Project Planning Document

City of Kalamazoo FY 2025
Drinking Water Project Planning Document

Prepared for
City of Kalamazoo

April 2024 – DRAFT

2240278

Contents

Figures

Appendices

1 INTRODUCTION

In Richland Township in the M-89 corridor, there is a facility identified as 34th Street Production Plated Plastics Company. That facility was closed in 1991 but the site had contamination from heavy metals and chlorinated volatile organic compounds. The site has an active groundwater extraction/treatment system and in 2018, PFAS was discovered in the system.

Groundwater flow from the site extends southward and southeastward into both Richland and Ross Townships. Groundwater sampling by the State of Michigan has revealed exceedances of current Michigan PFAS criteria in both townships. Additionally, both Chromium 6 and Nickel continue to migrate from the site into the townships. The primary project goal is to provide a permanent, long-term solution to contamination free drinking water source for the local residents and businesses.

2 BACKGROUND

2.1 Study and Service Area

The extent of the project area is illustrated in Figure 1 and is labelled as Phase 1. This area is proposed for fiscal year 2025. The area is bounded on the east by N 37th Street and N 36th Street, and by E D Avenue and E CD Avenue connecting them. The northern boundary is the intersection of E C Avenue and West Gull Lake Drive. The project extends west and south to tie into the existing water main on E C Avenue, N 35th Street, E D Avenue, M-89, and E DE Avenue. It also includes the neighborhoods along Lake Vista Drive, Delmar, Littlefield, Sherbrook, and Merrimac Street. No water main currently exists in the project area. The area is currently composed of 260 developed properties supplied with private wells. A comprehensive review of the current and future needs and development within the project area can be found in the latest City of Kalamazoo Water Reliability Study.

The project area crosses potential water withdrawal site WSSN 2013239 for 0.15 miles on N 37th St and E D Ave. The proposed water main will have no effects on this potential water withdrawal site.

2.2 Population

Based on the assumptions of the Water Model Analysis Memo dated September 5, 2023 included in Appendix G, the current population of the project area is approximated to be 650 people.

Based on the 2017 Kalamazoo Water Reliability Study, Richland Township is expected to increase population by approximately 12.25% every 5 years. Therefore, it is estimated that the population in the new service area will increase to approximately 1,100 people in 2045.

2.3 Existing Environmental Evaluation

2.3.1 Cultural and Historic Resources

2.3.1.1 THPO We have contacted all of the local Tribal Organizations who have confirmed there are no known cultural resources which may be impacted within the project areas. Copies of these correspondences are included in Appendix A.

2.3.1.2 SHPO The proposed projects will not impact existing structures in work areas. Therefore, no historic or archaeological sites will be impacted by the construction of the proposed project. A historical and environmental evaluation was performed by Orbis Environmental Consulting who is a State of Michigan approved consultant for this work. Their report of no impact is included in Appendix B.

2.3.2 Air Quality

There are no project activities which will affect air quality.

2.3.3 Wetlands

There is no project work proposed in wetland areas as can be seen in Figure 2.

2.3.4 Great Lakes Shorelands, Coastal Zones, and Coastal Management Areas

There is no project work which will affect great lakes shorelands, coastal zones, or coastal management areas.

2.3.5 Floodplains

There are no floodplains within the project area, as can be seen in Figure 3.

Commented [JS1]: Background, Environmental Evaluation, Direct Impacts, Indirect Impacts

2.3.6 Natural or Wild and Scenic Rivers

There is no project work which will affect these areas.

2.3.7 Major Surface Waters

In Ross Township, Gull Creek will be crossed at three locations at E DE Avenue, M-89, and E D Avenue as can be seen in Figure 1. At each of these locations, horizontal directional drilling methods are proposed to be used to avoid impacting the waterways. In Richland Township, a stream will be crossed on East DE Avenue approximately 4,000 feet west of N 37th Street. Although this stream may be crossed using open trench methods, no permanent changes will be made to the stream. EGLE permitting will be obtained for the construction of all stream crossings.

There is no project work which will affect Gull Lake or other major bodies of water.

2.3.8 Topography

There are no proposed topographical changes in the project.

2.3.9 Geology

There are no proposed changes to local geology nor is any dewatering anticipated.

It is not anticipated that contamination will affect the construction of the proposed project as all work will be within existing utility corridors. Corridors have been reviewed and no contamination is expected to be encountered.

2.3.10 Soil Types

Based on the USDA Web Soil Survey, local soils consist primarily of sandy loams and clay loams. No import of material or export of native material is anticipated.

2.3.11 Agricultural Resources

All of the proposed water main will be placed within existing road right-of-way and will not impact any adjacent farmlands.

2.3.12 Fauna and Flora

The proposed project work will be within the existing road right-of-way and will not impact fauna or flora within the project areas. Although the habitats of the Indiana bat (endangered) and the Northern long-eared bat (threatened) have the potential to be encountered as they typically roost under bark or in crevices in trees, if tree removal or trimming is required, it will be performed between October 15 and March 31 to prevent disruption of roosting bats.

The typical habitats of the Eastern Massasauga Rattlesnake (threatened) and the Whooping Crane (experimental population, non-essential) include stream beds, which are near our project area. The current plan is to utilize horizontal directional drilling methods to avoid impacts to existing streams. The clearance report through the National Fish and Wildlife Service is included in Appendix C.

2.4 Existing System

There are 260 developed properties within the project area which are supplied with water from private wells. There is currently no public water supply available to these properties.

The City of Kalamazoo currently provides municipal water to Richland Township through a water service agreement. The City of Kalamazoo and Ross Township are establishing a water service agreement in anticipation of this extension project.

Appendix G contains the report summarizing the modeling results of adding the existing Richland/Ross system to the Kalamazoo system. Based on the modeling, the existing system can support both current and future demand in the proposed project area.

The City of Kalamazoo system is supplied by several well fields n various locations throughout the system. The entire system has approximately 70,220 Residential Equivalent Units currently served. A full summary and analysis of the Kalamazoo water system is available in the latest Water Reliability Study.

2.5 Need for the Project

2.5.1 Standards Compliance and Reliability

Several Stat of Michigan monitoring wells have detected unacceptable levels of PFAS in Richland and Ross Townships within the project area, as can be seen in Figure 4.

The water main installation will effectively address water safety concerns for the 260 properties and approximated 650 residents. The City of Kalamazoo water system is currently in compliance with all drinking water standards and has the capacity to serve the affected area.

2.5.2 Orders of Enforcement Action

There are no court or enforcement orders against the City of Kalamazoo.

2.5.3 Drinking Water Quality Problems

The City of Kalamazoo water system is currently not providing water to the affected area. There are currently 260 private wells in the project area which are impacted by the PFAS to varying degrees. The proposed project is designed to provide water free of PFAS to the Richland and Ross Township residents in the affected areas.

2.6 Projected Future Needs

The project area is not currently fully developed. Based on current zoning/land use maps, , and land use may change in future years. Appendix G contains the report summarizing the modeling results of adding the existing Richland/Ross system to the Kalamazoo system. Based on the modeling, the existing system can support both current and future demand in the proposed project area.

3 NEW WATER SUPPLY WELL PROCEDURES

No new wells are proposed.

4 ANALYSIS OF ALTERNATIVES

4.1 No Action

This alternative is not acceptable to any of the communities as it does not address the immediate health concern or provide any other long-term solution.

4.2 Optimum Performance of the Existing System

There are no current or foreseen operational issues with the existing water system which would prevent/hinder the proposed water main extensions into Richland and Ross Townships.

4.3 Regionalization – Extension of the City of Kalamazoo Water System

The City of Kalamazoo is the regional water provider and will continue to be in the future. No other regional alternatives exist. The City of Kalamazoo water system is immediately adjacent to the area of Richland/Ross Townships affected by the PFAS contamination. The new water main

is proposed to tie into the existing water mains on E C Avenue, N 35th Street, E D Avenue, M-89, and E DE Avenue. No other routes will effectively reach the properties proposed for new water main. The Kalamazoo system has the capacity to meet all the demands in the Richland/Ross Townships area proposed to be served by the system extension. The City of Kalamazoo currently provides municipal water to Richland Township through a water service agreement. The City of Kalamazoo and Ross Township are establishing a water service agreement in anticipation of this extension project.

4.4 Monetary Evaluation

Although there are no alternatives to the proposed water main extension, a present worth analysis for the water main is provided in Figure 6.

4.5 Environmental Evaluation

4.5.1 Cultural and Historic Resources

4.5.1.1 THPO We have contacted all of the local Tribal Organizations who have confirmed there are no known cultural resources which may be impacted within the project areas. Copies of these correspondences are included in Appendix A.

4.5.1.2 SHPO The proposed projects will not impact existing structures in work areas. Therefore, no historic or archaeological sites will be impacted by the construction of the proposed project. A historical and environmental evaluation was performed by Orbis Environmental Consulting who is a State of Michigan approved consultant for this work. Their report of no impact is included in Appendix B.

4.5.2 Air Quality

There are no project activities which will affect air quality.

4.5.3 Wetlands

There is no project work proposed in wetland areas as can be seen in Figure 2.

4.5.4 Great Lakes Shorelands, Coastal Zones, and Coastal Management Areas

There is no project work which will affect great lakes shorelands, coastal zones, or coastal management areas.

4.5.5 Floodplains

There are no floodplains within the project area, as can be seen in Figure 3.

Commented [JS2]: Background, Environmental Evaluation, Direct Impacts, Indirect Impacts

4.5.6 Natural or Wild and Scenic Rivers

There is no project work which will affect these areas.

4.5.7 Major Surface Waters

In Ross Township, Gull Creek will be crossed at three locations at E DE Avenue, M-89, and E D Avenue as can be seen in Figure 1. At each of these locations, horizontal directional drilling methods are proposed to be used to avoid impacting the waterways. In Richland Township, a stream will be crossed on East DE Avenue approximately 4,000 feet west of N 37th Street. Although this stream may be crossed using open trench methods, no permanent changes will be made to the stream. EGLE permitting will be obtained for the construction of all stream crossings.

There is no project work which will affect Gull Lake or other major bodies of water.

4.5.8 Topography

There are no proposed topographical changes in the project.

4.5.9 Geology

There are no proposed changes to local geology nor is any dewatering anticipated.

It is not anticipated that contamination will affect the construction of the proposed project as all work will be within existing utility corridors. Corridors have been reviewed and no contamination is expected to be encountered. An environmental corridor review memorandum is included in Appendix H.

4.5.10 Soil Types

Based on the USDA Web Soil Survey, local soils consist primarily of sandy loams and clay loams. No import of material or export of native material is anticipated.

4.5.11 Agricultural Resources

All of the proposed water main will be placed within existing road right-of-way and will not impact any adjacent farmlands.

4.5.12 Fauna and Flora

The proposed project work will be within the existing road right-of-way and will not impact fauna or flora within the project areas. Although the habitats of the Indiana bat (endangered) and the Northern long-eared bat (threatened) have the potential to be encountered as they typically roost under bark or in crevices in trees, if tree removal or trimming is required, it will be performed between October 15 and March 31 to prevent disruption of roosting bats.

The typical habitats of the Eastern Massasauga Rattlesnake (threatened) and the Whooping Crane (experimental population, non-essential) include stream beds, which are near our project area. The current plan is to utilize horizontal directional drilling methods to avoid impacts to existing streams. The clearance report through the National Fish and Wildlife Service is included in Appendix C.

4.5.13 Anticipated Mitigation Requirements and Costs

As there are no anticipated detrimental Environmental impacts due to the project, there are no mitigation measures required and therefore no associated costs.

4.5.14 Technical Considerations

4.5.14.1 Pressure and Flow Capacity

Appendix G contains the report summarizing the modeling results of adding the existing Richland/Ross system to the Kalamazoo system. Based on the modeling, the existing system can meet current and future maximum day demand along with the desired fire flow in the project area.

4.5.15 New/Increased Water Withdrawals

No new or increased water withdrawals, above existing permit limits, are proposed for this project.

5 SELECTED ALTERNATIVE

5.1 Water Main Installation

5.1.1 Design Parameters

The routing and sizing of the proposed water main extensions were based on several factors:

- Potential new customers along the proposed water main extension route were divided into two categories: Current and Buildout. Existing homes and businesses along the proposed water main extension were incorporated into the model as current demands (260 REU) and were modeled as existing demands in the proposed scenarios. Houses were counted as 1 Residential Equivalence Unit (REU), and other structures were assigned an estimated REU based on size and function.
- Vacant parcels adjacent to the proposed water main extension were counted as future buildout customers. The zoning category for each parcel and the minimum lot size in the zoning ordinance for Richland and Ross Townships was used to estimate an REU per acre for each vacant parcel. Zoning categories predicted a higher customer demand than Future Land Use categories, and therefore were used for estimating future buildout demands (approximately 1,300 REU). For the buildout demand scenarios, the existing Kalamazoo distribution system was modeled using the 20-year projected demands from the 2017 Water System Reliability Study.
- Future phases of potential extensions were examined to provide additional service to other areas of Richland and Ross Townships. This generated the need for water main sizing that facilitated transmission capacity for an expanded future service district.
- Fire flows for both current and future service area.

5.1.2 Useful Life

5.1.3 Materials

Water Services – Current City of Kalamazoo Building Code adopts the use of the Michigan Building Code and Michigan Residential Code. These codes allow for the use of multiple water service materials on the private property side of water services. Because the City of Kalamazoo is responsible for water services from the water main up to, and including, the water meter, all water services installed will be Type K copper as is required of services in the City of Kalamazoo water system. These services are expected to have a useful life of 75 years.

Water Mains – The current City of Kalamazoo Standards for Construction require the use of minimum Class 52 Ductile Iron pipe, materials, and fittings in accordance with ANSI/AWWA Standards. The water mains are expected to have a useful life of 100 years.

5.1.4 Water and Energy Efficiency

Water meters will be placed at all current user connections and are required for all future connections. Billed water volumes are compared to production water volumes to quantify

unmetered water losses. Leaks and meter repairs are identified and maintenance activities directed to mitigate the losses.

5.1.5 Schedule for Design and Construction

Commented [JS3]: It seems like the 2024 document answers none of the requirements in this section from the Guidance Document. Which should we go with?

Commented [JS4R3]: In 2023 application, a full schedule is given.

Design for all of the proposed work will begin immediately after funding is secured. It is anticipated that all of the proposed work will be designed in 2025 and begin construction in 2026. Multiple contractors will be required, and multiple project segments will be constructed concurrently.

The table below is a schedule for the proposed water distribution system improvement project. It would be funded under the fourth quarter of fiscal year 2025.

DWRF Project (4rd Quarter 2025)
Proposed Project Schedule

Milestone	Date
Hold Public Meeting	April, 2024
Submit Final Project Plan to EGLE	June, 2024
Receive Funding Determination	September 2024
User Charge System Approved	January 2025
Plans and Specifications Approved	May 2025
Bid Advertisement	May 2025
Receive Construction Bids	June 2025
EGLE Order of Approval	August 2025
Begin Construction	April 2026
Construction Completed	October 2027

5.1.6 Cost Summary

Appendix D contains a detailed cost estimate for the proposed water system installation. The estimated $21,756,840 dollar project costs for FY 2025 includes both construction costs and construction administration/inspection costs.

The entire project plan of the proposed watermain extensions. Lead service replacements, and treatment upgrades is estimated to cost $70,700,000. If the entire project plan is DWRF loan funded with an estimated 2 % interest rate for a 30 year period, the expected annual debt service for the proposed project based on the DWRF loan criteria will be approximately $3,157,000 per year.

The city typically bases its cost allocations on a Residential Equivalent Unit (REU). One REU is the designation given to a single-family residential household which has an average water use of approximately 210 gallons per day and a water meter size of 1-inch. For businesses or industries with larger meters, the number of Residential Equivalent Units is calculated based on the meter size serving that entity. The larger the meter, the larger the number of equivalent units assigned to that meter. The assigned REU is directly proportional to the larger meter's capacity as compared to the capacity of a residential meter.

With the current number of 70,220 REU in the entire water system, there will be a usage cost increase of approximately $44.96 per year per REU.

Commented [JS5]: How can we know the cost increase per year per REU?

Commented [JS6R5]: There are 42,636 REU

5.1.7 Implementability

There are no physical, legal, or managerial issues which will prevent or affect the implementation of the proposed water main installation.

6 ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS

6.1 Direct Impacts

6.1.1 Social Impact/Economic Impact

The proposed projects will have a positive impact on the economics of the project area. Properties with wells affected by PFAS have been recommended to not utilize the water for drinking, food preparation/canning, teeth brushing, or any other task that could result in ingestion. Given the multiple impacts of PFAS on humans and other organisms, there is an atmosphere of fear which reduced the current quality of life in the area and is potentially affecting property values. The proposed installation of water main and connection to a reliable, safe potable water supply will significantly reduce or eliminate the current social and economic impacts of the PFAS contamination.

6.1.2 Construction Impacts

6.1.2.1 Construction Methods

With the exception of waterway crossings, water main will be installed using open cut trenching. The width of the trenches will vary based on the depth of the trench, but all

open cut work must be contained within the right-of-way, including the trench width. Water services will be connected using directional drill technology.

6.1.2.2 Natural and Man-Made Features

The water main and services will be installed underground, and thus their presence will not affect species or environments on the ground surface.

6.1.2.3 Historical/Archaeological

6.1.2.3.1 THPO We have contacted all of the local Tribal Organizations who have confirmed there are no known cultural resources which may be impacted within the project areas. Copies of these correspondences are included in Appendix A.

6.1.2.3.2 SHPO The proposed projects will not impact existing structures in work areas. Therefore, no historic or archaeological sites will be impacted by the construction of the proposed project. A historical and environmental evaluation was performed by Orbis Environmental Consulting who is a State of Michigan approved consultant for this work. Their report of no impact is included in Appendix B.

6.1.2.4 Water Quality

The proposed project will replace the PFAS contaminated well water sources and will provide local residents with potable municipal drinking water which meets all current public drinking water standards.

6.1.2.5 Endangered Species

The proposed project work will be within the existing road right-of-way and will not impact fauna or flora within the project areas. Although the habitats of the Indiana bat (endangered) and the Northern long-eared bat (threatened) have the potential to be encountered as they typically roost under bark or in crevices in trees, if tree removal or trimming is required, it will be performed between October 15 and March 31 to prevent disruption of roosting bats.

The typical habitats of the Eastern Massasauga Rattlesnake (threatened) and the Whooping Crane (experimental population, non-essential) include stream beds, which are near our project area. The current plan is to utilize horizontal directional drilling methods

to avoid impacts to existing streams. The clearance report through the National Fish and Wildlife Service is included in Appendix C.

6.1.2.6 Agricultural Land

All of the proposed water main will be placed within existing road right-of-way and will not impact any adjacent farmlands.

6.1.2.7 Groundwater Impacts

No dewatering is proposed for this project.

6.1.2.8 Traffic Impacts

The proposed project is within road rights-of-way where streets and driveways will be impacted. All components of the project will be coordinated carefully with residences and businesses in the area, and construction methods will be selected to minimize disruptions.

Standard traffic and safety control devices such as barricades and lighted barrels will be in place to warn and protect residents during construction activities.

6.1.2.9 Air Quality

All of the projects are installing underground water infrastructure. Therefore, the projects will not negatively impact the air quality in the affected areas.

6.1.2.10 Wetlands

There is no project work proposed in wetland areas as can be seen in Figure 2.

6.1.2.11 Great Lakes Shorelands, Coastal Zones, and Coastal Management Areas

There is no project work which will affect great lakes shorelands, coastal zones, or coastal management areas.

6.1.2.12 Floodplains

There are no floodplains within the project area, as can be seen in Figure 3.

Commented [JS7]: Background, Environmental Evaluation, Direct Impacts, Indirect Impacts

6.1.2.13 Natural or Wild and Scenic Rivers

We reviewed the State of Michigan Department of Natural Resources data and found that no designated wild, scenic or natural rivers or tributaries exist within the study area.

6.1.2.14 Dust and Noise

Dust control methods such as water and/or brine will be used to keep dust to a minimum. All public roadways will be swept regularly and maintained to assure residents access to the area. Construction equipment will be maintained in good condition to decrease noise.

6.2 Indirect Impacts

No long-term impacts to the environment are anticipated. No changes in the environment are proposed for this project.

6.3 Cumulative impacts

Once construction is completed, there are no anticipated permanent, detrimental impacts to the environment or the community.

7 MITIGATION

7.1 Short Term Construction Related Mitigation

Standard procedures used in the construction industry will be included in the construction contract documents to mitigate construction activities.

7.1.1 Traffic Disruption

The proposed project is within road rights-of-way where streets and driveways will be impacted. All components of the project will be coordinated carefully with residences and businesses in the area, and construction methods will be selected to minimize disruptions.

Standard traffic and safety control devices such as barricades and lighted barrels will be in place to warn and protect residents during construction activities.

7.1.2 Dust and Noise

Dust control methods such as water and/or brine will be used to keep dust to a minimum. All public roadways will be swept regularly and maintained to assure residents access to the area. Construction equipment will be maintained in good condition to decrease noise.

7.1.3 Soil Erosion

Soil erosion and sedimentation control measures such as straw bales, sedimentation basins, and silt fence, will be part of the construction activities to prevent soil release and protect streams, wetlands, and existing storm water system.

7.1.4 Potential Loss of Wildlife / Habitat

Given the potential for tree removal within the road right-of-way, tree removal can be limited to the time periods between October 1 and March 31, in order to protect young bats that are not able to fly. If tree cutting is performed outside of this season, surveys of the trees will be performed in order to determine whether they are roost trees for the endangered Indiana bat or the threatened Northern long-eared bat. No other habitat impacts are anticipated.

8 PUBLIC PARTICIPATION

As noted in the Project Need section, the proposed project work is in response to discovered lead contamination. The scope of the proposed project is based on the current testing data available and the public input received to date.

8.1 Public Meetings

A public meeting was held on April 15, 2024 at gracespring Bible Church on Ross Township.

A Notice of Public meeting was published on MLive prior to the Public Meeting and was posted on the websites for City of Kalamazoo, Richland Township, and Ross Township. Physical posters were also put up at the offices of both Townships. A copy of the notice and proof of advertisement are included in Appendix E. The Project Planning Document was posted on the city's website. The city received no comments or questions during the public advertisement period. Public Meeting Summary

A presentation was given by the City of Kalamazoo staff during which a description of the DWSRF program and general comments on the Project Planning Document were presented. It

was noted that the Project Planning Document contained cost estimates for projects and potential impacts. The Public Meeting summary is provided in Appendix E.

