schoonmaker Creek Culvert inspection documentation.

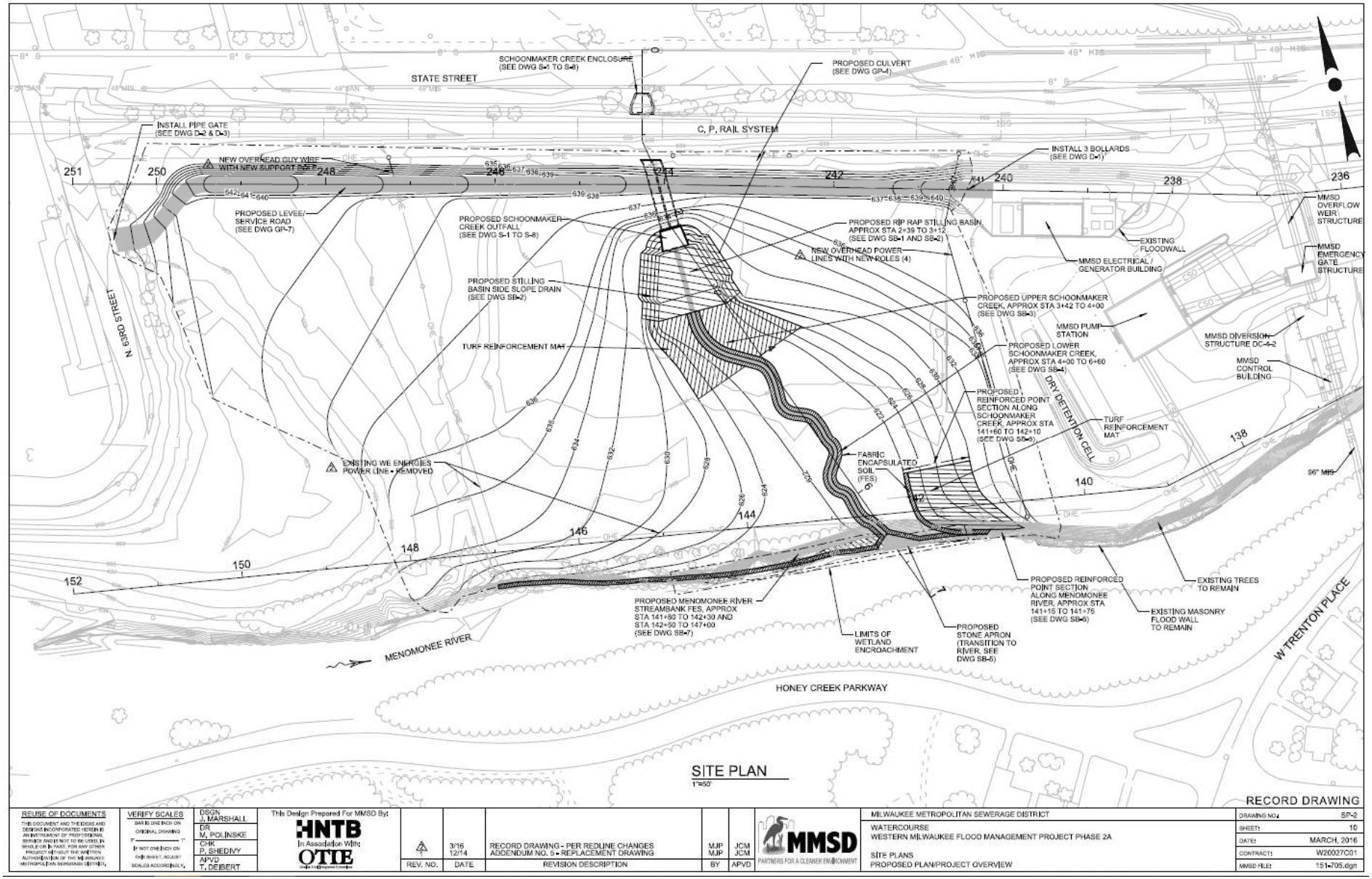


Figure 3-1. Overview of Schoonmaker Creek Culvert Location, Segments, and Modifications

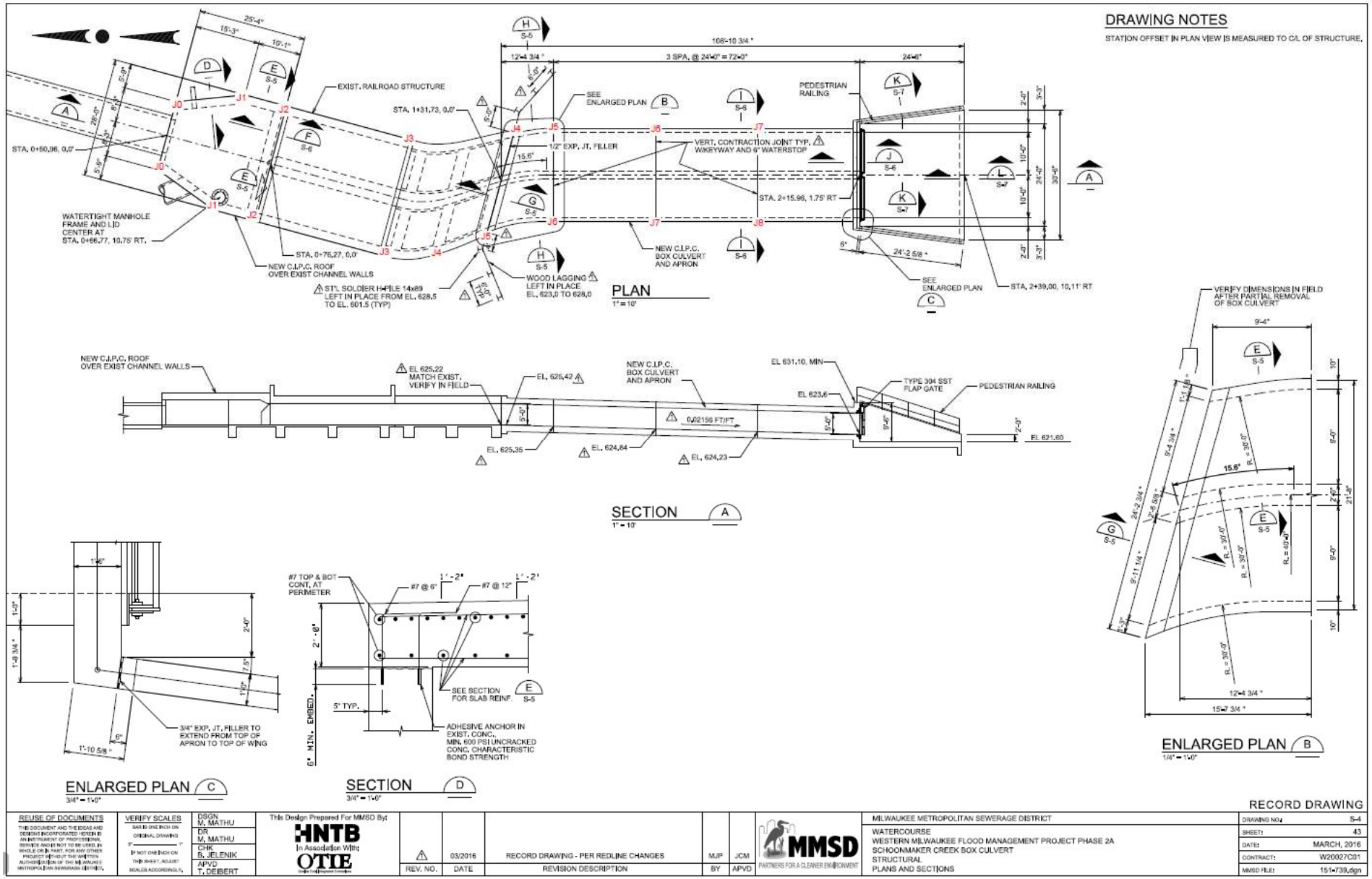


Figure 3-2. Schoonmaker Creek Culvert Joint Locations

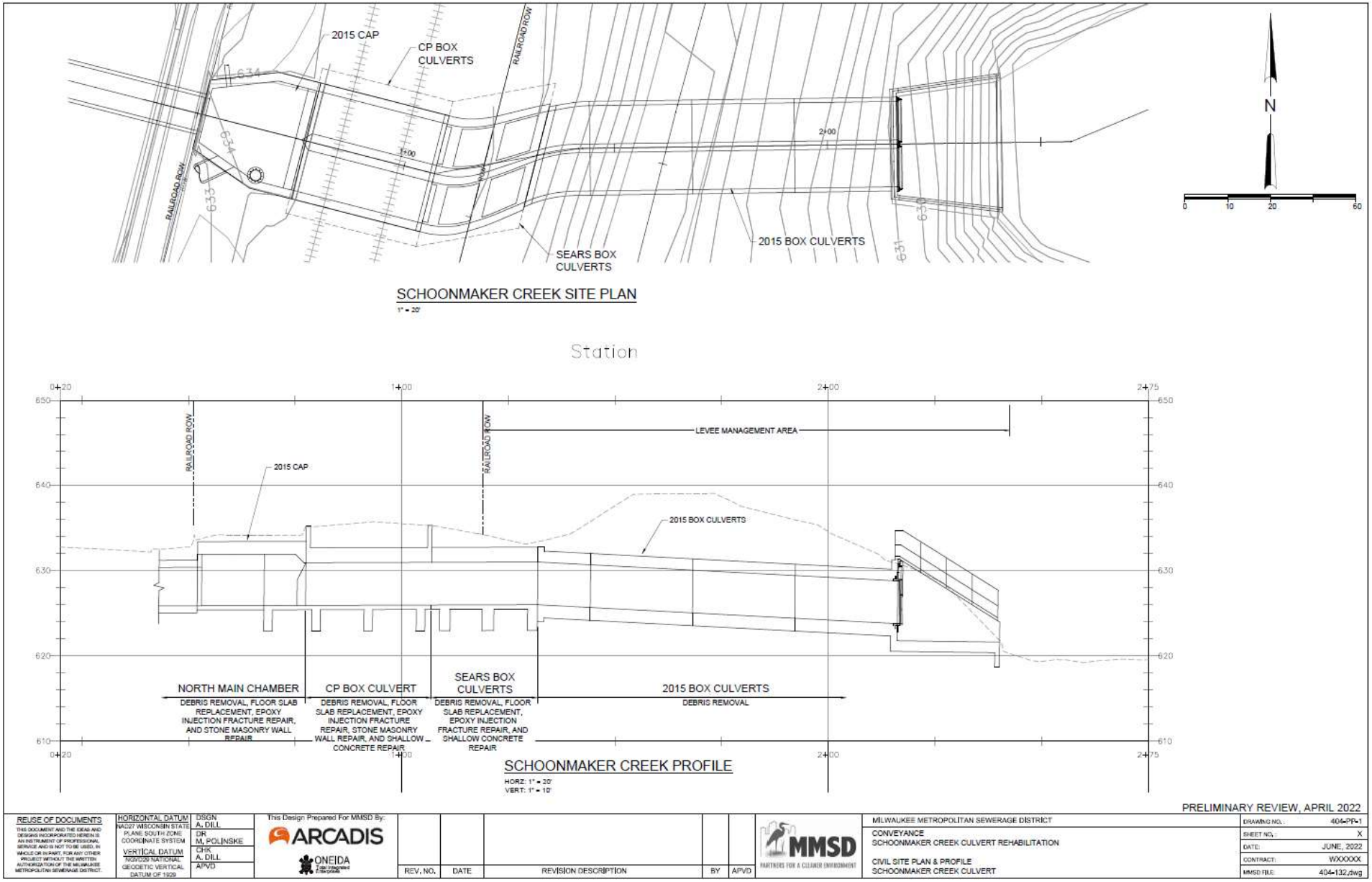


Figure 3-3. Schoonmaker Creek Culvert Plan and Profile and Recommended Repairs

3.1 Condition of Existing Culvert

Arcadis completed an inspection of the Schoonmaker Creek Culvert on December 2, 2021. CP provided a flagger during the inspection due to the close proximity of the access manhole to the active rail; MMSD has indicated it may consider installing one or two access manholes into the box culvert downstream of the railroad right-of-way to allow future access without the need for a CP flagger. The inspection consisted of photo documentation of the condition of the floor, walls, roof, and columns within the North Main Chamber, East Channel, and West Channel of the culvert. Defective areas were identified and quantified. See Appendix A for inspection photos and documentation.

The Arcadis team identified the following key observations from this inspection:

1. The concrete at pipe penetrations through the North Main Chamber walls did not show defects.
2. The concrete floor of the structure in the North Main Chamber and under the CP tracks was in poor condition and was missing in some locations. The concrete floor in the double-cell box culvert constructed in 2015 was in satisfactory condition.
3. Sections of the stone masonry at the wall faces of the culvert under the CP tracks were missing. The depth of the missing stone was less than 12 inches at all observed locations.
4. The culvert walls and roof had some locations of concrete spalling on faces and at joints, although not everywhere in the structure. Fractures were observed at some locations other than planned contraction joints; these fractures did not appear to be active. The ceiling joint and wall contraction joints were offset about 6 inches in the double-cell box culvert that was constructed in 2015 and had developed fractures at the top of the wall at those locations.
5. The flap gates, wing walls, and apron at the south end of the box culvert did not show defects.
6. The culvert contained loose debris such as sediment, stones, pieces of concrete, and steel grates.
7. There was a degraded corrugated metal pipe entering the west wall of the west culvert. This pipe was identified as WMW-21, which was planned to be abandoned per the Master Plan. No confirmation was made during this investigation as to whether or not the pipe is currently in service.

