

# *Planning and Engineering to Construction: Stormwater Wetlands for Water Quality and Habitat Restoration in the Ozaukee County Park System*



*Clean Rivers, Clean Lake Conference – September 8<sup>th</sup>, 2022*

*Andrew Struck, M.S., Director*

*Ozaukee County - Planning and Parks Department*





# Stormwater Wetlands for Water Quality and Habitat

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## CASE STUDIES – Ozaukee County Park System

- Planning - Virmond County Park Stormwater Wetland
- Design & Engineering – Mee-Kwon County Park Stormwater Wetlands
- Construction & Restoration - Little Menomonee River Fish & Wildlife Preserve County Park (LMRFPW) Stormwater Wetlands

# Virmond County Park – Planning and Design

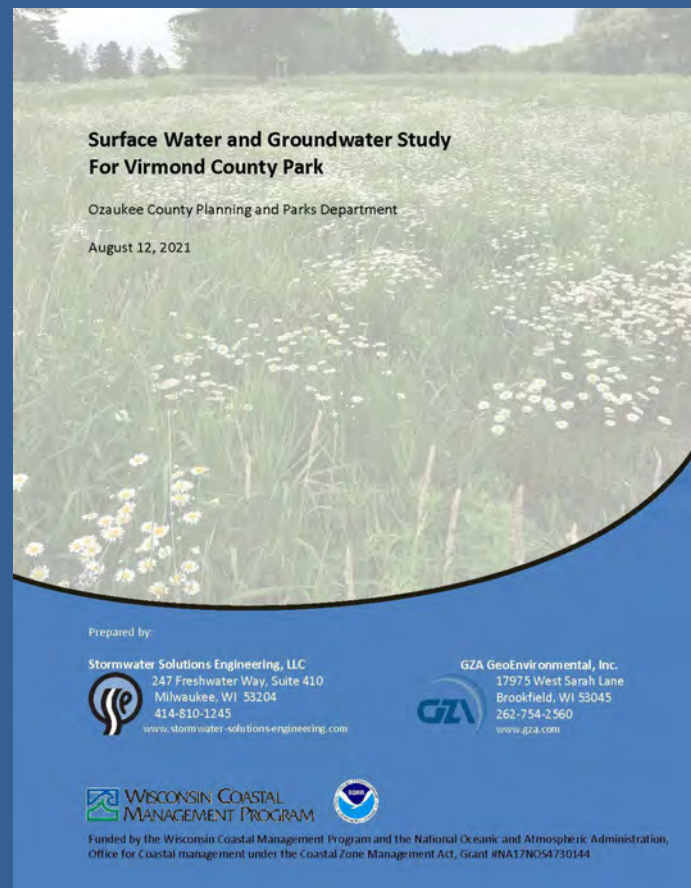
## Overall Project Goals:

- Improve stormwater/wetland drainage through a wetland restoration at Virmond County Park adjacent to unstable clay seepage bluffs on the Lake Michigan shoreline
- Preserve the bluffs to improve quantity and quality of surface waters by protecting the groundwater contributions and wetlands on and near the site
- Implement engineering recommendations from a recently completed 2021 WCMP funded Surface and Groundwater Study at Virmond County Park
  - understanding of surface stormwater drainage and other groundwater management issues
  - recommendations include capturing drainage from stormwater and existing wetlands and discharging it away from the bluff in an expanded restored wetland to provide additional storage, improve water quality and manage peak flows prior to discharging off-site



# Virmond County Park – Planning for Restoration Efforts

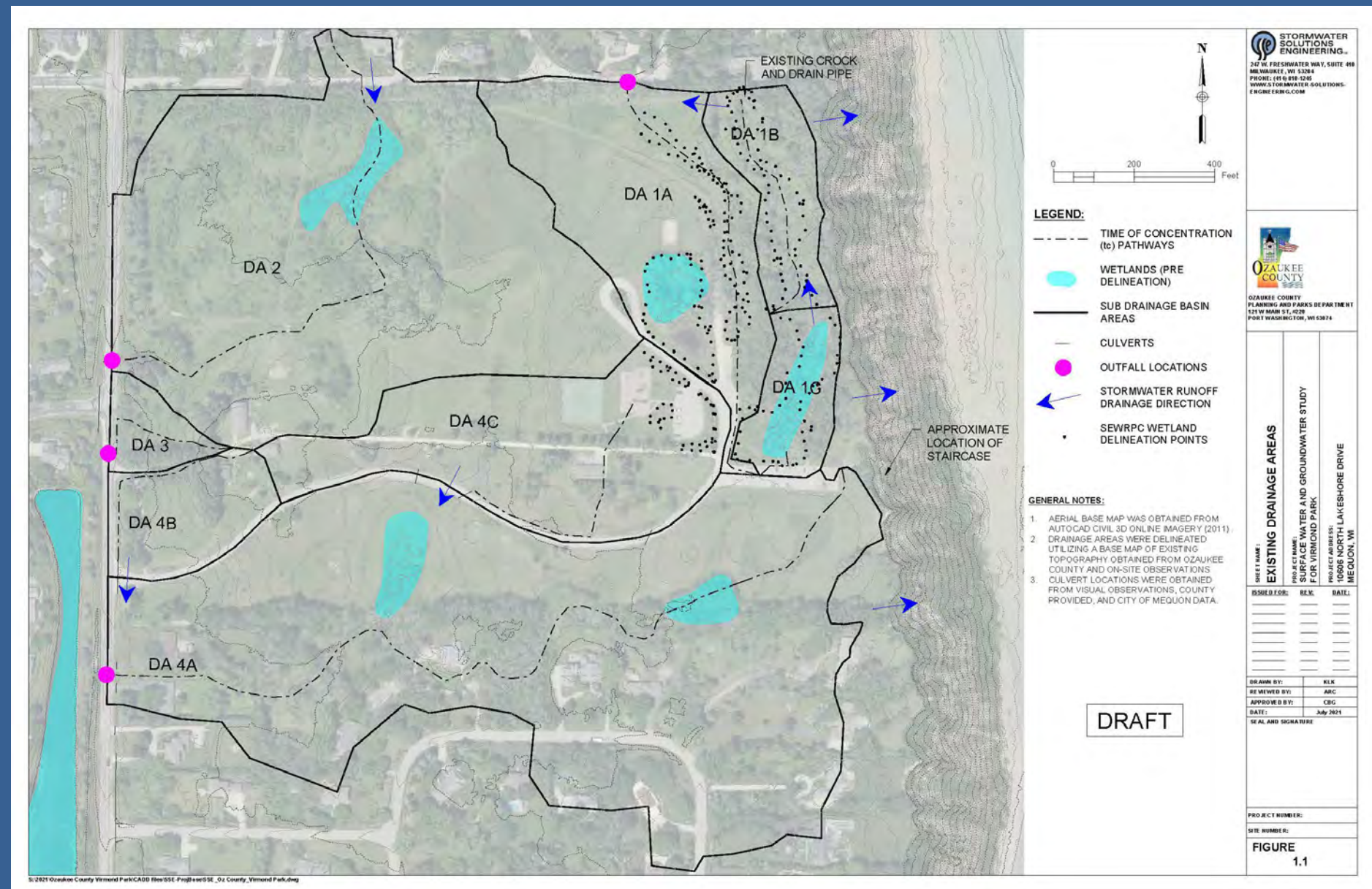
- Construction of an expanded wetland to provide additional storage and water quality benefits prior to discharging off-site per the original drainage pattern





# Virmond County Park Wetland Restoration & Stormwater Management

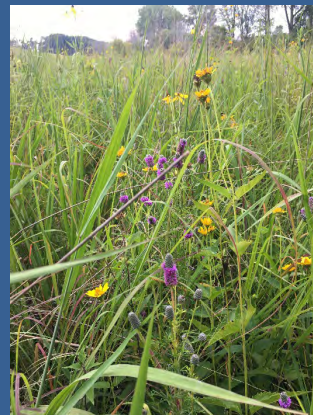
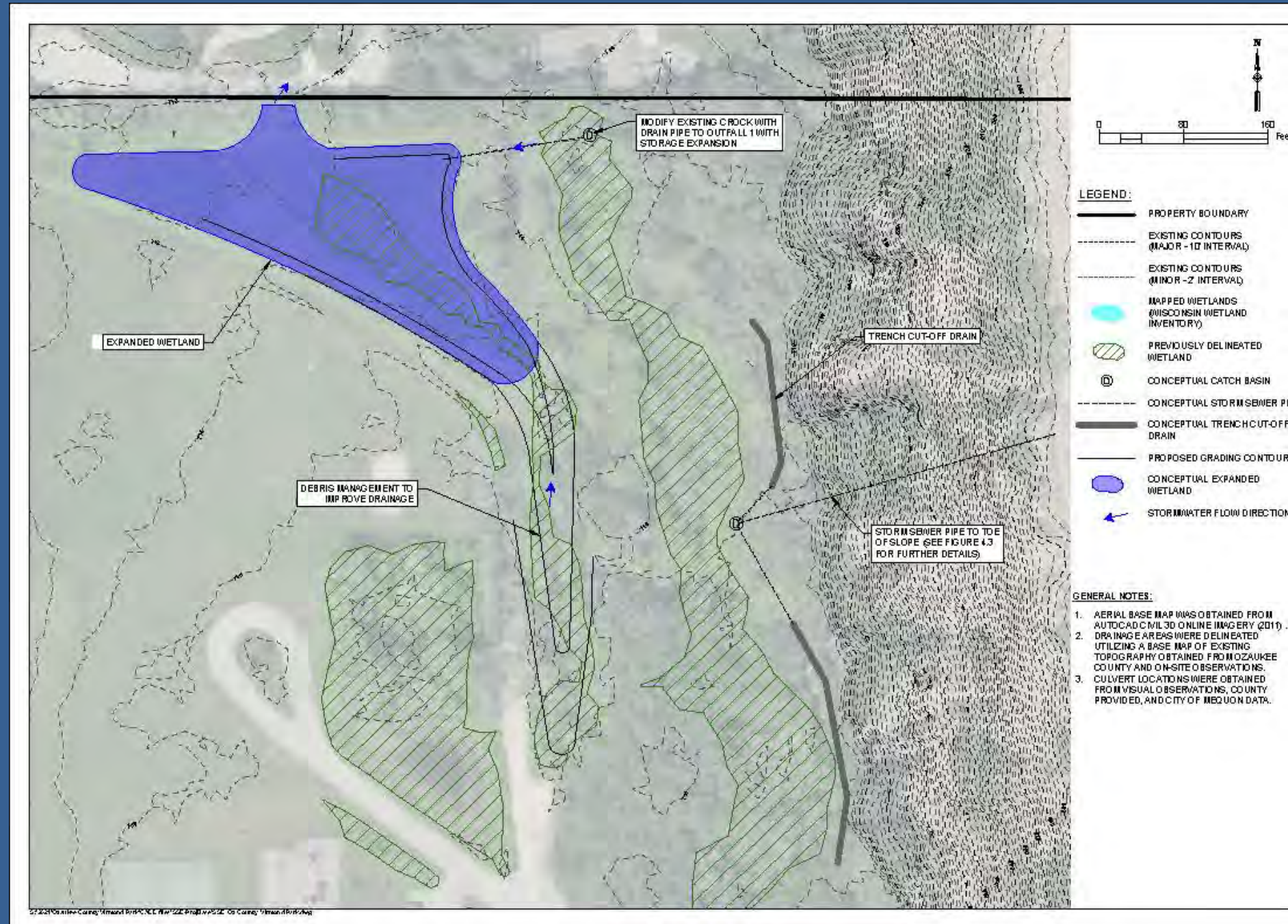
- Recommended in Recent Master Plan
- Capture Drainage from Existing Stormwater and Wetlands Causing Issues on Neighboring Properties, Bluff Erosion
- Reroute Drainage Away From Sensitive Areas





# Virmond County Park Wetland Restoration & Stormwater Management

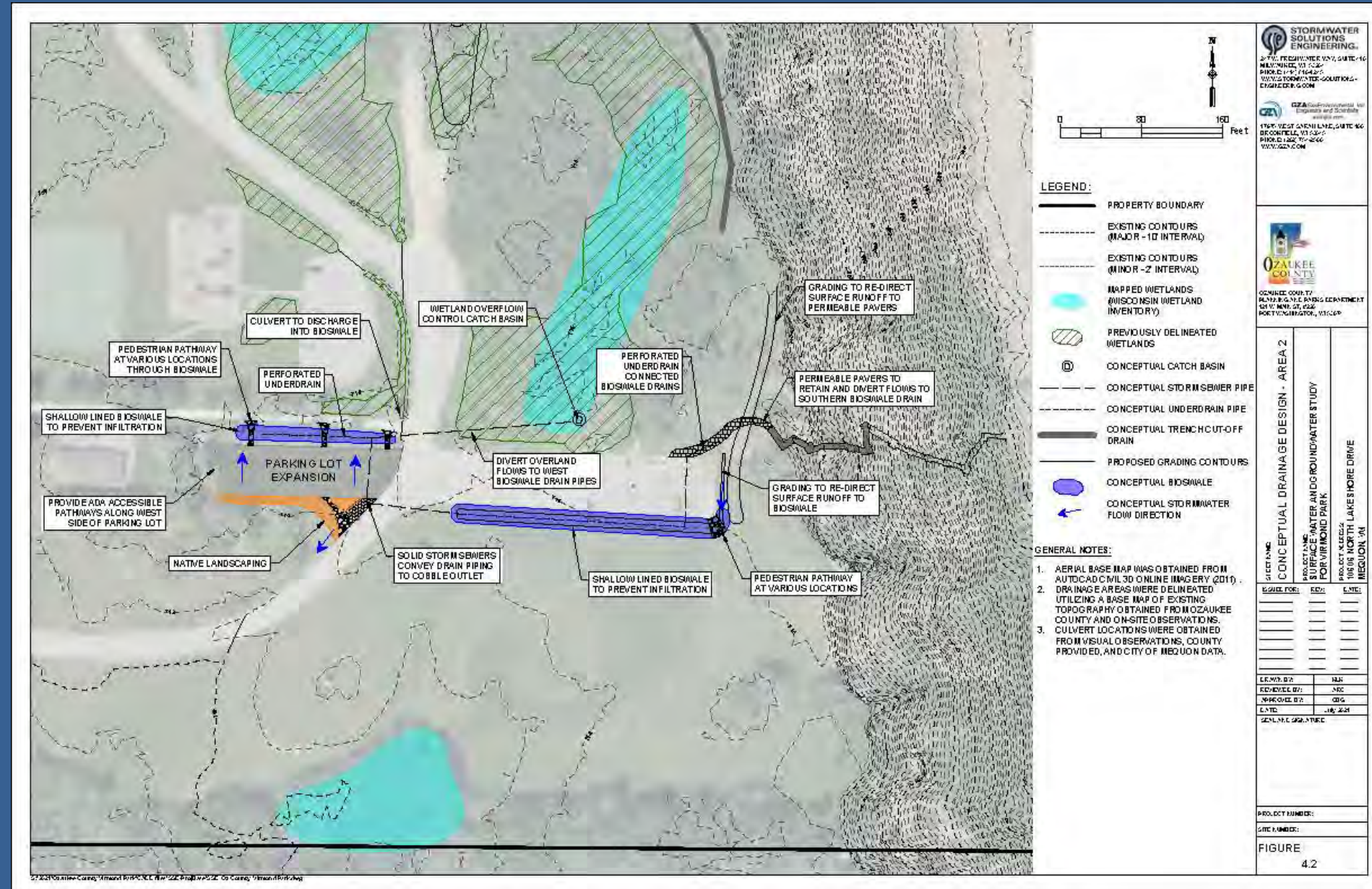
- Recommended in Recent Master Plan
- Capture Drainage from Existing Stormwater and Wetlands Causing Issues on Neighboring Properties, Bluff Erosion
- Reroute Drainage Away From Sensitive Areas
- Native Vegetation Plantings to Provide Habitat
- Construction Planned 2023 - 2024