8.2 Adoption of Project Planning Document

On Monday, May 6, 2024, the City of Kalamazoo City Commission passed a resolution adopting the Project Planning Document. A copy of the signed resolution is provided in Appendix F.

Figures

Existing Water Main

Proposed Water Main Phase 1

Project Boundaries

Proposed Water Main Phase 1

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5

Ross Township

Richland Township

Village of Richland

Gull Road Tank

SEE 33RD STREET INSET AT RIGHT

33RD STREET INSET

33RD STREET TRANSMISSION: HIGH / EAST SIDE HIGH PRESSURE DISTRICT CONNECTION

Note: Phase 1 is proposed for DWRF FY25. Phases 2-5 were identified for modeling purposes only.

E B AVE
E BC AVE
E C AVE
E CD AVE
E D AVE
E DE AVE
E EF AVE
M 89 & M 43
M 89
WEST GULL LAKE DR
WHIM TRL
COUNTRY CLUB DR
IDLEWILD DR
DELMAR ST
OAKDALE AVE
BURLINGTON DR
MIDLAKE DR
MIDLAND DR
N 40TH ST
N 39TH ST
N 37TH ST
N 36TH ST
N 35TH ST
N 34TH ST
N 32ND ST
N 30TH ST
N 28TH ST
EAST GULL LAKE DR
SOUTH GULL LAKE DR
N SHERMAN LAKE DR
CRANES AVE
GREER DR
LAUSEN LN
GEISER GRV
MACYWOOD LN
KAELIN LN
ENGELWOOD AVE
SILVERADO LN
HEMEL LN
FOXWOOD ST
YALE AVE
HATTON DR
BUNKERHILL ST
GULL RD

LEGEND

Proposed Water Main (Phase 1)
- 8"
- 12"

Proposed Water Main (Phase 2)
- 12"

Proposed Water Main (Phase 3)
- 12"

Proposed Water Main (Phase 4)
- 8"
- 12"

Proposed Water Main (Phase 5)
- 12"

Existing Water Main
- 4" and Smaller
- 6"
- 8"
- 10"
- 12"
- 16"
- Hydrant

0 0.25 0.5 0.75 1 Miles

CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN

FIGURE 1
ROSS TOWNSHIP WATER MAIN EXTENSIONS
OCTOBER 2023

Prein&Newhof
2180076

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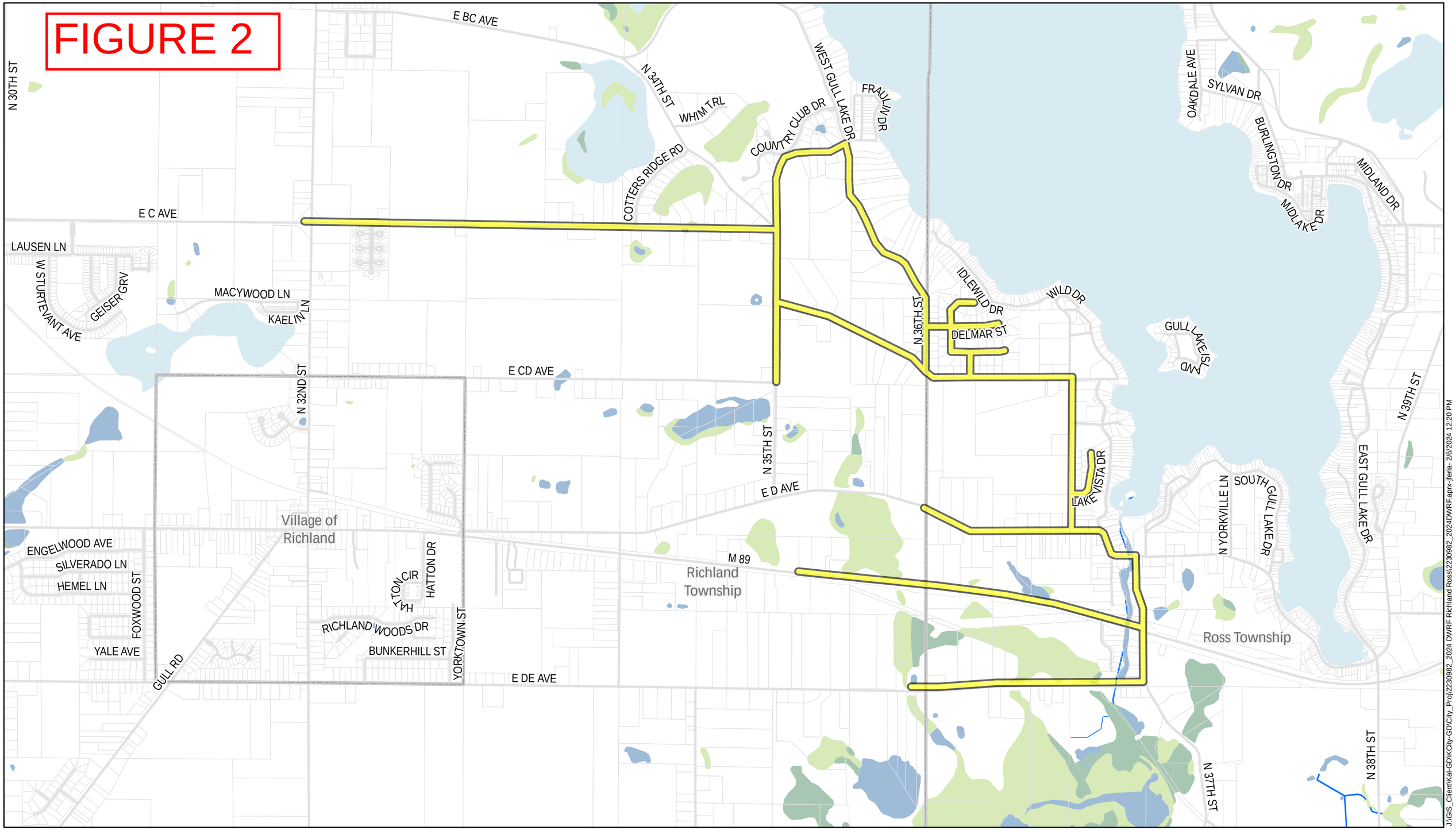
FIGURE 2



LEGEND

SCALE: 1" = 1,500 '

Project Area

National Wetlands Inventory

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine

CITY OF KALAMAZOO

RICHLAND AND ROSS TOWNSHIPS, KALAMAZOO COUNTY, MI

WETLANDS

2024 DWRF APPLICATION

Prein&Newhof

2230982

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FIGURE 3

E BC AVE
N 30TH ST
N 34TH ST
WHIM TRL
COTTERS RIDGE RD
COUNTRY CLUB DR
WEST GULL LAKE DR
FRALIN DR
OAKDALE AVE
SYLVAN DR
BURLINGTON DR
MIDLAKE DR
MIDLAND DR
E C AVE
LAUSEN LN
W STURTEVANT AVE
GEISER GRV
MACYWOOD LN
KAELIN LN
Richland Township
IDLEWILD DR
WILD DR
N 36TH ST
DELMAR ST
GULL LAKE SWD
E CD AVE
N 32ND ST
N 35TH ST
Ross Township
N 39TH ST
LAKE VISTA DR
SOUTH GULL LAKE DR
EAST GULL LAKE DR
N YORKVILLE LN
E D AVE
Village of Richland
ENGELWOOD AVE
SILVERADO LN
HEMEL LN
FOXWOOD ST
HATTON CIR
HATTON DR
M 89
RICHLAND WOODS DR
BUNKERHILL ST
YORKTOWN ST
YALE AVE
GULL RD
E DE AVE
N 37TH ST
N 38TH ST

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SCALE: 1" = 1,500 '

LEGEND

Project Area

FEMA Flood Hazard Areas

1% Annual Chance Flood Hazard

CITY OF KALAMAZOO

RICHLAND AND ROSS TOWNSHIPS, KALAMAZOO COUNTY, MI

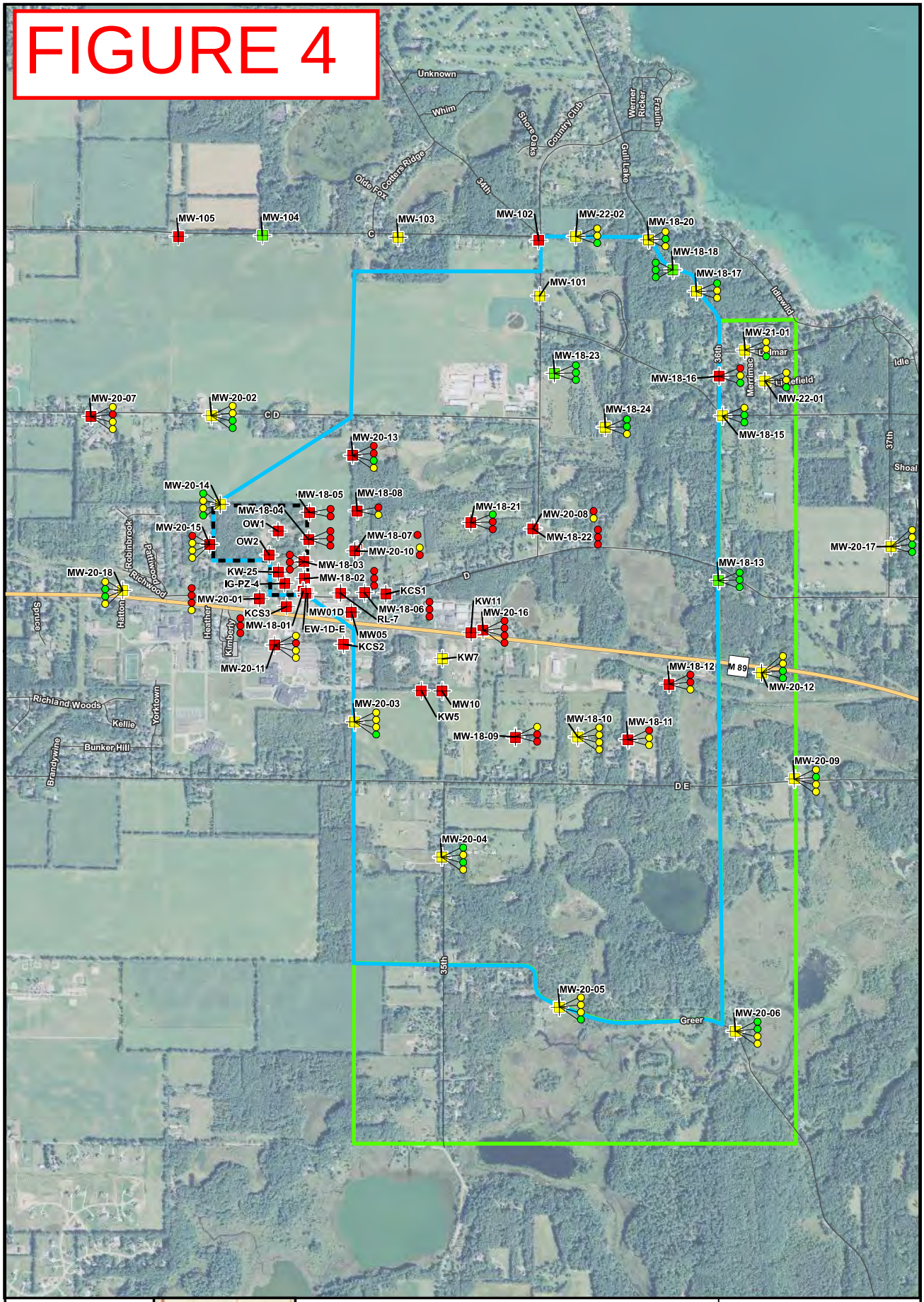
FEMA FLOOD HAZARD AREAS

2024 DWRF APPLICATION

Prein&Newhof

2230982

FIGURE 4



AECOM

Drawn: DP Date: 10/21/2022

Approved: JB Date: 10/21/2022

Project #: 60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Production Plated Plastics
- Study Area
- Buffer Zone

Results from nested monitoring wells:

- Top = Shallow
- Middle = Intermediate
- Bottom = Deep

*Locations without depth indicators have only one monitoring well.

N

0 0.2 0.4 Miles

PFAS HEAT MAP
AS OF AUGUST
2022

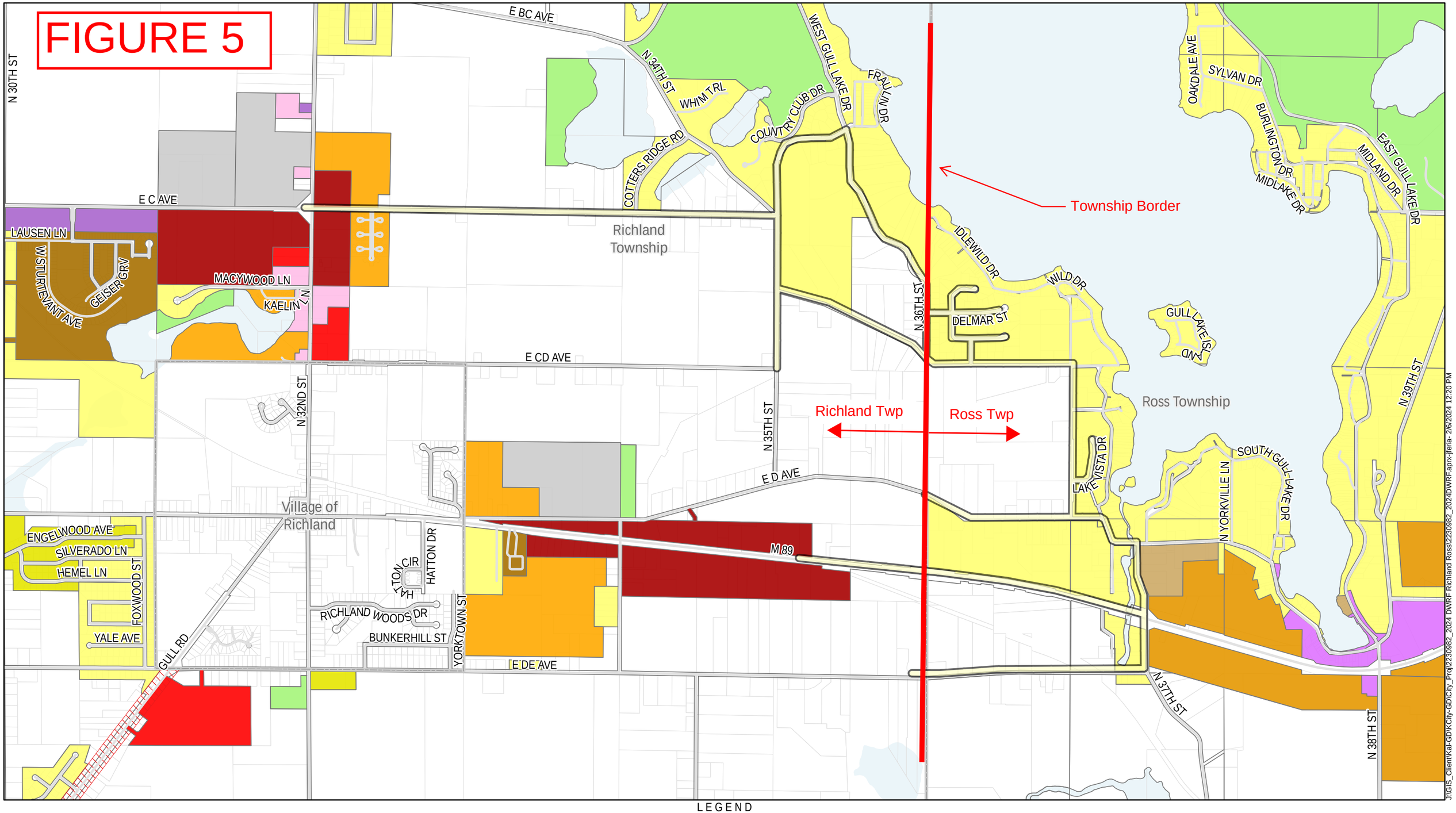
DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Second_Quarter_Sampling_PFAS.mxd

Aerial imagery: 2014 NAIP Imagery

FIGURE 5



LEGEND

Project Area

Richland Township Zoning
- R/OS Recreation / Open Space District
- A-1 Agricultural / Residential District
- A Single Family Residential District
- A-2 Two Family Residential District
- B-1 Multiple Family / Office District
- B-2 Mobile Home Park District

- C Office / Retail District
- C-1 Local Business District
- C-2 Highway Business District
- D Regional Commercial District
- D-1 Commercial / Industrial District
- CP Corridor Presrvation Overlay District

Ross Township Zoning
- AG Agricultural Preservation District
- C-1 Bay-Commercial District
- R-1 Single Family District
- R-2 Single & Two Family District
- R-3 Muiltiple Family Residental District
- RR Rural Residential District

SCALE: 1" = 1,500 '

CITY OF KALAMAZOO

RICHLAND AND ROSS TOWNSHIPS, KALAMAZOO COUNTY, MI

LAND USE

2024 DWRF APPLICATION

Prein&Newhof

2230982

J:\GIS_Client\Kal-GD\City-GD\City_Proj\2230982_2024 DWRF Richland Ross\2230982_2024DWRF-aprx-jferia- 2/6/2024 12:20 PM

FIGURE 6

Present Worth Analysis

	Project 1
Project Description	Water Service Replacements
	FY2025
Capital Costs (including ELAC)	
Structures	$18,500,000
Equipment	$0
Planning	$0
Design / Construction Engineering	$3,250,000
Project Cost	$21,750,000
(A) 20-yr Present Worth of Capital Costs [1]	$8,680,118
Operation, Maintenance & Replacement (OM&R)	
Energy Cost Savings	$0
OM&R	$0
Annual OM&R[2]	$0
(B) 20-yr Present worth of OM&R [1]	$0
(C) 20-yr Present worth of Energy Cost Savings [3]	$0
Salvage Value of Capital	
Salvage value at 20 years	$11,100,000
(D) 20-yr Present worth of Salvage [1]	$4,429,853
Total Present Worth (A + B + C - D)	**$4,250,265**
Equivalent Annual Cost (based on Total Present Worth)	$332,431

S:\2024\2240278 City of Kalamazoo\REP\FY2025 DWRF Submittal\Figures\Figure 6 - Present Worth Analysis

Appendices

Appendix A	THPO Review
Appendix B	SHPO Review
Appendix C	National Fish and Wildlife Service Review
Appendix D	Project Costs
Appendix E	Public Meeting Documentation
Appendix F	Project Plan Resolution
Appendix G	Water Modeling Memorandum
Appendix H	Environmental Corridor Review
Appendix I	Overburdened Worksheet

Appendix A

THPO Review

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

February 13, 2024
2240278

Match-E-Be-Nash-Shee-Wish Band of Pottawatomi Indians
2872 Mission Drive
Shelbyville, MI 49344
lakota.hobia@glt-nsn.gov
kaila.akina@glt-nsn.gov
shawn.mckenney@glt-nsn.gov

RE: **Notice and Opportunity to Comment**
City of Kalamazoo Water Main Installation

Lakota/Kaila/Shawn:

On behalf of the City of Kalamazoo, we are submitting the information noted below for the City of Kalamazoo Water Main Project for which we are completing a Section 106 review. This is required as part of the environmental review process associated with a State of Michigan Drinking Water State Revolving Fund (DWSRF) project. The City will be using the DWSRF funds to install water main throughout the Richland and Ross Townships.

We are proposing to install water main within Sections 11, 12, 13, 14, 24, and 25 in Township 1 South, Range 10 West and Sections 14 and 19 in Township 1 South, Range 9 West. The work will include trenching for water main within the right of way and running service lines to homes and businesses. The service lines will be connected using directional drills, so the project will involve disturbance to the surface within the right of way with minimized disturbance directly above the proposed services. A project phase map is attached. Please note that we are requesting review for Phase 1 only.

We would appreciate your response within 30 days of this request, so that we might include the correspondence with the environmental application submittal and have time to respond to any questions you might have.

We appreciate your time to review this matter. If you need any additional information to complete your review, please feel free to contact me at (616) 364-8491, bvilmont@preinnewhof.com.

Sincerely,

Prein&Newhof

Brian G Vilmont

Brian Vilmont, P.E.

JMD:BGV:dlj

Enclosure: Project Location Maps

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

February 13, 2024
2240278

Hannahville Potawatomi Indian Community
N-14911 Hannahville B-1 Road
Wilson, MI 49896
mschuster@hicservices.org
csagataw@hicservices.org
molly.meshigaud@hannahville.org

RE: **Notice and Opportunity to Comment**
City of Kalamazoo Lead Service Line Replacement

Michael/Cory/Molly:

On behalf of the City of Kalamazoo, we are submitting the information noted below for the City of Kalamazoo Water Main Project for which we are completing a Section 106 review. This is required as part of the environmental review process associated with a State of Michigan Drinking Water State Revolving Fund (DWSRF) project. The City will be using the DWSRF funds to install water main throughout the Richland and Ross Townships.

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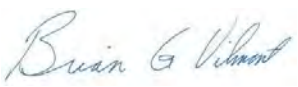
Sincerely,

Prein&Newhof



Brian Vilmont, P.E.

JMD:BGV:dlj

Enclosure: Project Location Maps

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

February 13, 2024
2240278

Little River Band of Ottawa Indians
2608 Governmental Center Drive
Manistee, MI 49660
jonniesam@lrboi-nsn.gov
williambeaver@lrboi-nsn.gov

RE: **Notice and Opportunity to Comment**
City of Kalamazoo Lead Service Line Replacement

Jay/Frank:

On behalf of the City of Kalamazoo, we are submitting the information noted below for the City of Kalamazoo Water Main Project for which we are completing a Section 106 review. This is required as part of the environmental review process associated with a State of Michigan Drinking Water State Revolving Fund (DWSRF) project. The City will be using the DWSRF funds to install water main throughout the Richland and Ross Townships.

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Sincerely,

Prein&Newhof

Brian G Vilmont

Brian Vilmont, P.E.

JMD:BGV:dlj

Enclosure: Project Location Maps

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

February 13, 2024
2240278

Nottawaseppi Huron Band of Pottawatomi Indians
1301 T Drive South
Fulton, MI 49052
douglas.taylor@nhbp-nsn.gov
environmental@nhbp-nsn.gov

RE: **Notice and Opportunity to Comment**
City of Kalamazoo Lead Service Line Replacement

Douglas/Nottawaseppi Environmental:

On behalf of the City of Kalamazoo, we are submitting the information noted below for the City of Kalamazoo Water Main Project for which we are completing a Section 106 review. This is required as part of the environmental review process associated with a State of Michigan Drinking Water State Revolving Fund (DWSRF) project. The City will be using the DWSRF funds to install water main throughout the Richland and Ross Townships.