3.2 Culvert Repair Recommendations

The Schoonmaker Creek Culvert 2021 inspection documentation (Appendix A) was further reviewed by HNTB to identify types of repairs needed at specific locations within the Schoonmaker Creek Culvert. Appendix B contains a summary table where each row corresponds to a page of the inspection documentation. The types of repairs needed to address defects observed in the Schoonmaker Creek Culvert fit within the categories described below. The repairs noted below as “required” are to address structural defects that are comparable to PACP Grade 4 or 5 defects for pipes associated with dams and levees (e.g., fractures, missing mortar, surface damage). Repairs noted as "recommended” are consistent with good asset management practices and, if funding is available, it would make sense to address the recommended repairs when a contractor is mobilized for other repairs. The US Army Corps of Engineers Engineering Manual for Conduits, Pipes, and Culverts Associated with Dams and Levee Systems (EM 1110-2-2902) requires mitigation of PACP Grade 4 or 5 structural defects and allows monitoring of less severe defects; however, many of the “required” repairs are outside of the levee management area. If no

repairs are made to the Schoonmaker Creek Culvert, the structure will continue to deteriorate. Future impacts to stormwater conveyance are possible if the structure condition results in reduced or obstructed flow conveyance. In addition, railroad operations could be impacted if settlement or movement of structure results in elevation changes at ground surface. See Section 3.5 for discussion regarding the extent of repairs MMSD intends to undertake.

1. No Repair:

   Some observations noted in the inspection documentation were deemed to not require repair work at this time.

2. Debris Removal:

   Although debris removal is not required by EM 1110-2-2902, debris removal is recommended along the entire culvert because the debris interferes with safe access throughout the culvert, the proper repair of the base slab and potential, and could potentially interfere with proper sealing of the flap gates.

   Description of work: Remove and properly dispose of loose debris consisting primarily of broken concrete and stone pieces, gravel, sediment, and miscellaneous objects (e.g., steel grates) from the culvert. No environmental assessment was completed for this project, but none of this material is anticipated to be hazardous.

3. Shallow Concrete Repair:

   This repair is recommended at spalled locations where reinforcement has not been exposed, generally outside of joints. The inspection revealed several additional locations at joints where the defect is not deep, and this type of repair can be used at those locations as well.

   Description of work: Saw cut around the perimeter of repair areas. Remove damaged concrete to sound concrete, clean the surface, and apply a bonding agent. Place new concrete using form-and-pump or low-pressure spraying techniques.

4. Deep Concrete Repair with Reinforcement:

   This repair is required at spalled locations where reinforcement has been exposed. The inspection revealed one location where this type of repair is needed.

   Description of work: Saw cut around the perimeter of repair areas. Remove damaged concrete to sound concrete and along corroded reinforcing steel to a point where there is no further delamination or reinforcing steel corrosion. Remove concrete around the exposed reinforcement to provide a minimum clearance of 0.75 inches or as required for the coarse aggregate in the repair concrete. Where reinforcement has more than 30 percent of the section missing, replace the reinforcement with new bars drilled into and anchored into the existing concrete. Apply cold galvanizing repair compound to existing exposed reinforcement. Clean the surface and apply a bonding agent. Place new concrete using form-and-pump or low-pressure spraying techniques.

5. Joint Repair:

   This repair is required where the concrete deterioration is more than 2 inches deep along existing contraction joints. The inspection revealed two joints where this type of repair applies.

   Description of work: Saw cut around the perimeter of repair areas. Remove damaged concrete to sound concrete, clean the surface, and apply a bonding agent. Install a preformed joint filler along the existing joint line. Place new concrete using form-and-pump or low-pressure spraying techniques.

6. Stone Masonry Repair:

   This repair is required where areas of the stone masonry is missing from the surface of the culvert walls under the CP tracks.

   Description of work: Remove damaged stone masonry to sound stone, clean the surface, and apply a bonding agent. Place new concrete using form-and-pump or low-pressure spraying techniques.

7. Floor Slab Replacement:

   Replacement of the entire floor pavement between the north end of the culvert and the new two-cell box culvert is required. It is difficult to identify the cause of the floor slab deterioration because of the age of the structure and the varying environments to which the structure was subjected to (e.g., north chamber was open to the elements until the roof was added in 2015); however, freeze-thaw conditions and deferred maintenance are likely causes. The existing structure plans indicate that the floor is a 6-inch non-structural pavement between deep grade beams located approximately 10 feet apart. The floor can be removed and replaced without affecting the load carrying capacity of the structure if the grade beams remain in place. This is a non-structural repair, but it is recommended to prevent leakage and undermining of the structure and piping beneath the levee.

   Description of work: Saw cut around the perimeter of the grade beams and wall foundations. Remove all pavement concrete. Control water through the culvert by diversion to create dry work areas. Place a new thicker, reinforced concrete pavement. The preliminary opinion of probable cost in Table 3-1 assumes an 8-inch slab with #5 rebar at 12 inches each way, each face.

8. Epoxy Injection Fracture Repair:

   This type of structural repair is required at fractures that are not located at contraction joints. The inspection documentation identified locations on the culvert walls and roof where this type of repair can be used.

   Description of work: Install entry and venting ports and a surface seal along the fracture. Inject the structural epoxy using material per the proprietary epoxy manufacturer's instructions. After the structural epoxy has set, repeat the injection procedure until all ports refuse injection. Remove the ports and the surface seal.

3.3 Culvert Repair Preliminary Opinion of Probable Construction Cost

The Arcadis team has assigned unit prices to each repair type described above and applied at specific locations within the culvert. Table 3-1 provides a preliminary opinion of probable construction cost by repair type, where quantities have been rounded up to the nearest increment of ten or hundred. It is also assumed that there will be administrative costs to comply with railroad requirements including, but not limited to, railroad insurance, costs for a flagger, and adherence to railroad safety protocols.

Table 3-1. Preliminary Opinion of Probable Construction Cost – Schoonmaker Creek Culvert Repairs

Item Description	Quantity	Unit	Unit Price	Estimated Cost
Mobilization (15% of Repair Items)	1	LS	$19,000	$19,000
Debris Removal (Repair Type 2)	1	LS	$12,000	$12,000
Shallow Concrete Repair (Repair Type 3)	150	SF	$380	$57,000
Deep Concrete Repair with Reinforcement (Repair Type 4)	10	SF	$440	$4,400
Joint Repair (Repair Type 5)	10	LF	$290	$2,900
Stone Masonry Repair (Repair Type 6)	40	CF	$760	$30,400
Floor Slab Replacement (Repair Type 7)	1800	SF	$10	$18,000
Epoxy Injection Fracture Repair (Repair Type 8)	10	LF	$150	$1,500
Control of Water (15% of Repair Items)	1	LS	$19,000	$19,000
Railroad Allowance	1	LS	$40,000	$40,000
			Subtotal	**$204,200**
			Contingency (35%)	$71,500
			Total Preliminary Opinion of Probable Construction Cost	**$275,700**

For a total culvert length of approximately 166 feet between Joint 0 and the downstream flap gate, the total preliminary opinion of probable construction cost is $275,700 or $1,660/LF of culvert or $830/LF/barrel. See Appendix B for the quantity and cost at each repair location.

A fairly large contingency is included in the preliminary opinion of probable construction cost in an attempt to account for unknowns associated with repair-type projects. It is possible that removal of deteriorated concrete may reveal additional areas that require repair beyond what is identified in this report. Concrete repair work is highly dependent upon the skill of the contractor and the conditions found during construction. It is recommended that an MMSD representative be available throughout the construction to inspect the work, document changed conditions discovered during construction, and review/approve necessary changes.

Complete reconstruction of the Schoonmaker Creek Culvert was not evaluated as part of this project.

3.4 Operation and Construction Considerations

The following operation and construction considerations will need to be accounted for during the design phase of the culvert repairs.

1. Flow Control:

   Concrete and masonry repair work must be completed in dry conditions (i.e., it may be damp, but flowing water should not be present). Furthermore, the concrete requires that repair locations be protected from

damage caused by flowing water during the curing period. Isolating or diverting normal flows (into one of the channels) and managing storm flows will be necessary during construction. This is anticipated to include contractor-designed system(s) of small dams, bypass flumes/pipes, or small pumps to control normal/low flows.

2. Schedule:

   It is estimated that culvert repairs will take between 4 and 8 weeks to complete. It is recommended that any construction work occur when storm flows are anticipated to be less of a factor during the dry summer/fall months and the air temperature is compatible with concrete and epoxy curing requirements.

3. Debris and Sediment:

   Removal of debris and sediment is required prior to any repair work occurring. At a minimum, debris and sediment would need to be removed in the vicinity of each repair location.

3.5 Planning and Coordination Considerations

The Schoonmaker Creek Culvert is physically located under land owned by both CP and the City of Wauwatosa. MMSD intends to only repair the portions of the Schoonmaker Creek culvert that lie within the levee management area. This area can be described by extending a line downwards at a 1:1 slope from the toe of the levee on both the dry and wet sides of the levee. Within these parameters and extending them slightly to be conservative, this report recommends MMSD implement repairs to the segments of the Schoonmaker Creek culvert labeled Sears Box Culverts and 2015 Box Culverts in Figure 3-3, with repairs to the other portions of the Schoonmaker Creek culvert implemented by others. The following clarifications may need to be obtained during the design phase of the culvert repairs:

1. Ownership limits of the Schoonmaker Creek Culvert by each party noted above
2. Plan review and approval process by each party noted above and MMSD
3. Access and staging locations
4. Future inspection and maintenance

The Schoonmaker Creek Culvert is a confined space and necessary certifications will be required for contractors and inspectors during the construction phase. Access to the culvert is either from a manhole located at the north end, which requires coordination with CP, or through the flap gates at the south end reach from the levee access road, which would require lifting equipment. The Arcadis team recommends that a site visit be included as part of the bidding process so that potential bidders are aware of access restrictions and conditions in the culvert and are able to evaluate how debris removal will occur.

Since the scope of work is limited to repair work on an existing culvert structure and no ground disturbance will occur, a Wisconsin Pollutant Discharge Elimination System General Permit, Chapter 30 (Wisconsin Statues) Permit, or wetland permit from the WDNR are not required. The following permits are anticipated:

1. City of Wauwatosa Construction/Right-of-Entry Permit
2. CP Right-of-Entry Permit

Any additional permits required by the construction contract documents or local, state, or federal law are to be obtained by the contractor.

4 Summary of Recommendations

4.1 Storm Sewer/Outfall on Honey Creek Parkway between 70th and 72nd Streets (HPS-9)

Based on the project goals and inspection findings, the Arcadis team recommends repairing some of the WPA wall stone masonry, improving the WPA wall penetration, and removing the existing RCP/VCP piping and replacing it with new SDR-35 PVC 8-inch storm piping using the existing alignment. The stone masonry repair would be limited to the area surrounding the 8-inch storm piping outfall (See Figure 2-2: WPA-era Wall at Honey Creek Parkway between 70th and 72nd Streets Storm Sewer Outfall). Permits will be required for storm sewer construction from Milwaukee County Parks (park access), WDNR (Chapter 30 permit), City of Wauwatosa (erosion control). Consultation with the City of Wauwatosa's Historic Preservation Commission, Milwaukee County, and the State Historic Preservation Office will be required to confirm jurisdiction and permits required for modifications to the WPA wall. This would allow for a good and consistent sewer run using modern materials and would minimize disturbance to the stone and mortar WPA wall and project costs.

4.2 Schoonmaker Creek Culvert

The Arcadis team recommends that all repairs identified in Section 3 be made under a single construction contract to preserve the integrity of the Schoonmaker Creek Culvert. If no repairs are made to the Schoonmaker Creek Culvert, the structure will continue to deteriorate. Future impacts to stormwater conveyance are possible if the structure condition results in reduced or obstructed flow conveyance. In addition, railroad operations could be impacted if settlement or movement of structure results in elevation changes at ground surface. Close coordination of these repairs with CP and the City of Wauwatosa is recommended and right-of-entry permits from these entities will be required. MMSD intends to only repair the portions of the Schoonmaker Creek culvert that lie within the levee management area. This area can be described by extending a line downwards at a 1:1 slope from the toe of the levee on both the dry and wet sides of the levee. Within these parameters and extending them slightly to be conservative, this report recommends MMSD implement repairs to the segments of the Schoonmaker Creek culvert labeled Sears Box Culverts and 2015 Box Culverts in Figure 3-3, with repairs to the other portions of the Schoonmaker Creek culvert implemented by others.