# Virmond County Park Wetland Restoration & Stormwater Management

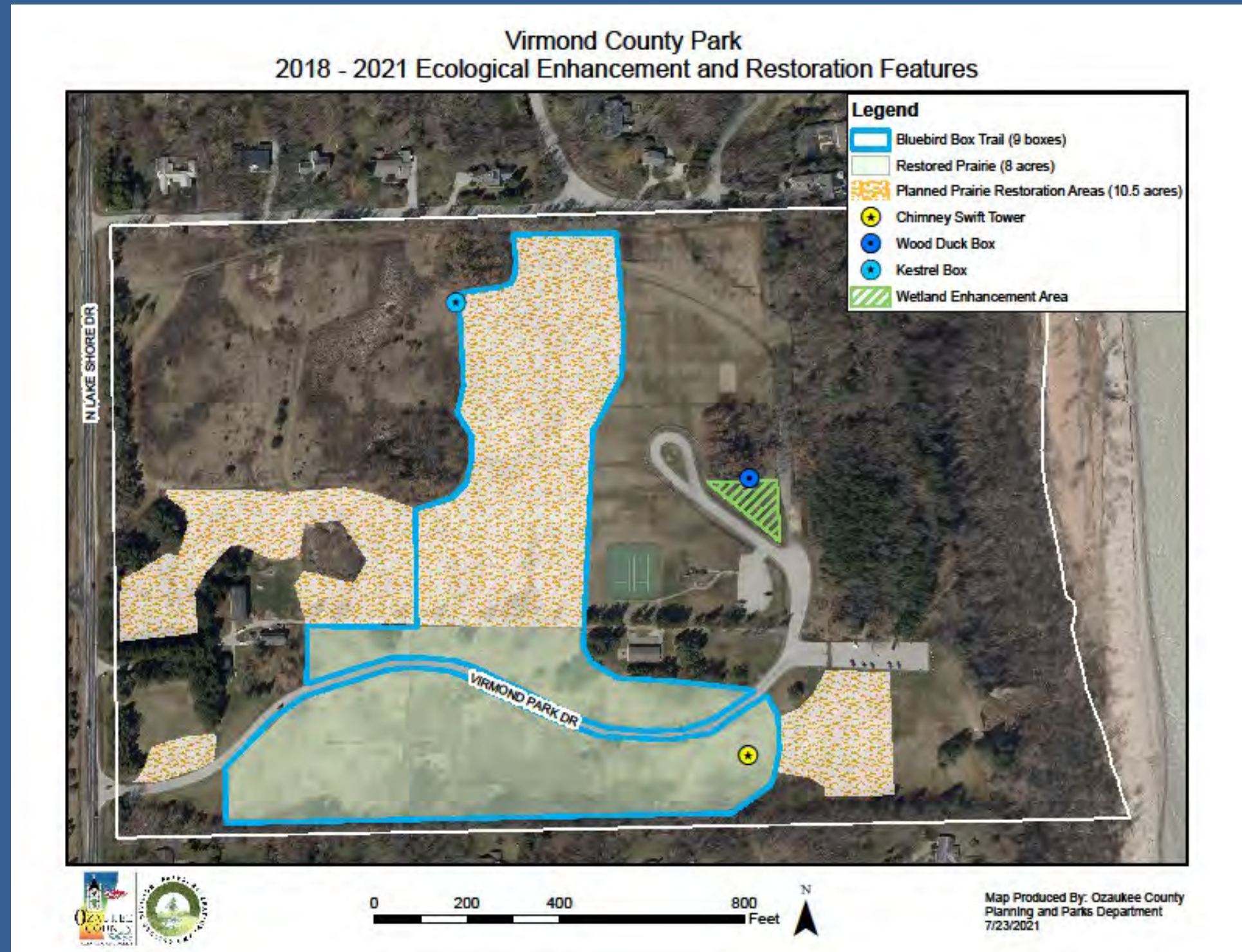
- Recommended in Recent Master Plan
- Capture Drainage from Existing Stormwater and Wetlands Causing Issues on Neighboring Properties, Bluff Erosion
- Reroute Drainage Away From Sensitive Areas
- Native Vegetation Plantings to Provide Habitat





# Virmond County Park - Restoration

- Wetland Restoration
- Prairie Restoration
- Invasive Species Removal
- Tree Planting
- Habitat Enhancement (e.g. bird boxes)





# Mee-Kwon County Park – Engineering and Design

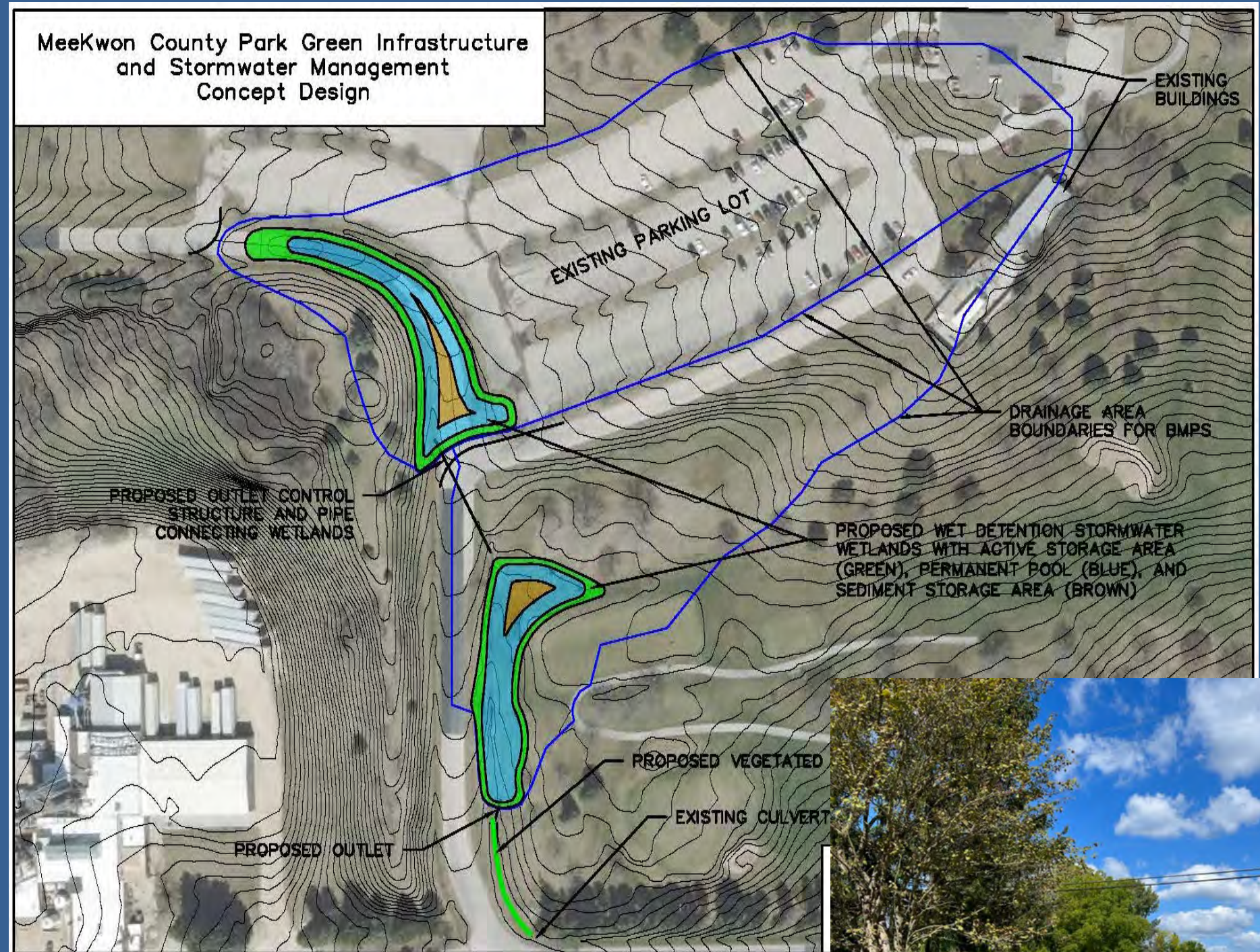
## Overall Project Goals:

- Remove an unnecessary portion of asphalt near the golf course clubhouse and create two stormwater wetlands to treat stormwater runoff from the parking lot, improve water quality, and reduce peak flows for downstream neighbors and streams
  - Wetland 1 will have a contributing watershed area of 4 acres
  - Primary discharge from wetland 1 will enter wetland 2, which also receives runoff from an additional 2.8 acres
- System is expected to remove ~90% of the total suspended solids and 60% of the total phosphorus loads from the project drainage areas
- Wetlands will be planted with native vegetation to provide habitat for a variety of native wildlife species and aesthetics



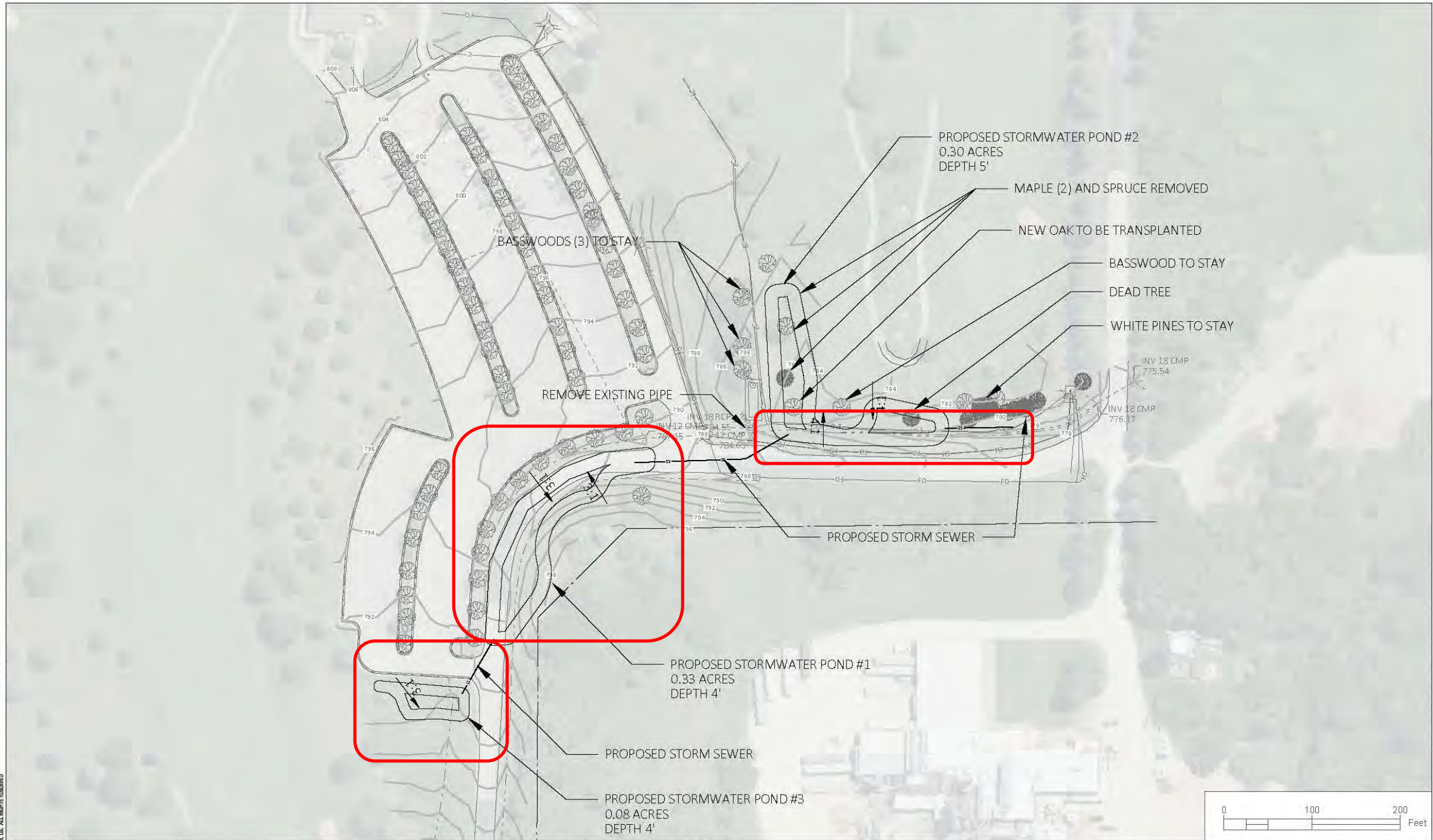
# Mee-Kwon County Park Wetland Restoration & Stormwater Management