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Sincerely,

Prein&Newhof

Brian G Vilmont

Brian Vilmont, P.E.

JMD:BGV:dlj

Enclosure: Project Location Maps

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

February 13, 2024
2240278

Pokagon Band of Potawatomi Indians
59291 Indian Lake Road
P.O. Box 180
Dowagiac, MI 49047
matthew.bussler@pokagonband-nsn.gov
jennifer.kanine@pokagonband-nsn.gov

RE: **Notice and Opportunity to Comment**
City of Kalamazoo Lead Service Line Replacement

Matthew/Jennifer:

On behalf of the City of Kalamazoo, we are submitting the information noted below for the City of Kalamazoo Water Main Project for which we are completing a Section 106 review. This is required as part of the environmental review process associated with a State of Michigan Drinking Water State Revolving Fund (DWSRF) project. The City will be using the DWSRF funds to install water main throughout the Richland and Ross Townships.

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We appreciate your time to review this matter. If you need any additional information to complete your review, please feel free to contact me at (616) 364-8491, bvilmont@preinnewhof.com.

Sincerely,

Prein&Newhof

Brian G Vilmont

Brian Vilmont, P.E.

JMD:BGV:dlj

Enclosure: Project Location Maps

Existing Water Main

Proposed Water Main Phase 1

Project Boundaries

Proposed Water Main Phase 1

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5

Richland Township

Ross Township

Village of Richland

Comstock Township

Gull Road Tank

SEE 33RD STREET INSET AT RIGHT

33RD STREET TRANSMISSION: HIGH / EAST SIDE HIGH PRESSURE DISTRICT CONNECTION

33RD STREET INSET

E B AVE
E BC AVE
E C AVE
E CD AVE
E D AVE
E DE AVE
E EF AVE
M 89 & M 43
M 89
WEST GULL LAKE DR
WHIM TRL
COUNTRY CLUB DR
IDLEWILD DR
DELMAR ST
OAKDALE AVE
BURLINGTON DR
MIDLAKE DR
MIDLAND DR
N 40TH ST
N 39TH ST
N 37TH ST
N 36TH ST
N 35TH ST
N 34TH ST
N 32ND ST
N 30TH ST
N 28TH ST
EAST GULL LAKE DR
SOUTH GULL LAKE DR
N SHERMAN LAKE DR
CRANES AVE
GREER DR
LAUSEN LN
GEISER GRV
MACYWOOD LN
KAELIN LN
ENGELWOOD AVE
SILVERADO LN
HEMEL LN
FOXWOOD ST
YALE AVE
HATTON DR
BUNKERHILL ST
GULL RD
Gull Road Tank
Richland Township
Comstock Township
N 33RD ST

LEGEND

Proposed Water Main (Phase 1)
- 8"
- 12"

Proposed Water Main (Phase 2)
- 12"

Proposed Water Main (Phase 3)
- 12"

Proposed Water Main (Phase 4)
- 8"
- 12"

Proposed Water Main (Phase 5)
- 12"

Existing Water Main
- 4" and Smaller
- 6"
- 8"
- 10"
- 12"
- 16"
- Hydrant

0 0.25 0.5 0.75 1 Miles

0 1 2 Miles

CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN

FIGURE 1
ROSS TOWNSHIP WATER MAIN EXTENSIONS
OCTOBER 2023

Prein&Newhof
2180076

J:\GIS_Client\Kal-GDI\City-GDI\City_Proj\2180076_WaterModelingServices\2180076_Modeling_Report_Figures.aprx - jferia - 10/30/2023 1:39 PM

Appendix B

SHPO Review

No effect on historic structures is anticipated. Full SHPO documentation will be included in the final Project Plan.

Appendix C

USFWS Review

A determination of NO EFFECT on all threatened and endangered species has been made. Full documentation will be included in the final Project Plan.

Appendix D

Project Costs

CITY OF KALAMAZOO

FY2025 DWRF - Richland/Ross Water Main

				Opinion of Probable Cost	
Item	**Description**	**Qty**	**Unit**	**Unit Price**	**Extended Price**
1	Mobilization (5% max)	1	LS	$ 425,000	$ 425,000.00
2	Testing	1	Allowance	$ 42,500	$ 42,500.00
3	Traffic Control	1	LS	$ 85,000	$ 85,000.00
4	Soil Erosion Control	1	LS	$ 17,000	$ 17,000.00
5	Removal, Curb and Gutter	1,000	LF	$ 10	$ 10,151.83
6	Removal, Sidewalk	1,000	LF	$ 10	$ 10,000.00
7	Removal, HMA Roadway	48,000	LF	$ 20	$ 960,000.00
8	Remove and Replace Unsuitable Soil	1000	CYD	$ 43	$ 43,109.17
9	Removal, Driveway	260	EA	$ 300	$ 78,000.00
10	Removal, Tree, 8-18"	1000	EA	$ 800	$ 800,000.00
11	Removal, Tree, 19"-24"	500	EA	$ 2,000	$ 1,000,000.00
12	Removal, Tree, 25"+	200	EA	$ 3,100	$ 620,000.00
13	Removal, Stump	50	EA	$ 450	$ 22,500.00
15	Water Main, 8" DI	4,800	LF	$ 120	$ 573,797.60
16	Water Main, 12" DI	4000	LF	$ 200	$ 800,000.00
	Directional Drilling	3200	LF	$ 1,000	$ 3,200,000.00
21	Water Main, 8" Fitting	50	EA	$ 1,200	$ 59,977.56
22	Water Main, 12" Fitting	120	EA	$ 1,900	$ 227,961.84
25	Water Main, 8" Valve and Box	20	EA	$ 3,000	$ 60,000.00
26	Water Main, 12" Valve and Box	30	EA	$ 6,000	$ 180,000.00
28	Fire Hydrant	157	EA	$ 9,000	$ 1,410,000.00
30	Water Main, Air Release Chamber	10	EA	$ 10,000	$ 100,000.00
31	Water Main, 1-1/4" Service, Short Side	130	EA	$ 2,000	$ 260,000.00
32	Water Main, 1-1/4" Service, Long Side	130	EA	$ 3,200	$ 416,000.00
33	Water Main, 1-1/4" Service, Outside of	52,000	LF	$ 40	$ 2,080,000.00
36	Water Main, 2" Water Service	30000	LF	$ 100	$ 3,000,000.00
37	Water Main, 1-1/4" Meter Pit	100	EA	$ 1,300	$ 130,000.00
39	Water Main, House Service Connection	260	EA	$ 1,400	$ 364,000.00
40	Water Main, Polyethylene Encasement	4000	LF	$ 5	$ 20,000.00
42	Restoration, HMA Roadway	20,000	LF	$ 130	$ 2,592,330.00
43	Restoration, Drive Replacement	260	EA	$ 3,100	$ 806,000.00
44	Restoration, Turf Over Water Main	28,000	LF	$ 20	$ 560,000.00
45	Restoration, Landscape Area	40	EA	$ 5,000	$ 200,000.00
46	Remove and Replace Drive Culvert	50	EA	$ 1,200	$ 60,000.00
48	Restoration, Concrete Curb and Gutter	1000	LF	$ 50	$ 50,000.00
49	Restoration, Sidewalk	1,000	LF	$ 50	$ 50,028.17
				Construction	$ 18,116,352.74
				Engineering	$ 2,717,452.91
				Contingency	$ 905,817.64
				TOTAL	$ 21,739,623.29

Appendix E

Public Meeting

NOTICE OF PUBLIC MEETING

City of Kalamazoo, Richland Township, and Ross Township
Potential Public Water Main Extension

The City of Kalamazoo will present the Project Plan for the Fiscal Year 2025 Drinking Water Revolving Fund application for the purpose of receiving comments from interested persons.

The meeting will be held on Monday, April 15, 2024 at 6 p.m. EST at Gracespring Bible Church located at 8643 Gull Rd, Richland, MI 49083.

The purpose of the proposed project is to extend the existing Kalamazoo Area Public Water System in sections of both Richland Township and Ross Township in response to PFAS contamination in some areas of the local groundwater. The project would also extend individual water services to each resident requesting service (or as required due to well contamination) in the project area.

The project will have temporary impacts to individual homes while their water service is installed. There will also be temporary traffic impacts in the areas of work.

The full project plan includes lead service replacements and water treatment upgrades in other areas of the water system. If fully loan funded, the estimate costs to water system customers is expected to be around $11.24 per billing quarter.

The Project Plan document is available for viewing on the City website at www.kalamazoocity.org

Written comments received in writing before the meeting or received verbally during the meeting will receive responses in the final Project Plan. Written comments should be sent to:

Kalamazoo Public Service Department
c/o Department Director
415 East Stockbridge Avenue
Kalamazoo MI 49007

Appendix F

Project Plan Resolution

CITY OF KALAMAZOO

RESOLUTION NO. _____

A RESOLUTION ADOPTING A FINAL PROJECT PLAN FOR WATER SYSTEM IMPROVEMENTS AND DESIGNATING AN AUTHORIZED PROJECT REPRESENTATIVE

Minutes of a regular meeting of the City Commission of the City held on May __, 2024, at 7:00 o'clock p.m., local time, at City Hall.

PRESENT, Commissioners:

ABSENT, Commissioners:

WHEREAS, the City of Kalamazoo recognizes the need to make improvements to its existing water treatment and distribution system; and

WHEREAS, the City of Kalamazoo authorized Prein&Newhof, Inc. to prepare a Project Plan, which recommends the replacement of existing lead/galvanized water services, pump station improvements, and water main in Richland/Ross Townships for the City of Kalamazoo Water System; and

WHEREAS, said Project Plan was presented at a Public Meeting held on April 15, 2024 and all public comments have been considered and addressed; and

NOW THEREFORE BE IT RESOLVED, that the City of Kalamazoo formally adopts said Project Plan and agrees to implement the replacement of existing lead/galvanized water services, pump station improvements, and water main in Richland/Ross Townships for the City of Kalamazoo Water System.

BE IT FURTHER RESOLVED, that the City Engineer, a position currently held by James J. Baker, P.E., is designated as the authorized representative for all activities associated with the project referenced above, including the submittal of said Project Plan as the first step in applying to the State of Michigan for a Drinking Water Revolving Fund Loan to assist in the implementation of the selected alternative.

The above resolution was offered by _____ and supported by_____.
Yeas:

Nays:

I certify that the above Resolution was adopted the City of Kalamazoo on May __, 2024.

BY: _____
Name and Title *(please print or type)*

_____
Signature Date

SAMPLE

Appendix G

Water Modeling Memorandum

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

Memorandum

Date:	September 5, 2023
To:	James Baker, P.E.
Company:	City of Kalamazoo – Department of Public Services
From:	Julie Feria, P.E.
Project #:	2180076
Re:	Model Analysis for Proposed Transmission and Distribution Main Extensions in Richland and Ross Townships

Purpose

The City of Kalamazoo's water distribution system hydraulic model was used to analyze projected pressures, available fire flow, and water age for a proposed water main extension in Richland and Ross Townships. This water main extension is intended to expand the municipal drinking water supply to properties with groundwater wells that could be impacted by PFAS contamination.

The proposed water main extension is in the East Side High pressure district and is shown in Figure 1. Transmission and distribution main between North 37th Street and the existing Richland Township water distribution system was modeled as "Phase 1", and includes five connection points to existing 12-inch water main. An additional transmission loop west of North 37th Street through Yorkville to the intersection of North 40th Street and M-89 was modeled as "Phase 2".

Model Development

The proposed water main was added to the City of Kalamazoo's InfoWater model as future pipe in two phases. The proposed water main was split every 300 feet to allow for analysis of available hydrant flow and system pressures along the proposed water main. The USGS 1-meter digital elevation model was used to assign elevations to new model nodes.

Current Demands

Potential new customers along the proposed water main extension route were divided into two categories: Current and Buildout. Existing homes and businesses along the proposed water main extension were incorporated into the model as current demands, and were modeled as existing demands in the proposed scenarios. Houses were counted as 1 Residential Equivalence Unit (REU), and other structures were assigned an estimated REU based on size and function.

Buildout Demands

Vacant parcels adjacent to the proposed water main extension were counted as future buildout customers. The zoning category for each parcel and the minimum lot size in the

zoning ordinance for Richland and Ross Townships was used to estimate an REU per acre for each vacant parcel. Zoning categories predicted a higher customer demand than Future Land Use categories, and therefore were used for estimating future buildout demands. For the buildout demand scenarios, the existing Kalamazoo distribution system was modeled using the 20-year projected demands from the 2017 Water System Reliability Study.

Demand Assumptions

Using an estimated 210 gallons per day per REU of average day water use, and an assumed maximum day demand multiplier of 2.5 times the average day demand, the demands from current structures and potential buildout were determined as shown in Table 1. Demands from each parcel were assigned to the closest model node.

Table 1. Estimated Demands from Current Structures and Future Buildout

	Current Demand (gpm)		Buildout Demand (gpm)	
Township and Phase	**ADD**	**MDD**	**ADD**	**MDD**
Richland Township (Phase 1)	11	27	122	306
Ross Township (Phase 1)	27	69	67	168
Ross Township (Phase 2)	16	39	101	252
Total Demand (Phase 1)	38	95	190	474
Total Demand (Phases 1 & 2)	54	135	291	727

Notes:
1. Richland Township REU per acre assumptions based on zoning are as follows: A-Single Family Residential (3.5 REUs/acre), A-1 (1 REU/acre), B-1 (11 REUs/acre), D (3.5 REUs/acre).
2. Ross Township REU per acre assumptions based on zoning are as follows: R-R (1 REU/acre), R-1 (2.5 REUs/acre), R-2 (3 REUs/acre), R-3 (5.5 REUs/acre), C-1 (3.5 REUs/acre), A (0 REUs/acre).

Hydraulic Analysis Assumptions

Pressures at the connection points and within the proposed development were modeled under steady state average day demand and maximum day demand conditions. Tanks were assumed to be at 5 feet below full for the steady state pressure and available fire flow scenarios. Available fire flows were modeled assuming maximum day demand conditions. Water age was modeled using average day demand conditions.

Modeled Scenarios

The proposed water main extension was modeled using both existing and projected future demands to analyze system pressures and available fire flow. The system was modeled both with and without the additional Yorkville transmission loop (Phase 2), and with and without the 33rd Street High / East Side High water main connection in place.

Water age was also modeled to estimate the impact of new transmission main with potentially low water demands on water age and therefore water quality.

Model Results

Pressure

Tables 2 and 3 provide the model results for average day and maximum day pressures at select nodes with the proposed water main extensions in place. Existing system pressures are also shown for comparison. Average day pressures in the proposed system range from 45 to 74 psi under current demand conditions, and maximum day pressures range from 44 to 73 psi. A map of maximum day pressures is provided in Figure 2.

Under buildout maximum day demand conditions, the minimum pressure drops to 41 psi at the high elevation point along West Gull Lake Road. As demands increase in Richland and Ross Townships and throughout the Kalamazoo distribution system, improvements in pumping capacity and/or transmission may be needed to maintain normal operating pressures above 35 psi both in the proposed main and in the existing system serving the Village of Richland.

The model results show that system pressures in the proposed system are adequate under current conditions. In addition, the proposed transmission main extension had a negligible impact on the existing filling and emptying rate of the Gull Road Tank.

Table 2. Average Day Pressure at Select Locations

Node ID	Location	Municipality	Existing System	Current Demands (Phase 1)	Current Demands (Phase 2)	Buildout Demands (Phase 1)	Buildout Demands (Phase 2)
J15238	N 32nd St. & E D Ave.	Village of Richland	46	46	46	45	45
J16580	N 30th St. & E C Ave.	Village of Richland	46	46	46	46	46
J14990	N 30th St. & Gull Rd.	Richland Twp.	52	52	52	52	52
J15182	M-89 existing dead end	Richland Twp.	59	59	59	58	58
J16902	E D Ave. existing dead end	Richland Twp.	59	59	59	59	59
J16904	N 35th St. & E CD Ave.	Richland Twp.	49	49	49	49	48
J15350	N 32nd St. & E C Ave.	Richland Twp.	42	42	42	41	41
J16544	E DE Ave. existing Dead end	Richland Twp.	73	73	73	73	73
J16982	E C Ave. & West Gull Lake Dr.	Richland Twp.	*NA*	55	55	55	55
J17106	Merrimac St. dead end	Ross Twp.	*NA*	64	64	64	63
J17108	Delmar St. dead end	Ross Twp.	*NA*	62	62	61	61
J17110	Littlefield Ave. dead end	Ross Twp.	*NA*	48	48	47	47
J17112	N 37th St. & E CD Ave.	Ross Twp.	*NA*	47	47	47	46
J17146	N 37th St & E D Ave. (East)	Ross Twp.	*NA*	58	58	58	58
J16912	N 37th St. & M89	Ross Twp.	*NA*	60	60	60	60
J16930	Lake Vista Dr. dead end	Ross Twp.	*NA*	48	48	48	47
J17268	E D Ave. between 39th St. & 40th St.	Ross Twp.	*NA*	*NA*	50	*NA*	50
J17070	West Gull Lake Drive high elevation point	Richland Twp.	*NA*	45	45	45	45
J17124	N 37th Street high elevation point	Ross Twp.	*NA*	46	46	46	45
J17214	E DE Ave. low elevation point	Ross Twp.	*NA*	74	74	74	74

Notes:

1. Average day demand conditions were modeled both with and without the 33rd Street transmission main in service. The difference in pressures with the main in service and out of service was negligible.
2. For future buildout demand scenarios, no water main, booster station, or pump station improvements in the remainder of the distribution system were included in the simulation.

Table 3. Maximum Day Pressure at Select Locations

Node ID	Location	Municipality	Existing System	Current Demands (Phase 1)	Current Demands (Phase 2)	Buildout Demands (Phase 1)	Buildout Demands (Phase 2)
J15238	N 32nd St. & E D Ave.	Village of Richland	45	45	45	43	42
J16580	N 30th St. & E C Ave.	Village of Richland	46	46	46	44	43
J14990	N 30th St. & Gull Rd.	Richland Twp.	52	52	52	51	50
J15182	M-89 existing dead end	Richland Twp.	58	58	58	56	55
J16902	E D Ave. existing dead end	Richland Twp.	58	58	58	56	55
J16904	N 35th St. & E CD Ave.	Richland Twp.	48	48	48	46	45
J15350	N 32nd St. & E C Ave.	Richland Twp.	41	41	41	39	38
J16544	E DE Ave. existing Dead end	Richland Twp.	73	72	72	70	69
J16982	E C Ave. & West Gull Lake Dr.	Richland Twp.	*NA*	54	54	53	52
J17106	Merrimac St. dead end	Ross Twp.	*NA*	63	63	61	60
J17108	Delmar St. dead end	Ross Twp.	*NA*	61	61	59	58
J17110	Littlefield Ave. dead end	Ross Twp.	*NA*	47	47	45	44
J17112	N 37th St. & E CD Ave.	Ross Twp.	*NA*	46	46	44	43
J17146	N 37th St & E D Ave. (East)	Ross Twp.	*NA*	57	57	55	54
J16912	N 37th St. & M89	Ross Twp.	*NA*	60	60	58	57
J16930	Lake Vista Dr. dead end	Ross Twp.	*NA*	47	47	45	44
J17268	E D Ave. between 39th St. & 40th St.	Ross Twp.	*NA*	*NA*	49	*NA*	42
J17070	West Gull Lake Dr. high elevation point	Richland Twp.	*NA*	44	44	42	41
J17124	N 37th St. high elevation point	Ross Twp.	*NA*	45	45	43	42
J17214	E DE Ave. low elevation point	Ross Twp.	*NA*	73	73	72	70

Notes:

1. Maximum day demand conditions were modeled both with and without the 33rd Street transmission main in service. The difference in pressures with the main in service and out of service was at most 1 psi lower with the 33rd Street Transmission Main in service.
2. For future buildout demand scenarios, no water main, booster station, or pump station improvements in the remainder of the distribution system were included in the simulation.

Available Fire Flow

Available fire flow results are provided in Table 4 for select nodes and mapped in Figure 3 for all hydrant locations. Fire flows range from 1,500 gpm at the proposed 8-inch dead end of Lake Vista Drive to 3,300 gpm at N 37th Street and M-89, assuming all 12-inch transmission main.

Table 4. Available Fire Flow at Select Locations

Node ID	Location	Municipality	Existing System	Current Demands (Phase 1)	Current Demands (Phase 2)	Buildout Demands (Phase 1)	Buildout Demands (Phase 2)
J15238	N 32nd St. & E D Ave.	Village of Richland	4,180	4,080	4,040	3,080	2,840
J16580	N 30th St. & E C Ave.	Village of Richland	2,640	2,760	2,740	2,230	2,110
J14990	N 30th St. & Gull Rd.	Richland Twp.	6,550	6,460	6,410	5,160	4,880
J15182	M-89 existing dead end	Richland Twp.	2,470	3,430	3,420	2,870	2,630
J16902	E D Ave. existing dead end	Richland Twp.	2,620	3,460	3,440	2,710	2,480
J16904	N 35th St. & E CD Ave.	Richland Twp.	2,980	3,370	3,340	2,630	2,420
J15350	N 32nd St. & E C Ave.	Richland Twp.	2,420	2,800	2,780	2,190	2,040
J16544	E DE Ave. existing Dead end	Richland Twp.	2,040	3,050	3,030	2,500	2,340
J16982	E C Ave. & West Gull Lake Dr.	Richland Twp.	*NA*	2,850	2,830	2,300	2,140
J17106	Merrimac St. dead end	Ross Twp.	*NA*	2,010	2,000	1,840	1,790
J17108	Delmar St. dead end	Ross Twp.	*NA*	1,900	1,890	1,740	1,690
J17110	Littlefield Ave. dead end	Ross Twp.	*NA*	1,630	1,630	1,450	1,380
J17112	N 37th St. & E CD Ave.	Ross Twp.	*NA*	2,880	2,860	2,350	2,180
J17146	N 37th St & E D Ave. (East)	Ross Twp.	*NA*	3,360	3,320	2,680	2,460
J16912	N 37th St. & M89	Ross Twp.	*NA*	3,420	3,370	2,780	2,520
J16930	Lake Vista Dr. dead end	Ross Twp.	*NA*	1,530	1,530	1,370	1,300
J17268	E D Ave. between 39th St. & 40th St.	Ross Twp.	*NA*	*NA*	2,350	*NA*	1,860

Notes:

1. Available fire flow was modeled with maximum day demands, tanks at 5 feet below full, and with a minimum residual pressure of 20 psi.
2. Available fire flows were modeled both with and without the 33rd Street transmission main in service. The difference in available fire flows with the main in service and out of service was at most 3% lower with the 33rd Street Transmission Main in service.
3. For future buildout demand scenarios, no water main, booster station, or pump station improvements in the remainder of the distribution system were included in the simulation.
4. Available fire flow values are color coded using the following groups: 1,000 gpm to 1,999 gpm; 2,000 to 3,499 gpm; greater than 3,500 gpm.