Appendix A: Schoonmaker Creek Culvert 2021 Inspection Documentation

MMSD Sewer Inspection

Ceily Fessel Doan & Tanvi Naidu

12/2/2021

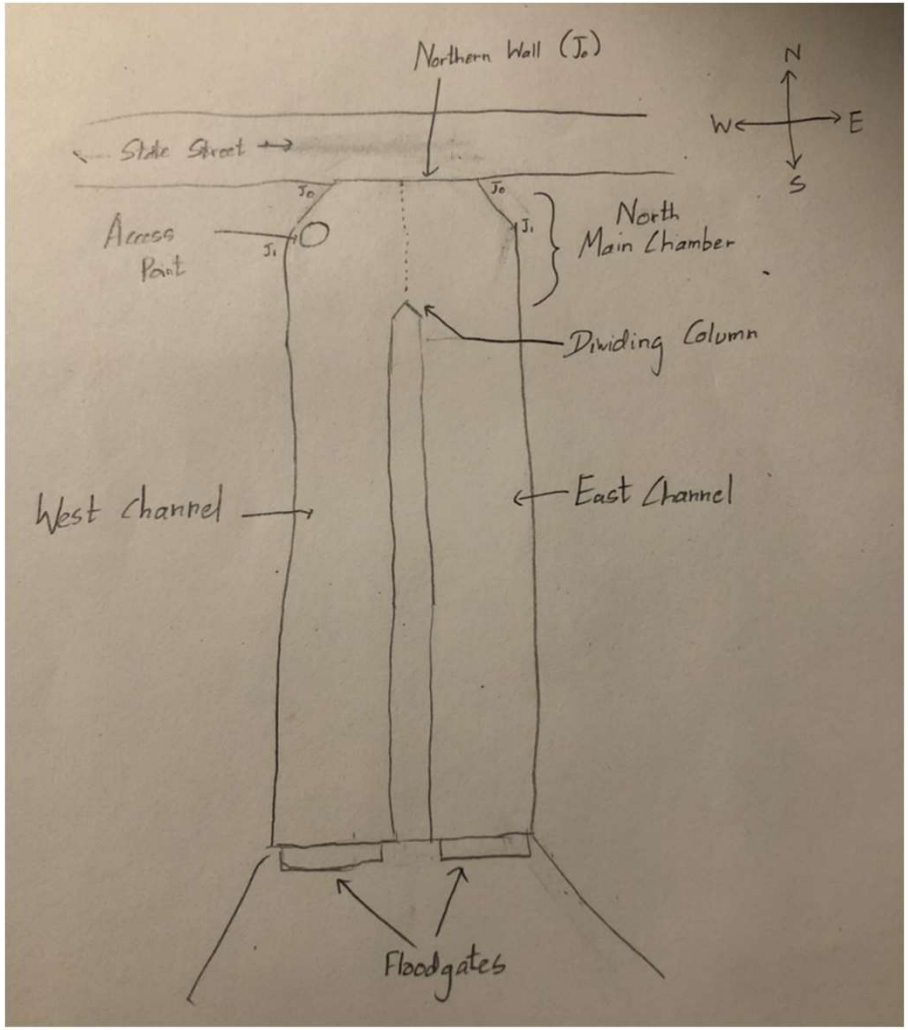
Near 1600 W State Street, Milwaukee, WI

Storm Sewer Inspection Details

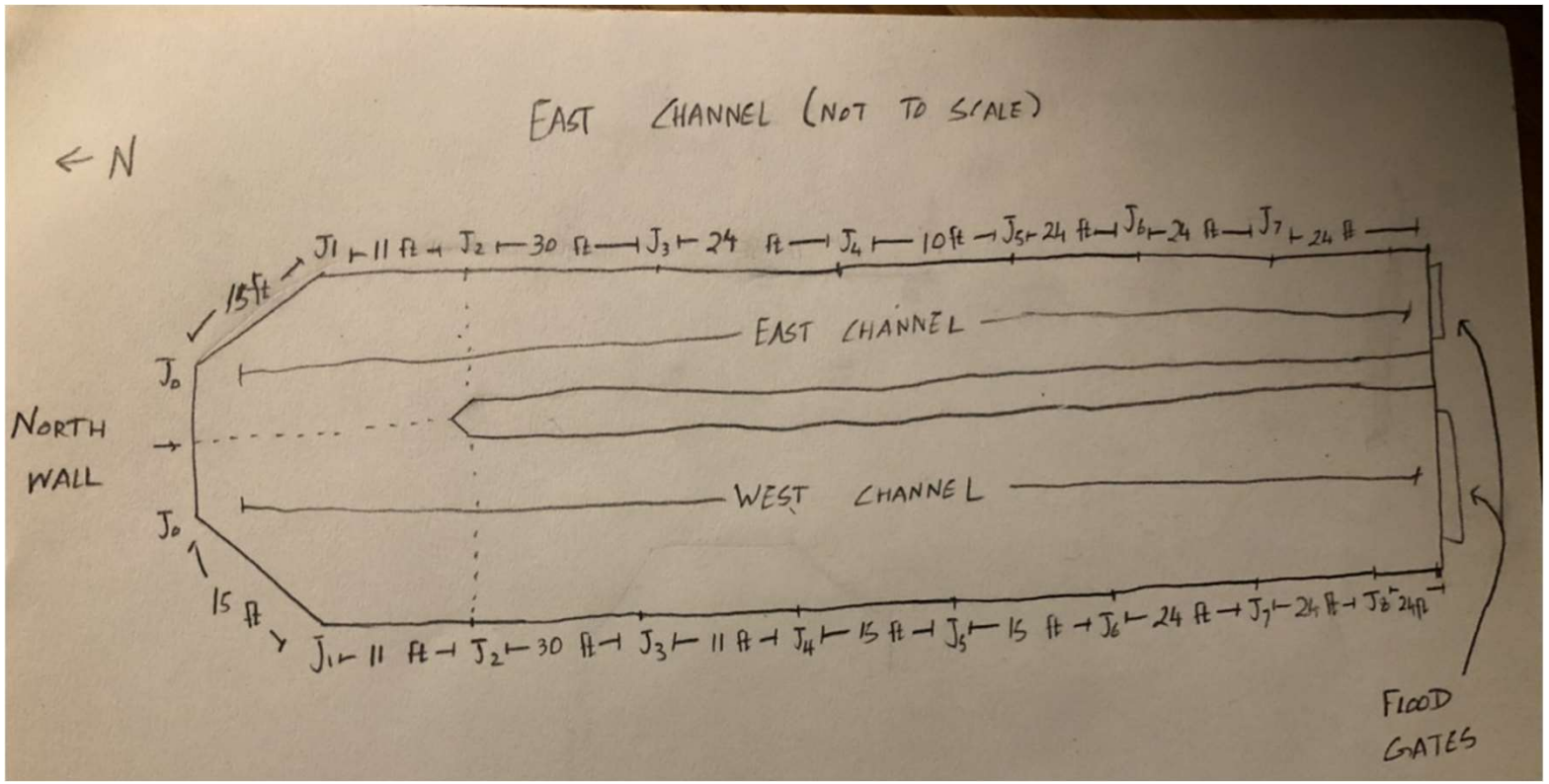
Overview

- Inspected from North to South, heading downstream
- Objective: to capture defects, describe their location and size

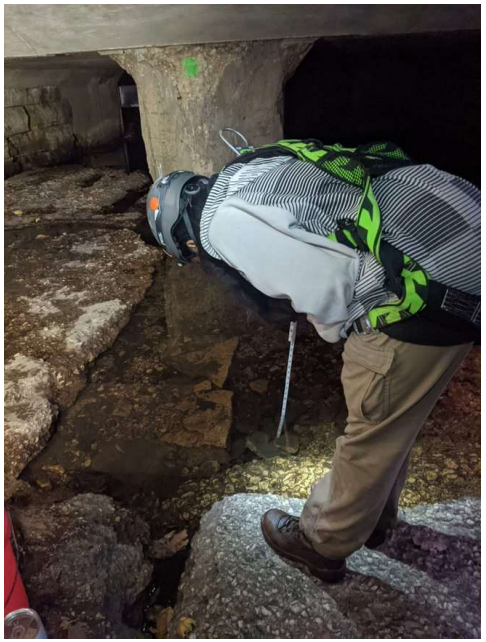
Overview Sketches



Overview Sketches



Northern Main Chamber



Northern Main Chamber Overview

- Width: 24'0" at widest
- Height: 6'3" (bottom 3" represents floor defect/ missing floor in several areas)
- Length: 23'6" from northern wall to dividing column
- Water Depth: range from 1" to 21" (deep puddles/ floor defects)
- Splits into two trapezoidal channels starting at column

Dividing Wall

- Top Defect/ missing wall:
- Height: 18"
- Depth: 14"
- Width: 4'5"
- Bottom defect/ missing wall:
- Height: 27"
- Depth: 14"
- Width: 4'5"

East Channel Overview

- Trapezoidal section:
- H: 4’11” (center)
- h: 4’ (wall)
- Width: varies between 9’0” and 12’3”
- Length: 162 ft
- (79 LF from North wall to new section
- 83 LF from new section to flood gates)

Joint 0 to Joint 1: 15'

Note: ‘Joint 0’ refers to the north wall near the point of entry

Defect/feature Overview:

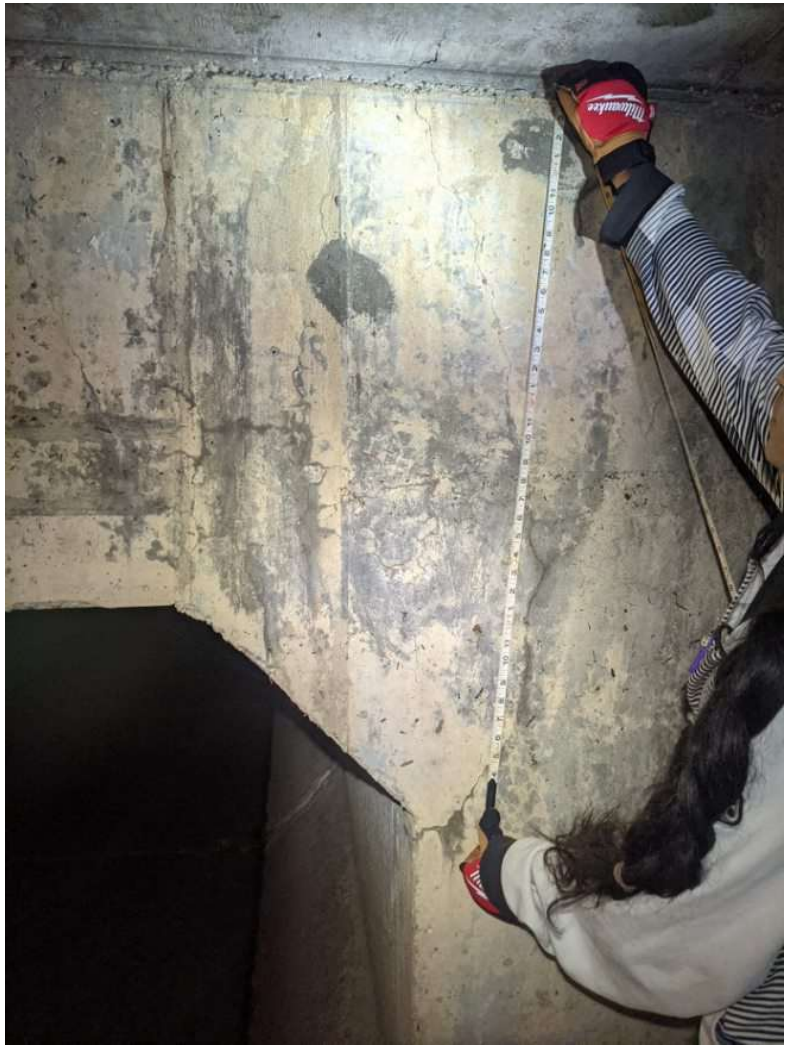
- Vertical fracture 3'4" from ceiling on north wall
- Inlet pipe at 2’10”, diameter 1’7”
- 10'6" vertical fracture from top to bottom of chamber
- Sediment and floor defect continuous from joint 0 to joint 4

East Channel

Joint 0 to Joint 1

Vertical fracture on North wall near trapezoidal inlet channel

Length: 3’4” from ceiling

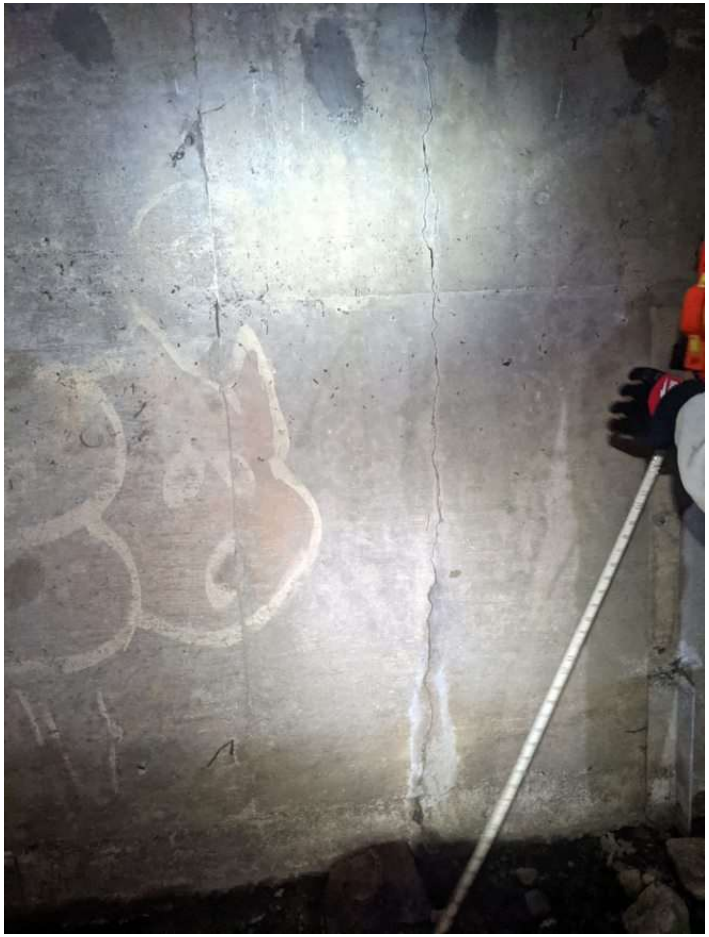


Joint 0 to Joint 1

- Inlet pipe at 2’10” from joint 0,
- Diameter 19"