- Total Contributing Area of ~ 4 acres that is 65% impervious
- Removal of 90% of TSS and 60% of Total P
- Drains to Pigeon Creek and Milwaukee River
- Native Vegetation Plantings to Provide Habitat
- Permanent Educational Signage and New Hiking Trail along wetlands connecting park areas
- Construction Planned 2022-2023





# Engineering and Design



PROJECT: 22-706-124 MEE KWON GOLF COURSE DEVELOPMENT (MEQUON) 18 MEQUON CONCEPT PLAN V2.DWG DATE OF PLOT: 04/11/2022 7:40 AM  
 COPYRIGHT © 2022 M SQUARED ENGINEERING, LLC. ALL RIGHTS RESERVED

LEGEND	
PROPOSED STORMWATER POND	
PROPOSED STORM PIPE	
EXISTING PROPERTY LINE	
EXISTING ELECTRIC	
EXISTING FIBER OPTIC	
EXISTING CABLE	
EXISTING UTILITY PEDESTAL	
EXISTING STORM SEWER	

DATE	DESCRIPTION OF REVISION	NORTH ARROW:

<b>PROJECT:</b> <b>MEE KWON GOLF COURSE</b> 6333 W BONNIEWELL RD MEQUON, WI 53097	
<b>PROJECT #:</b> 22-706-124	<b>DATE:</b> 04/11/2022
<b>DRAWN BY:</b> PP	<b>CHECKED BY:</b> MPH

PREPARED BY:  
  
**M SQUARED ENGINEERING LLC**  
 M SQUARED ENGINEERING.COM  
 CEDAR BURGS - (262) 376-4246

0 100 200 Feet	
<b>CLIENT:</b> <b>MEE-KWON GOLF COURSE</b> 6333 W BONNIEWELL RD MEQUON, WI 53097	<b>SHEET:</b> 1
<b>DRAWING TITLE:</b> PROPOSED SITE PLAN	



# Mee-Kwon County Park - Stormwater Wetland Areas





# Little Menomonee River Fish and Wildlife Preserve

## Overall Project Goals:

- Convert straightened portion of Little Menomonee River into meandering stream and connect to restored floodplain wetland
- Construct several wetlands adjacent to this reach of the river, including:
  - Emergent marsh
  - Wooded ephemeral pond
  - Waterfowl and shorebird wetland that removes pollutants from stormwater runoff
- The series of wetlands are configured to detain water for flood management benefits, remove pollutants, and provide habitat for species of local conservation interest



# Little Menomonee River – Project Objectives

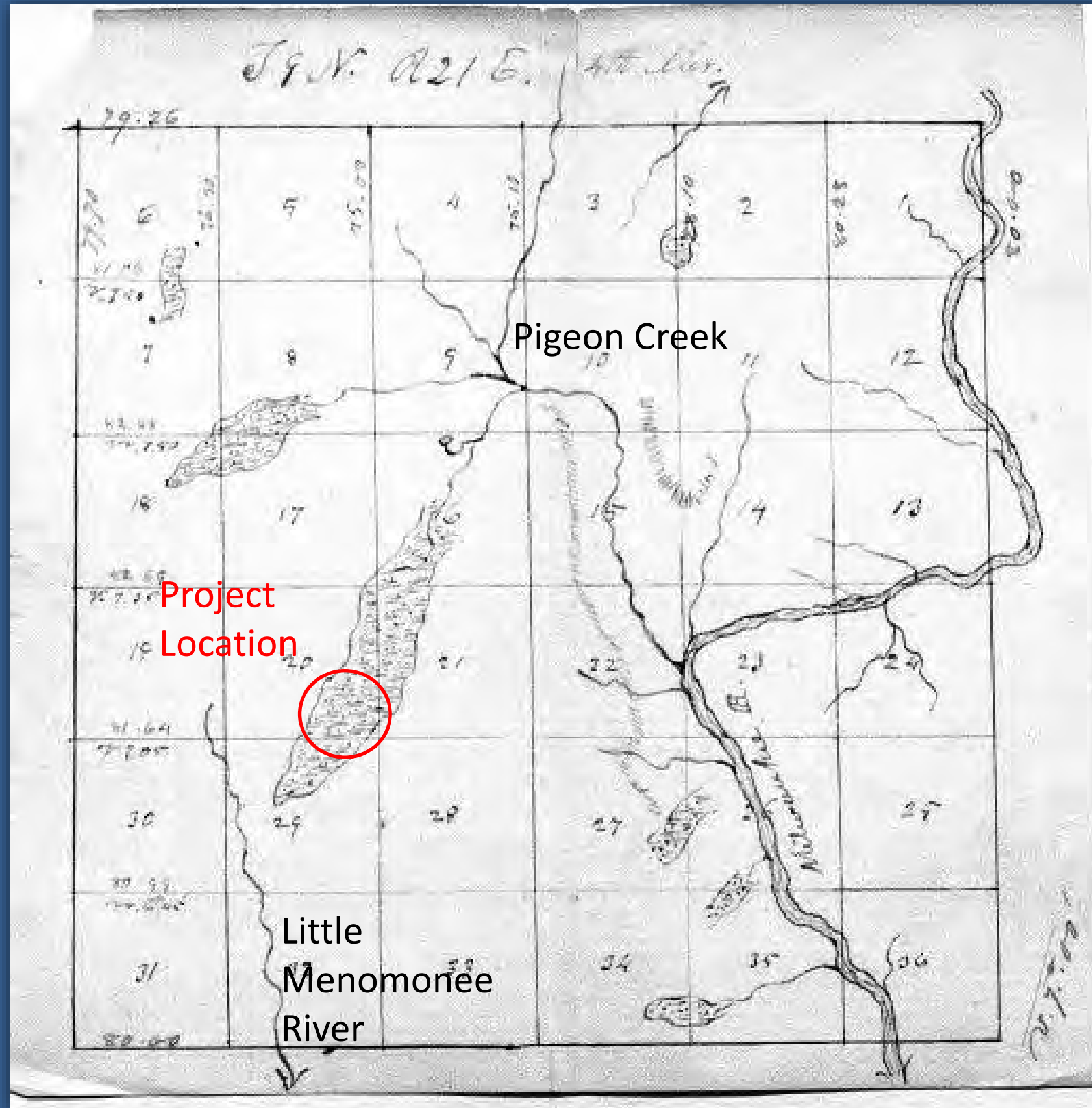
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Goal: Restore ecological function to the Little Menomonee River and adjacent wetland systems

- Improve habitats for fish and wildlife
- Improve geomorphic function of the Little Menomonee River
- Improve overall native vegetation diversity
- Demonstrate successful use of the GIS Tool
- Improve water quality
- Document impacts through monitoring – biological and chemical

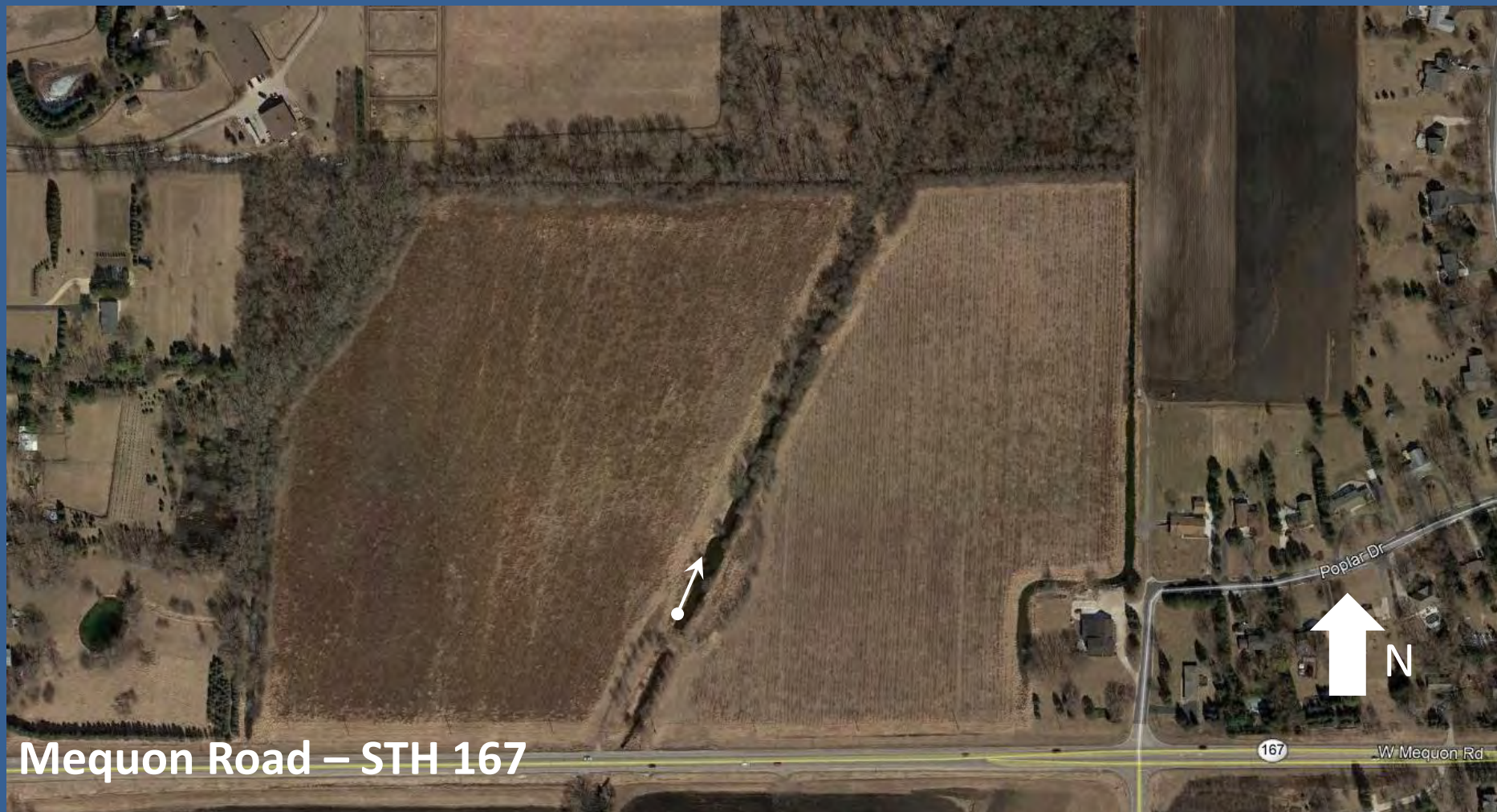
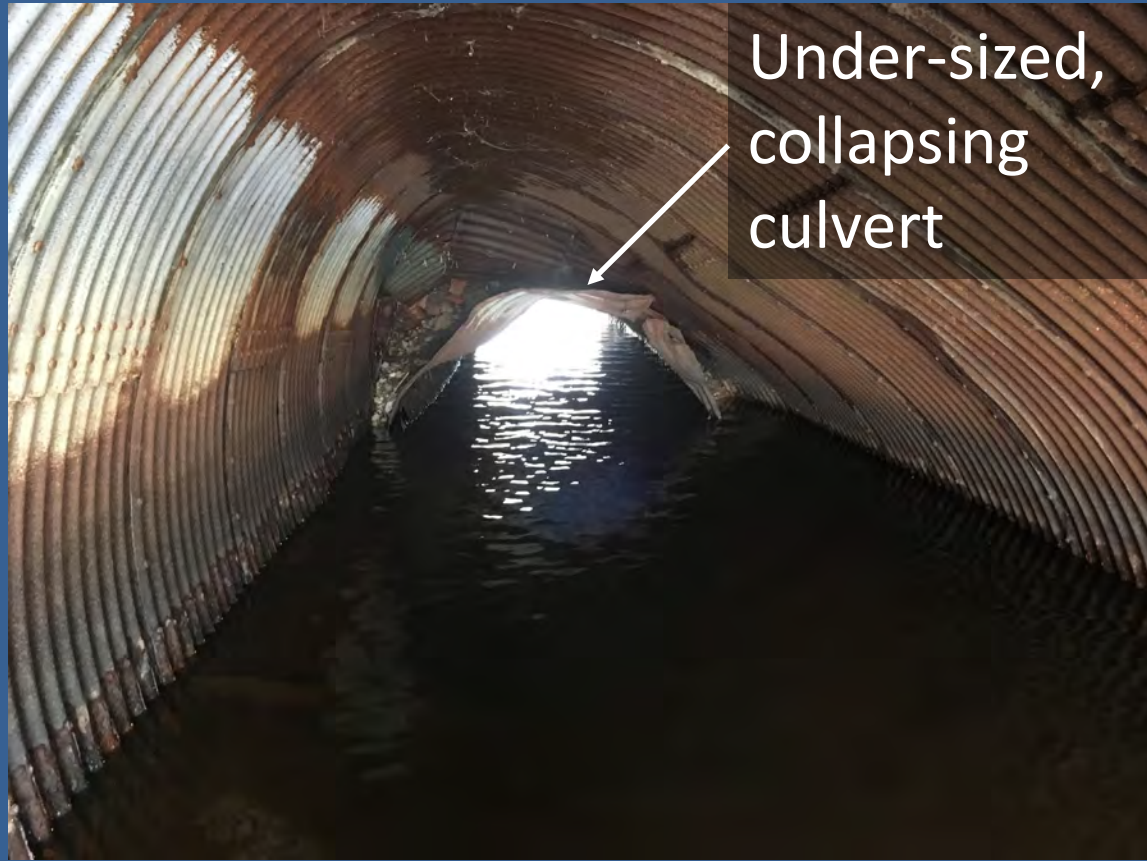