Water Age

Water age results are provided in Table 5. Water age is simulated based on current, automated operations. It does not account for changes in operation, and it has not been calibrated to data which can represent water age, such as chlorine residual concentrations in the distribution system. The age data in Table 5 provides a comparison between different scenarios and can illustrate which locations are more susceptible to higher water age. The model results show that the transmission main extension does not have a significant impact on water age in the existing distribution system, except at the existing transmission main dead ends on E D Avenue and E DE Avenue, where water age is significantly improved.

Transmission Main Sizing Analysis

Smaller transmission main reduces the volume of the water system and therefore reduces overall water age and improves water quality. Additional analysis was performed with 8-inch water main on M-89 between the existing system and North 37th Street and on West Gull Lake Drive between East C Avenue and East CD Avenue. Available fire flows remain above 1,500 gpm at all locations in the Existing Demands (Phase 2) scenario. Table 6 shows the available fire flow comparison with the reduced water main diameter at select nodes.

The water age analysis shown in Table 5 illustrates that reducing the proposed water main size on on M-89 between the existing system and North 37th Street and on West Gull Lake Drive between East C Avenue and East CD Avenue does not have a significant impact on water age in the Richland and Ross Township distribution system. Smaller diameter water main will reduce the overall age of the water system, but the model simulations show the impact within the proposed transmission area is not significant.

Table 5. Modeled Water Age (Days) at Select Locations

Node ID	Location	Municipality	Existing System	Current Demands (Phase 1) without 33rd St. Transmission	Current Demands (Phase 1) with 33rd St. Transmission	Current Demands (Phase 1) with 33rd St. Transmission and Reduced Main Size[2]
J15238	N 32nd St. & E D Ave.	Village of Richland	12	11	12	12
J16580	N 30th St. & E C Ave.	Village of Richland	12	11	12	12
J14990	N 30th St. & Gull Rd.	Richland Twp.	11	10	11	11
J15182	M-89 existing dead end	Richland Twp.	12	11	8	9
J16902	E D Ave. existing dead end	Richland Twp.	85	9	10	11
J16904	N 35th St. & E CD Ave.	Richland Twp.	12	10	12	9
J15350	N 32nd St. & E C Ave.	Richland Twp.	13	23	23	24
J16544	E DE Ave. existing Dead end	Richland Twp.	61	5	4	13
J16982	E C Ave. & West Gull Lake Dr.	Richland Twp.	*NA*	17	14	14
J17106	Merrimac St. dead end	Ross Twp.	*NA*	20	22	21
J17108	Delmar St. dead end	Ross Twp.	*NA*	20	17	20
J17110	Littlefield Ave. dead end	Ross Twp.	*NA*	24	20	22
J17112	N 37th St. & E CD Ave.	Ross Twp.	*NA*	14	11	12
J17146	N 37th St & E D Ave. (East)	Ross Twp.	*NA*	12	11	10
J16912	N 37th St. & M89	Ross Twp.	*NA*	10	11	13
J16930	Lake Vista Dr. dead end	Ross Twp.	*NA*	18	17	17

Notes:

1. Water age was modeled with existing average day demands and current system pump and tank controls.
2. See description of modeled water main sizing alternative in the next section: Transmission Main Sizing Analysis. The proposed 12-inch transmission on M-89 between the existing system and N 37th Street and on West Gull Lake Drive was modeled as 8-inch main to determine the impact on available fire flow and water age.
3. Water age has not been calibrated or compared to chlorine residual data. Age results should only be used for comparison between scenarios and to identify potential problem areas.

Table 6. Available Fire Flow at Select Locations with Less Transmission Main

Node ID	Location	Municipality	Current Demands (Phase 2) – All 12"	Current Demands (Phase 2) – 8" on West Gull Lake Dr. and M-89	Available Fire Flow Change in gpm (% Change)
J15182	M-89 existing dead end	Richland Twp.	3,390	2,880	510 (15%)
J16902	E D Ave. existing dead end	Richland Twp.	3,400	3,310	90 (3%)
J16904	N 35th St. & E CD Ave.	Richland Twp.	3,310	3,290	20 (1%)
J15350	N 32nd St. & E C Ave.	Richland Twp.	2,750	2,740	10 (0%)
J16544	E DE Ave. existing Dead end	Richland Twp.	3,000	2,950	50 (2%)
J16982	E C Ave. & West Gull Lake Dr.	Richland Twp.	2,790	2,530	260 (9%)
J17106	Merrimac St. dead end	Ross Twp.	1,990	1,920	70 (4%)
J17108	Delmar St. dead end	Ross Twp.	1,880	1,820	60 (3%)
J17110	Littlefield Ave. dead end	Ross Twp.	1,610	1,580	30 (2%)
J17112	N 37th St. & E CD Ave.	Ross Twp.	2,830	2,750	80 (3%)
J17146	N 37th St & E D Ave. (East)	Ross Twp.	3,290	3,090	200 (6%)
J16912	N 37th St. & M89	Ross Twp.	3,340	3,100	240 (7%)
J16930	Lake Vista Dr. dead end	Ross Twp.	1,510	1,500	10 (1%)
J17268	E D Ave. between 39th St. & 40th St.	Ross Twp.	2,330	2,250	80 (4%)

Notes:

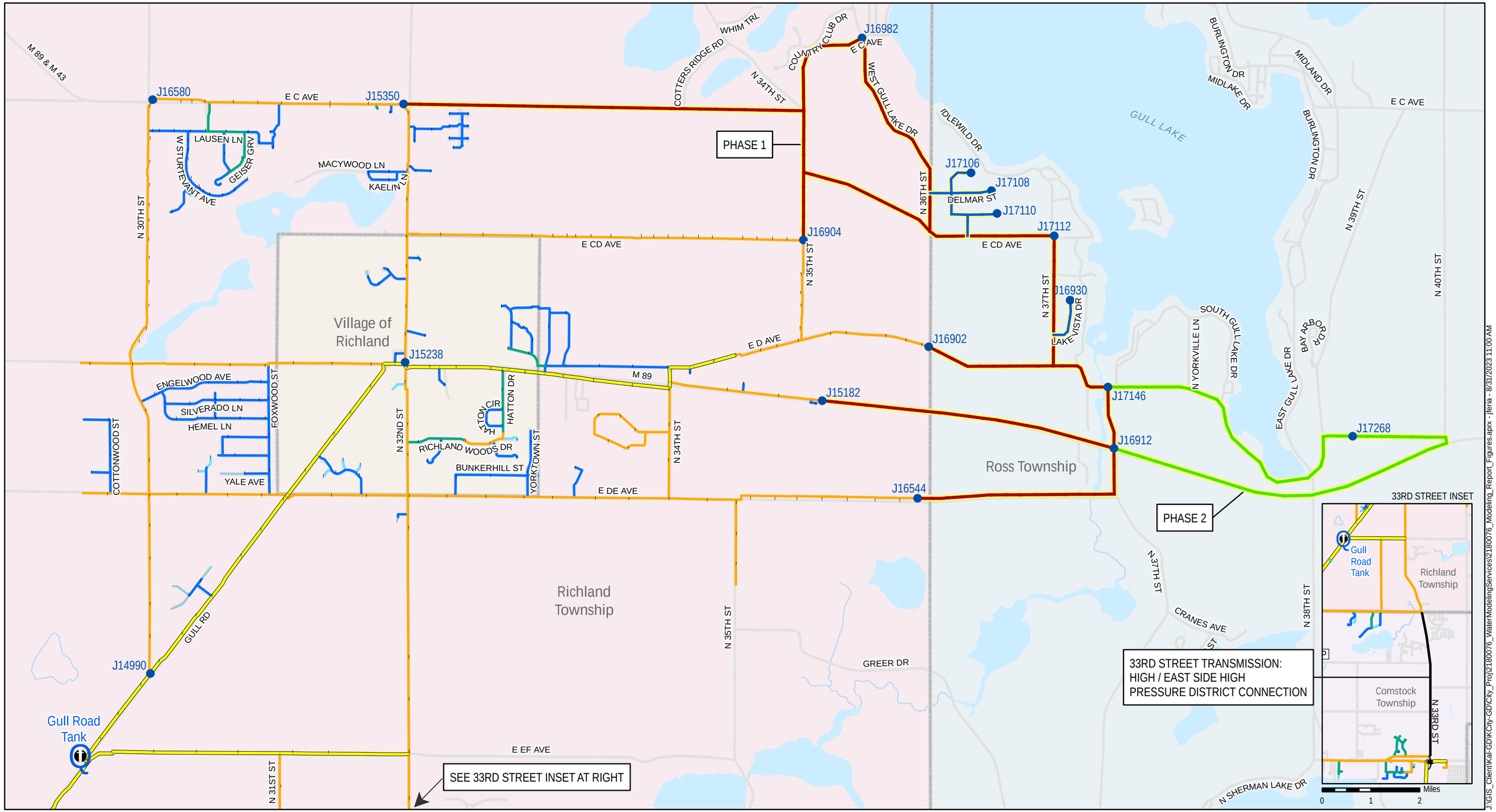
1. Available fire flow was modeled with maximum day demands, tanks at 5 feet below full, and with a minimum residual pressure of 20 psi.
2. Available fire flows in this table were modeled with the 33rd Street transmission main in service.

Conclusions

Under existing demand conditions, pressures are maintained above 44 psi in the proposed system extension, and available fire flows are above 1,500 gpm at all locations. The addition of the Phase 2 water main loop through Yorkville has a negligible impact on pressures and available fire flow.

Future buildout demand scenarios show pressures dropping to 38 psi in the existing Richland Township system and 41 psi in the proposed system extension. As demands increase, pressures should be monitored and improvements to the pumping capacity or transmission capacity of the water distribution system should be considered to maintain normal operating pressures above 35 psi. Available fire flows are maintained above 1,000 gpm at all locations in the proposed system extension under future demands.

Water age at the existing dead end mains is improved with the proposed transmission extension, although the overall age of water in the distribution system as a whole will increase if additional demands are smaller than the added volume of the new transmission main.



LEGEND

Select Model Node

Proposed Water Main (Phase 1)
- 8"
- 12"

Proposed Water Main (Phase 2)
- 12"

Existing Water Main
- 4" and Smaller
- 6"
- 8"
- 10"
- 12"
- 16"
- 20"
- 24"
- 30"

Existing Hydrant

Bleeder Station

0 0.25 0.5 0.75 1 Miles

CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN

FIGURE 1: PROPOSED WATER MAIN EXTENSION

SEPTEMBER 2023

Prein&Newhof

2180076

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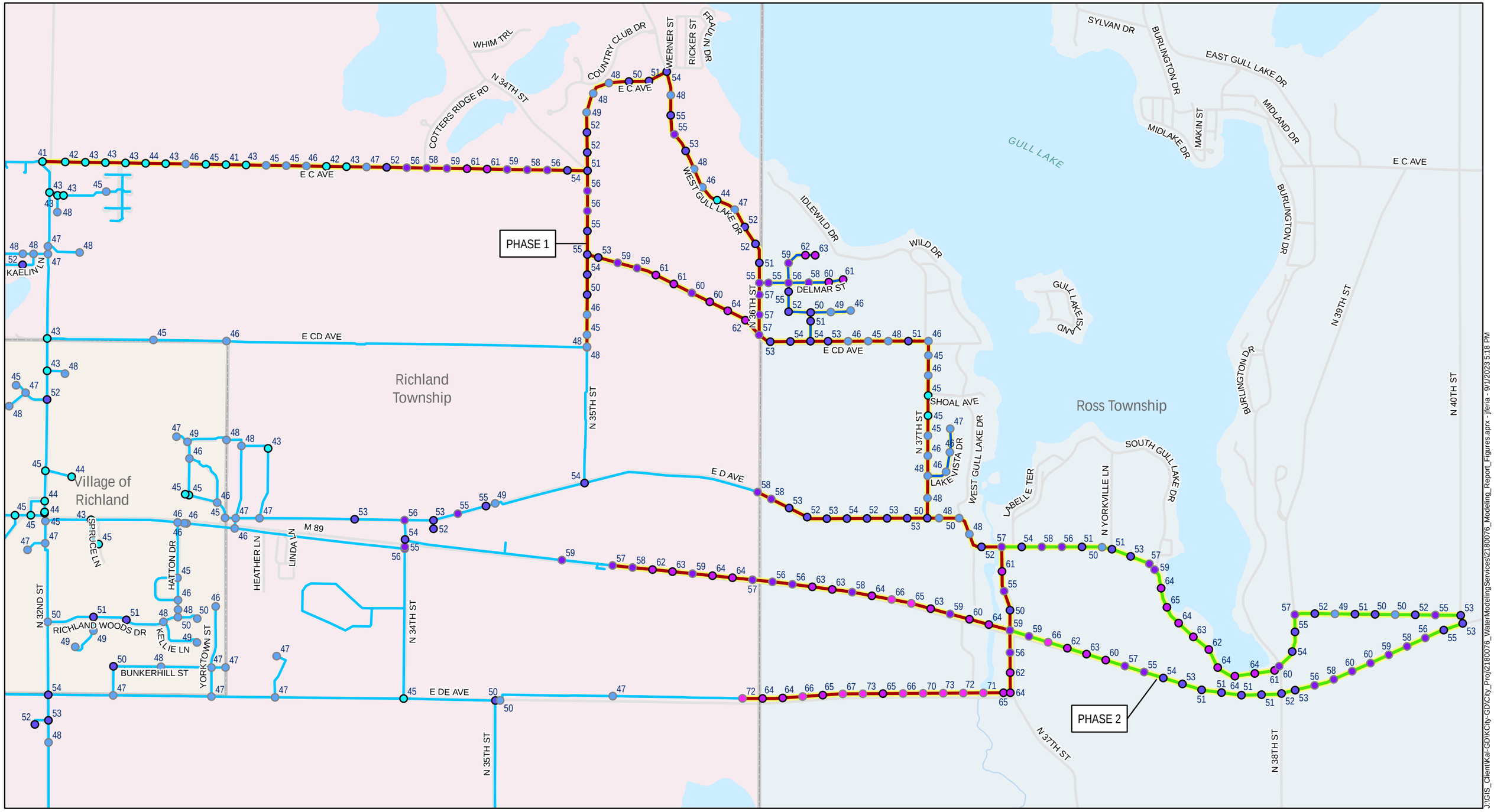

CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN

FIGURE 4: MODELED PRESSURE

SEPTEMBER 2023

Prein&Newhof

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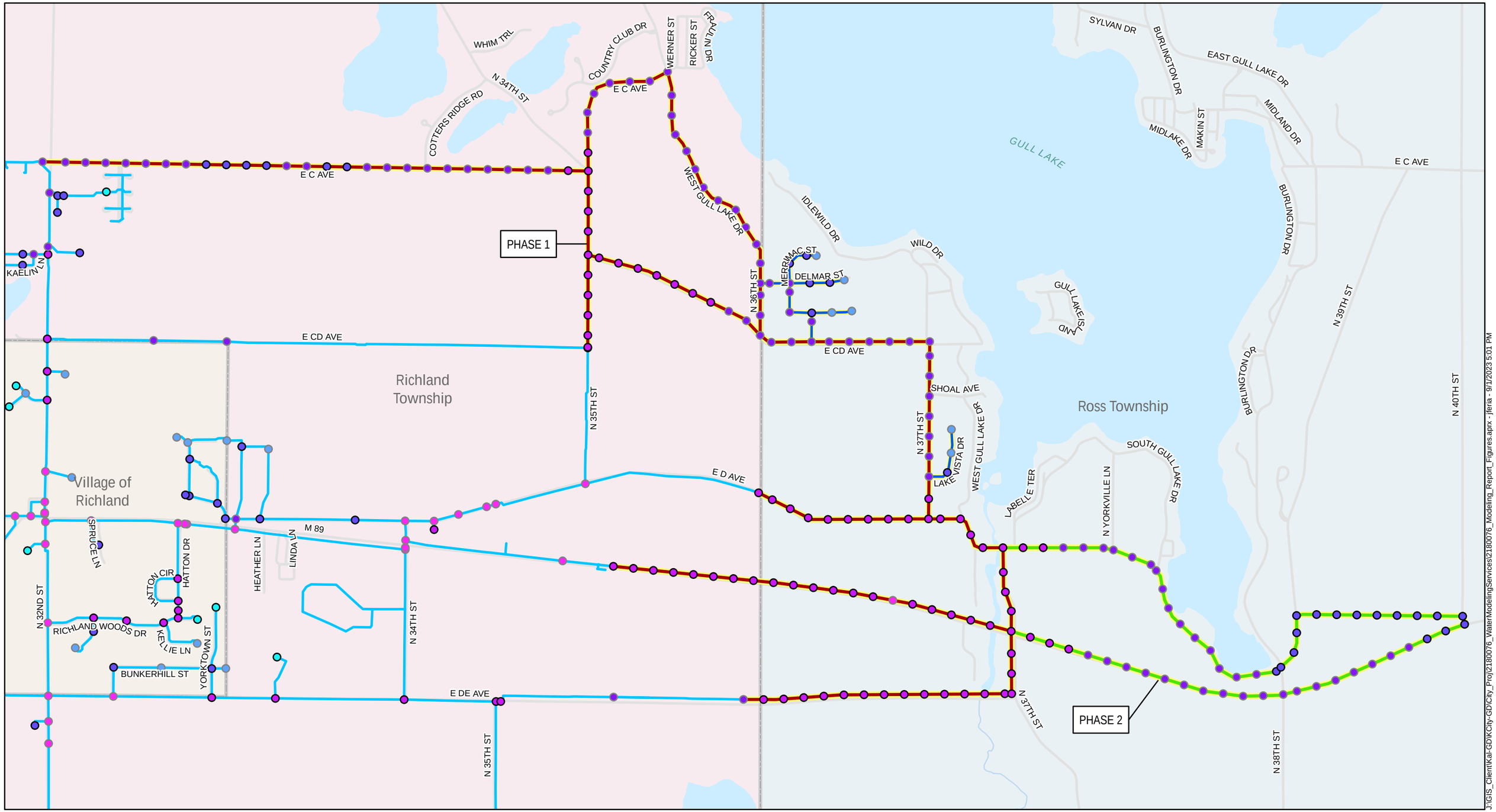

LEGEND

Available Fire Flow at Model Nodes

- Less than 1,500 gpm
- 1,501 to 2,000 gpm
- 2,001 to 2,500 gpm
- 2,501 to 3,000 gpm
- 3,001 to 3,500 gpm
- Greater than 3,500 gpm

Proposed Water Main (Phase 1)

- 8"
- 12"

Proposed Water Main (Phase 2)

- 12"

Existing Water Main

0 1,000 2,000 3,000 4,000 Feet

CITY OF KALAMAZOO

KALAMAZOO COUNTY, MICHIGAN

FIGURE 3: MODELED AVAILABLE FIRE FLOW

SEPTEMBER 2023

Prein&Newhof

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Appendix H

Environmental Corridor Memorandum

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

Memorandum

Date:	March 29, 2024
To:	Mr. John Standinger and Mr. Brian Vilmont, P.E.
Company:	Prein&Newhof
From:	Tim Woodburne, CPG and Chris Cruickshank, P.E.
Project #:	2230982 – Ross Township Water Main
Re:	Environmental Corridor Study – Ross Township Water Main

1 INTRODUCTION

The purpose of this Environmental Corridor Study is to determine if known sites of environmental contamination exist along or in the vicinity of the construction area for water main proposed in Ross Township located west of Gull Lake. The Environmental Corridor Study has two main components that include a site visit along the proposed route to view adjacent sites from the road right-of-way, and a search of environmental sites of known or suspected environmental contamination on the Michigan Environmental Mapper maintained by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The environmental sites identified were evaluated to determine the potential environmental impact to the proposed Project. The preliminary construction location is shown on maps in Appendix A.

2 SITE VISIT

Adjacent properties were reviewed by driving with occasional walking along the proposed route on March 12, 2024. Photographs were taken as the survey progressed with selected photographs included in Appendix B.

The site visit began at the south end of project near address 10921 East DE Avenue at the west end of East DE Avenue and proceeded east to N 37 Street. This area had wooded land and occasional residences and some farmland.

The visit proceeded north along N 37 Street to M-89 and this section had residences on the west side of the street and vacant wooded land on the east side of the street.

The portion of the project along M-89 was mostly vacant land and two residences at the west end of M-89 at the west end of the project.

The section along N 37 Street north of M-89 to E D Avenue had residential homes.

The Project turns west on E D Avenue from N 37th Street and extends over Gull Creek, then turns north and then turns west at the intersection of West Gull Lake Drive. At this intersection Mac's Garage, an automotive repair shop, was observed at the address of 11574 E D Avenue. As shown below this site is a closed UST site. A pump dispenser island presumably for the closed USTs was observed between the building and the road, as shown in the photographs. Review of the UST closure documents is included below because this site is adjacent to the project.

The inspection continued along East D Avenue to approximately the address of 10876 East D Avenue. This section of the project is entirely residential parcels.

At N 37th Street the Project turns north from E D Avenue to E CD Avenue. A church was observed on the northeast corner of N 37th Street at E D Avenue. Agricultural land is along the west side of the street and residential homes are along the east side of the street. The north end of the street has residences on both sides of the street.

E CD Avenue from N 37 Street to N 35 Street had residential parcels and vacant land. A residence at the address of 11272 E CD Avenue had orchards on the east and west sides of the house. Fruit orchards are an environmental concern due to the potential for the application of the spray known as lead-arsenate, which is no longer allowed to be used. Given that the project will be in the road right of way the impact from the orchards is not expected.

N 36 the Street north of E CD Avenue becomes West Gull Lake Drive and extends north to E C Avenue. The area is entirely residential.

E C Avenue to N 32nd Street has agricultural land and residential parcels, and no environmental issues were identified.

N 35 Street extends south from E C Av to E CD Avenue and has agricultural and residential parcels. A farm with cattle is located at the northwest corner of E CD Avenue and N 35 Street.