Joint 0 to Joint 1

- At 10’6” from joint 0: Vertical fracture from top to bottom of chamber



Joint 0 to Joint 1

- Continuous sediment and floor defect on east side of northern chamber:
- Standing water depth: 1- 2"
- Continuous to Joint 2

Joint 1 to Joint 2: 11'

Defect Overview:

- Patch work on east wall of chamber: 4'11" top length, 3' height on left side, approximate right triangle shape (see figure on next slide)
- At 3" from joint 1 on bottom: stone wall, pieces missing
- Calcium deposits begin from joint 1 continuous to joint 3
- At 8'10": Wire mesh visible on floor. length 10'6", width 2'1"

East Channel

Joint 1 to Joint 2

- At 0 ft from Joint 1:
- Patch work on top of East side of channel, 4'11" top length, 3' height on left side, right triangle shape
- (Missing stone wall visible on bottom)

Joint 1 to Joint 2

At 0 ft from Joint 1:
Missing stone wall visible on bottom.
Details on following 2 slides

Joint 1 to Joint 2

- Starting 4" from joint 1, the first large piece of missing wall is 46" in length, 10" tall, and varies from 1" to 11" in depth (6" average depth)

Joint 1 to Joint 2

- Starting 4" from joint 1, the first large piece of missing wall is 46" in length, 10" tall, and varies from 1" to 11" in depth (6" average depth)

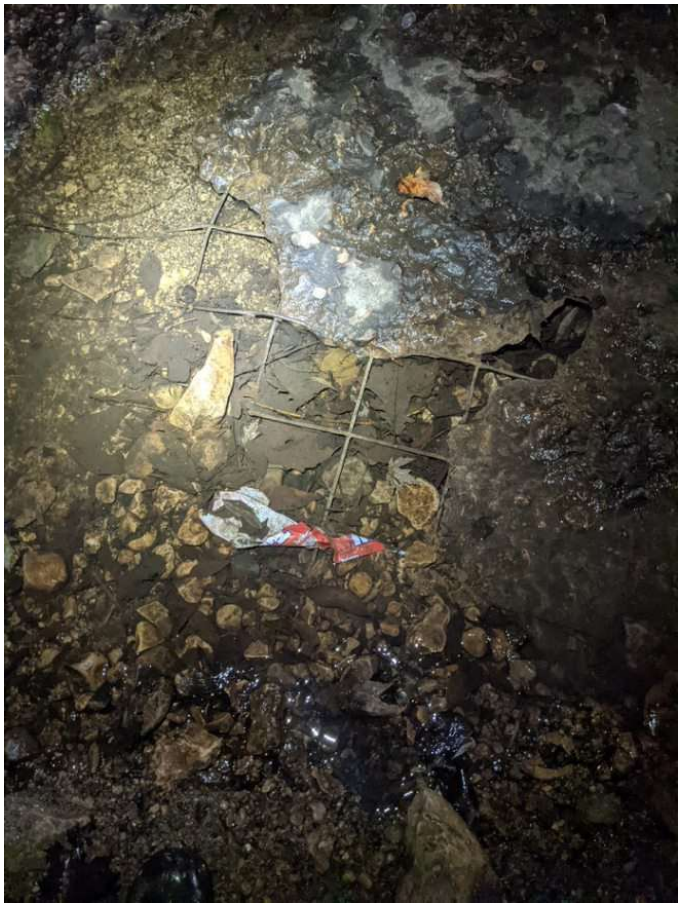
Joint 1 to Joint 2

Second Section of missing wall:

Starting at 13'5" from Joint 1, there is an 11' long hole along the floor, 1' tall, and varies in depth from 5" to 17" (average 11" depth)

Joint 1 to Joint 2

- At 8'10": Wire mesh visible on floor
- Length: 1'8"
- Width 2'1"



Joint 2 to Joint 3 – 30'

The distance/ 'joint' at which the trapezoidal channel section begins was labelled Joint 2

Joint 2 to Joint 3

- Calcium deposits begin from joint 2 and continue to Joint 3 along the top of the east and west walls

Joint 2 to Joint 3

- At 2 ft from Joint 2: circumferential crack with calcium deposits, especially severe on roof
- Defect width: 1'3"
- Possibly Intentional holes in ceiling of channel, 6 total

Joint 2 to Joint 3

Continued from previous slide:

At 2 ft from Joint 2: circumferential crack with calcium deposits, especially severe on roof

Defect width: 1'3"

Possibly Intentional holes in ceiling of channel, 6 total,

Joint 2 to Joint 3

- At 16 ft from Joint 2: Large missing section of floor creating pool of standing water. Ends at Joint 3
- Length: 14'
- Width: 9'
- Depth: Average 15" (19" at deepest)
- 2-3" sediment in places

Joint 2 to Joint 3

- A smaller region of damaged floor at the entrance of the eastern trapezoidal channel on the west side (likely caused by vehicle/ equipment) :
- Measures 28" wide, roughly 8' in length, with a depth of 1"

Joint 2 to Joint 3

At 5' from joint 2: missing section of stone wall
Length: 4'6"
Height: 27"
Depth: 10" average

Joint 2 to Joint 3

At 5' from joint 2:
missing section of stone wall
Length: 4'6"
Height: 27"
Depth: 10" average

[Continued from prior slide]

Joint 2 to Joint 3

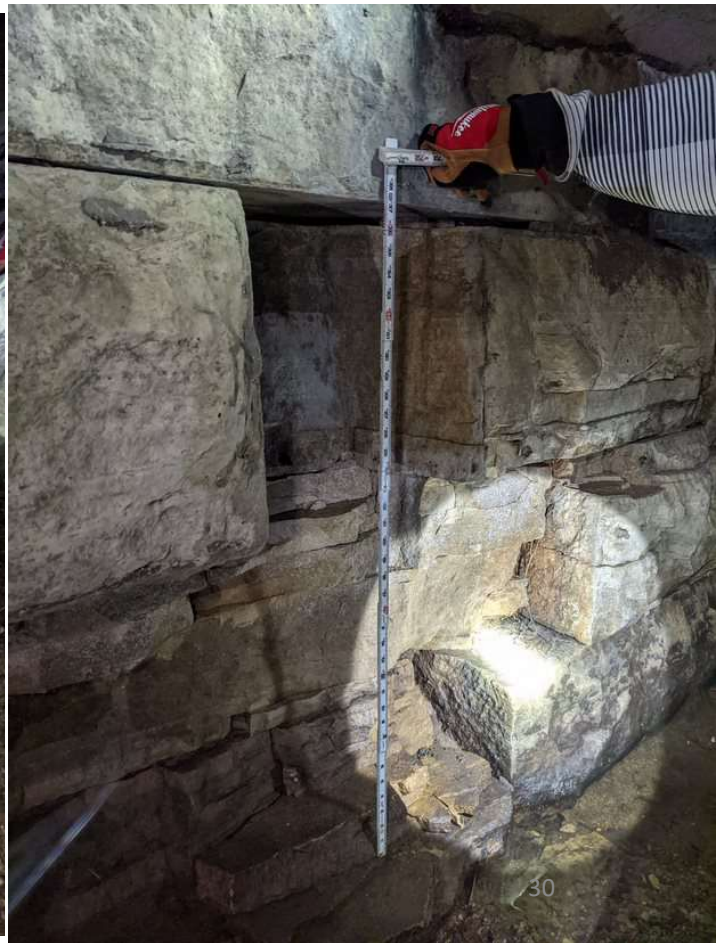
- 11' from joint 2: missing section of stone wall
- Irregular shape
- Height: 37" at highest
- Width: 60" at widest
- Depth: 8" average

Joint 2 to Joint 3

[same defect as prior slide]

11' from joint 2: missing section of stone wall

- Irregular shape
- Height: 37" at highest
- Width: 60" at widest
- Depth: 8" average



Joint 2 to Joint 3

[same defect as prior slide]

11' from joint 2: missing section of stone wall

- Irregular shape
- Height: 37" at highest
- Width: 60" at widest
- Depth: 8" average

East Channel East Wall

Joint 2 to Joint 3

- At 20' from joint 2: Missing section of concrete wall.
- Length: 40"
- Height: 2' tall
- Depth: 8" average (2" to 14")

Joint 2 to Joint 3

[Continued from prior slide]

At 20' from joint 2: missing section of concrete wall.

- Length: 40"
- Height: 2' tall
- Depth: 8" average (2" to 14")

ARCADIS

Joint 2 to Joint 3

West wall:

- Missing wall/ wall defects along bottom of west wall.
- Height: 5" on average
- Starting at Joint 2, ends at Joint 3

Joint 3 to Joint 4: 24'

Defect overview (photo shows J3 on east wall)

1' after joint 3: 2'8" tall crack from bottom of channel

Debris along bottom west side of channel, 5' in length

Rebar visible at joint 4 (roof)

12'4" capped inlet in center of ceiling 12" diameter

Joint 3 to Joint 4

Wall defect at Joint 3 (missing wall at joint connection)

Full height of east wall (4'), 1.5' wide on average, <1" depth

Joint 3 to Joint 4

- A region of missing floor with standing water, continuous from Joint 3 to 4
- Measures 24' in length, 9' width, and depth of 1-2"

Joint 3 to Joint 4

- 1' after joint 3:
- 2'8" tall crack from bottom of channel

Joint 3 to Joint 4

- 4' from Joint 3:
- Some debris visible along eastern side of channel, 5' in length, 2 large stone/concrete blocks

Joint 3 to Joint 4

- 12'4" from Joint 3:
- Capped inlet in center of ceiling 12" diameter

Joint 4 to Joint 5 – 10'

Defect Overview:

Circumferential fracture around joint 4 with rebar showing

Joint 4 to Joint 5

- At Joint 4:
- Circumferential fracture and hole with rebar visible on ceiling of channel.
- 1' width, 2 ft length, 2" depth, center of ceiling

Joint 4 to Joint 5

Continued from prior slide:

At Joint 4:

Circumferential fracture and hole with rebar visible on ceiling of channel.

- 1' width, 2 ft length, 2" depth, center of ceiling

Joint 5 to Joint 6 – 24'

Defect Overview:

Crack along joint connection at Joint 5: joint at ceiling slightly offset from joints all walls

Some bumps from patch work on east wall of channel

Joint 5 to Joint 6

- Some bumps from patch work on East wall of channel

Joint 6 to Joint 7– 24'

Small crack along joint connection at joint 6 (joint at ceiling offset from joint at walls) infiltration stain

Joint 7 to Flood Gates – 24'

Small crack at joint connection at joint 7 (joint at ceiling offset from joint at walls)

West Channel

Length: 169 ft

Width: Varies between 9 and 10 ft

Height: Trapezoidal

H: 4’11“ (center)

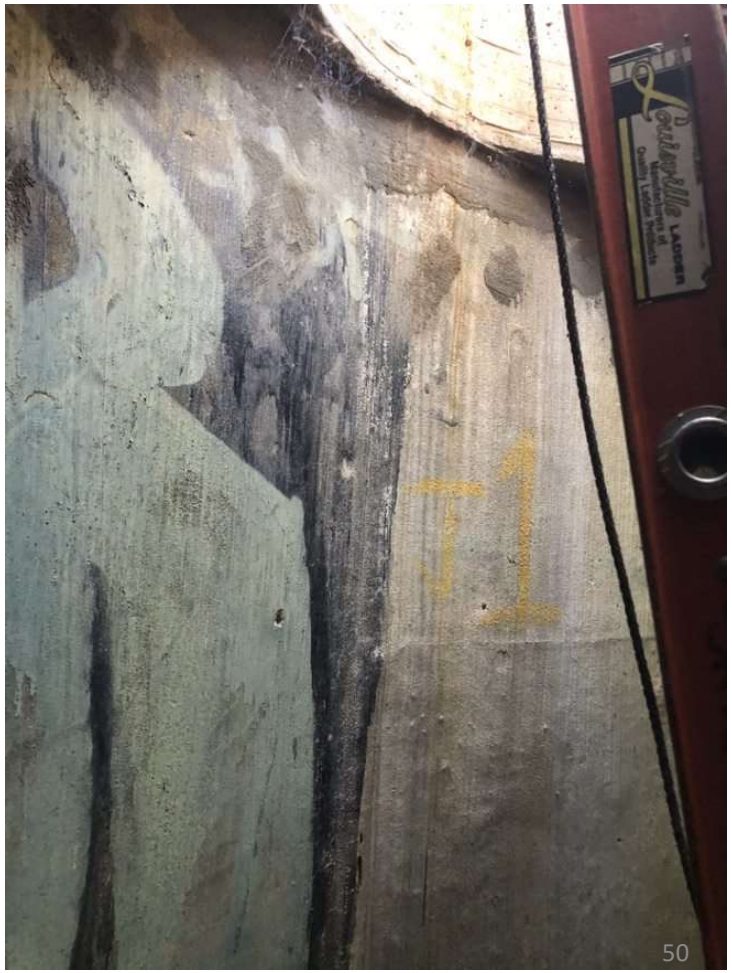
h: 4’0’ (wall)