# Original Land Survey 1836



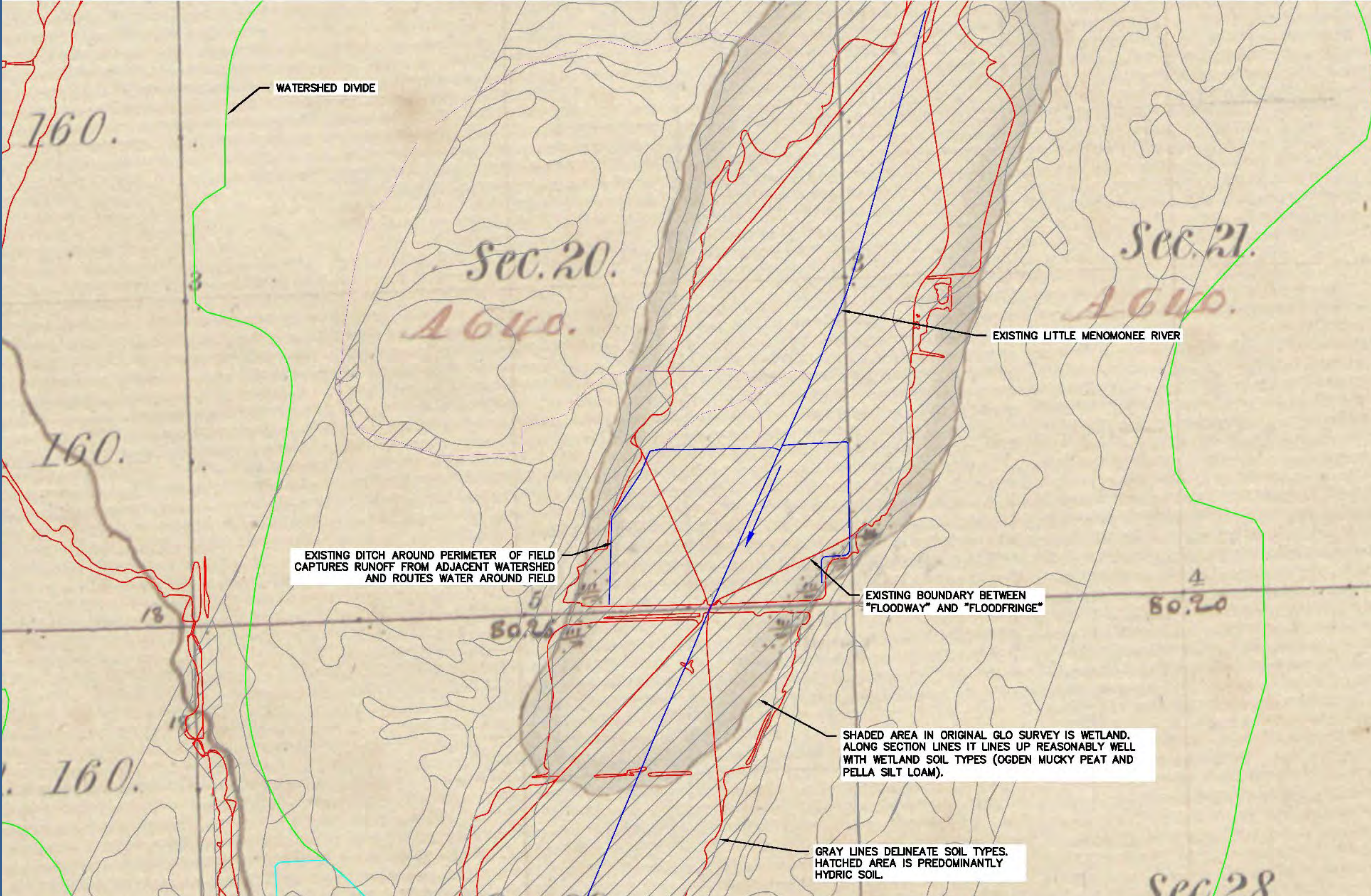


# Existing Conditions





# Existing Conditions over Historic Survey





# GIS-Based Fish and Wildlife Decision Support Tool

- Program staff and partners are developing and refining GIS Tools to:
  - Identify native fish and wildlife Species of Local Conservation Interest (SLCI)
  - Identify critical habitats important to ensuring the survival of native fish and wildlife, especially SLCI's
  - Guide habitat enhancement projects for maximum economic and ecological value

## Ozaukee County Planning & Parks Department FISH PASSAGE PROGRAM

### Coastal Fish and Wildlife Habitat Protection and Planning

#### Existing and Potential Wildlife Habitat

Source: WDNR

#### Existing and Potentially Restorable Wetlands

Source: WDNR

#### Overall Process

Select watershed and gather data Develop Data (Drainage Delineation, Road Center, Grazing) ID Potentially Restorable Wetlands Fish & Wildlife Habitat Test Water Quality and Hydrology Tools Apply Models for Decision making	<b>Maximizing Habitat Quality</b> Solve Umbrella Species Populate Matrices Apply Pressure & Patch Size Test the model Develop Habitat Quality Index (HQI) Apply Models for Decision making
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#### UMBRELLA SPECIES FISHERIES

Northern Pike

Sturgeon

Walleye

#### COMBINING ASSOCIATION RESULTS

Habitat Quality Index (HQI) = sum of all scores for each grid cell

#### WILDLIFE HABITAT QUALITY INDEX

Source: WDNR, NRCS, SEWPC

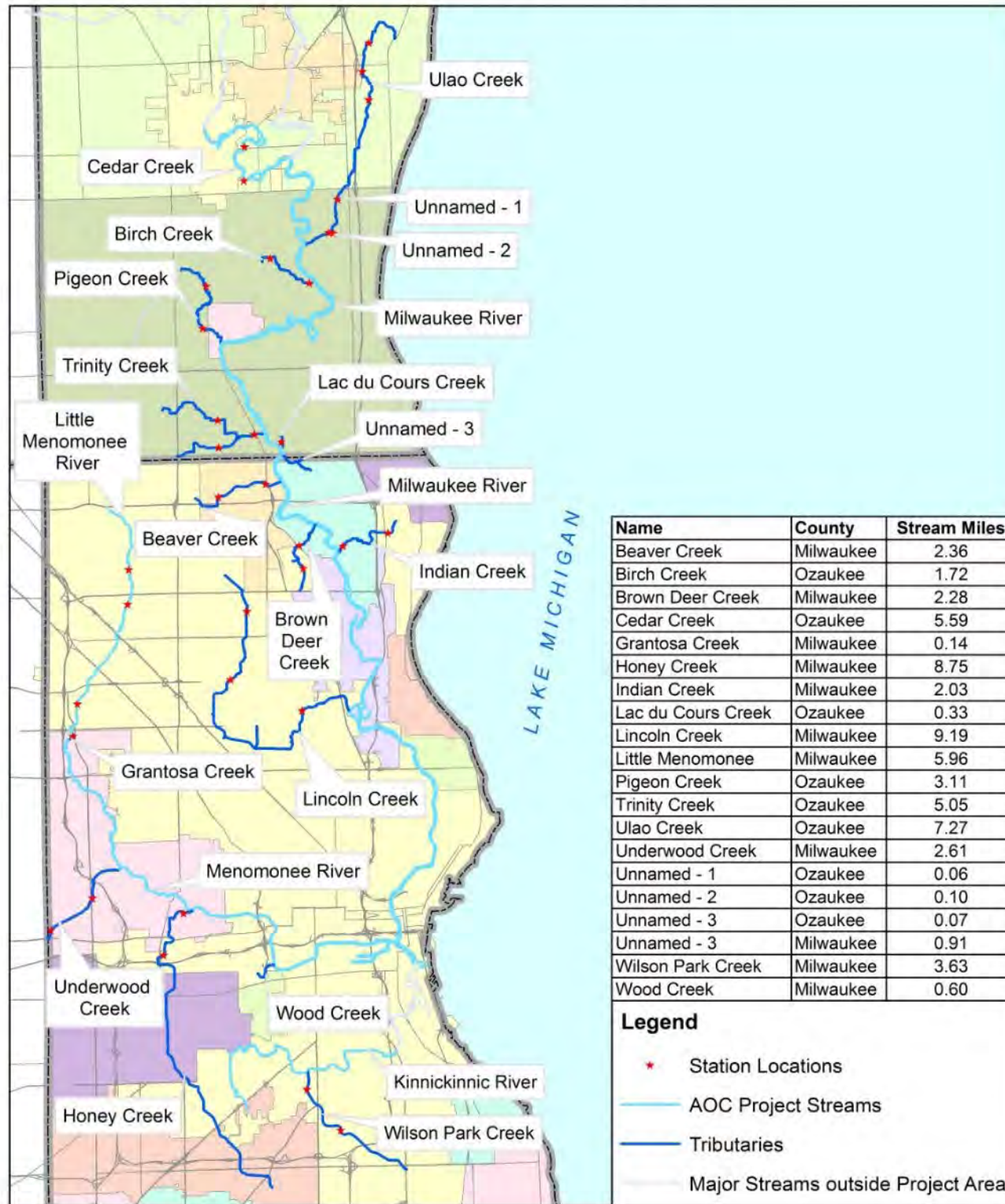
#### WILDLIFE HABITAT

OZAUKEE COUNTY PLANNING & PARKS DEPARTMENT  
 FISH PASSAGE PROGRAM  
 121 W. Main Street, PO Box 994, Port Washington, WI 53074  
 T 262.238.8257 F 262.238.8269 www.co.ozaukee.wi.us/planningparks  
 Andrew T. Struck, Director a struck@co.ozaukee.wi.us