3 ENVIRONMENTAL MAPPER REVIEW

Sites of known or suspected contamination on the EGLE Environmental Mapper were reviewed to identify sites along or within the vicinity of the Project. The map from Environmental Mapper identifying the environmental sites is shown in Appendix C. The sites labeled as "Closed USTs" and Closed LUST are not expected to have a direct environmental impact on the Project. A UST site adjacent to the project is reviewed as noted below. The BEA site and open LUST east of the project are not expected to have a direct environmental impact based on the distance of greater than ½ mile and their location adjacent to Gull Lake where the groundwater flow would be expected to be toward Gull Lake or away from the Project. Only one site with a restrictive covenant was located within the Village of Richland boundary and this site was not included in the review due to the distance of greater than 1/2 mile from the project. The remaining sites within approximately one to the west of the Project were reviewed. The sites reviewed are tabulated below with summaries following for these sites.

Summary of Environmental Sites Reviewed

Database Listed	*Site Name and Address*	*Location relative to the Project*
Part 201 MPART	North 34th Street - MPART Production Plated Plastics 9899 E D Ave	Address located approximately 3/4 mile west-northwest of Project at M-89
BEA and Part 201	145 Acres of Agricultural Land north of M-89 and west of N 32nd Street	1/4 – 1/2 mile west of E C Ave and N 32nd Street intersection
BEA	9776 E D Ave	Approximately 0.9 mile west of Project at M-89

Database Listed	*Site Name and Address*	*Location relative to the Project*
BEA and Part 201	Gull Lake Community Schools 9724 - 9766 East M-89	Approximately 0.9 Miles west of the project
BEA and Part 201	Village Laundry 7800 N. 34th Street	Approximately 1/2 Miles west of the project
BEA and Part 201	Gull Lake Animal & Boarding 7820 North 34th Street	Approximately 1/2 Miles west of the project
UST – Closed	Mac's Automotive 11574 E D Ave	South side of D Avenue at Gull Lake Road
UST – Closed	Gilmore Enterprises Farm 7966 E C Ave	Site is miss plotted on EGLE Mapper – actual location is ± 1.1 miles west of Project at E C Ave.

MPART Site – North 34th Street, Production Plated Plastics, 9899 East D Avenue

The Michigan PFAS Action Response Team (MPART) has included the Production Plated Plastics site in a larger area being investigated known as North 34th Street. This is the only MPART site in the area of the Project as shown on the MPART Map in Appendix C. A request under FOIA was made for the most up-to-date information and the information was provided on March 22, 2024.

Production Plated Plastics manufactured painted and chrome-plated plastic parts primarily for the automotive industry. Production Plated Plastics operated at this address from approximately 1966 until bankruptcy in 1991. Historic releases of waste treatment and process solutions into the facility subsurface soils has resulted in elevated concentrations of hexavalent chromium (Cr VI) and nickel in soil and groundwater.

Chlorinated volatile organic compounds were identified in 1985 in the area and determined to be originating from Production Plated Plastics as well as the Village Cleaners site, a dry-cleaning business. The groundwater flow direction was determined to be east-southeasterly generally toward the proposed Project. The heavy metals nickel and hexavalent chromium were delineated to the east of the proposed Project.

In the 1980s, the Production Plated Plastics started operating a groundwater extraction and treatment system. Municipal water was extended to the Production Plated Plastics area in 1988 and the water wells were abandoned after connecting to the municipal water. In 1991 Production Plated Plastics declared bankruptcy, so the State of Michigan took over the environmental response activities.

Polyfluoroalkyl substances (PFAS) were discovered from this site in April 2018 from a surface water investigation when a sample was collected from an Industrial Pretreatment Program a.k.a. "IPP" sample from an extraction well designed to capture the chromium and nickel plumes in the shallow and deep aquifers at the site. The extraction system was permitted to discharge to the City of Kalamazoo Water Reclamation plant. The sample detected 9,640 ng/L perfluorooctanesulfonic acid (PFOS) in the discharge sample. After this sample result, an emergency PFAS treatment system consisting of granulated activated

carbon (GAC) was installed and started operating by July 31, 2018 with the treated water discharged to the publicly owned Kalamazoo Water Reclamation Plant.

As a result, additional remedial investigation phases have been conducted by EGLE including soil and groundwater investigations, surface water sampling, and residential well sampling. Other than an incremental sampling report of soil sampling at the PPP site, no other reports of the PFAS results were provided. Several draft maps and cross sections from the investigations were provided as a result of the FOIA and select documents are attached in Appendix D. Two groundwater contour maps show a shallow and deeper interval of groundwater. The groundwater in the area is generally flows towards the Project in the east-southeasterly direction and then gradually turns and flows to the southeast direction, as shown on the maps in Appendix. As shown in several maps and cross sections, the groundwater is impacted with PFAS. The most recent map showing the locations compared to their Part 201 PFAS Criteria shows that exceedances extent to the project area as shown on the draft map dated March 29, 2021 by AECOM. Based on this review the PFAS is impacting groundwater in the area of the Project. Attached for review are two groundwater contour maps from measurements in February 2023; the most recent March 2021 PFAS map showing groundwater concentrations; 2023 maps showing groundwater sampling results for PFAS, VOCs, chromium, and nickel; and several cross sections. The VOCs, Cr VI, and nickel appear to be defined and do not appear to be impacting groundwater in the area of the Project.

BEA on Village Laundry 7800 N. 34th Street, Richland, Michigan

The BEA site had been used as a laundry business. The BEA was prepared for Dr. Michael Sharp, DDS, which intended to occupy the parcel for a dentist office. The BEA was completed on May 18, 1998 by American Hydrogeology Corporation (AHC). The BEA was based on previous contamination from the uses as Village Laundry. The contamination identified in the BEA was identified in environmental reports by Brown & Root Environmental, which detected chlorinated VOCs from the past laundry usage including perchloroethylene (PCE) trichloroethylene (TCE) 1,1-dichloroethane, 1,1-dichloroethylene (1,1-DCE) and cis 1,2-dichloroethylene, and trans 1,2- dichloroethylene, chloroform, and toluene. The depth to groundwater was not provided in the BEA. Given the location of the subject property at least 1/4 mile from the project site, this BEA site and contamination are not expected to have a direct impact on the project site.

BEA on Gull Lake Animal & Boarding 7820 N. 34th Street, Richland, Michigan

The BEA site was a veterinary hospital and animal boarding facility. The intended use of the parcel is for National Veterinary Associates to continue to operate a veterinary hospital and boarding facility in the subject building. The BEA was completed on March 25, 2022 by Partner Engineering and Science, Inc. The BEA was based on previous contamination identified in environmental reports by Brown & Root Environmental (1994 report) which detected chlorinated VOCs from the Village Cleaners Site in the area and heavy metals from the nearby Production Plated Plastics facility at 9899 East D Avenue. The BEA reported on the subject parcel that recent groundwater sampling from the subject parcel had 1,1,1-TCA and 1,1-dichloroethylene (1,1-DCE) and 1,1-dichloroethane (1,1-DCA) detected in the groundwater at levels that exceeded their Part 201 GRCC. the heavy metals arsenic and lead, and hexavalent chromium and nickel were also detected in groundwater samples above Part 201 GRCC. The BEA report also indicated that PFAS contamination in groundwater have been detected in the area of the subject parcel

being investigated by EGLE and associated with Production Plated Plastics property. The depth to groundwater was not provided in the BEA. Given the location of the subject property at least 1/4 mile from the project site, this BEA site and contamination are not expected to have a direct impact on the project site.

BEA – 145 Acres of Agricultural Land, north of M-89, Richland Township

The BEA site and a Part 201 Site on the Michigan's Environmental Mapper is located at north of E C Avenue and approximately 1/4 mile west of North 32nd Street and so this site is not directly adjacent to the project. The BEA was completed on February 24, 2004 by Soil and Materials Engineers, Inc (SME). The Phase 1 Environmental Site Assessment (ESA) on the Property identified residential well supplies on the adjoining parcels had historically high levels of nitrates identified as the sole REC. A limited Phase II ESA involving soil and groundwater samples from two drilling locations identified nitrate in the groundwater samples from the subject property at levels the exceeded the Part 201 Generic residential cleanup criteria, so the BEA was submitted to the State of Michigan. The depth to groundwater was between 29 and 31 feet below ground level when the samples were collected. Given the depth to groundwater and the location of the subject property at least 1/4 mile from the project site, this BEA site and contamination are not expected to have a direct impact on the project site.

BEA on Gull Lake Community Schools, 9724 - 9766 East M-89

The environmental site located at is located on the south side of East M-89, approximately 0.7 miles east of the Village of Richland's central business district. A Phase 1 ESA was conducted on this property June 16, 2023 by SES for the benefit of Gull Lake Community Schools which purchased the property. According to the Phase I ESA, the following RECs were identified at the subject parcel, as paraphrased: soil contamination from arsenic, cobalt, and iron identified in a 2012 BEA; heating oil UST(s) identified in 2012 BEA; and commercial small engine service operations building connected to a septic system creating the potential source of subsurface contamination by discharge to the septic system.

To assess the RECs identified, SES completed eight soil borings (i.e., SB-1 through SB-8) on July 13, 2023. Sixteen soil samples were collected and submitted for laboratory chemical analysis of volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), polychlorinated biphenyls (PCBs), and Michigan 10 Metals (i.e., arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc), or some combination thereof, to assess the RECs described previously. Soil borings were drilled to 20 feet and no groundwater was encountered. The subject property is classified as a "facility" because concentrations of the arsenic, cobalt, iron, and selenium were detected in soil exceeding EGLE Part 201 Residential Generic Cleanup Criteria.

The contamination was reported to be in the soil from this site. No groundwater samples were collected and the depth to groundwater was reported greater than 20 feet at this site. While the potential for groundwater contamination cannot be ruled out, this site is not expected to have a direct environmental impact to the Project due to the horizontal distance of approximately 0.9 miles from the project.

BEA site located at 9776 E D Avenue

A BEA was completed on this parcel by Superior Environmental Corp (SEC) on October 19, 2007. According to the BEA, this parcel had a single-family residence that had been converted for retail purposes. The potential for migrating contamination from the adjacent site Production Plated Plastics Inc. at 9899 East D Avenue was the only environmental concern identified. SEC

advanced three borings on the northeast portion of the property to evaluate the potential migrating contamination. A total of three groundwater samples were collected for VOCs PNAs, and metals testing. Groundwater was encountered at approximately 29.5 feet bgs. Based on the analysis, concentration of lead in one groundwater sample exceeded the current EGLE clean-up criteria. In a follow up letter, the Michigan Department of Environmental Quality (now EGLE), indicated that the BEA was not accepted, as there was insufficient information to demonstrate that the property is a facility as defined by Part 201. As such, this site is not expected to have an environmental impact on the proposed project.

Closed UST site at Mac's Automotive, 11574 E D Avenue

The according to the EGLE's Remediation Information Data Exchange (RIDE) database listing this underground storage tank (UST) was registered to Carl M. Waldorf and last used in May 20, 1991. The UST was removed from the ground on May 22, 1991. RIDE reported four USTs of 1,000-gallon capacity for gasoline storage. Three of these USTs were installed on April 26, 1956 and one was installed April 27, 1971. Each UST was removed from the ground on November 5, 1990. No release was reported from the tanks; therefore, it was closed by the State of Michigan. When a tank is closed and there is no release, the site is not considered a site of environmental contamination. Based on the closed status of this UST, this site is not expected to have an environmental impact on the Project.

Closed UST site at Gilmore Enterprises Farm, 7966 East C Avenue

This site is incorrectly plotted at the corner of 32nd Street and East C Avenue on the EGLE Environmental Mapper, which appeared to be adjacent to the Project. Because EGLE Environmental Mapper plotted this site adjacent to the Project, the LARA file for this UST Closure was obtained and reviewed. Based on the information in the LARA file, it was determined that the actual location is near the intersection of 30th Street and East C Avenue, which is more than 1 mile west of the Project and not adjacent to the Project. Given that this is a closed UST and more than one mile away from the Project, it is not expected to have a direct environmental impact to the project.

4 CONCLUSIONS

The proposed Project will be constructed along the route referenced in this report. Soil will need to be excavated and temporarily stockpiled while the utility is constructed, and then the area will be backfilled. The sites reviewed are not expected to have soil contamination that will impact the construction of the water main. This site visit and the review of the environmental contamination has the following findings:

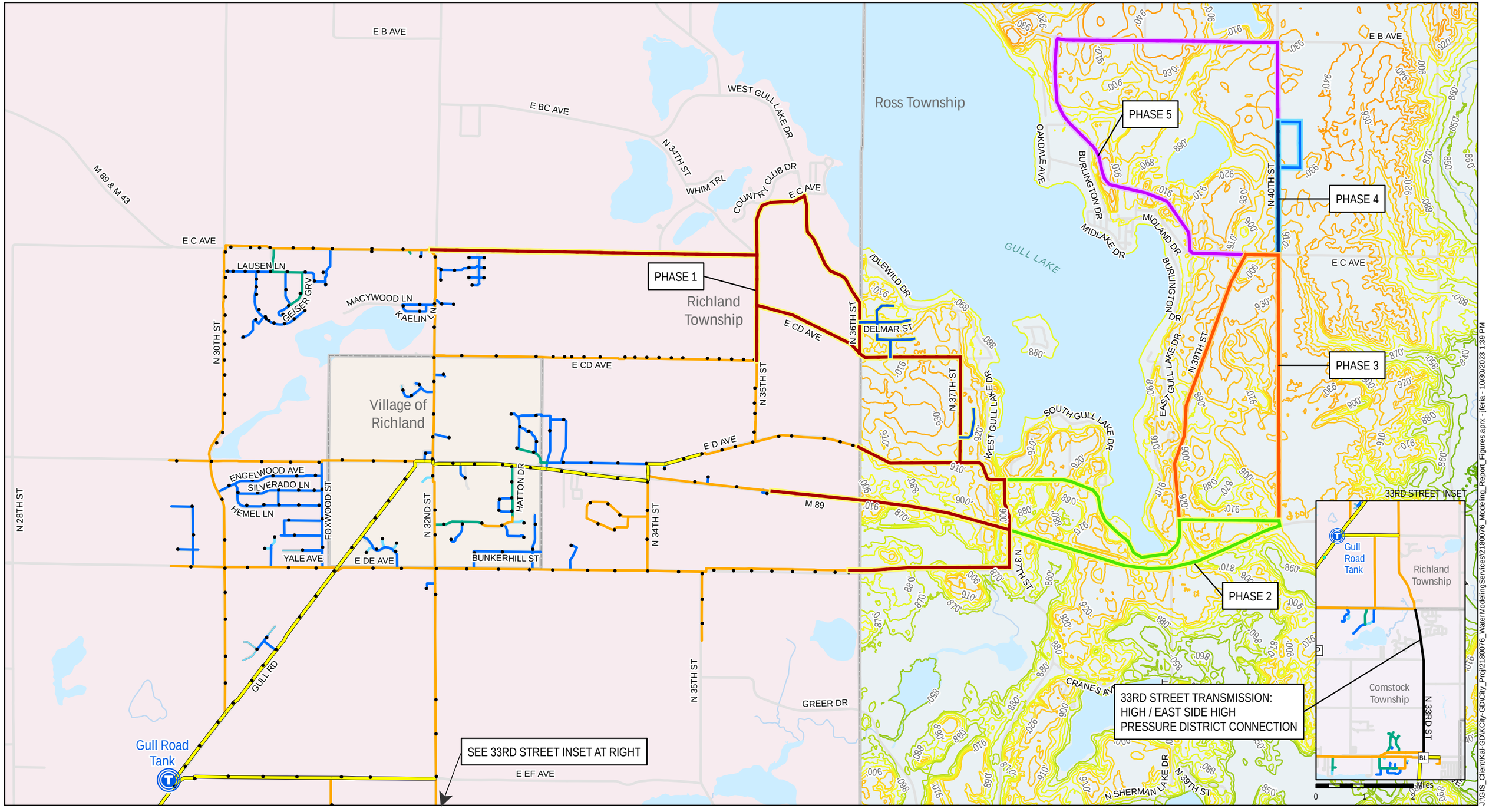
1. The MPART site known as North 34th Street area at Production Plated Plastics, 9899 East D Avenue, is being investigated for PFAS contamination. The PFAS has migrated in groundwater easterly toward the project. For this reason, the water main associated with this Project is being designed and will be constructed as a remedy. Because of the potential impact to the project, three temporary well locations are planned for PFAS testing to determine management of dewatering water.
2. Fruit orchards were observed south of East CD Avenue on east and west sides of the residence at the address of 11272 E CD Avenue. Fruit orchards are an environmental concern due to the potential for the application of the spray known as lead-arsenate,

which is no longer allowed to be used. Given that the project will be in the road right of way, and not directly through the orchard, the impact from the orchards is not expected in the road right of way, and no further evaluation is warranted in the road right of way.

3. A UST site along the project known as Mac's Automotive at 11574 E D Avenue has a pump dispenser island visible from the site visit. A pump dispenser is considered a part of the "UST System". This UST is closed by the State of Michigan, so the pump dispenser is also closed, so no contamination is expected from this closed UST site.

Appendix A

Figure for Ross Township Water Main Extensions



LEGEND

Proposed Water Main (Phase 1)
- 8"
- 12"

Proposed Water Main (Phase 2)
- 12"

Proposed Water Main (Phase 3)
- 12"

Proposed Water Main (Phase 4)
- 8"
- 12"

Proposed Water Main (Phase 5)
- 12"

Existing Water Main
- 4" and Smaller
- 6"
- 8"
- 10"
- 12"
- 16"
- Hydrant

0 0.25 0.5 0.75 1 Miles

CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN

FIGURE 1
ROSS TOWNSHIP WATER MAIN EXTENSIONS
OCTOBER 2023

Prein&Newhof
2180076

J:\GIS_Client\Kal-GDI\City-GDI\City_Proj\2180076_WaterModelingServices\2180076_Modeling_Report_Figures.aprx - jferia - 10/30/2023 1:39 PM

Appendix B

Photographic Log

2230982 - Photographic log of site visit for Phase I water main, Ross Township, Kalamazoo County, Michigan.
Photographs taken March 12, 2024 by Tim Woodburne.

Looking northerly along E D Avenue.

Mac's Automotive at 11574 E D Avenue.

View of a pump dispenser island at Mac's Garage.

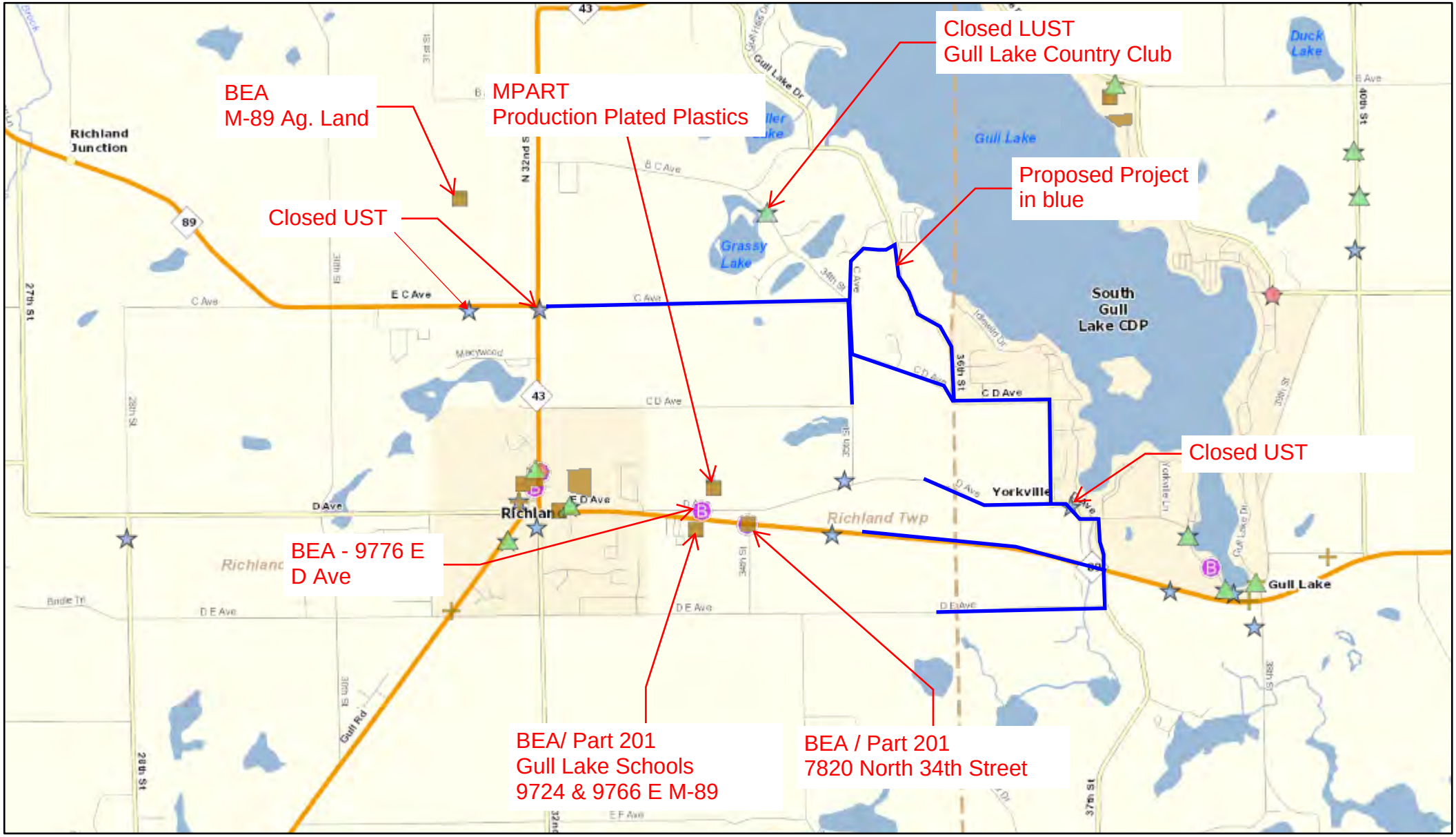
Looking west along E CD Avenue.

These two photographs form a panoramic view of orchards looking easterly and then south near 11272 E CD Avenue.