Joint 0 to Joint 1 – 15'

- At 5'3": Elliptical Inlet pipe, 6'10" width, 3'7" height

Joint 1 to Joint 2

- Joint 1 is at the manhole entrance,
- Channel wall makes a turn here (trapezoidal shape in plan view)



Joint 1 to Joint 2 – 11'

- Overview:
- Floor is missing
- Circumferential crack at joint 2
- Calcium deposits continuous defect from joint 1 to joint 4

West Channel

Joint 1 to Joint 2

Large pool near dividing column on west side of north main chamber

Details in following slide

West Channel

Joint 1 to Joint 2 – 11'

Floor defect:

- Approximate rectangle with length 11 ft and width 10 ft.
- Average depth 12"
- (ranges from 6" to 21" depth)
- Deepest point just near dividing column

Joint 2 to Joint 3 – 29'6"

Defect Overview:

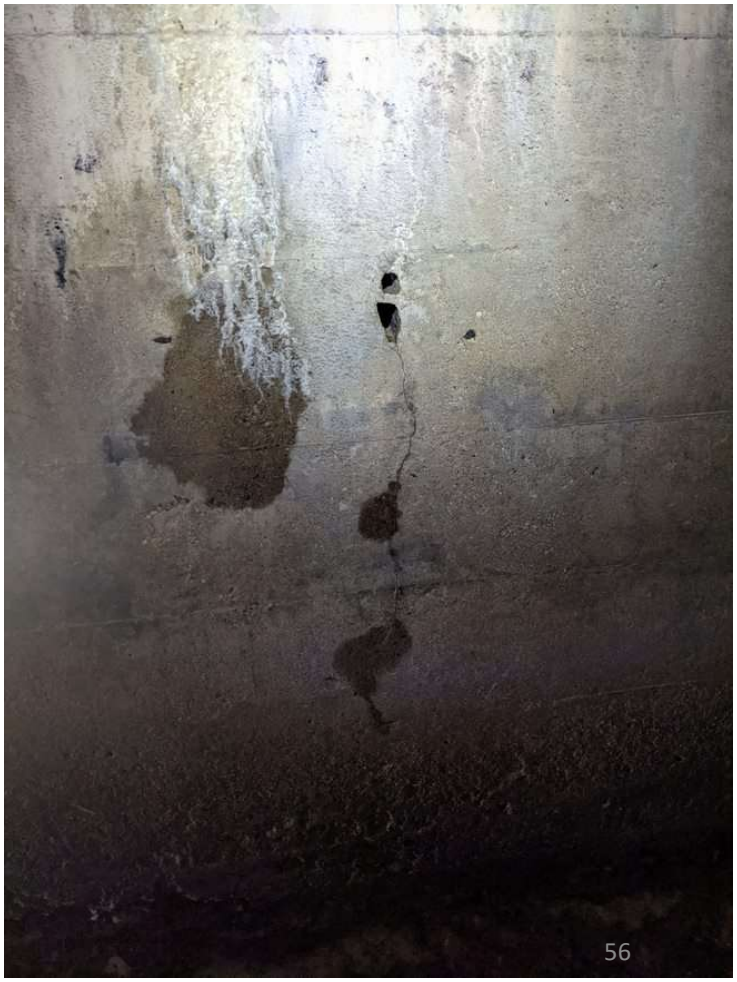
- Aggregate visible width is 1.5' on both walls, ceiling has deposits and cracks, 1' width
- Water depth is 21" at base of column, deep holes until joint 3
- Calcium deposits along walls and ceiling
- 2' oval hole that goes through column
- 4.5' to 6' vertical cracks on west wall with calcium
- 6' vertical crack on east wall with hole
- 18' vertical crack on west wall
- 20'6" vertical crack that runs entire height on east wall
- 20' large debris pile

Joint 2 to Joint 3

- 2' from Joint 2:
- Hole that goes through the column

Joint 2 to Joint 3

- 6' from Joint 2:
- Vertical crack on East side with hole



Joint 2 to Joint 3

- Continuous spall along bottom of east and west walls from joint 2 to joint 3,
- Image and defect dimension for the west wall:
- Height: 6"-8"
- Depth: <1"

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Joint 2 to Joint 3

- Continuous spall along bottom of east and west walls from joint 2 to joint 3,
- Image and defect dimension of the east wall:
- Height: 6"-12", average 8"
- Depth: 1"

Joint 2 to Joint 3

- Calcium deposits continuous defect from joint 2 to joint 3, on both East and West walls of channel.
- Images on this slide are of the east wall

West Channel East Wall

Joint 2 to Joint 3

- Calcium deposits continuous defect from joint 2 to joint 3, on both East and West walls of channel.
- Images on this slide are of the east wall.
- Horizontal crack on east wall from Joint 2 to joint 3 at 4' height. 1" depth at deepest point measured.

West Channel East Wall

Joint 2 to Joint 3

- 20' from Joint 2: Vertical crack along east wall and roof of channel

Joint 2 to Joint 3

Wall defect on west wall and roof at Joint 2:

Wall defect:

Height: 4'11"

Width: 2' at widest, 1 ft average

Depth: 5" average

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Joint 2 to Joint 3

[Continued from prior slide]

Wall defect on west wall and roof at Joint 2:

Wall defect:

Height: 4'11"

Width: 2' at widest, 1 ft average

Depth: 5" average

West Channel

Joint 2 to Joint 3

At Joint 2, cracks and calcium deposits on roof:
Width of deposits: 1ft

Roof defect (hole):

Depth: 1"

Width: 3"

West Channel East Wall

Joint 2 to Joint 3

Wall defect, aggregate visible on east wall (dividing wall) at Joint 2:

Wall defect:
Height: 4'11"
Width: 2' at widest, 1 ft average
Depth: 3" average

Joint 2 to Joint 3

- Pool/ floor defect starts at 4'8" from joint 2
- 9'6" width
- 9" average depth
- 26' length

Joint 2 to Joint 3

- Extensive debris southern end of pool/ floor defect. Mostly concrete debris and one storm grate

Joint 2 to Joint 3

- 4.5' to 6' from Joint 2:
- Vertical cracks on west side with calcium
- Length: 1 ft

Joint 3 to Joint 4 – 11'3"

Channel takes a turn:

Length on 8'10 East side: 8'10"

Length on west side: 11'3"

Defect Overview:

-Circumferential crack at joint 3, aggregate visible

- Floor defect/ Pool 22', average 1" depth standing water

- Debris pile

No photo

Joint 3 to Joint 4

Circumferential crack at joint 3, aggregate visible

Joint 3 to Joint 4

- From Joint 3 to Joint 5:
- Floor defect/ Pool 22', average 1" depth standing water

Joint 3 to Joint 4

Large debris pile begins just before joint 4

Joint 4 to Joint 5 – 14'6"

Defect Overview

- Inlet pipe on west side 20" diameter
- Infiltration stains on west side
- Bottom of corrugated metal pipe is corroded/ missing at opening

Joint 4 to Joint 5

- Infiltration stains on West side, continuous defect

Joint 4 to Joint 5

- Bumps on floor, continuous from Joint 4 to Flood Gates, minor defects in floor

Joint 5 to Joint 6 – 15'6"

Defect Overview

- Aggregate visible around joint, mastic showing, infiltration stain, 1' in width at widest point
- Lumber left from concrete pouring, infiltration stain
- Bumps on floor

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Joint 5 to Joint 6

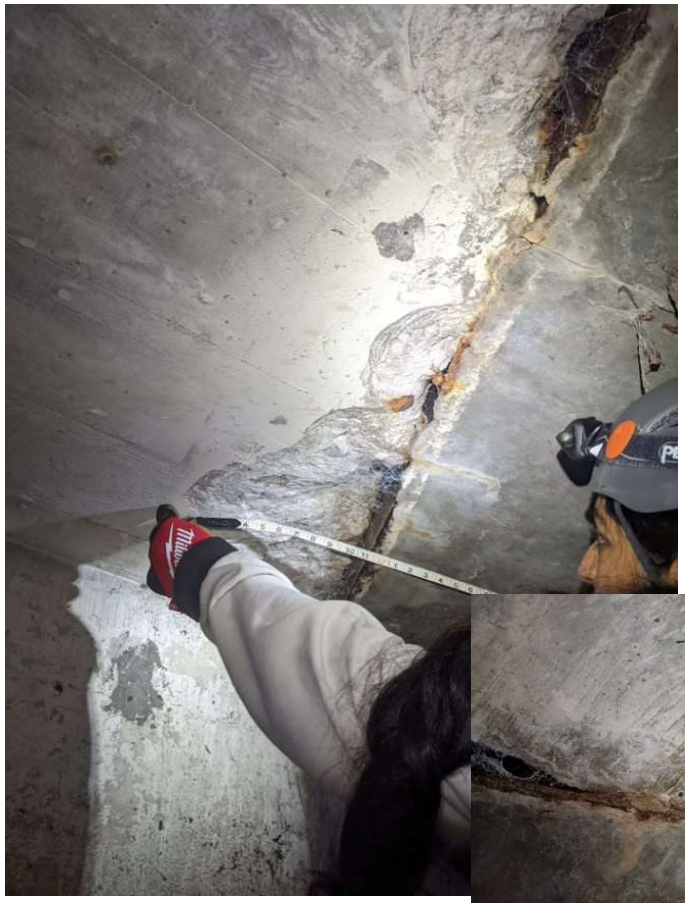
- Aggregate visible around joint 5, mastic showing, infiltration stain, 1' in width at widest point. Average depth 2" (1" to 3")

West Channel

Joint 5 to Joint 6

Continued from prior slide

Aggregate visible around joint 5, mastic showing, infiltration stain, 1' in width at widest point. Average depth 2" (1" to 3")



Joint 5 to Joint 6

- Lumber left from concrete pouring at Joint 5 on floor.
- Infiltration stain on east wall.

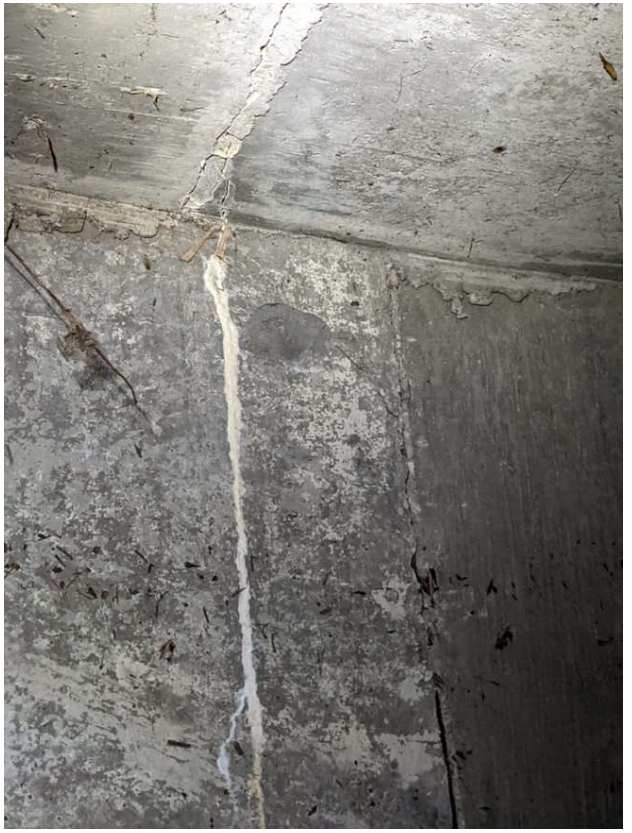
Joint 6 to Joint 7 – 24'

Defect Overview

- Crack at joint 6
- Ceiling joint and wall joint are offset about 6"
- Cable showing on ceiling