# Habitat and Fish Inventories for Predictive Model

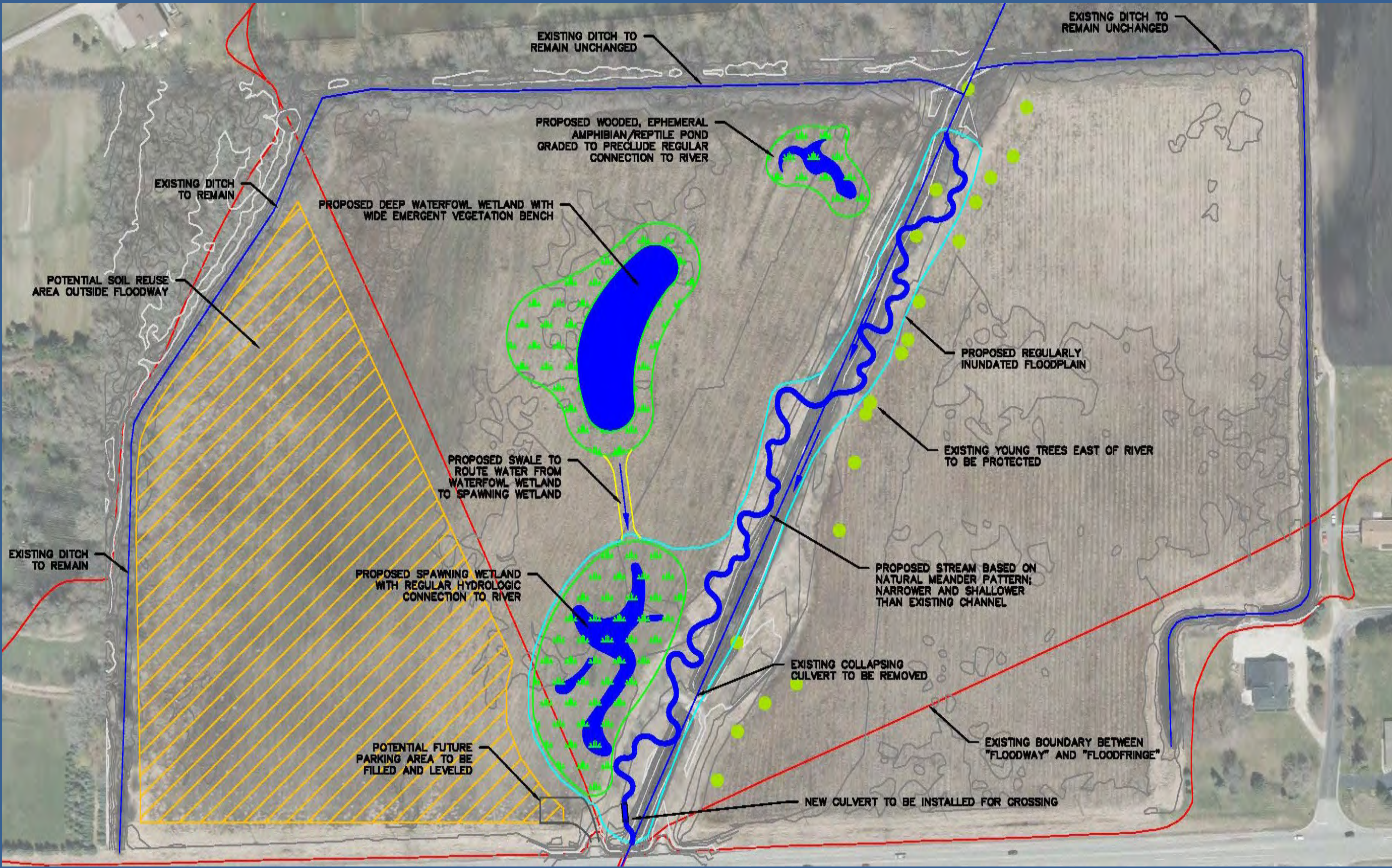
AOC Habitat Inventory Station Locations



Map Produced By: Ozaukee County Planning and Parks Department 1/17/2018

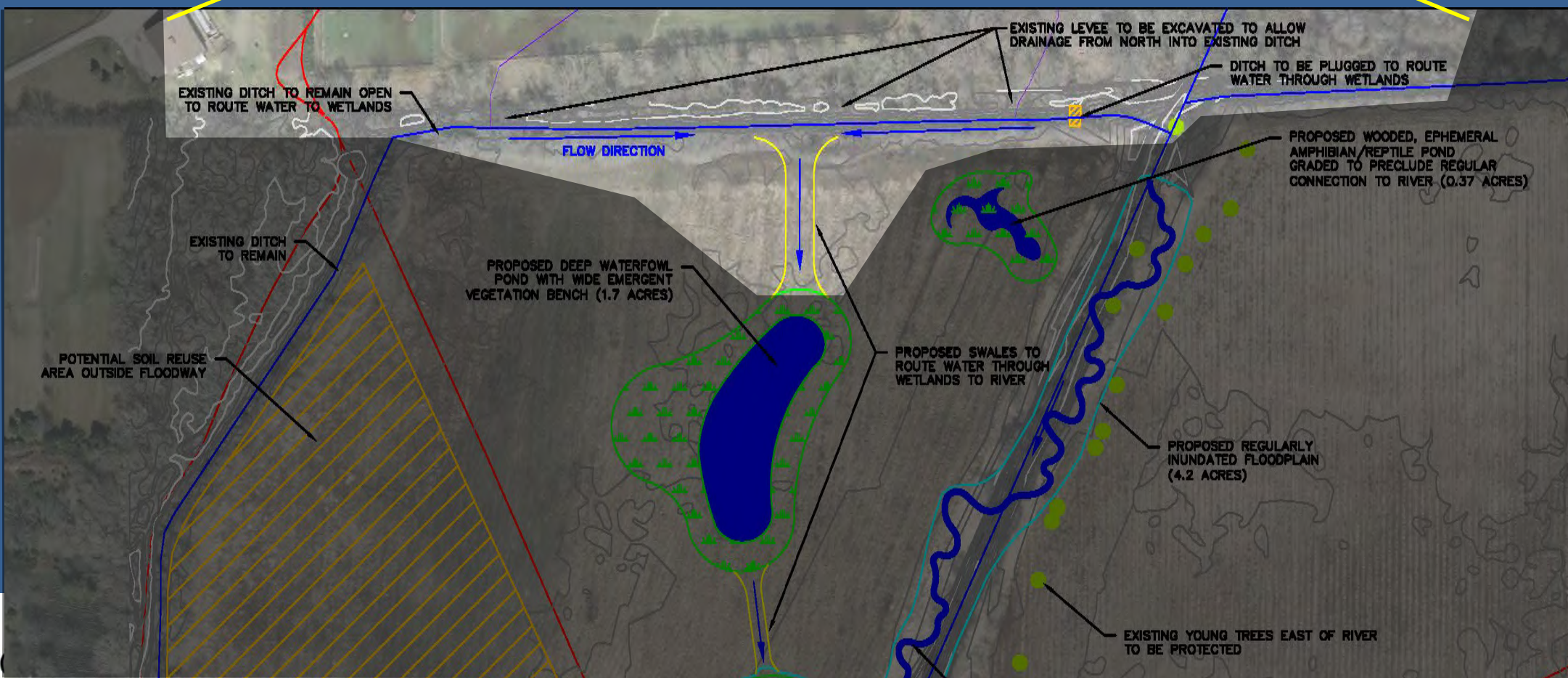


# Concept Design



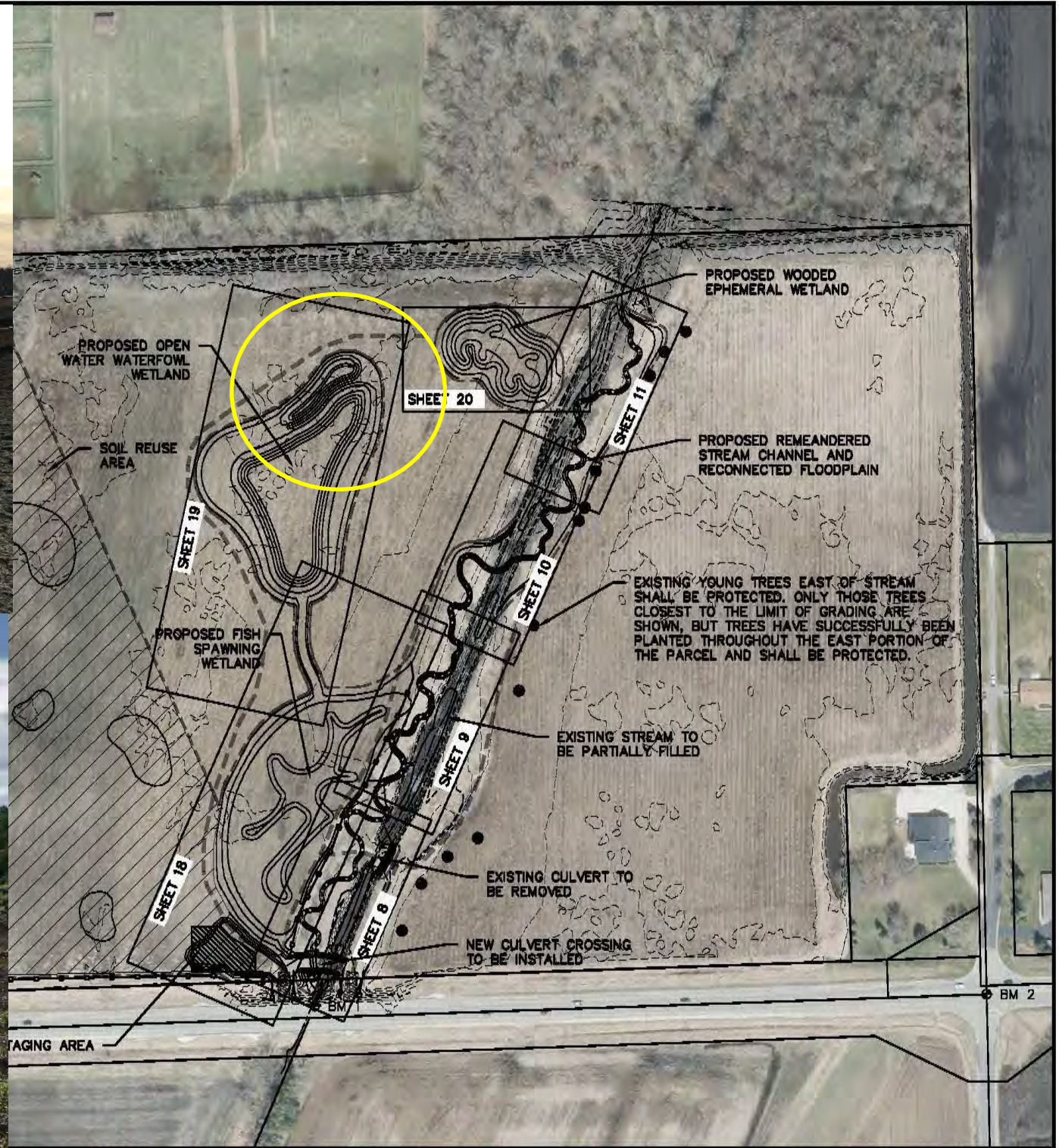


# Stormwater Management Alternative





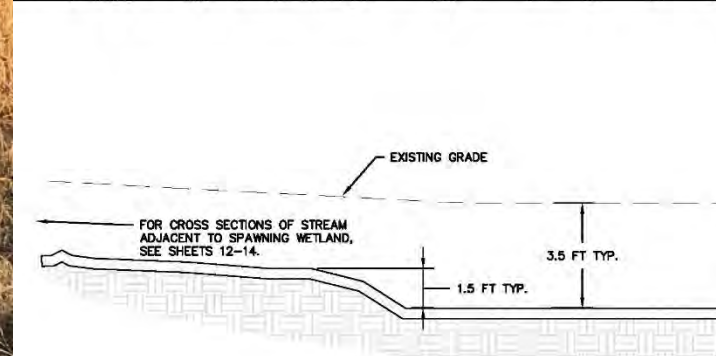
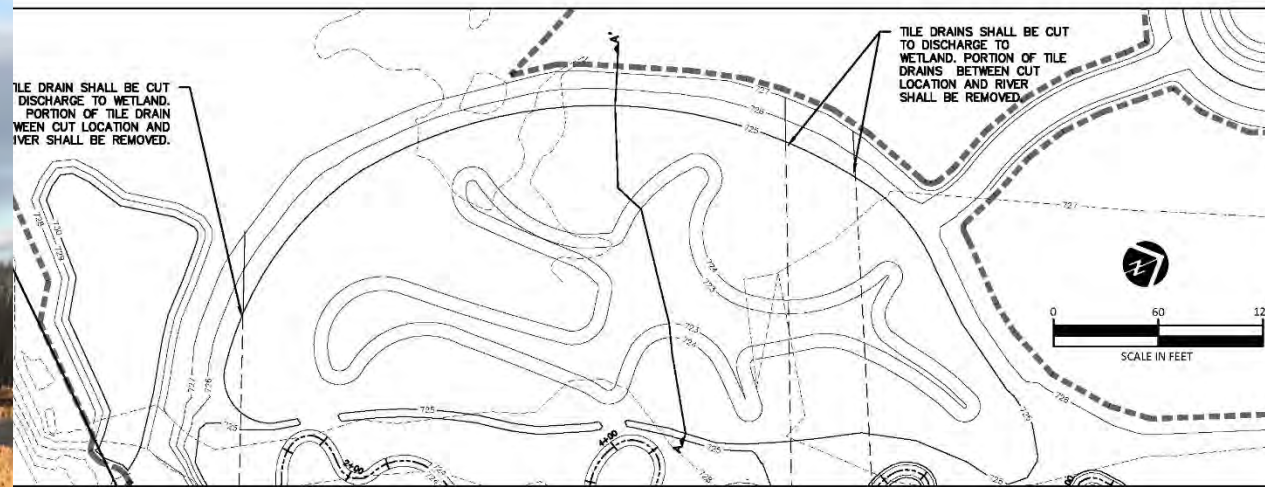
# Complete Engineering & Design Plans-Stormwater



 	 	 	 	<b>SITE PLAN AND PROJECT OVERVIEW</b>	<b>SHEET 3 OF 21</b>
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# Fish Spawning Wetland – Northern Pike



1  
18 TYPICAL SECTION A-A'  
SPAWNING WETLAND  
NTS



MBW, ATS  
DESIGNED  
9/19/19  
DATE




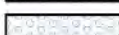
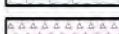


OZAUKEE COUNTY PLANNING AND PARKS DEPARTMENT  
LITTLE MENOMONEE RIVER CORRIDOR ECOSYSTEM RESTORATION  
MEQUON ROAD PARCEL





# Restoration and Planting Plan

## PLAN LEGEND

-  DIVERSE MESIC PRAIRIE (SEEDING)
-  WET PRAIRIE DOMINATED BY GRASSES (SEEDING)
-  EMERGENT WETLAND (SEEDING)
-  MESIC WOODS – WOODED WITH UNDERSTORY AND CANOPY TREE SPECIES
-  FLOODPLAIN MESIC WOODS – WOODED WITH CANOPY TREE SPECIES
-  SAVANNA – OPEN WITH SCATTERED CANOPY TREE SPECIES
-  LIMIT OF GRADING

## SPECIES LISTS



MBW, ATS  
DESIGNED  
9/19/19  
DATE

MBW  
CHECKED

OZAUKEE COUNTY PLANNING AND PARKS DEPARTMENT  
LITTLE MENOMONEE RIVER CORRIDOR ECOSYSTEM RESTORATION  
MEQUON ROAD PARCEL