Appendix C

EGLE Environmental Mapper and MPART Map

Environmental Mapper



March 29, 2024

- Notice of Corrective Action - Polygon
- Restrictive Covenant - Polygon
- Baseline Environmental Assessment
- Closed Tanks
- Active Tanks
- Sites of Environmental Contamination (Part 201)
- Open
- Closed

1:40,708

0 0.35 0.7 1.4 mi

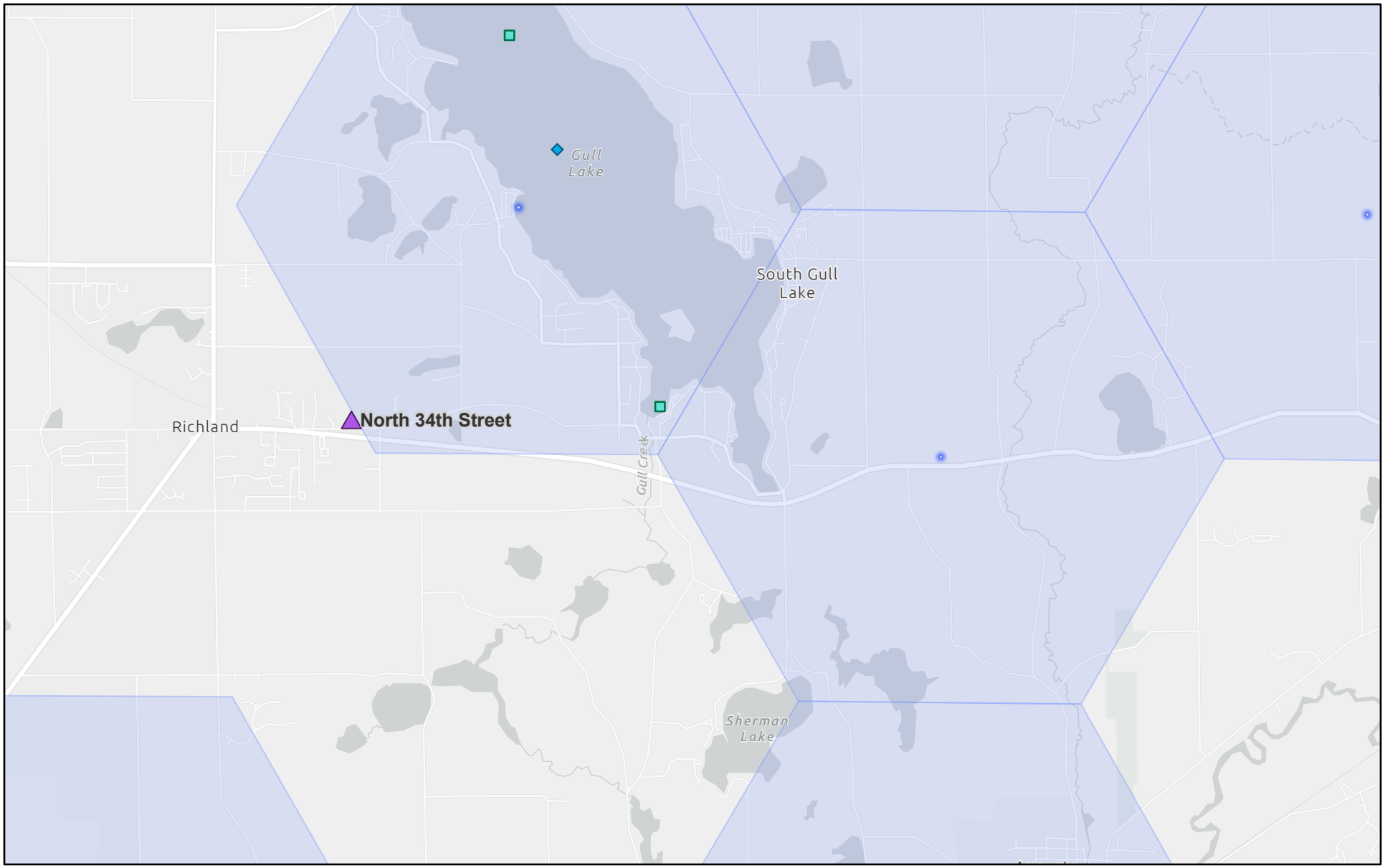
0 0.5 1 2 km

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Map by: State of Michigan - CSS

copyright 2015

MPART: PFAS Information System



3/29/2024, 1:05:58 PM

Public Water Supply Sampling Hexbins and Results

1
5
10
50
100

PFAS Sites
PFAS Surface Water Sampling
Fish Contaminant Monitoring Program Sampling Sites and Select Results

1:72,224

0 0.45 0.9 1.8 mi
0 0.75 1.5 3 km

Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

EGLE

Copyright 2021 State of Michigan

Appendix D

Select Maps from North 34th Street – MPART – Production Plated Plastics Environmental Investigations

M 89

Groundwater Samples
PFAS Compounds (ppt)

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded

- Residential Well Sample
- Monitoring Well Sample

Surface Water Samples
PFOS Concentration (ppt)

- Non-Detect
- >0 - <12
- >12

AECOM

Drawn: DP Date: 3/29/2021

Approved: JB Date: 3/29/2021

Project #: 60582450

Legend

- Staff Gauge Location
- Production Plated Plastics
- Study Area
- Buffer Zone

N

0 0.2 0.4 Miles

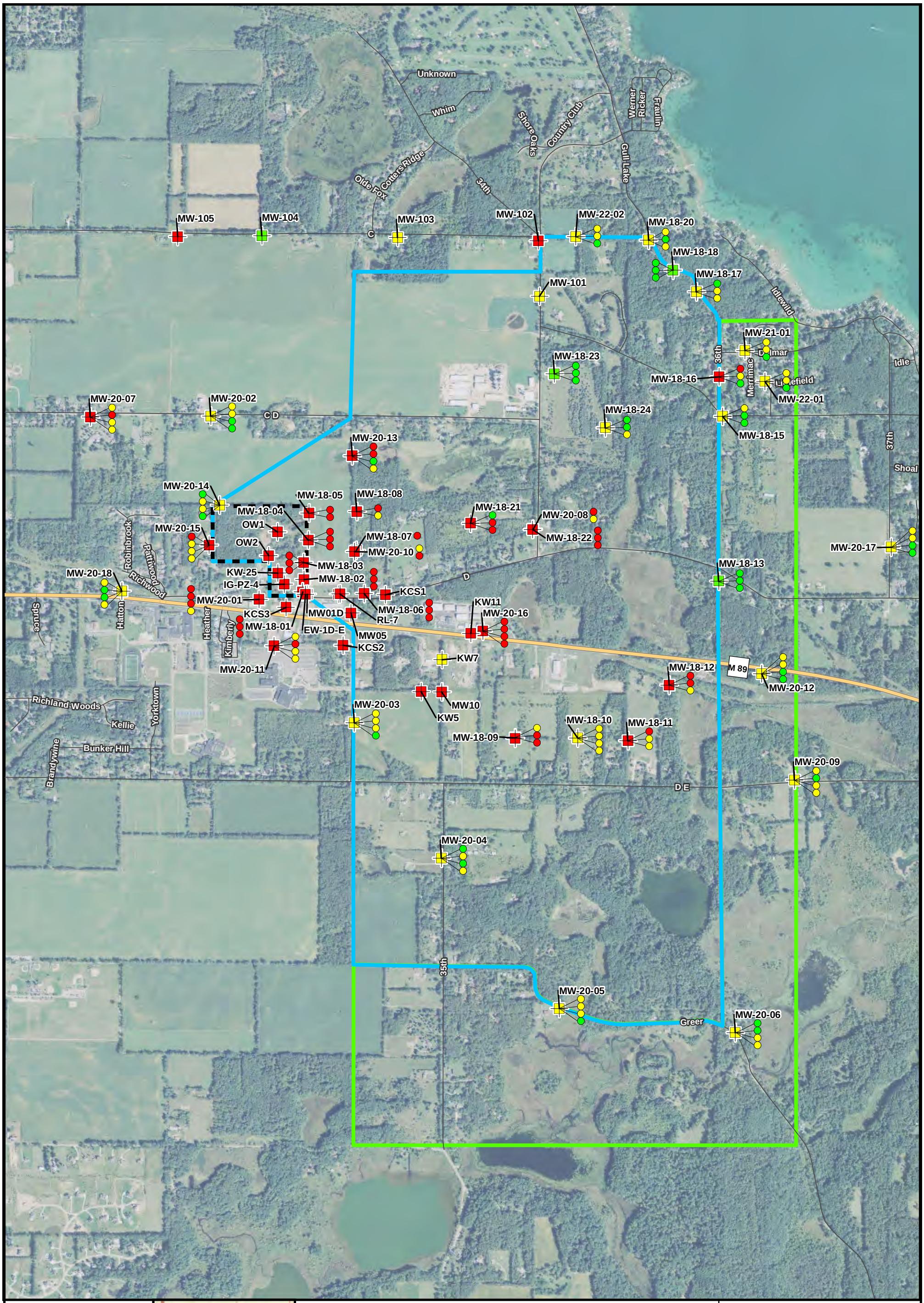
CONCENTRATIONS OF PFAS COMPOUNDS (ppt) COMPARED TO PART 201 CRITERIA

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Part201_PFAS_heatmap.mxd

Aerial imagery: 2014 NAIP Imagery



AECOM

Drawn:	DP Date: 10/21/2022
Approved:	JB Date: 10/21/2022
Project #:	60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Production Plated Plastics
- Study Area
- Buffer Zone

Results from nested monitoring wells:

- Top = Shallow
- Middle = Intermediate
- Bottom = Deep

*Locations without depth indicators have only one monitoring well.

N

0 0.2 0.4 Miles

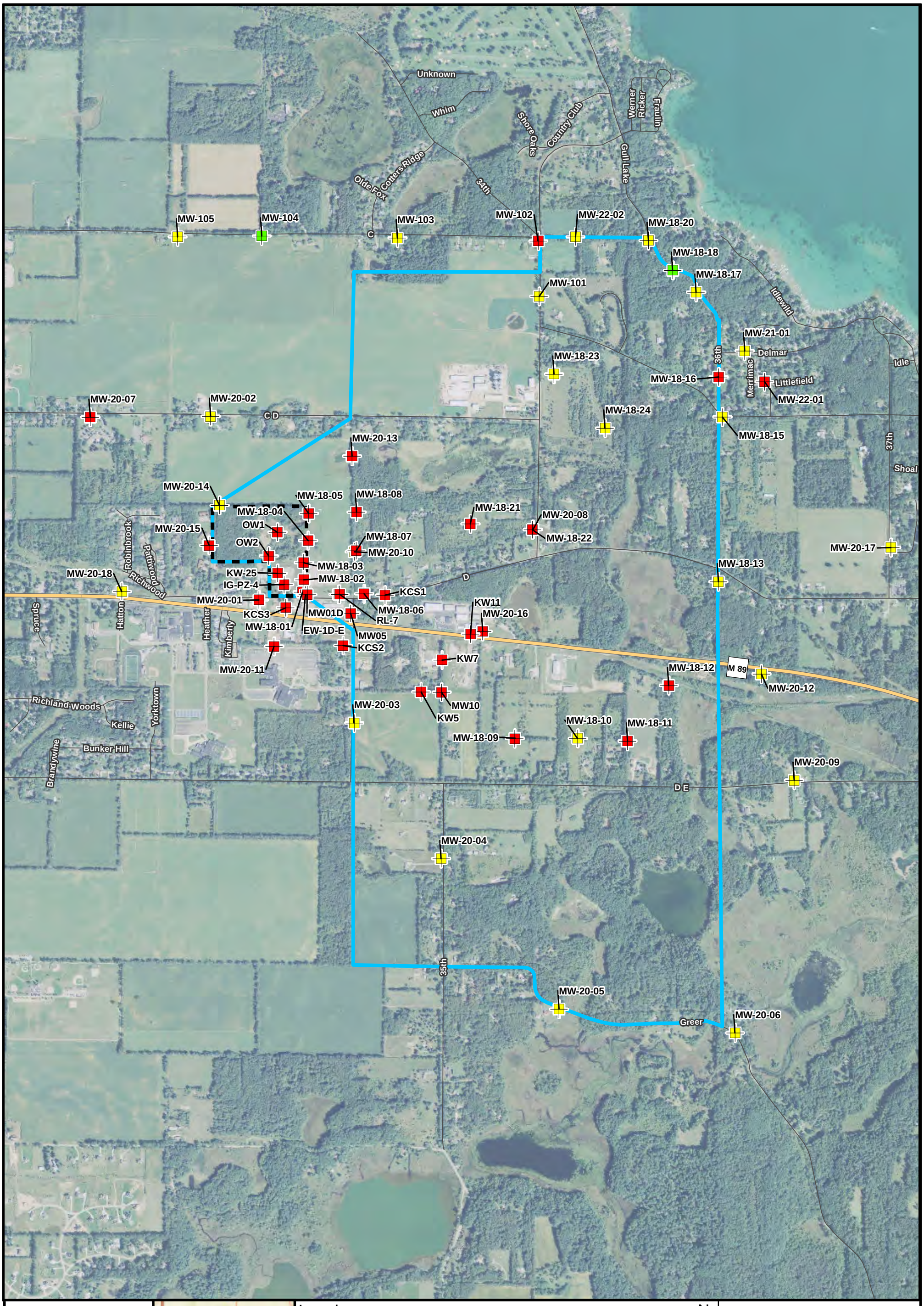
PFAS HEAT MAP AS OF NOVEMBER 2022

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Second_Quarter_Sampling_PFAS.mxd

Aerial imagery: 2014 NAIP Imagery



AECOM

Drawn: DP Date: 8/30/2022

Approved: JB Date: 8/30/2022

Project #: 60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Production Plated Plastics
- Study Area

N

0 0.2 0.4 Miles

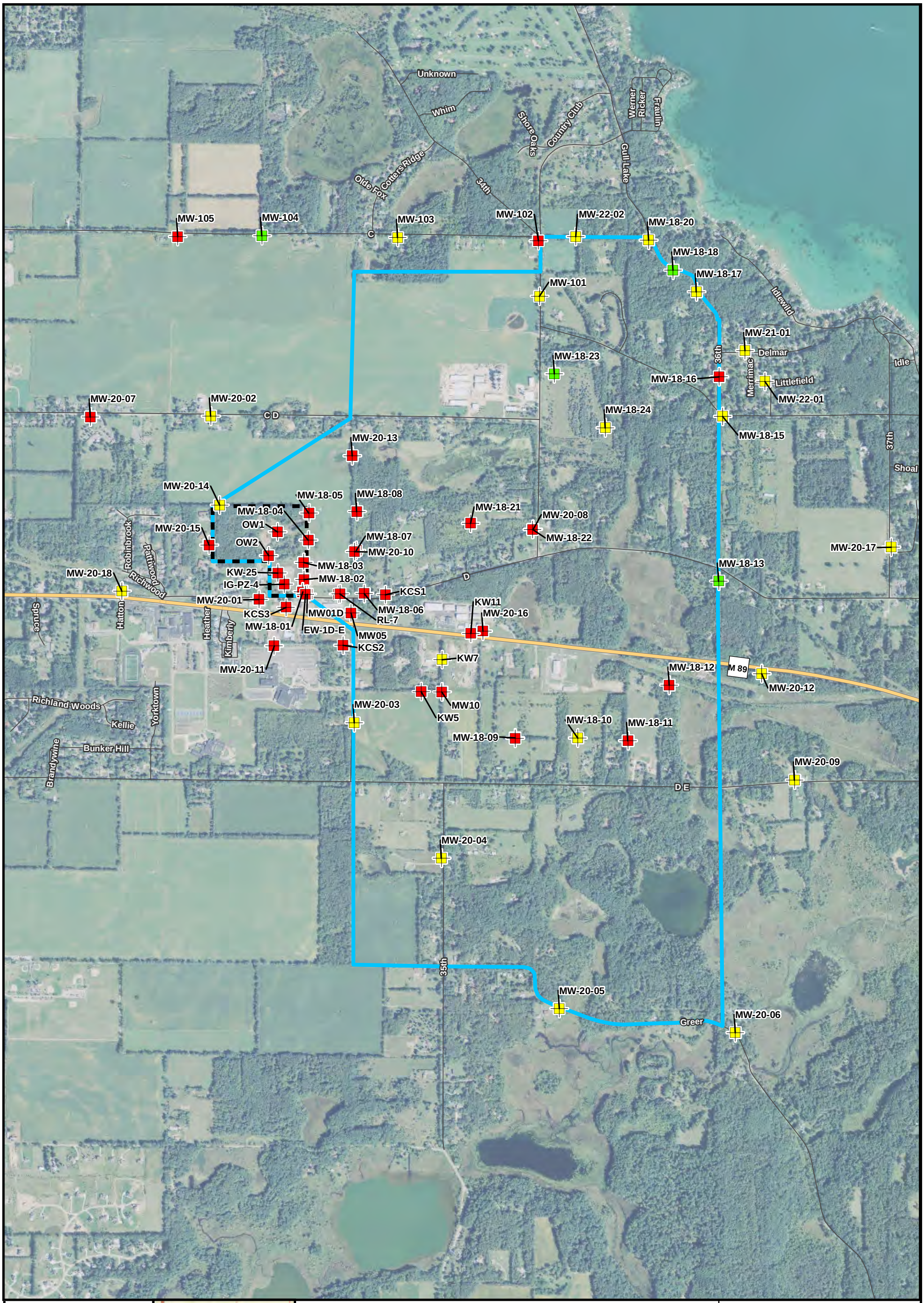
QUARTER 1 SAMPLING PFAS HEAT MAP

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\First_Quarter_Sampling_PFAS.mxd

Aerial imagery: 2014 NAIP Imagery



AECOM

Drawn: DP Date: 10/21/2022

Approved: JB Date: 10/21/2022

Project #: 60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Production Plated Plastics
- Study Area

N

0 0.2 0.4 Miles

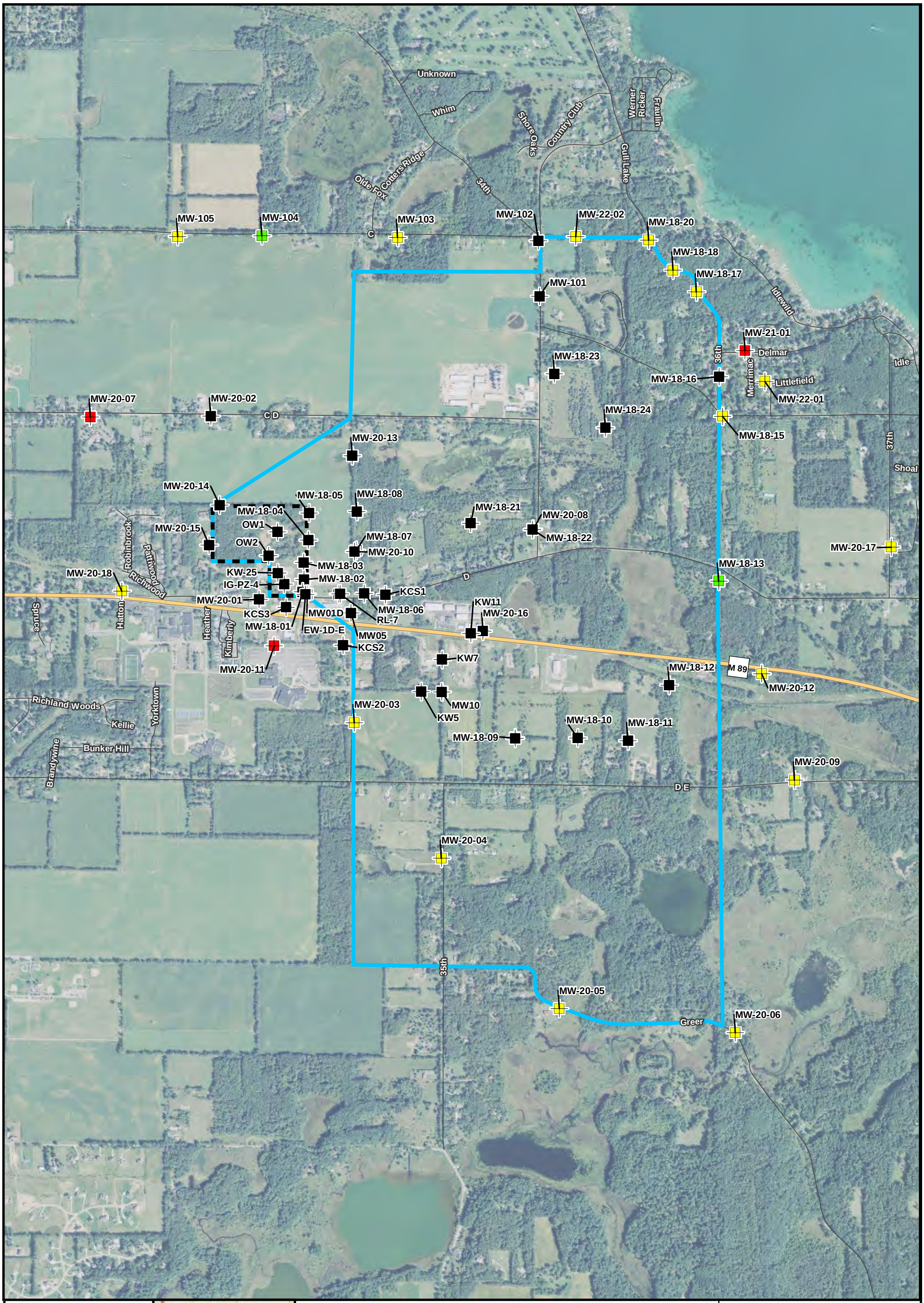
QUARTER 2 SAMPLING PFAS HEAT MAP

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Second_Quarter_Sampling_PFAS.mxd