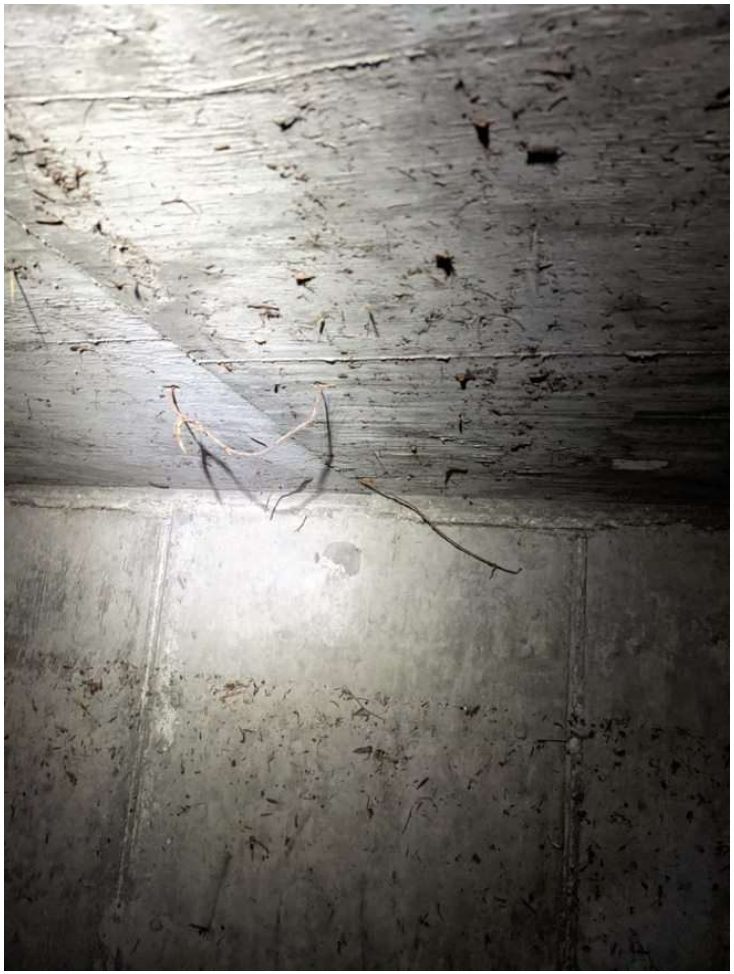
Joint 6 to Joint 7

- Crack at joint 6
- Ceiling joint and wall joint are offset about 6"



Joint 6 to Joint 7

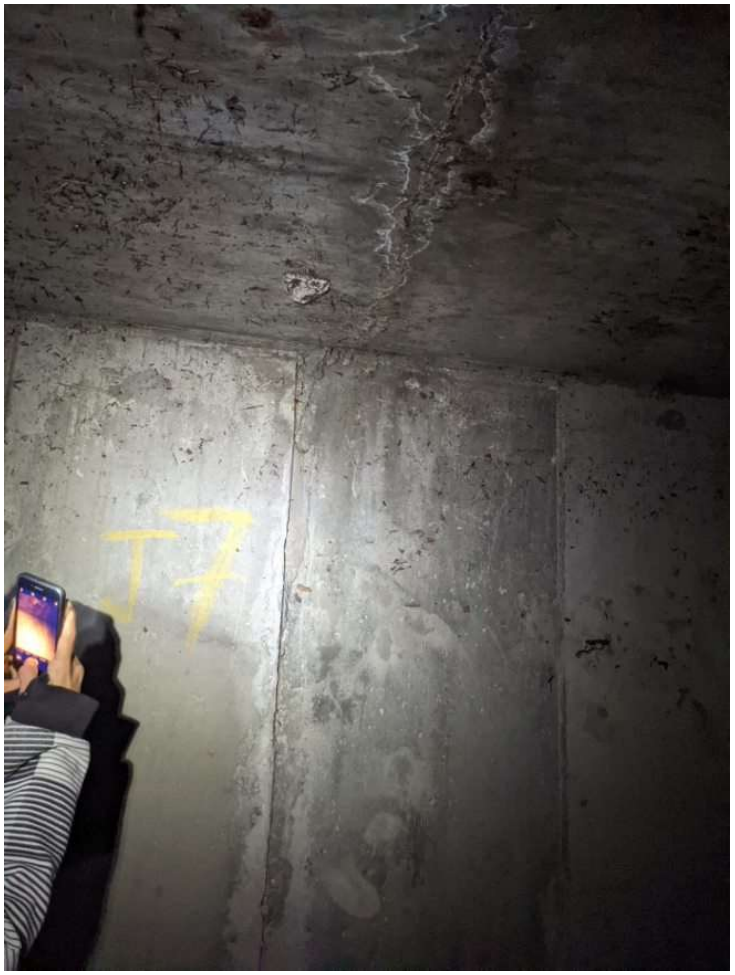
- Cable showing on ceiling



Joint 7 to Joint 8 – 24'

Defect Overview

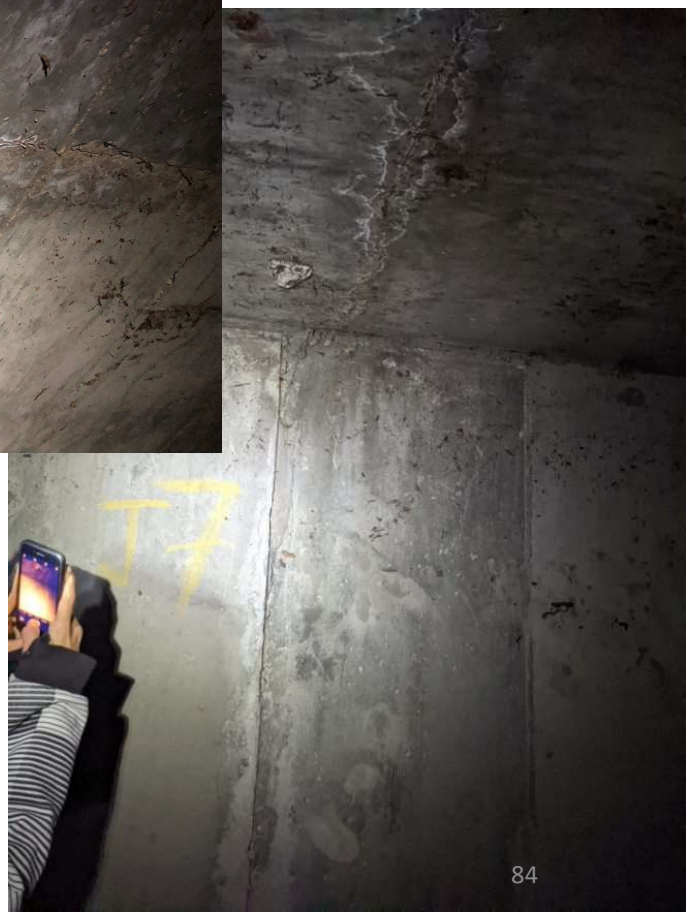
- Ceiling joint and wall joint are offset about 6"
- Signs of infiltration on ceiling
- Thin wires/cable showing on ceiling
- Bumps on floor .



West Channel

Joint 7 to Joint 8

- Signs of infiltration on ceiling



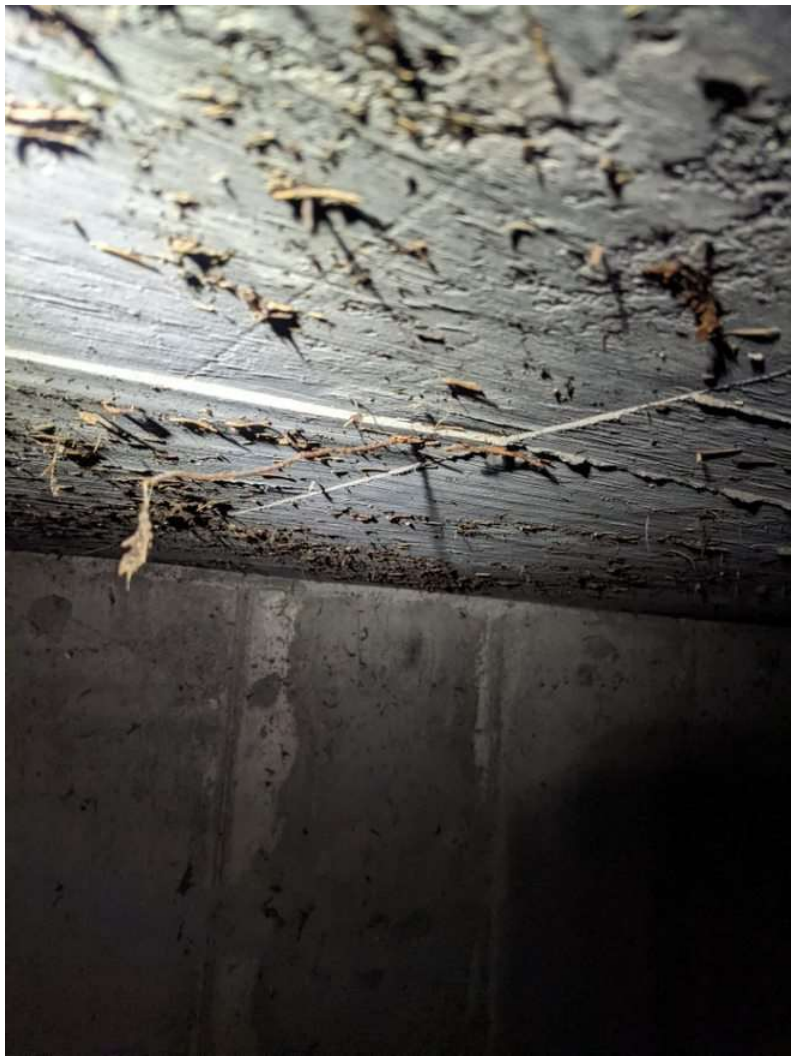
West Channel

Joint 7 to Joint 8

- Ceiling joint and wall joint are offset about 6" (joint 7)

Joint 7 to Joint 8

- Thin metal wires/cables hanging from ceiling



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Joint 8 to Flood Gates – 24'2

Defect Overview

- Some aggregate visible at wall/ceiling connection on west side at joint 8, Circumferential fracture
- Wires visible

Joint 8 to Floodgate

- Circumferential crack at Joint 8

Appendix B: Summary of Schoonmaker Creek Culvert Repair Recommendations

ID	Page	Channel	Title	Text	Repair	Repair Text	Length (ft)	Width (ft)	Depth (ft)	Quantity	Units	Unit Price	Cost	Notes
001	1		MMSD Sewer Inspection		1	No repair								
002	2		Inspected from North to South, heading downstream		1	No repair								
003	2		Objective: to capture defects, describe their location and size		1	No repair								
004	3		Overview Sketches		1	No repair								
005	4		Overview Sketches		1	No repair								
006	5		Northern Main Chamber		1	No repair								
007	6		Northern Main Chamber Overview		1	No repair								
008	7		Dividing Wall	Top Defect/ missing wall:	3	Shallow concrete repair	4.42	1.50	1.17	6.7	SF	$380.00	$2,546.00	
009	7		Dividing Wall	Bottom defect/ missing wall:	3	Shallow concrete repair	4.42	2.25	1.17	10.0	SF	$380.00	$3,800.00	
010	8	East	East Channel Overview		1	No repair								
011	9	East	Joint 0 to Joint 1: 15'	Vertical fracture 3'4" from ceiling on north wall	x	Repair noted on another slide								page 10
012	9	East	Joint 0 to Joint 1: 15'	Inlet pipe at 2'10", diameter 1'7"	1	No repair								
013	9	East	Joint 0 to Joint 1: 15'	10'6" vertical fracture from top to bottom of chamber	1	No repair								
014	9	East	Joint 0 to Joint 1: 15'	Sediment and floor defect continuous from joint 0 to joint 4	7	Floor slab replacement				1772.7	SF	$10.00	$17,727.00	
015	10	East	Joint 0 to Joint 1	Vertical fracture on North wall near trapezoidal inlet channel	1	No repair								
016	11	East	Joint 0 to Joint 1	Inlet pipe at 2’10” from joint 0, Diameter 19"	1	No repair								
017	12	East	Joint 0 to Joint 1	At 10’6” from joint 0: Vertical fracture from top to bottom of chamber	8	Epoxy injection crack repair	5.00				LF	$150.00		
018	13	East	Joint 0 to Joint 1	Continuous sediment and floor defect on east side of northern chamber:	7	Floor slab replacement					SF	$10.00		
019	14	East	Joint 1 to Joint 2: 11'	Patch work on east wall of chamber: 4'11" top length, 3' height on left side, approximate right triangle shape	1	No repair								
020	14	East	Joint 1 to Joint 2: 11'	At 3" from joint 1 on bottom: stone wall, pieces missing	x	Repair noted on another slide								page 17
021	14	East	Joint 1 to Joint 2: 11'	Calcium deposits begin from joint 1 continuous to joint 3	1	No repair								
022	14	East	Joint 1 to Joint 2: 11'	At 8'10": Wire mesh visible on floor. length 10'6", width 2'1"	7	Floor slab replacement					SF	$10.00		
023	15	East	Joint 1 to Joint 2	At 0 ft from Joint 1: Patch work on top of East side of channel, 4'11" top length, 3' height on left side, right triangle shape	1	No repair								
024	15	East	Joint 1 to Joint 2	(Missing stone wall visible on bottom)	x	Repair noted on another slide								page 17
025	16	East	Joint 1 to Joint 2	At 0 ft from Joint 1: Missing stone wall visible on bottom. Details on following 2 slides	x	Repair noted on another slide								page 17
026	17	East	Joint 1 to Joint 2	Starting 4" from joint 1, the first large piece of missing wall is 46" in length, 10" tall, and varies from 1" to 11" in depth (6" average depth)	6	Stone masonry repair	3.83	0.83	0.50	1.6	CF	$760.00	$1,216.00	
027	18	East	Joint 1 to Joint 2	Starting 4" from joint 1, the first large piece of missing wall is 46" in length, 10" tall, and varies from 1" to 11" in depth (6" average depth)	x	Repair noted on another slide								page 18
028	19	East	Joint 1 to Joint 2	Starting at 13'5" from Joint 1, there is an 11' long hole along the floor, 1' tall, and varies in depth from 5" to 17" (average 11" depth)	6	Stone masonry repair	11.00	1.00	0.92	10.1	CF	$760.00	$7,676.00	
029	20	East	Joint 1 to Joint 2	At 8'10": Wire mesh visible on floor	7	Floor slab replacement					SF	$10.00		
030	21	East	Joint 2 to Joint 3 — 30'		1	No repair								
031	22	East	Joint 2 to Joint 3	Calcium deposits begin from joint 2 and continue to Joint 3 along the top of the east and west walls	1	No repair								
032	23	East	Joint 2 to Joint 3	At 2 ft from Joint 2: circumferential crack with calcium deposits, especially severe on roof	3	Shallow concrete repair	20.00	1.25	0.17	25.0	SF	$380.00	$9,500.00	
033	23	East	Joint 2 to Joint 3	Possibly Intentional holes in ceiling of channel, 6 total	1	No repair								
034	24	East	Joint 2 to Joint 3	At 2 ft from Joint 2: circumferential crack with calcium deposits, especially severe on roof	x	Repair noted on another slide								page 23
035	24	East	Joint 2 to Joint 3	Possibly Intentional holes in ceiling of channel, 6 total	x	Repair noted on another slide								page 23
036	25	East	Joint 2 to Joint 3	At 16 ft from Joint 2: Large missing section of floor creating pool of standing water. Ends at Joint 3	7	Floor slab replacement					SF	$10.00		
037	26	East	Joint 2 to Joint 3	A smaller region of damaged floor at the entrance of the eastern trapezoidal channel on the west side (likely caused by vehicle/ equipment) :	7	Floor slab replacement					SF	$10.00		
038	27	East	Joint 2 to Joint 3	At 5' from joint 2: missing section of stone wall	6	Stone masonry repair	4.50	2.25	0.83	8.5	CF	$760.00	$6,460.00	
039	28	East	Joint 2 to Joint 3	At 5' from joint 2: missing section of stone wall	x	Repair noted on another slide								page 28
040	29	East	Joint 2 to Joint 3	11' from joint 2: missing section of stone wall	6	Stone masonry repair	5.00	3.08	0.67	10.3	CF	$760.00	$7,828.00	