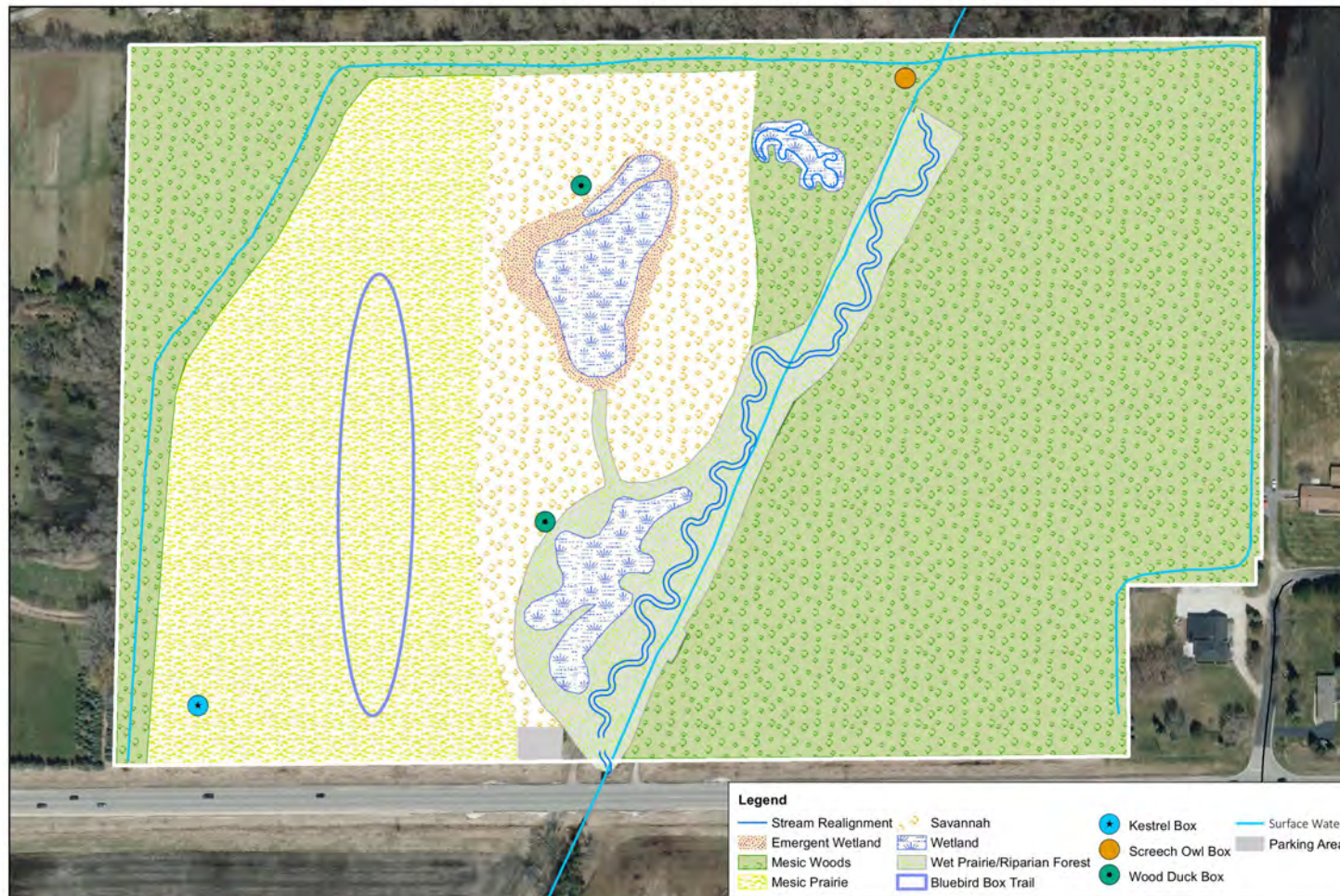
PLANTING PLAN

SHEET  
21 OF 21



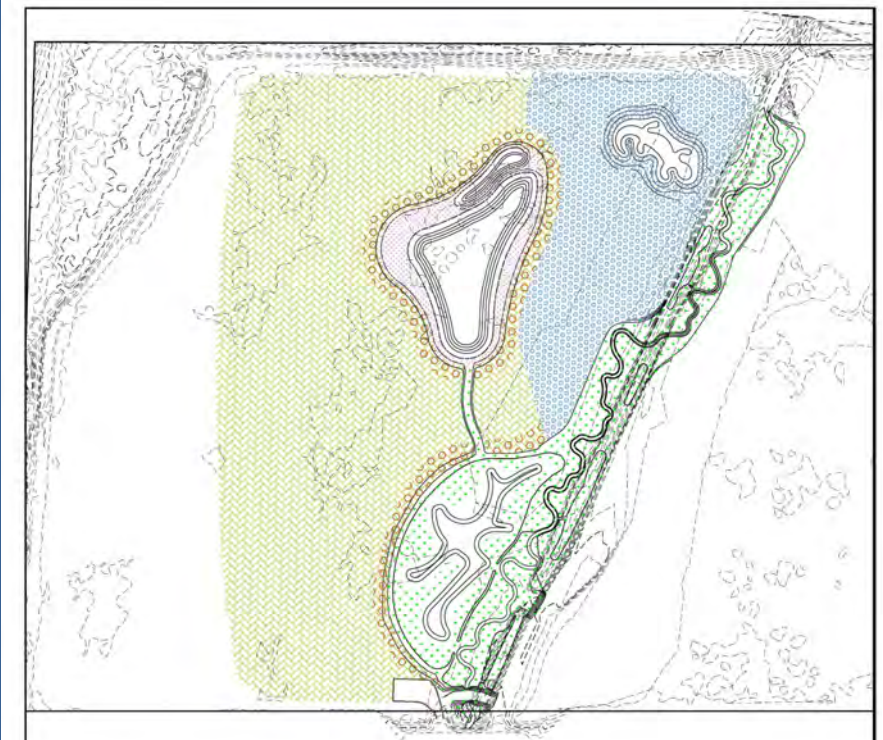
# Master Plan Restoration Map

Little Menomonee River Fish and Wildlife Area County Park  
Habitat Enhancement and Restoration Features



0 0.0175 0.035 0.07 0.105 0.14 Miles

Map Produced By:  
Ozaukee County Planning and Parks Department  
2/24/2021



**PLAN LEGEND**

- DIVERSE MESIC PRAIRIE (SEEDING) – 11.5 ACRES
- WET PRAIRIE DOMINATED BY GRASSES (SEEDING) – 3.5 ACRES
- EMERGENT WETLAND (SEEDING)
- MESIC WOODS – WOODED WITH UNDERSTORY AND CANOPY TREE SPECIES
- SAVANNA – OPEN WITH SCATTERED CANOPY TREE SPECIES

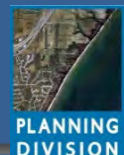


0 200 400  
SCALE IN FEET

LITTLE MENOMONEE RIVER CORRIDOR  
ECOSYSTEM RESTORATION  
MEQUON ROAD PARCEL

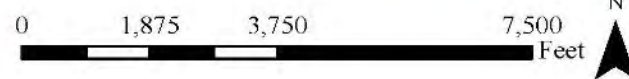
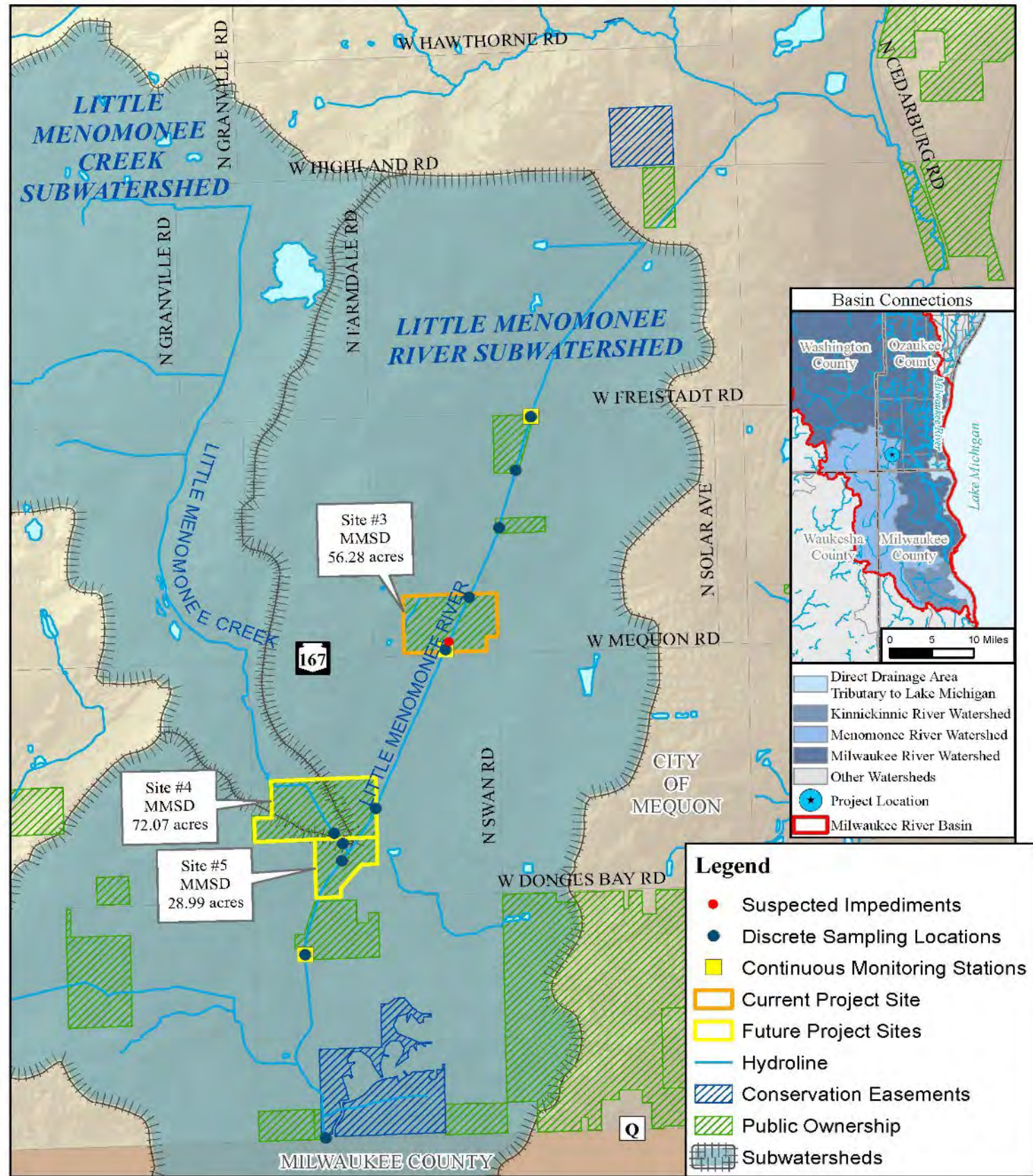


PLANTING PLAN





# Little Menomonee Corridor Ecosystem Restoration: Stream and Wetland Habitat Construction



Map Produced By: Ozaukee County  
Planning and Parks Department  
09/24/18



# Habitat Restorations – Water Quality Monitoring

- WQ monitoring to determine effectiveness of stream remeandering and wetland / floodplain reconnection as a best management practice to reduce pollutant loads (e.g., Total Maximum Daily Loads – TMDLS)
- Continuous Water Quality Sampling / On-site Handheld
  - Temperature (air & water), Turbidity, Water Depth, DO, pH, Conductivity, Total Dissolved Solids, Salts, Nitrates, Chlorides, Velocity, and Pressure Transducers – Depth to Calculate Flow/Discharge
- Grab Samples
  - Fecal Coliform (E-Coli with high hits), Total Phosphorus, Nitrites/Nitrates





# Little Menomonee River and Creek Water Quality Sampling Locations

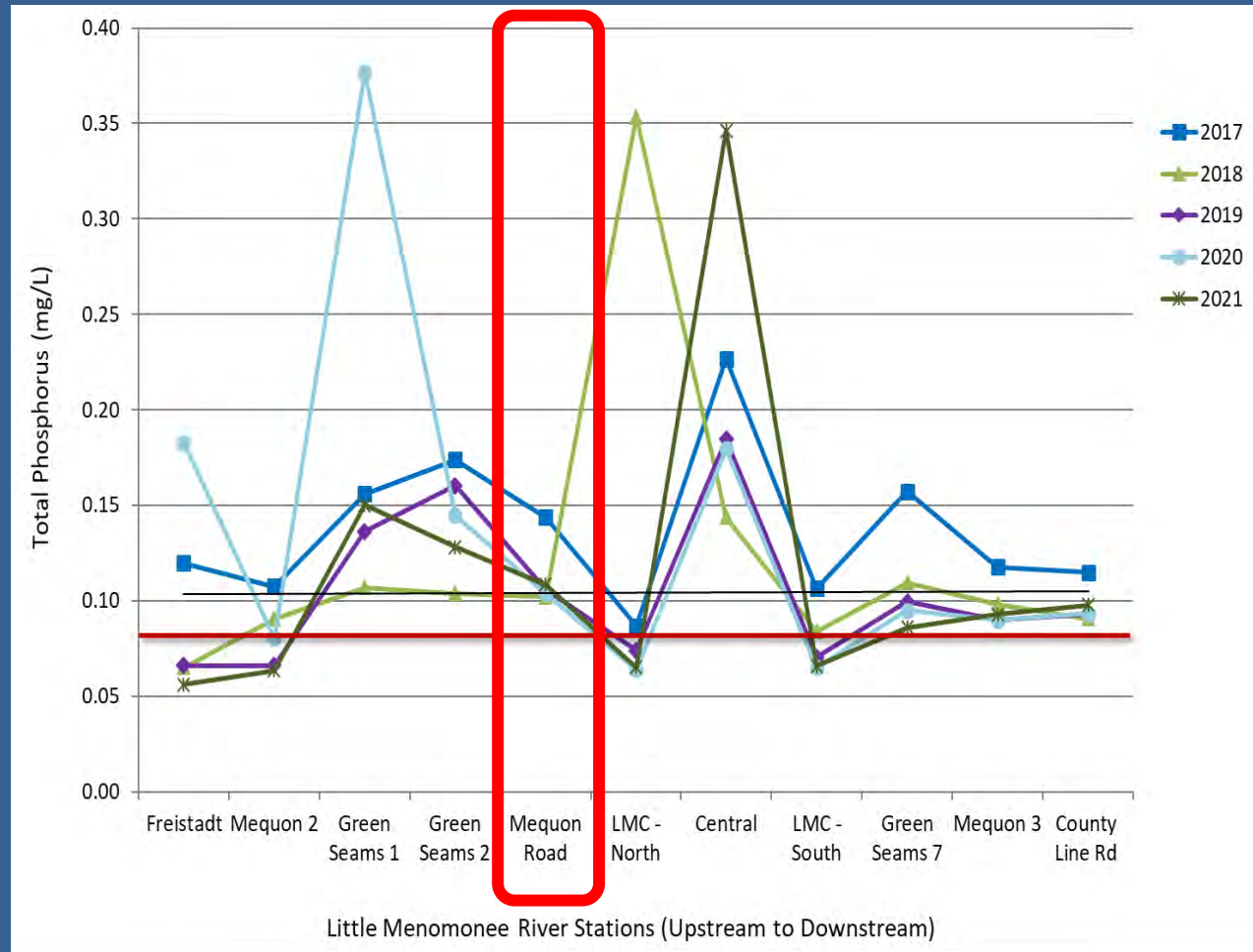


Map Produced By: Ozaukee County Planning and Parks Department  
9/4/2019

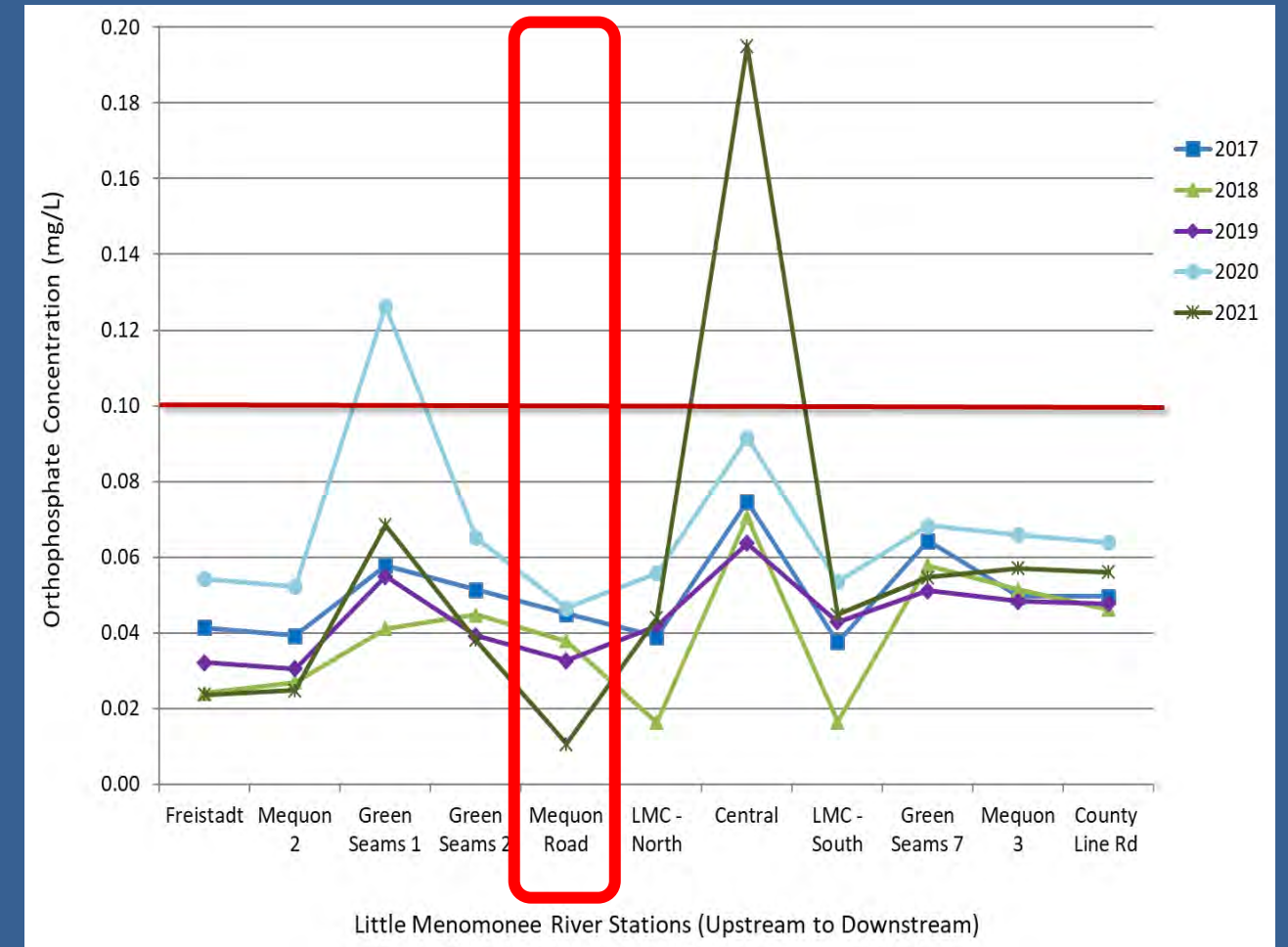


# Preliminary Results – Total Phosphorus and Orthophosphate

Mean concentrations of total phosphorus and orthophosphate (mg/L) per year per water quality sampling station on the Little Menomonee River and Creek in Ozaukee County, WI.