Aerial imagery: 2014 NAIP Imagery



AECOM

Drawn: DP Date: 1/31/2023

Approved: JB Date: 1/31/2023

Project #: 60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Not Sampled

- Production Plated Plastics
- Study Area

N

0 0.2 0.4 Miles

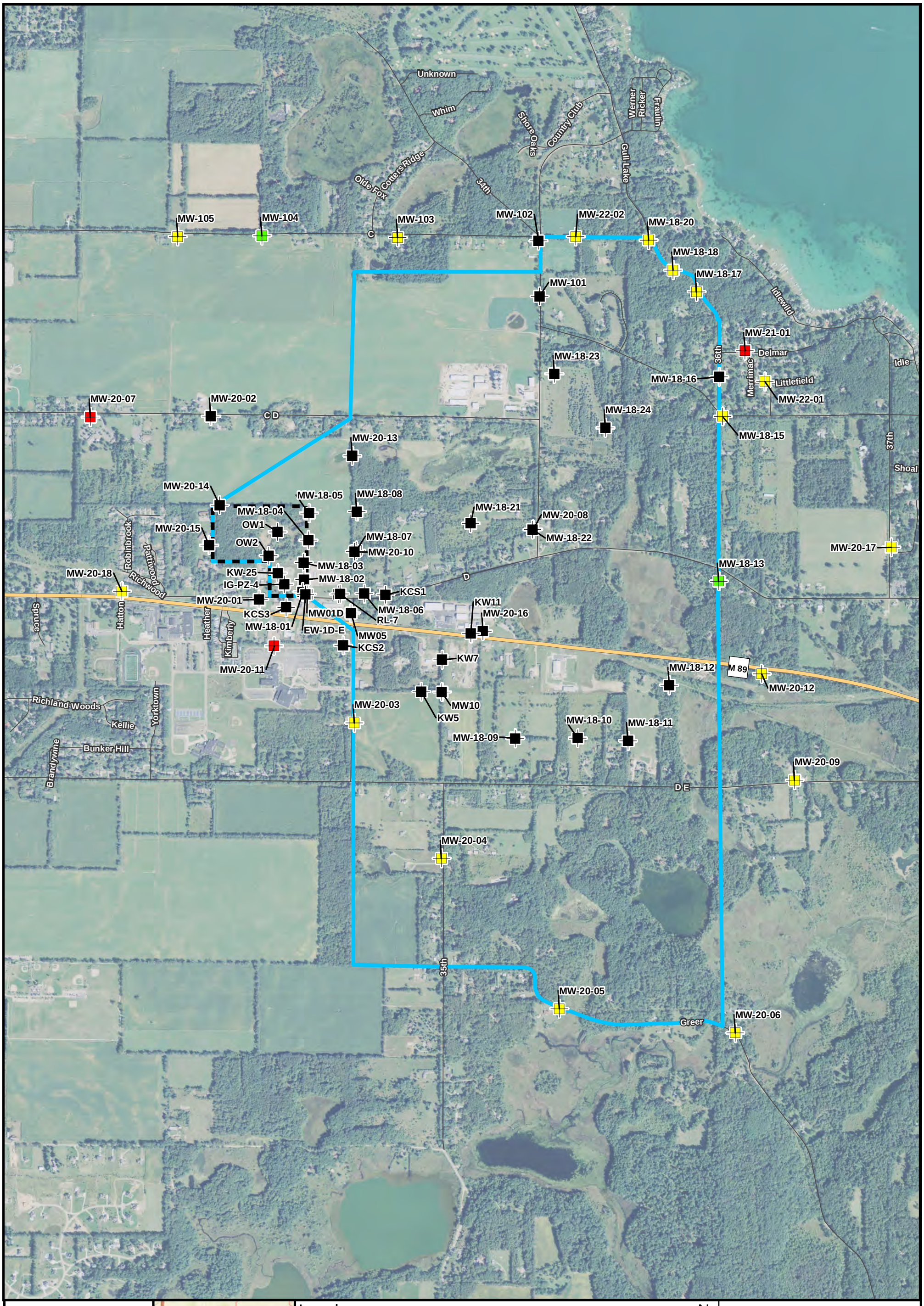
QUARTER 3 SAMPLING PFAS HEAT MAP

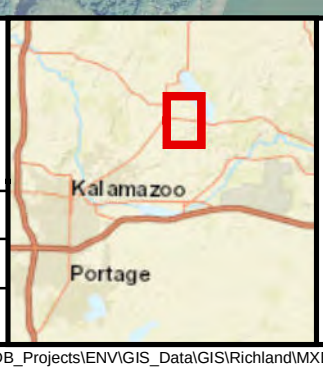
DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Third_Quarter_Sampling_PFAS.mxd

Aerial imagery: 2014 NAIP Imagery





AECOM

Drawn: DP Date: 5/1/2023

Approved: JB Date: 5/1/2023

Project #: 60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Not Sampled

Production Plated Plastics Study Area

N

0 0.2 0.4 Miles

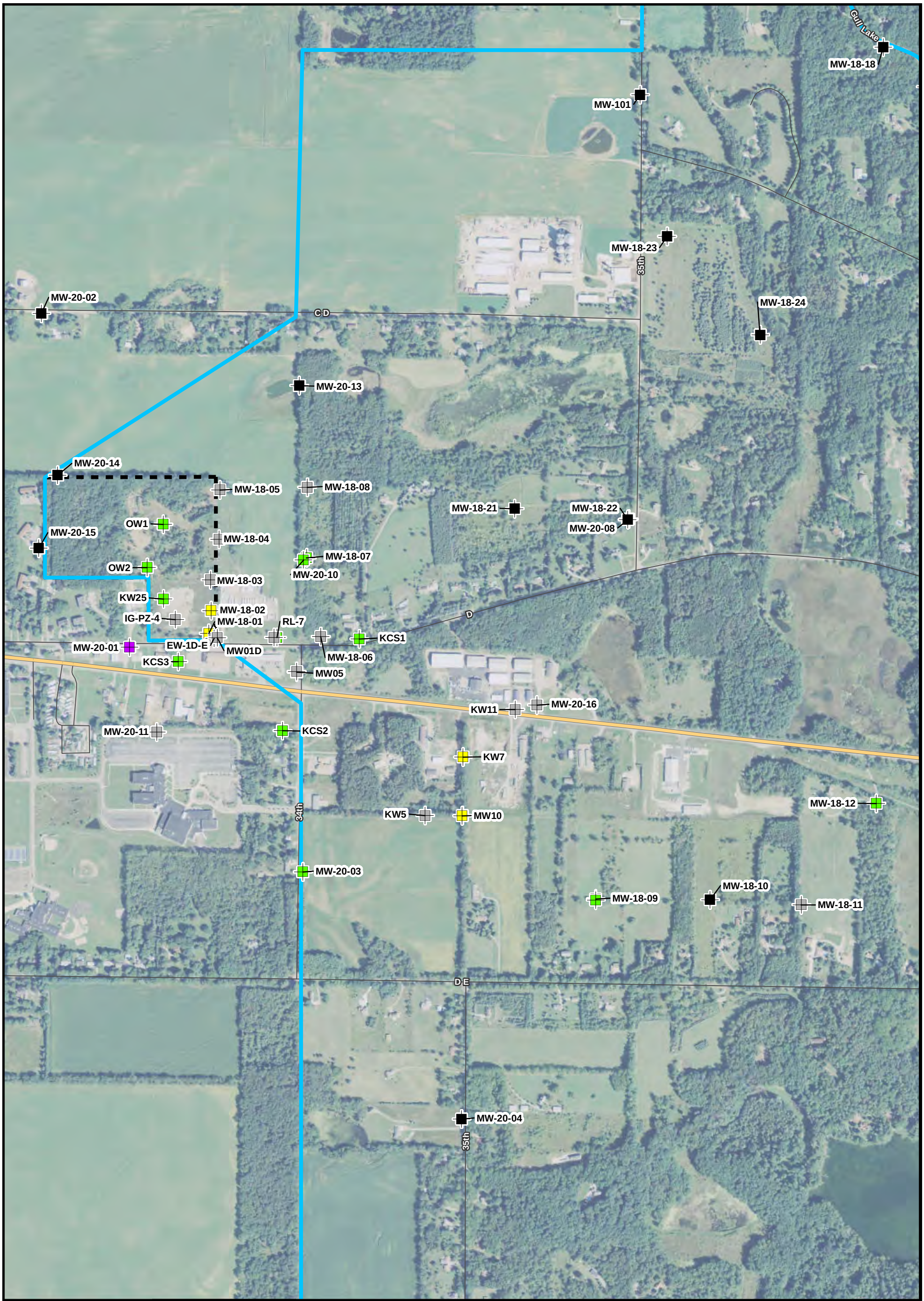
QUARTER 4 SAMPLING PFAS HEAT MAP

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Fourth_Quarter_Sampling_PFAS.mxd

Aerial imagery: 2014 NAIP Imagery



AECOM

Drawn: DP Date: 5/2/2023

Approved: JB Date: 5/2/2023

Project #: 60582450

QUARTER 4 SAMPLING VOC HEAT MAP

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Fourth_Quarter_Sampling_VOCs.mxd

Aerial imagery: 2014 NAIP Imagery

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891.96
MW-104
890.30
MW-103
888.74
MW-102
885.02
MW-22-02A
882.73
MW-18-20A
879.84
MW-18-18A
879.45
MW-101
886.40
MW-18-17A
879.34
MW-21-01A
879.34
MW-18-16A
879.74
MW-18-23A
884.69
MW-22-01A
878.90
MW-20-07A
892.07
MW-20-02A
890.67
MW-18-15A
879.37
SG-2
886.08
MW-18-24A
881.61
SG-1
888.19
MW-20-13A
888.45
SG-3
883.37
MW-20-14A
890.23
OW1S
889.78
MW-18-04A
889.24
MW-18-21A
883.91
MW-18-22A
882.04
MW-20-15A
890.38
OW2S
889.70
MW-18-03A
888.15
MW-20-08A
878.98
MW-20-10A
883.06
SG-5
876.56
MW-18-13A
875.64
MW-20-17A
875.76
KW-25
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IG-PZ-4
888.06
KCS-1
886.28
MW-20-18A
891.96
MW-20-01A
888.84
KCS3
887.86
RL-7S
887.28
MW-05-S
886.86
KW-11
881.93
MW-20-16A
881.38
MW-18-01A
887.44
MW-20-11A
888.60
KCS2
886.80
KW-7
880.29
MW-18-12A
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870.00
KW-5
884.79
MW10S
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MW-20-03A
883.75
MW-18-09A
872.77
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872.06
MW-18-11A
869.68
SG-6
866.05
MW-20-09A
864.25
MW-20-04A
871.18
SG-7
863.27
MW-20-05A
854.84
MW-20-06A
853.88
890
892
888
886
884
882
880
878
876
874
872
870
868
866
864
862
860
858
856
854

AECOM

Drawn: DP Date: 5/8/2023

Approved: MW Date: 5/8/2023

Project #: 60582450

Kalamazoo

Portage

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Not Sampled for PFAS
- Staff Gauge
- Lake (Elevation Estimated)
- February 2023 Groundwater Contour (2' interval)
- Production Plated Plastics
- Study
- Buffer Zone

N

0 0.15 0.3 Miles

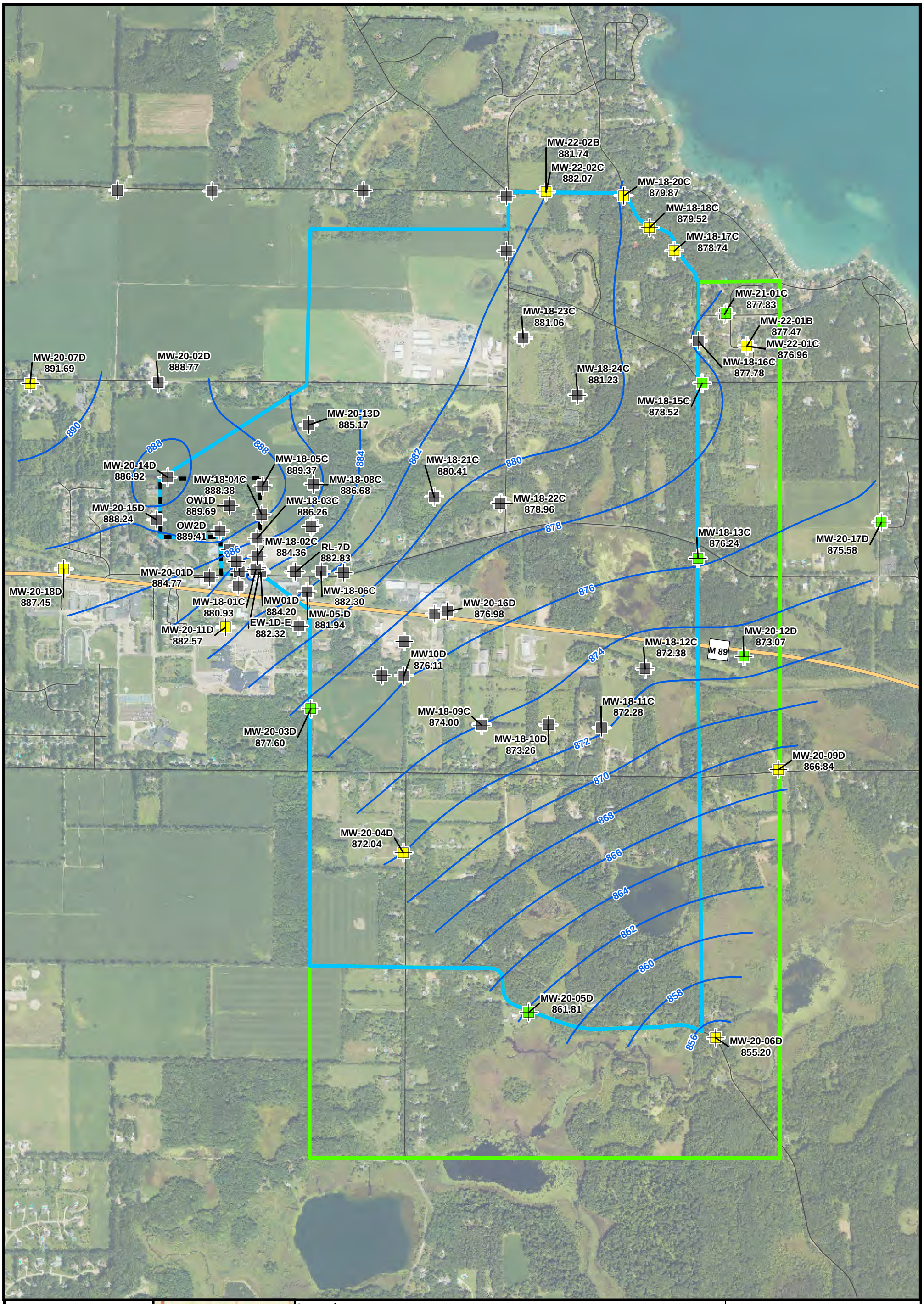
SHALLOW GROUNDWATER CONTOURS FEBRUARY 2023 ELEVATIONS USING ESTIMATED LAKE ELEVATIONS

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Feb2023_Shallow_GW_Contours.mxd

Aerial imagery: 2014 NAIP Imagery



AECOM

Drawn: DP Date: 5/9/2023

Approved: MW Date: 5/9/2023

Project #: 60582450

Legend

Monitoring Well

- Non-Detect for Part 201 PFAS Compounds
- Detection below Part 201 PFAS Criteria, but no Exceedance
- One or more Part 201 PFAS Criteria Exceeded
- Not Sampled for PFAS

- February 2023 Groundwater Contour (2' interval)
- Production Plated Plastics
- Study
- Buffer Zone

N

0 0.15 0.3 Miles

DEEP GROUNDWATER CONTOURS FEBRUARY 2023 ELEVATIONS

DRAFT

RICHLAND, MI

Document Path: L:\DCS\GIS\ArcMap_GeoDB_Projects\ENV\GIS_Data\GIS\Richland\MXDs\Feb2023_Deep_GW_Contours.mxd

Aerial imagery: 2022 NAIP Imagery

MW-101
MW-18-23
35th
CD
MW-18-24
MW-20-13
MW-18-05
MW-18-08
MW-18-21
MW-18-22
MW-20-08
OW1
MW-18-04
MW-18-07
MW-20-10
OW2
MW-18-03
KW25
MW-18-02
IG-PZ-4
MW-18-01
MW01D
EW-1D-E
RL-7
KCS1
MW-18-06
MW-20-01
KCS3
MW05
D
KW11
MW-20-16
MW-20-11
KCS2
KW7
MW-18-12
34th
KW5
MW10
MW-20-03
MW-18-09
MW-18-10
MW-18-11
DE
35th
MW-20-04

AECOM

Drawn: DP Date: 11/2/2023

Approved: JB Date: 11/2/2023

Project #: 60627149

Kalamazoo

Portage

Legend

Monitoring Well

- Non-Detect for Chromium
- Detection of Chromium, but no Exceedance
- Chromium exceeds GSIC
- Chromium exceeds multiple criteria- DWC, GSIC, GVIIC, and/or FAV
- Not Sampled

Study

Production Plated Plastics

N

0 0.095 0.19 Miles

SEMI-ANNUAL 1 SAMPLING CHROMIUM HEAT MAP

DRAFT

RICHLAND, MI

Aerial imagery: 2014 NAIP Imagery

MW-101
MW-18-23
35th
C D
MW-18-24
MW-20-13
MW-18-05
MW-18-08
MW-18-21
MW-18-22
MW-20-08
OW1
MW-18-04
MW-18-07
MW-20-10
OW2
MW-18-03
KW25
IG-PZ-4
MW-18-02
MW-18-01
MW01D
EW-1D-E
RL-7
KCS1
MW-18-06
MW-20-01
KCS3
MW05
D
KW11
MW-20-16
MW-20-11
KCS2
KW7
MW-18-12
KW5
MW10
34th
MW-20-03
MW-18-09
MW-18-10
MW-18-11
D E
35th
MW-20-04

AECOM

Drawn: DP Date: 11/2/2023

Approved: JB Date: 11/2/2023

Project #: 60627149

Kalamazoo

Portage

Legend

Monitoring Wells

- Non-Detect for Nickel
- Detection of Nickel, but no Exceedance
- Nickel Exceeds DWC
- Not Sampled

- Study
- Production Plated Plastics

N

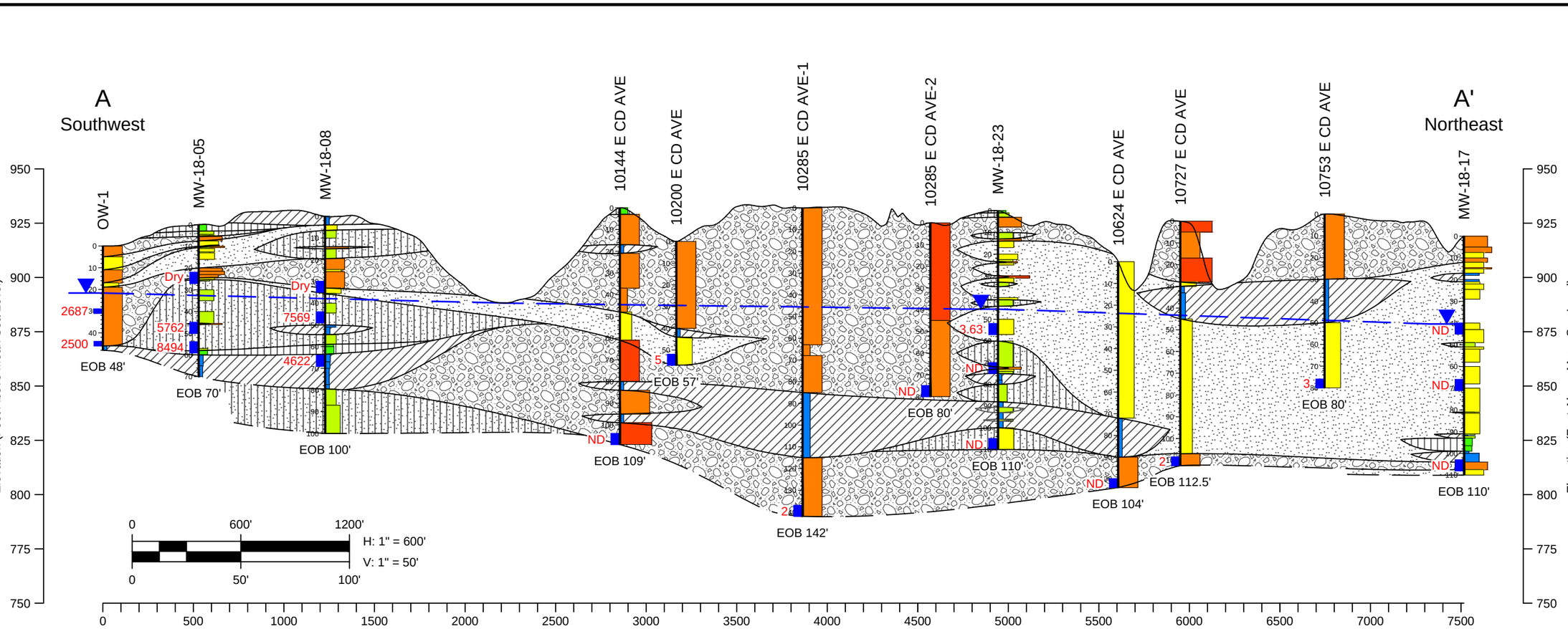
0 0.095 0.19 Miles

SEMI-ANNUAL 1 SAMPLING NICKEL HEAT MAP

DRAFT

RICHLAND, MI

Aerial imagery: 2014 NAIP Imagery



Borehole Legend

Borehole Designation — MW-18-05

Depth (Feet Below Ground Surface)

Water Table

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

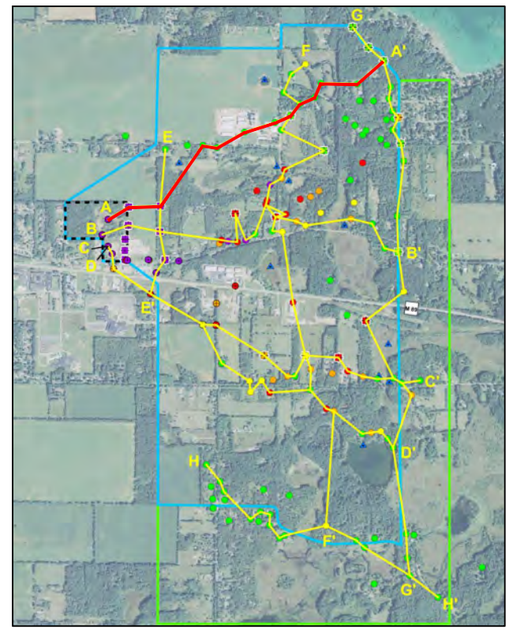
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



Index Map

GEOLOGIC CROSS SECTION A - A'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

Figure: 1

Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

Last saved by: WILZBACHERN (2019-06-22) Last Plotted: 2019-06-22
Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\910-CAD\01 MODELS\60582450 XSEC.DWG

Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

B
West

B'
East

OW-2 | MW-18-04 | MW-18-07 | 10243 E D AVE | 10275 E D AVE | 10353 E D AVE | MW-18-21 | 10359 E D AVE | 10415 E D AVE | 8249 N 35th ST | MW-18-22 | 10585 E D AVE | 10641 E D AVE | 10851 E D AVE | 10897 E D AVE | 10876 E D AVE | MW-18-13

Elevation (Feet Above Mean Sea Level)

950 925 900 875 850 825 800 775 750

1225 | 1245 | 4416 | 11790 | 14184 | Dry | 1409 | 1121 | 1225 | 736 | 45.6 | 915 | 545 | ND | 2599 | 3564 | 802 | 503 | 93 | 412 | 39 | 63 | 5 | ND | ND | ND | ND

EOB 49' | EOB 100' | EOB 60' | EOB 106' | EOB 112' | EOB 121' | EOB 130' | EOB 77' | EOB 118' | EOB 124' | EOB 130' | EOB 107' | EOB 88' | EOB 39' | EOB 85' | EOB 45' | EOB 100'