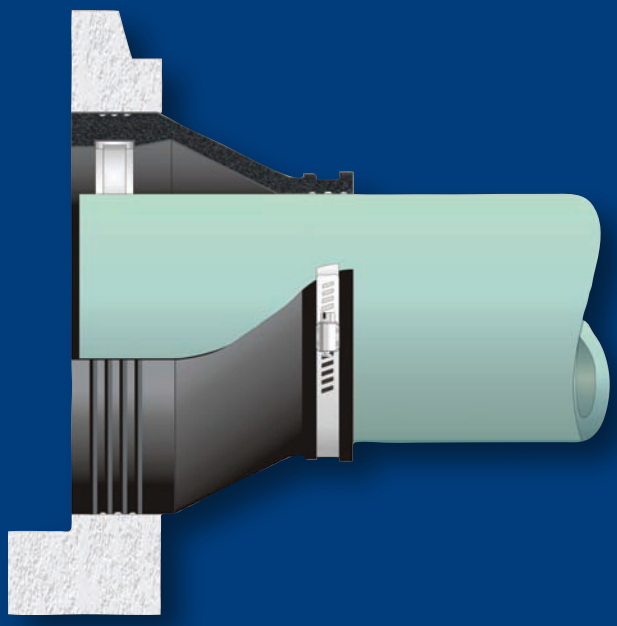
ID	Page	Channel	Title	Text	Repair	Repair Text	Length (ft)	Width (ft)	Depth (ft)	Quantity	Units	Unit Price	Cost	Notes
041	30	East	Joint 2 to Joint 3	11' from joint 2: missing section of stone wall	x	Repair noted on another slide								page 29
042	31	East	Joint 2 to Joint 3	11' from joint 2: missing section of stone wall	x	Repair noted on another slide								page 29
043	32	East	Joint 2 to Joint 3	At 20' from joint 2: Missing section of concrete wall.	6	Stone masonry repair	3.33	2.00	0.67	4.5	CF	$760.00	$3,420.00	
044	33	East	Joint 2 to Joint 3	At 20' from joint 2: Missing section of concrete wall.	x	Repair noted on another slide								page 32
045	34	East	Joint 2 to Joint 3	Missing wall/ wall defects along bottom of west wall.	3	Shallow concrete repair	30.00	0.42	0.17	12.5	SF	$380.00	$4,750.00	
046	35	East	Joint 3 to Joint 4: 24'	1' after joint 3: 2'8" tall crack from bottom of channel	x	Repair noted on another slide								page 38
047	35	East	Joint 3 to Joint 4: 24'	Debris along bottom west side of channel, 5' in length	x	Repair noted on another slide								page 39
048	35	East	Joint 3 to Joint 4: 24'	Rebar visible at joint 4 (roof)	x	Repair noted on another slide								page 42
049	35	East	Joint 3 to Joint 4: 24'	12'4" capped inlet in center of ceiling 12" diameter	x	Repair noted on another slide								page 40
050	36	East	Joint 3 to Joint 4	Wall defect at Joint 3 (missing wall at joint connection)	3	Shallow concrete repair	4.00	1.50	0.17	6.0	SF	$380.00	$2,280.00	
051	37	East	Joint 3 to Joint 4	A region of missing floor with standing water, continuous from Joint 3 to 4	7	Floor slab replacement					SF	$10.00		
052	38	East	Joint 3 to Joint 4	2'8" tall crack from bottom of channel	1	No repair								
053	39	East	Joint 3 to Joint 4	Some debris visible along eastern side of channel, 5' in length, 2 large stone/concrete blocks	2	Debris removal				1.0	LS	$12,000.00	$12,000.00	
054	40	East	Joint 3 to Joint 4	Capped inlet in center of ceiling 12" diameter	3	Shallow concrete repair	1.00	1.00	0.17	1.0	SF	$380.00	$380.00	
055	41	East	Joint 4 to Joint 5 — 10'	Circumferential fracture around joint 4 with rebar showing	x	Repair noted on another slide								page 42
056	42	East	Joint 4 to Joint 5	Circumferential fracture and hole with rebar visible on ceiling of channel.	4	Deep concrete repair with reinforc	2.00	1.00	0.33	2.0	SF	$440.00	$880.00	
057	43	East	Joint 4 to Joint 5	Circumferential fracture and hole with rebar visible on ceiling of channel.	x	Repair noted on another slide								page 42
058	44	East	Joint 5 to Joint 6 — 24'	Defect Overview:	x	Repair noted on another slide								pages 45, 46
059	45	East	Joint 5 to Joint 6	Some bumps from patch work on East wall of channel	1	No repair								
060	46	East	Joint 5 to Joint 6	Small crack along joint connection at joint 6 (joint at ceiling offset from joint at walls) infiltration stain	1	No repair								
061	47	East	Joint 7 to Flood Gates — 24'	Small crack at joint connection at joint 7 (joint at ceiling offset from joint at walls)	1	No repair								
062	48	West	West Channel		1	No repair								
063	49	West	Joint 0 to Joint 1 — 15'	At 5'3": Elliptical Inlet pipe, 6'10" width, 3'7" height	1	No repair								
064	50	West	Joint 1 to Joint 2		1	No repair								
065	51	West	Joint 1 to Joint 2 — 11'	Floor is missing	7	Floor slab replacement					SF	$10.00		
066	51	West	Joint 1 to Joint 2 — 11'	Circumferential crack at joint	x	Repair noted on another slide								
067	51	West	Joint 1 to Joint 2 — 11'	Calcium deposits continuous defect from joint 1 to joint 4	1	No repair								
068	52	West	Joint 1 to Joint 2	Large pool near dividing column on west side of north main chamber	x	Repair noted on another slide								page 53
069	53	West	Joint 1 to Joint 2 — 11'	Floor defect:	x	Repair noted on another slide								page 51
070	54	West	Joint 2 to Joint 3 — 29'6"	Aggregate visible width is 1.5' on both walls, ceiling has deposits and cracks, 1' width	x	Repair noted on another slide								pages 56-57
071	54	West	Joint 2 to Joint 3 — 29'6"	Water depth is 21" at base of column, deep holes until joint 3	x	Repair noted on another slide								page 66
072	54	West	Joint 2 to Joint 3 — 29'6"	Calcium deposits along walls and ceiling	x	Repair noted on another slide								pages 59-60
073	54	West	Joint 2 to Joint 3 — 29'6"	2' oval hole that goes through column	x	Repair noted on another slide								page 55
074	54	West	Joint 2 to Joint 3 — 29'6"	4.5' to 6' vertical cracks on west wall with calcium	x	Repair noted on another slide								page 68
075	54	West	Joint 2 to Joint 3 — 29'6"	6' vertical crack on east wall with hole	x	Repair noted on another slide								page 56
076	54	West	Joint 2 to Joint 3 — 29'6"	18' vertical crack on west wall	8	Epoxy injection crack repair	5.00				LF	$150.00		
077	54	West	Joint 2 to Joint 3 — 29'6"	20'6" vertical crack that runs entire height on east wall	x	Repair noted on another slide								page 60
078	54	West	Joint 2 to Joint 3 — 29'6"	20' large debris pile	x	Repair noted on another slide								page 67
079	55	West	Joint 2 to Joint 3	Hole that goes through the column	1	No repair								
080	56	West	Joint 2 to Joint 3	Vertical crack on East side with hole	8	Epoxy injection crack repair	4.00				LF	$150.00		
081	57	West	Joint 2 to Joint 3	Continuous spall along bottom of east and west walls from joint 2 to joint 3,	3	Shallow concrete repair	29.50	0.67	0.17	19.7	SF	$380.00	$7,486.00	
082	58	West	Joint 2 to Joint 3	Continuous spall along bottom of east and west walls from joint 2 to joint 3,	3	Shallow concrete repair	29.50	0.67	0.17	19.7	SF	$380.00	$7,486.00	
083	59	West	Joint 2 to Joint 3	Calcium deposits continuous defect from joint 2 to joint 3, on both East and West walls of channel.	1	No repair								
084	60	West	Joint 2 to Joint 3	Calcium deposits continuous defect from joint 2 to joint 3, on both East and West walls of channel.	1	No repair								
085	60	West	Joint 2 to Joint 3	Horizontal crack on east wall from Joint 2 to joint 3 at 4' height. 1" depth at deepest point measured.	3	Shallow concrete repair	29.50	0.50	0.08	14.8	SF	$380.00	$5,624.00	
086	61	West	Joint 2 to Joint 3	20' from Joint 2: Vertical crack along east wall and roof of channel	8	Epoxy injection crack repair	6.00			6.0	LF	$150.00	$900.00	
087	62	West	Joint 2 to Joint 3	Wall defect on west wall and roof at Joint 2:	5	Joint repair	4.92	1.00	0.42	5.0	LF	$290.00	$1,450.00	