Total phosphorus - The red line is set at the established Wisconsin desirable concentration of 0.075 mg/L.

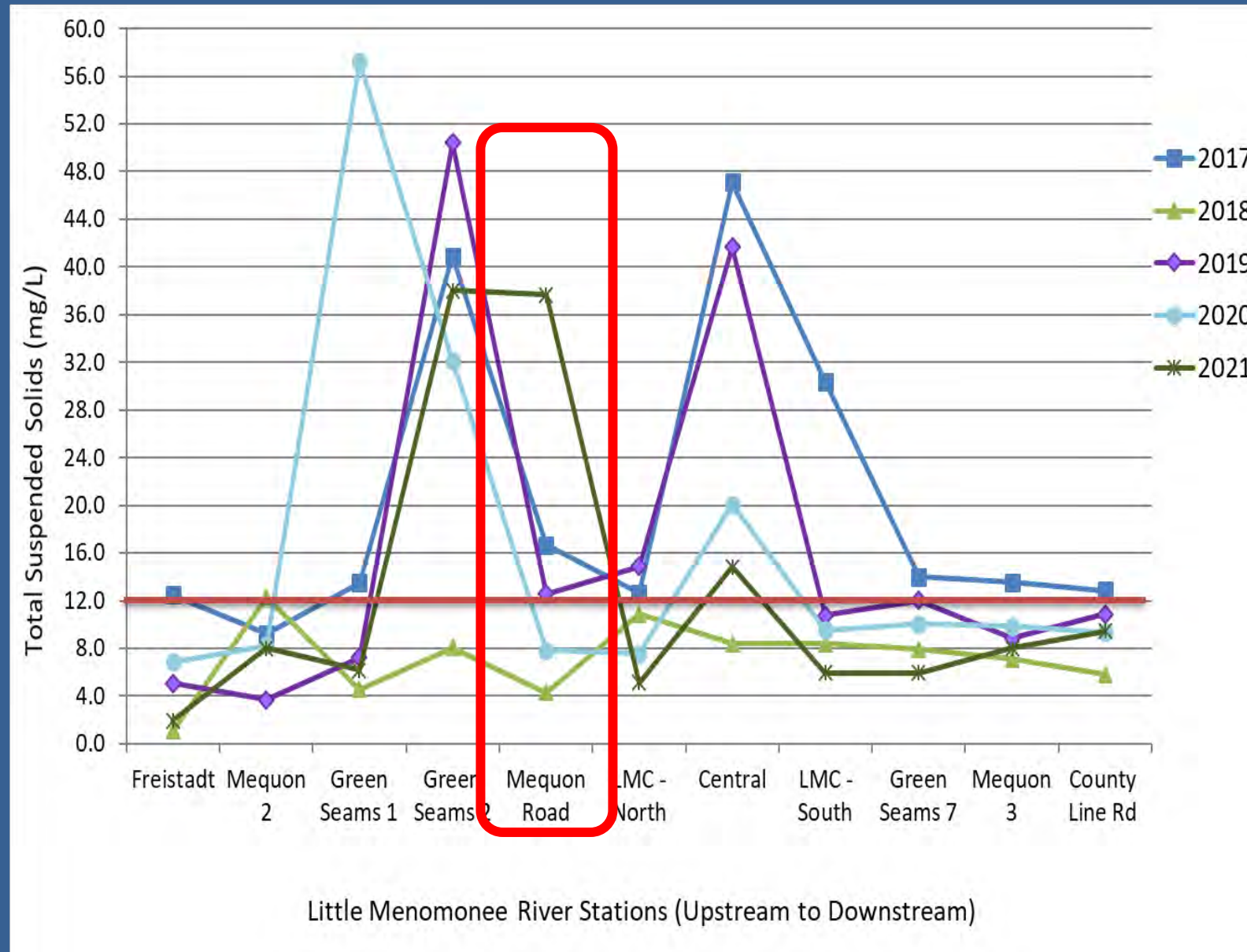


Orthophosphate - The red line is set at the maximum desired federal water quality standard of 0.1 mg/L.



# Preliminary Results – Total Suspended Solids

Mean total suspended solids concentration (mg/L) per year per water quality sampling station on the Little Menomonee River and Creek in Ozaukee County, WI.

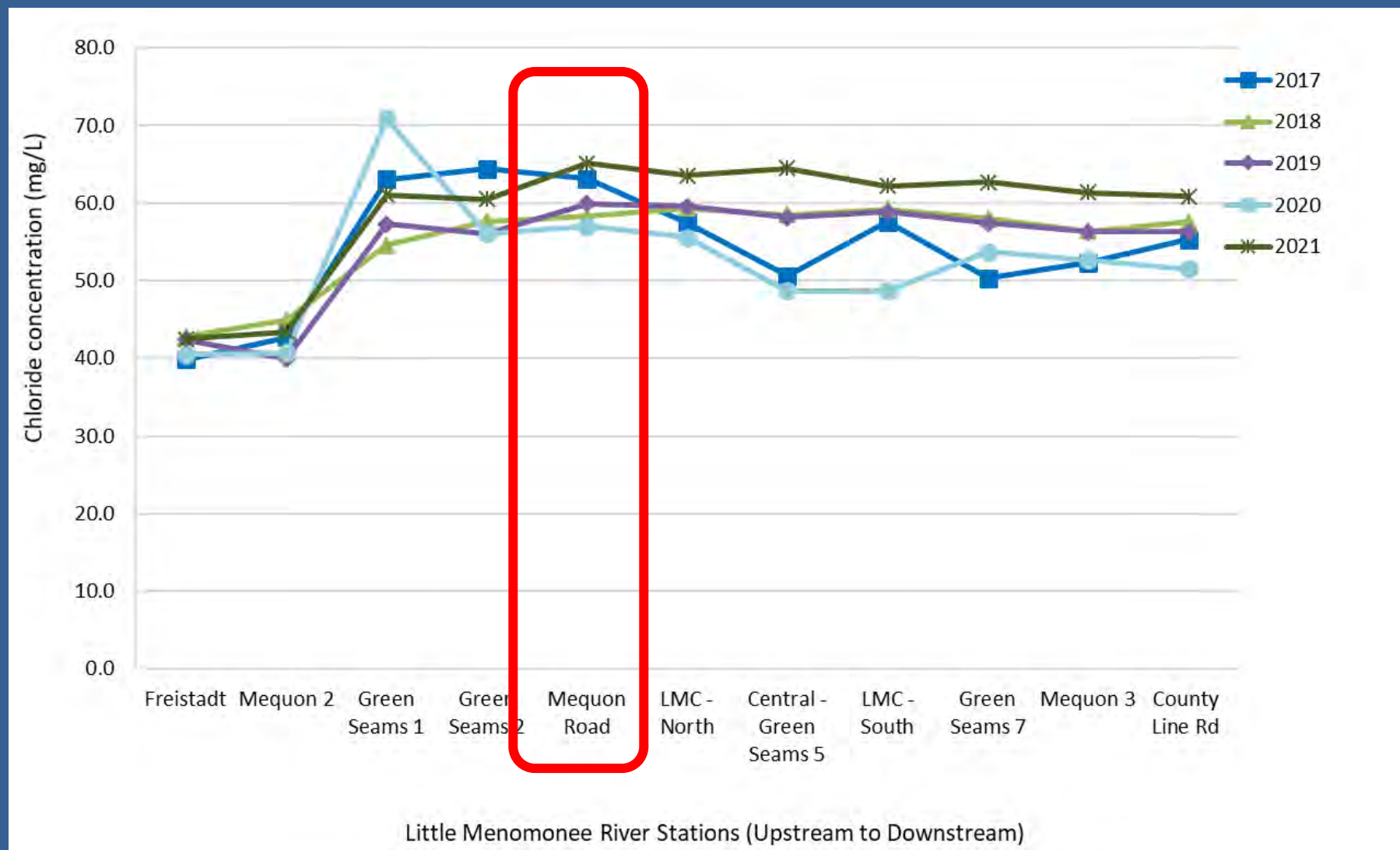


The red line indicates the TMDL target concentration of 12 mg/L.



# Preliminary Results – Chloride

Mean chloride concentration (mg/L) per year per water quality sampling station on the Little Menomonee River and Creek in Ozaukee County, WI.

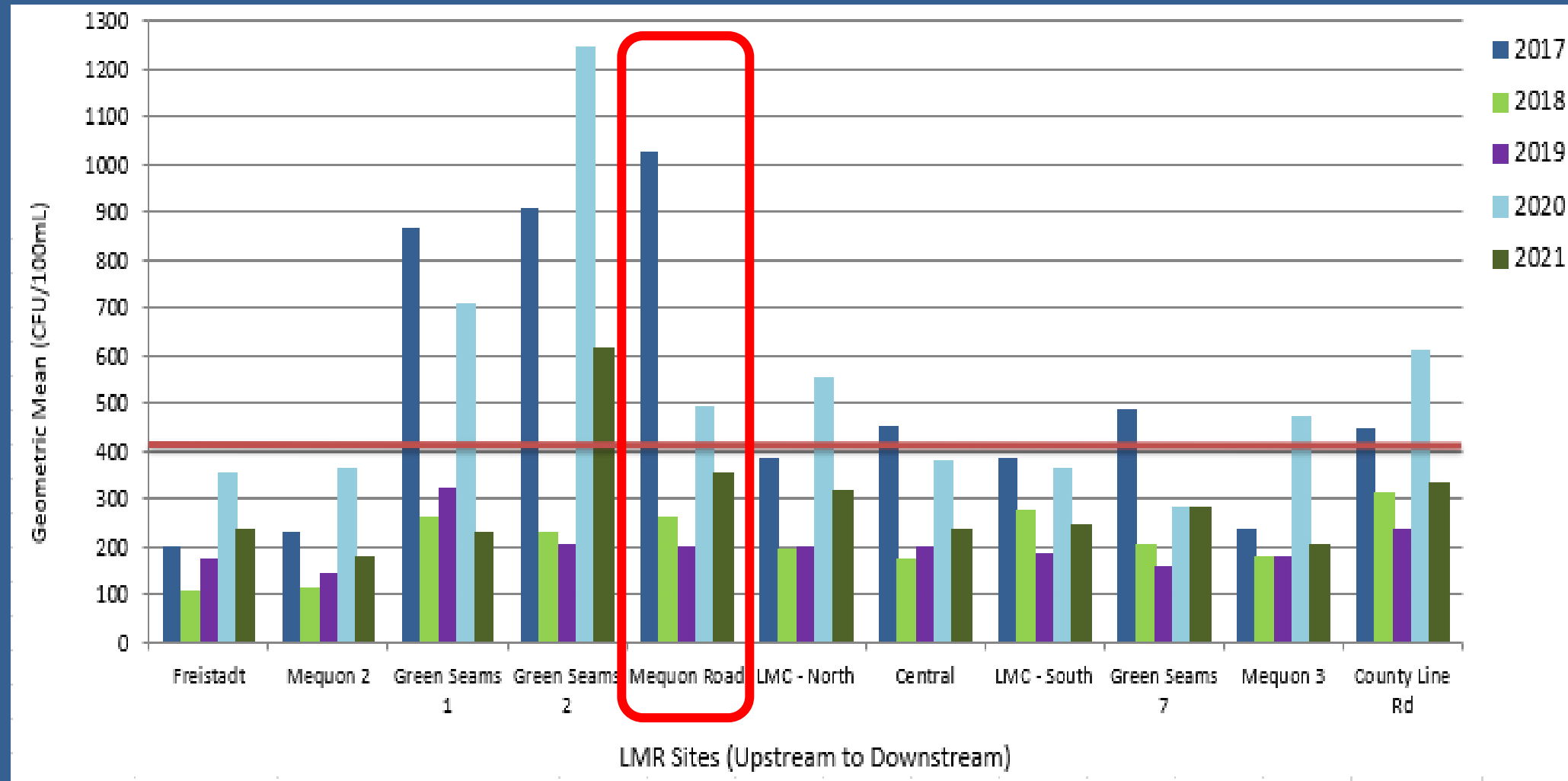


The WDNR has set the target concentration of chloride in Wisconsin's aquatic systems as less than 395 mg/L for chronic exposure and 757 mg/L for acute exposure.



# Preliminary Results – E. Coli

Mean *E. coli* concentration (MPU/100 mL) per year per water quality sampling station in the Little Menomonee River and Creek in Ozaukee County, WI.