0 700' 1400'
H: 1" = 700'
V: 1" = 50'
0 50' 100'

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 850

Horizontal Distance (Feet)

14X Vertical Exaggeration

Borehole Legend

Borehole Designation — MW-18-05

Depth (Feet Below Ground Surface)

Water Table

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Gravelly Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

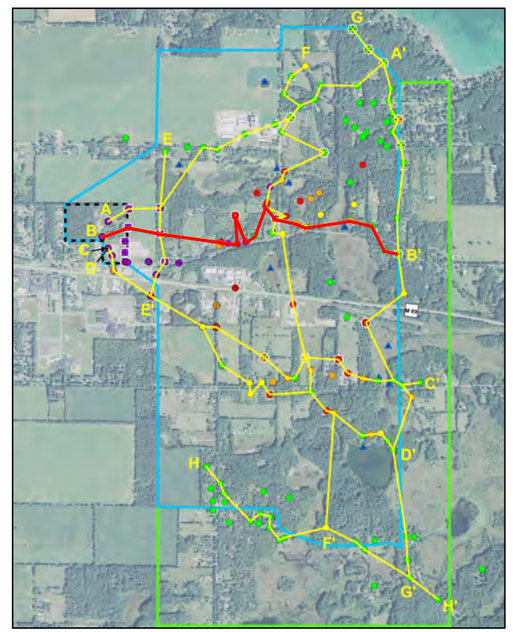
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



Index Map

GEOLOGIC CROSS SECTION B - B'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

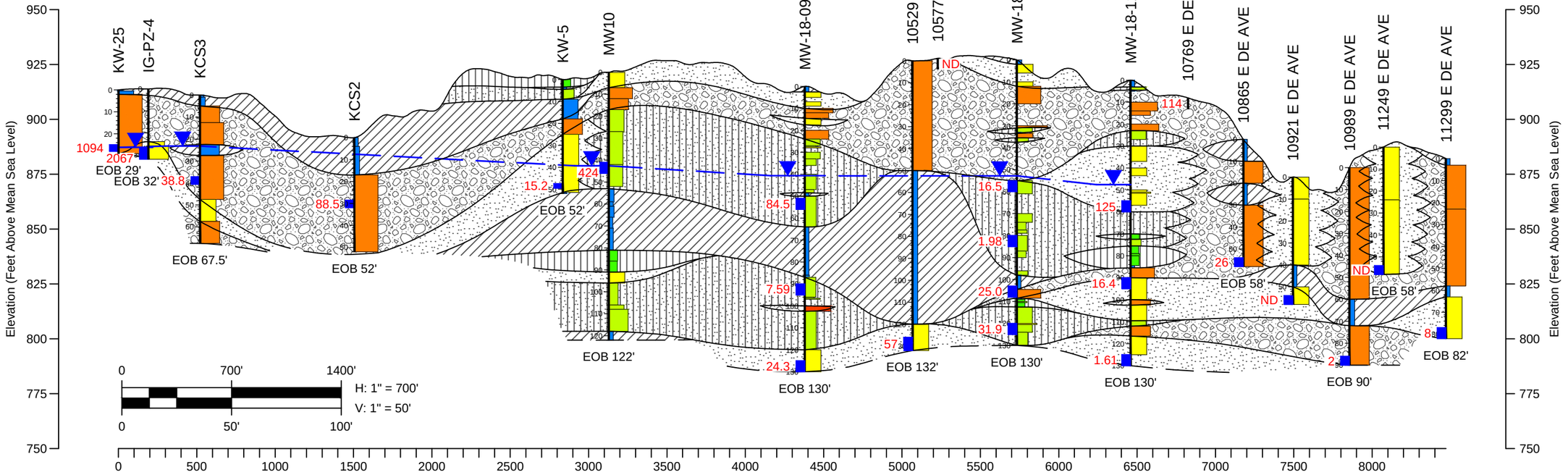
Figure: 2

Last saved by: WILZBACHERN(2019-06-22) Last Plotted: 2019-06-22
Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\0910-CAD\01 MODELS\60582450 XSEC.DWG

Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

C
Northwest

C'
Southeast



Borehole Legend

Borehole Designation — MW-18-05

Depth (Feet Below Ground Surface)

Water Table

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

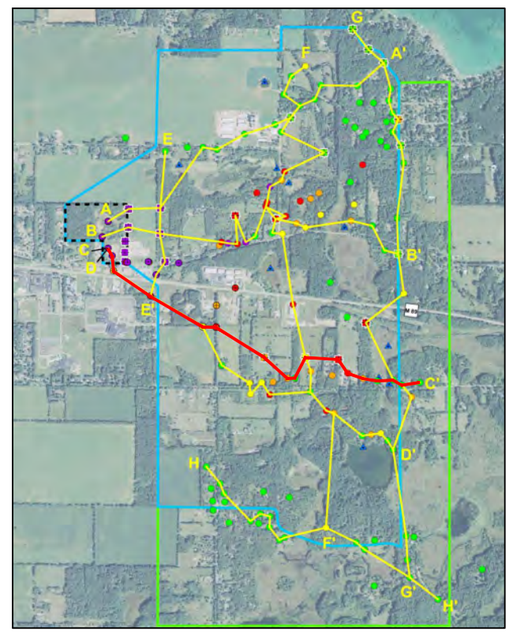
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



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GEOLOGIC CROSS SECTION C - C'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

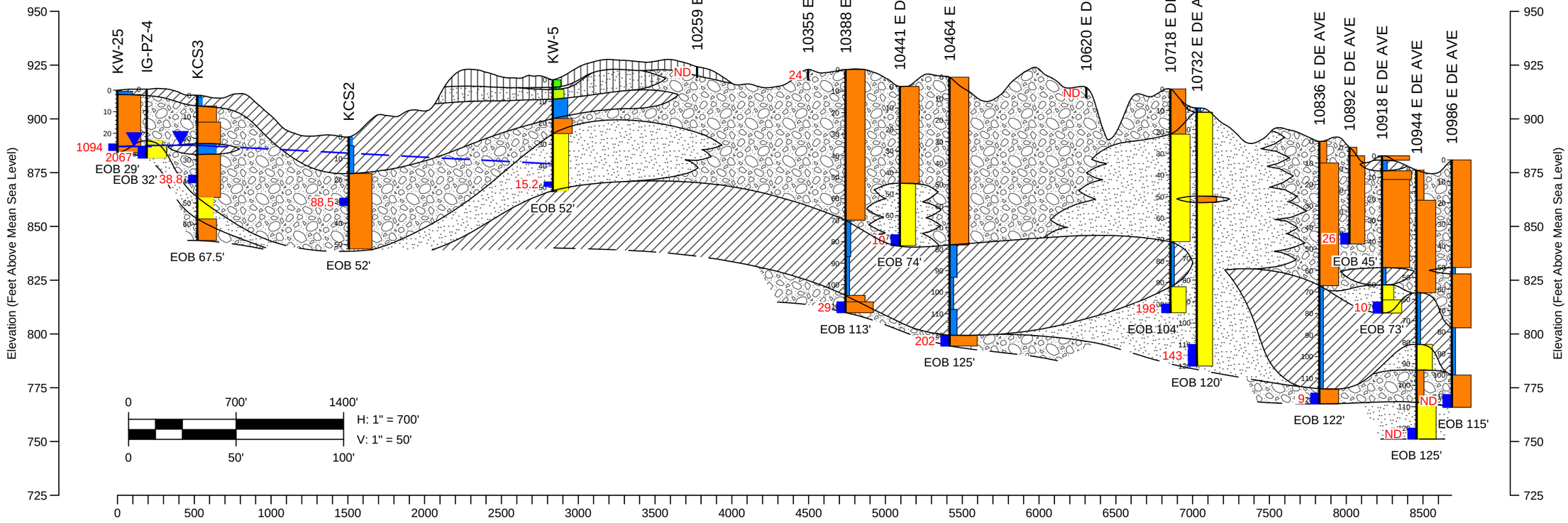
Figure: 3

Last saved by: WILZBACHERN(2019-06-22) Last Plotted: 2019-06-22
Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\D910-CAD\01 MODELS\60582450 XSEC.DWG

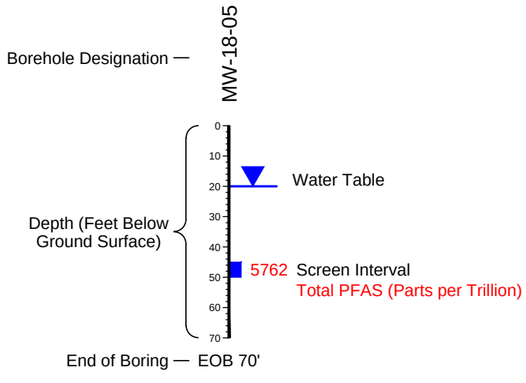
Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

D — Northwest

D' — Southeast



Borehole Legend



Main Stratigraphic Units

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

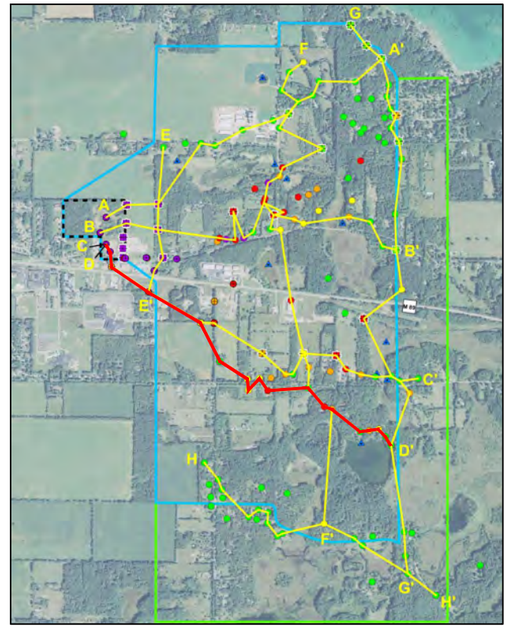
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



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GEOLOGIC CROSS SECTION D - D'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

Figure: 4

Last saved by: WILZBACHERN(2019-06-22) Last Plotted: 2019-06-22
Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\0910-CAD\01 MODELS\60582450 XSEC.DWG

Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

E
North

E'
South

10000 E CD AVE

MW-18-08

MW-18-07

MW-18-06

MW05

KCS2

Dry

7569

4622

Dry

1409

5931

1588

88.58

441

142

ND

EOB 121'

EOB 100'

EOB 60'

EOB 100'

EOB 92'

EOB 52'

0 250' 500'
H: 1" = 250'
V: 1" = 50'
0 50' 100'

Elevation (Feet Above Mean Sea Level)

950 925 900 875 850 825 800 775 750

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200

Horizontal Distance (Feet)

5X Vertical Exaggeration

Borehole Legend

Borehole Designation — MW-18-05

Depth (Feet Below Ground Surface)

Water Table

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

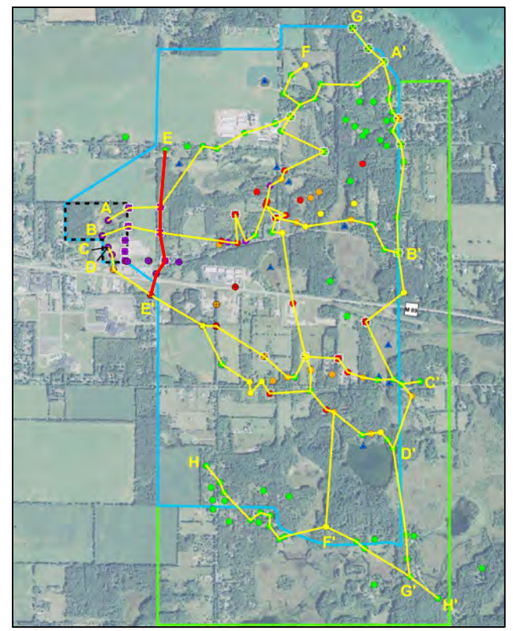
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



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GEOLOGIC CROSS SECTION E - E'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

Figure: 5

Last saved by: WILZBACHERN(2019-06-22) Last Plotted: 2019-06-22
Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\D910-CAD\01 MODELS\60582450 XSEC.DWG

Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

F

North

F'

South

10727 E CD AVE-2
8770 N 35th ST
8698 N 35th ST
8612 N 35th ST
MW-18-23
10285 E CD AVE-3
MW-18-24
8386 N 35th ST
8338 N 35th ST
8345 N 35th ST
8279 N 35th ST
8249 N 35th SR
MW-18-22
10527 E D AVE
10538 M-89
MW-18-10
10647 E DE AVE
10620 E DE AVE
10718 E DE AVE
10625 GREER DR

Elevation (Feet Above Mean Sea Level)

950 925 900 875 850 825 800 775 750

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000 10500 11000 11500 12000

Horizontal Distance (Feet)

20X Vertical Exaggeration

0 1000' 2000'

H: 1" = 1000'

V: 1" = 50'

0 50' 100'

EOB 112.5' EOB 58' EOB 79' EOB 118' EOB 110' EOB 130' EOB 100' EOB 40' EOB 56' EOB 115' EOB 124' EOB 67.5' EOB 110' EOB 105' EOB 130' EOB 110' EOB 104' EOB 77'

ND 46 ND ND ND 3.63 ND ND ND 1.52 160 49 1373 356 802 18 772 503 93 181 16.52 1.98 24.97 31.85 ND 53 198 27

Borehole Legend

Borehole Designation — MW-18-05

Water Table

Depth (Feet Below Ground Surface)

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Gravelly Clay
- Silt
- Silty Sand
- Gravelly Silt
- Sand
- Sand and Gravel

Grain Size Delineation

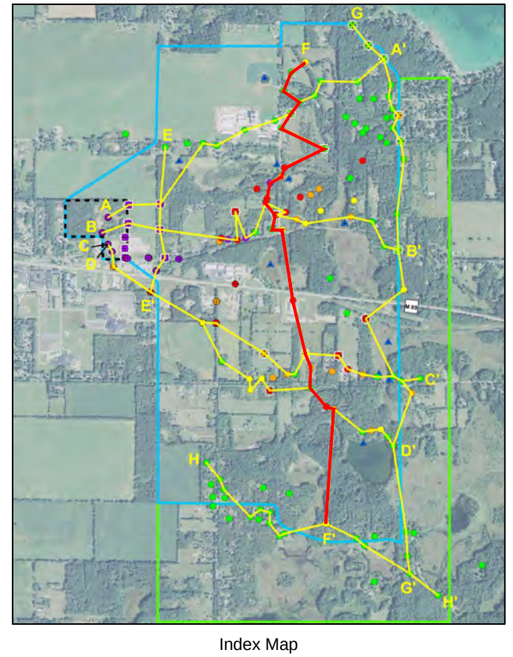
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



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GEOLOGIC CROSS SECTION F - F'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

Figure: 6

Last saved by: WILZBACHERN (2019-06-22) Last Plotted: 2019-06-22
Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\0910-CAD\01 MODELS\60582450 XSEC.DWG

Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

G
North

G'
South

MW-18-20 | MW-18-18 | MW-18-17 | 8749 N 36th ST | 8691 N 36th ST | 8637 N 36th ST | MW0-18-16 | 10985 EAST CD AVE | MW-18-15 | 11026 E CD AVE | 10959 E D AVE | MW-18-13 | 10589 M-89 | MW-18-12 | 10989 E DE AVE | 11249 E DE AVE | 11280 E DE AVE | 10986 E DE AVE | 11023 GREER DR | 11056 GREER DR | 11070 GREER DR

Elevation (Feet Above Mean Sea Level)

950 925 900 875 850 825 800 775 750 725 700

3 ND ND ND ND 5.22 — EOB 110'
ND ND ND — EOB 110'
84 ND 63.2 64.1 1.79 — EOB 104'
ND 17.41 ND 8 — EOB 110'
ND ND ND — EOB 110'
ND ND ND — EOB 77'
ND ND ND — EOB 114'
131.59 18 85.89 80.38 — EOB 110'
ND ND ND — EOB 100'
ND 15 ND 2 — EOB 90'
ND ND — EOB 115'
ND ND ND — EOB 141'
ND ND — EOB 68'
ND — EOB 41'
EOB 58'
EOB 35'

0 1000' 2000'
H: 1" = 1000'
V: 1" = 50'
0 50' 100'

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000 10500 11000 11500 12000 12500 13000

Horizontal Distance (Feet)

20X Vertical Exaggeration

Borehole Legend

Borehole Designation — MW-18-05

Depth (Feet Below Ground Surface)

0 10 20 30 40 50 60 70

Water Table

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

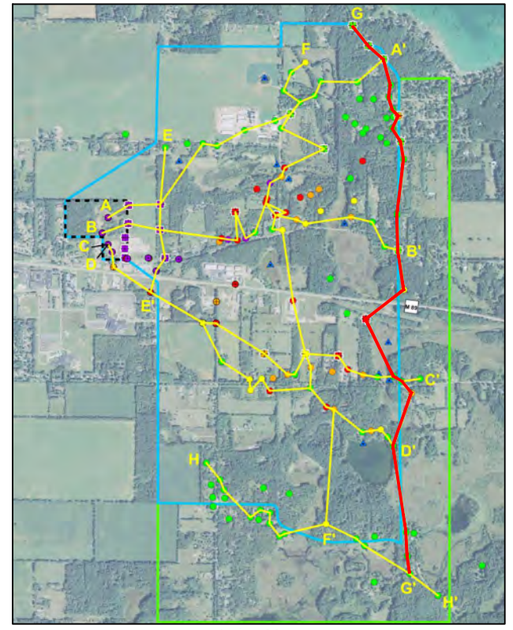
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



Index Map

GEOLOGIC CROSS SECTION G - G'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

Figure: 7

Last saved by: WILZBACHERN(2019-06-22) Last Plotted: 2019-06-22
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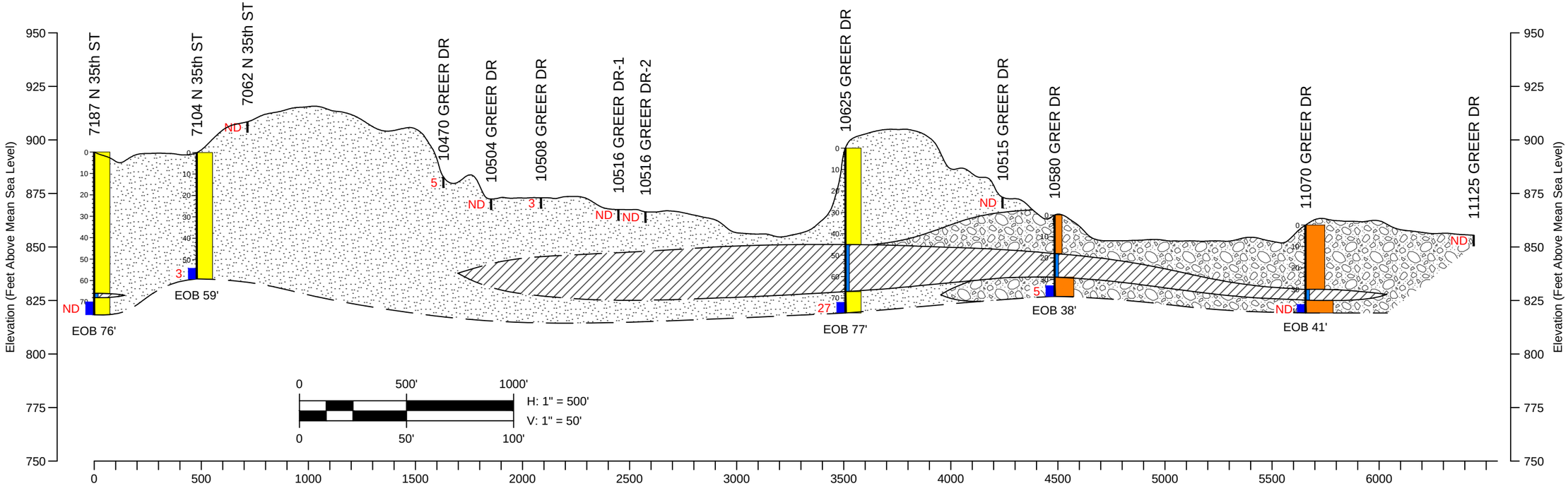
Project Management Initials: Designer: NLW Checked: MW Approved:____ ANSI B 11" x 17"

H
West

H'
East



Borehole Legend

Borehole Designation — MW-18-05

Depth (Feet Below Ground Surface)

Water Table

5762 Screen Interval
Total PFAS (Parts per Trillion)

End of Boring — EOB 70'

Main Stratigraphic Units

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel

Grain Size Delineation

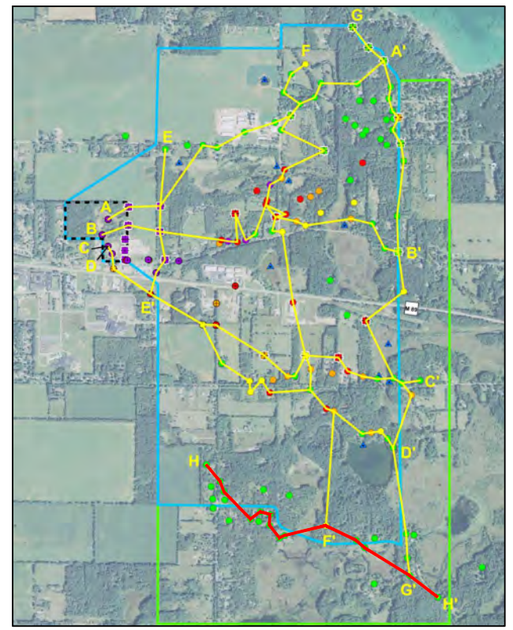
- Clay
- Silt
- Very Fine Sand
- Fine Sand
- Medium Sand
- Coarse Sand
- Very Coarse Sand
- Granules
- Pebbles
- Cobbles
- Boulders

Horizontal Length of Grain Size Bar Denotes Predominant Grain Size. Bar Color Denotes Stratigraphy. For Example:

- = Coarse Sand
- = Fine Sand
- = Silty Fine Sand
- = Gravelly Fine Sand

Stratigraphic Log

- Clay
- Silt
- Silty Sand
- Sand
- Sand and Gravel
- Gravel



Index Map

Figure: 8

GEOLOGIC CROSS SECTION H - H'

RICHLAND PFAS EVALUATION
RICHLAND, MICHIGAN

Project No.: 60582450 Date: 2019-06-22

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Filename: C:\PROJECT FOLDERS\60582450-RICHLAND\D910-CAD\01 MODELS\60582450 XSEC.DWG

Appendix I

Overburdened Calculation

Full documentation will be included in the final Project Plan.