ID	Page	Channel	Title	Text	Repair	Repair Text	Length (ft)	Width (ft)	Depth (ft)	Quantity	Units	Unit Price	Cost	Notes
088	63	West	Joint 2 to Joint 3	Wall defect on west wall and roof at Joint 2:	X	Repair noted on another slide								
089	64	West	Joint 2 to Joint 3	At Joint 2, cracks and calcium deposits on roof:	5	Joint repair	10.00	0.25	0.08	2.5	LF	$290.00	$725.00	assume full width of roof joint
090	65	West	Joint 2 to Joint 3	Wall defect, aggregate visible on east wall (dividing at Joint 2:	3	Shallow concrete repair	4.92	1.00	0.25	5.0	SF	$380.00	$1,900.00	
091	66	West	Joint 2 to Joint 3	Pool/ floor defect starts at 4'8" from joint 2	7	Floor slab replacement					SF	$10.00		
092	67	West	Joint 2 to Joint 3	Extensive debris southern end of pool/ floor defect. Mostly concrete debris and one storm grate	2	Debris removal					LS	$12,000.00		
093	68	West	Joint 2 to Joint 3	Vertical cracks on west side with calcium	1	No repair								
094	69	West	Joint 3 to Joint 4 — 11'3"	Circumferential crack at joint 3, aggregate visible	x	Repair noted on another slide								page 70
095	69	West	Joint 3 to Joint 4 — 11'3"	Floor defect/ Pool 22', average 1" depth standing water	x	Repair noted on another slide								page 71
096	69	West	Joint 3 to Joint 4 — 11'3"	Debris pile	x	Repair noted on another slide								page 72
097	70	West	Joint 3 to Joint 4	Circumferential crack at joint 3, aggregate visible	3	Shallow concrete repair	20.00	1.00	0.17	20.0	SF	$380.00	$7,600.00	
098	71	West	Joint 3 to Joint 4	Floor defect/ Pool 22', average 1" depth standing water	1	No repair								
099	72	West	Joint 3 to Joint 4	Large debris pile begins just before joint 4	1	No repair								
100	73	West	Joint 4 to Joint 5 — 14'6"	Inlet pipe on east side 20" diameter	1	No repair								
101	73	West	Joint 4 to Joint 5 — 14'6"	Infiltration stains on east side	1	No repair								
102	73	West	Joint 4 to Joint 5 — 14'6"	Bottom of corrugated metal pipe is corroded/ missing at opening	1	No repair								does not affect strength of pipe at this section since it is embedded in the concrete wall
103	74	West	Joint 4 to Joint 5	Infiltration stains on West side, continuous defect	1	No repair								
104	75	West	Joint 4 to Joint 5	Bumps on floor, continuous from Joint 4 to Flood Gates, minor defects in floor	1	No repair								'minor'
105	76	West	Joint 5 to Joint 6 — 15'6"	Aggregate visible around joint, mastic showing, infiltration stain, 1' in width at widest point	x	Repair noted on another slide								pages 77-78
106	76	West	Joint 5 to Joint 6 — 15'6"	Lumber left from concrete pouring, infiltration stain	x	Repair noted on another slide								page 79
107	76	West	Joint 5 to Joint 6 — 15'6"	Bumps on floor	1	No repair								
108	77	West	Joint 5 to Joint 6	Aggregate visible around joint 5, mastic showing,	5	Joint repair	20.00	0.08	0.17	1.7	LF	$290.00	$493.00	
109	78	West	Joint 5 to Joint 6	Continued from prior slide	x	Repair noted on another slide								is this on floor also
110	79	West	Joint 5 to Joint 6	Lumber left from concrete pouring at Joint 5 on floor.	1	No repair								
111	79	West	Joint 5 to Joint 6	Infiltration stain on east wall.	1	No repair								
112	80	West	Joint 6 to Joint 7 — 24'	Defect Overview	x	Repair noted on another slide								
113	81	West	Joint 6 to Joint 7	Crack at joint 6	1	No repair								
114	81	West	Joint 6 to Joint 7	Ceiling joint and wall joint are offset about 6"	1	No repair								
115	82	West	Joint 6 to Joint 7	Cable showing on ceiling	1	No repair								
116	83	West	Joint 7 to Joint 8 — 24'	Ceiling joint and wall joint are offset about 6"	x	Repair noted on another slide								page 85
117	83	West	Joint 7 to Joint 8 — 24'	Signs of infiltration on ceiling	x	Repair noted on another slide								page 84
118	83	West	Joint 7 to Joint 8 — 24'	Thin wires/cable showing on ceiling	x	Repair noted on another slide								page 86
119	83	West	Joint 7 to Joint 8 — 24'	Bumps on floor	1	No repair								
120	84	West	Joint 7 to Joint 8	Signs of infiltration on ceiling	1	No repair								
121	85	West	Joint 7 to Joint 8	Ceiling joint and wall joint are offset about 6" (joint 7)	1	No repair								
122	86	West	Joint 7 to Joint 8	Thin metal wires/cables hanging from ceiling	1	No repair								
123	87	West	Joint 8 to Flood Gates 24'2	Some aggregate visible at wall/ceiling connection on west side at joint 8,Circumferential fracture	x	Repair noted on another slide								page 88
124	87	West	Joint 8 to Flood Gates 24'2	Wires visible	1	No repair								
125	88	West	Joint 8 to Floodgate	Circumferential crack at Joint 8	1	No repair								no dimensions

Appendix C: Kor-N-Seal I 106/406 Series Pipe-to-Manhole Connector Data Sheet

TRELLEBORG

Kor-N-Seal® I
106/406 Series Pipe-to-Manhole Connector



- *Most widely used flexible connector in sanitary sewer applications throughout the world*
- *Easy-to-Install*
- *Meets the specifications of ASTM C923*

Patented Waveband technology creates a more effective seal by concentrating the compressive force of the expansion band. The rubber is "captured" between the band and the concrete.

Kor-N-Seal I
106/406 Series Pipe-to-Manhole Connector

Wedge Style Connectors EX Series Plastic or Stainless Steel

Installation requires a ½" socket wrench & preset torque limiter.

PIPE O.D. RANGE	MODEL NUMBER	NOMINAL HOLE SIZE
1.50 – 4.80	S106-7MW	7"
3.50 – 4.50	S106-7W	7"
4.20 – 6.40	S106-8SRW	8"
1.50 – 4.80	S106-8MW	8"
5.10 – 5.90	S106-8W	8"
6.00 – 6.75	S406-10AW	10"
7.50 – 8.20	S406-10W	10"
6.00 – 6.75	S406-10.5AW	10½"
7.50 – 8.70	S406-10.5W	10½"
6.00 – 7.00	S406-11BW	11"
7.50 – 9.00	S406-11AW	11"
3.50 – 6.90	S106-12M	12"
6.00 – 7.00	S406-12CW	12"
6.25 – 7.50	S406-12BW	12"
7.50 – 9.00	S406-12AW	12"
9.00 – 10.20	S406-12W	12"
5.75 – 7.00	S106-12BW	12"
7.00 – 8.50	S106-12AW	12"
8.25 – 9.75	S106-12W	12"
9.50 – 11.25	S106-14AW	14"
9.50 – 11.25	S106-16BW	16"
11.25 – 13.00	S106-16AW	16"
13.00 – 14.20	S106-16W	16"
14.00 – 15.50	S106-20BWS	20"
15.50 – 17.00	S106-20AWS	20"
17.00 – 18.15	S106-20WS	20"

Refer to Recommended Installation Instructions.

Toggle Style Connectors (Jack-In Style)

Installation requires a hydraulic jack assembly

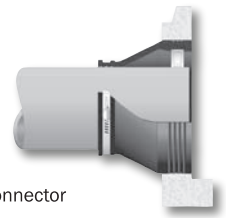
PIPE O.D. RANGE	MODEL NUMBER	NOMINAL HOLE SIZE
1.50 – 4.80	S106-7MT	7"
3.50 – 4.50	S106-7T	7"
4.20 – 6.40	S106-8SRT	8"
1.50 – 4.80	S106-8MT	8"
5.10 – 5.90	S106-8T	8"
6.00 – 6.75	S406-10AT	10"
7.50 – 8.40	S406-10T	10"
6.00 – 6.75	S406-10.5AT	10½"
7.50 – 8.90	S406-10.5T	10½"
6.00 – 7.00	S406-11BT	11"
7.50 – 9.00	S406-11AT	11"
3.50 – 6.90	S106-12MT	12"
6.00 – 7.00	S406-12CT	12"
6.25 – 7.50	S406-12BT	12"
7.50 – 9.00	S406-12AT	12"
9.00 – 10.50	S406-12T	12"
5.75 – 7.00	S106-12BT	12"
7.00 – 8.50	S106-12AT	12"
8.25 – 9.75	S106-12T	12"
9.50 – 11.25	S106-14AT	14"
9.50 – 11.25	S106-16BT	16"
11.25 – 13.00	S106-16AT	16"
13.00 – 14.50	S106-16T	16"

Refer to Recommended Installation Instructions.

To Install 7" & 8" Toggle Style Connectors:

Expander Assembly (p/n 90225)
8" Extension (p/n 13808)

Ordering Information



Kor-N-Seal I:
106/406 Series
Pipe-to-Manhole Connector

The 106 Series connector is 8 inches long, the 406 Series connector is 6 inches long.
The number following the hyphen in our model numbers is the required hole size.
The S106-20 Series is available in Stainless Steel Wedge only.

Recommended Torque Values:

Connectors with 8" hole size and smaller:

Steel Wedge - 1/2" Socket Wrench - 8 ft. lbs.

Connectors with 10 - 20" hole sizes:

EX Series - 1/2" Socket Wrench – 12 - 20 ft. lbs.
Steel Wedge - 1/2" Socket Wrench - 12 ft. lbs.

Preset torque limiters are available. Contact Customer Service at 1-800-626-2180 for more information.

For larger pipe sizes refer to Kor-N-Seal II Series Connectors

206 Series - For pipe sizes 15" - 51" in diameter.

306 Series - To fit larger pipe into smaller diameter manholes.

506 Series - Designed specifically for stormwater applications.

Using Corrugated Pipe

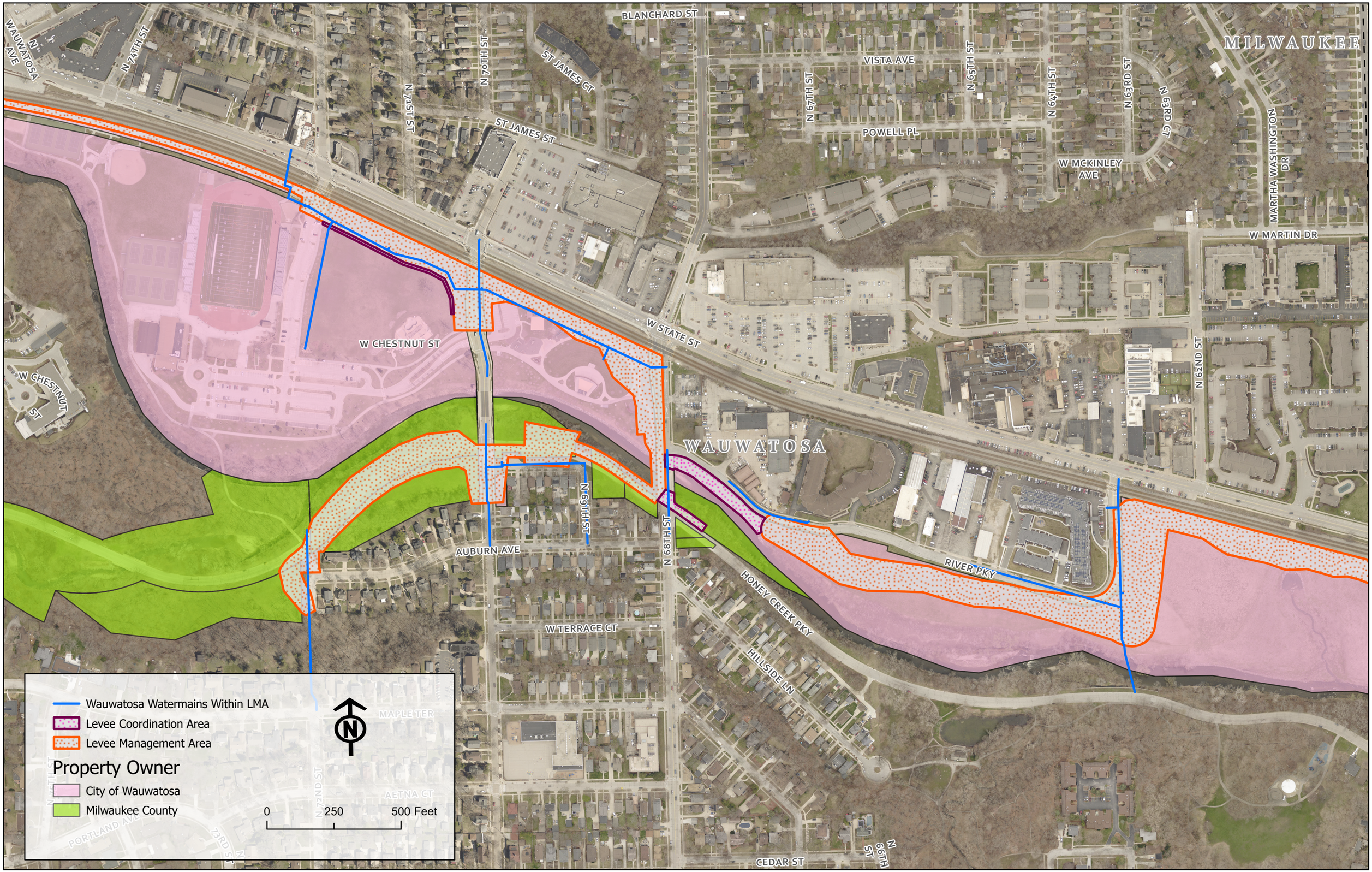
Adapters are required when using Corrugated Pipe. Refer to the Corrugated Pipe Adapter Data Sheet for details.

TRELLEBORG

Trelleborg Pipe Seals Milford, Inc.
P.O. Box 301, 250 Elm Street, Milford, New Hampshire 03055 U.S.A.
Tel: 800-626-2180 603-673-8680 Fax: 603-673-7271 www.trelleborg.com/npc

Arcadis U.S., Inc.
126 North Jefferson Street, Suite 400
Milwaukee
Wisconsin 53202
Phone: 414 276 7742
Fax: 414 276 7603
www.arcadis.com

Attachment J: Water Mains Near the Levee


BLANCHARD ST
N WAUWATOSA AVE
N 74TH ST
N 73ST ST
N 70TH ST
ST JAMES CT
ST JAMES ST
VISTA AVE
N 67TH ST
N 65TH ST
N 64TH ST
N 63RD ST
N 63RD CT
POWELL PL
W MCKINLEY AVE
MILWAUKEE
MARTHA WASHINGTON DR
W MARTIN DR
N 62ND ST
W STATE ST
W CHESTNUT ST
W CHESTNUT ST
WAUWATOSA
N 69TH ST
N 68TH ST
AUBURN AVE
W TERRACE CT
HONEY CREEK PKY
HILLSIDE LN
RIVER PKY
MAPLE TER
N 72ND ST
AETNA CT
PORTLAND AVE
73RD ST
CEDAR ST
N 66TH ST
Wauwatosa Watermains Within LMA
Levee Coordination Area
Levee Management Area
Property Owner
City of Wauwatosa
Milwaukee County
0
250
500 Feet