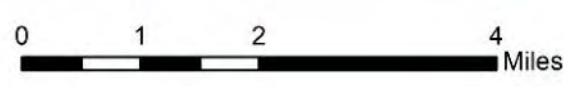
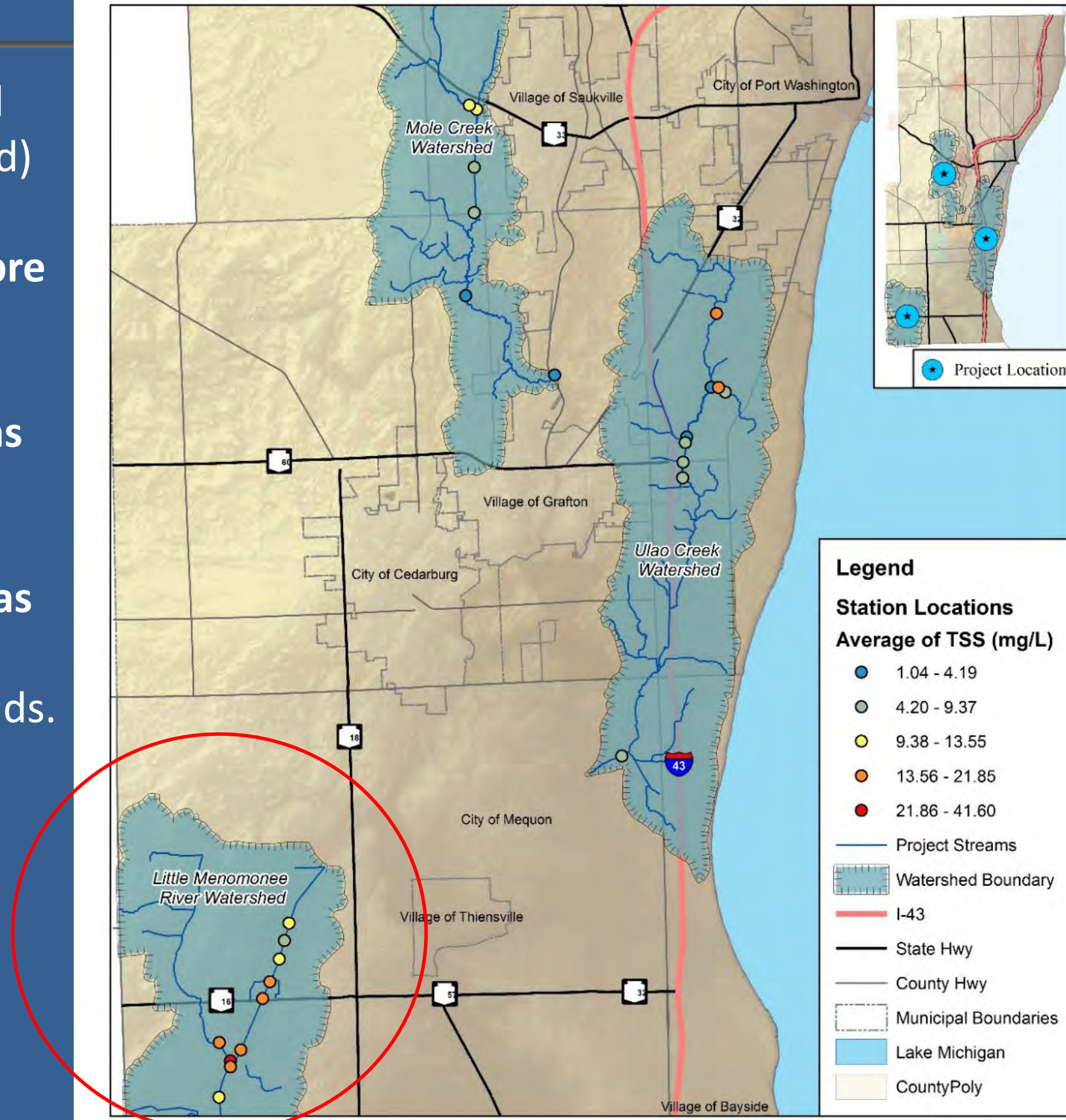


The red line indicates the Wisconsin State Recreational Use Standards for *E. coli* of a maximum of 410 CFU/100 mL.

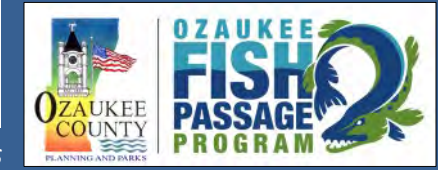
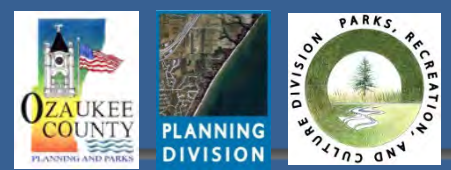


Acquire TMDL (Total Maximum Daily Load) constituent water quality monitoring pre and post stream, floodplain and wetland restorations to determine effectiveness of stream restoration as a BMP practice to reduce pollutant loads.

### Water Quality Monitoring - Average Total Suspended Solids (TSS) Little Menomonee, Mole, and Ulao Creek



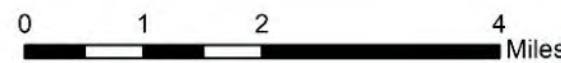
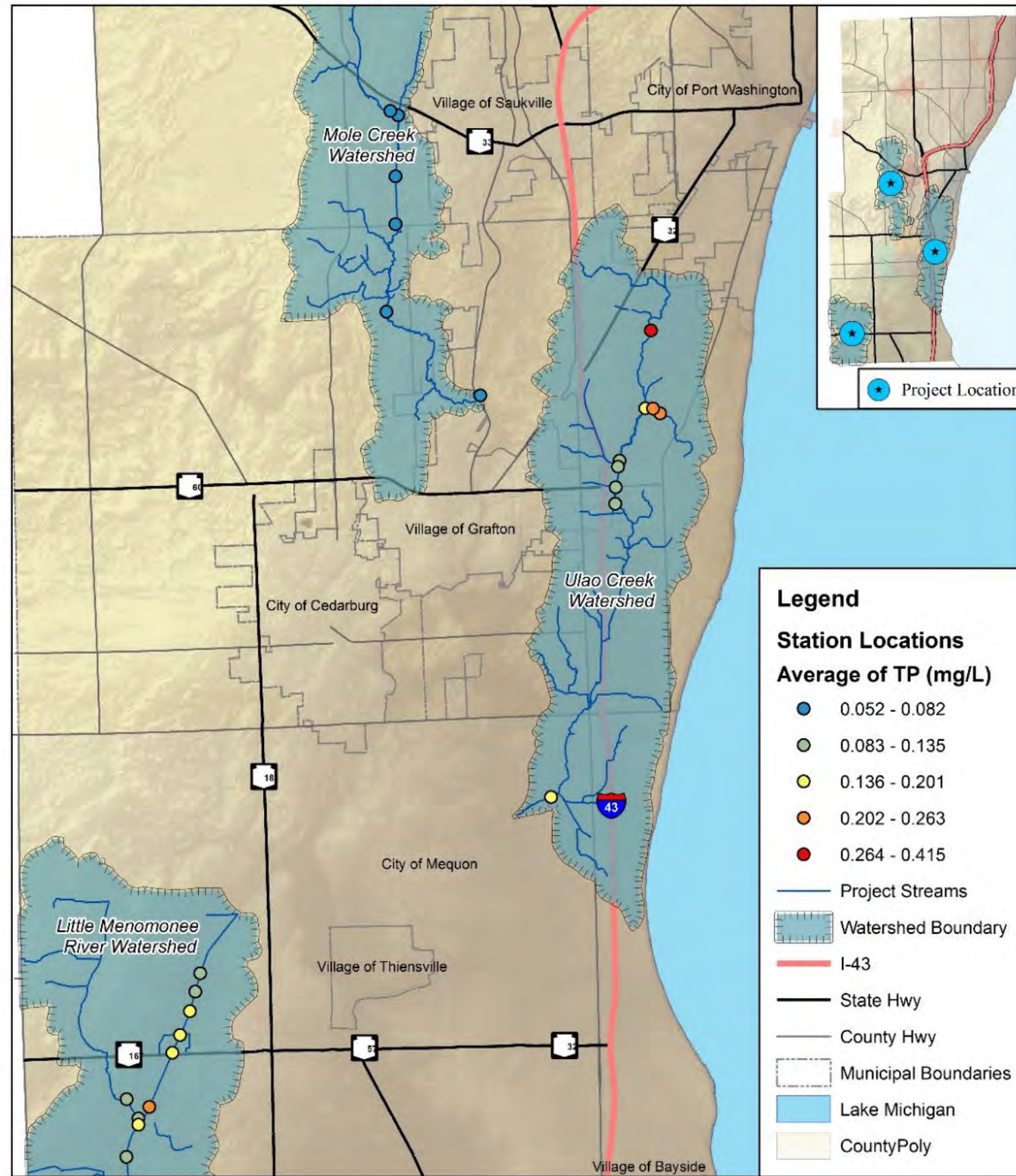
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2/14/2018



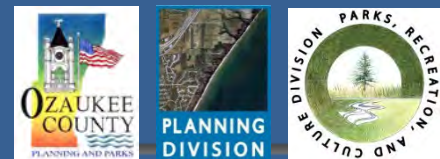


Compare water quality for three similarly sized watersheds (LMR, Mole, and Ulao Creek Watersheds) with comparable land uses under different temperature regimes (e.g. cold-cool water, cool-warm water and warm water).

### Water Quality Monitoring - Average of Total Phosphorus (TP) Little Menomonee, Mole, and Ulao Creek



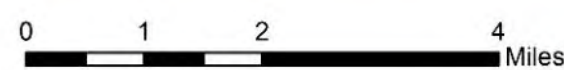
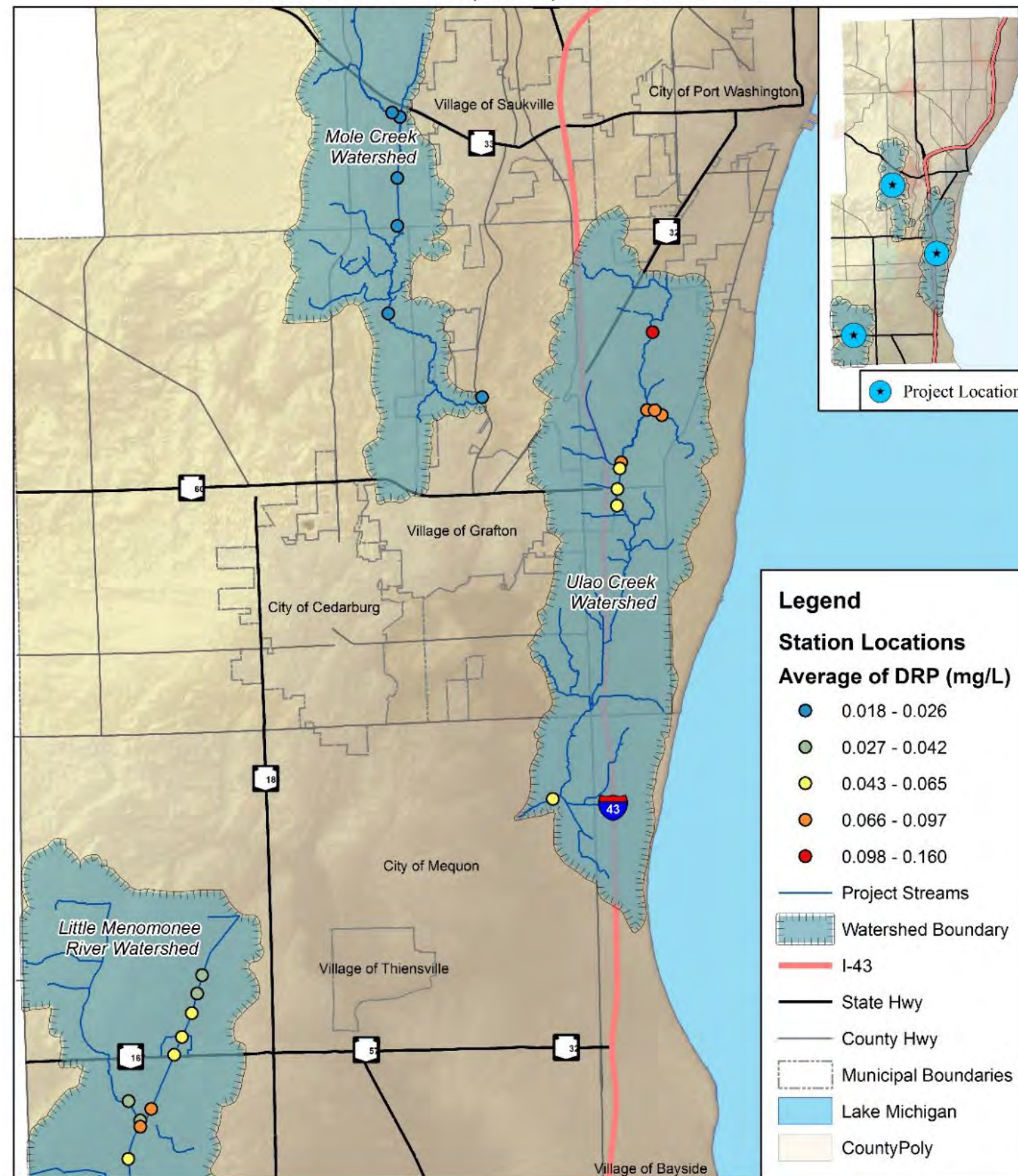
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Planning and Parks Department  
2/14/2018



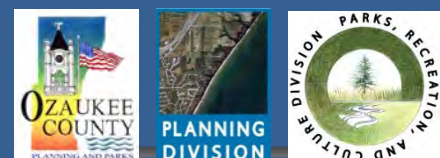


## Water Quality Monitoring - Average Dissolved Reactive Phos (DRP) Little Menomonee, Mole, and Ulao Creek

Relate water quality parameters (e.g. chemical) to biological (e.g. fisheries, macroinvertebrates) monitoring data through paired sampling.



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 Planning and Parks Department  
 2/14/2018





# Linking Chemical to Biological Water Quality



Larval trapping of young of the year fish at Little Menomonee River... Larval Northern Pike

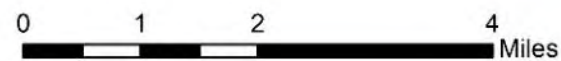
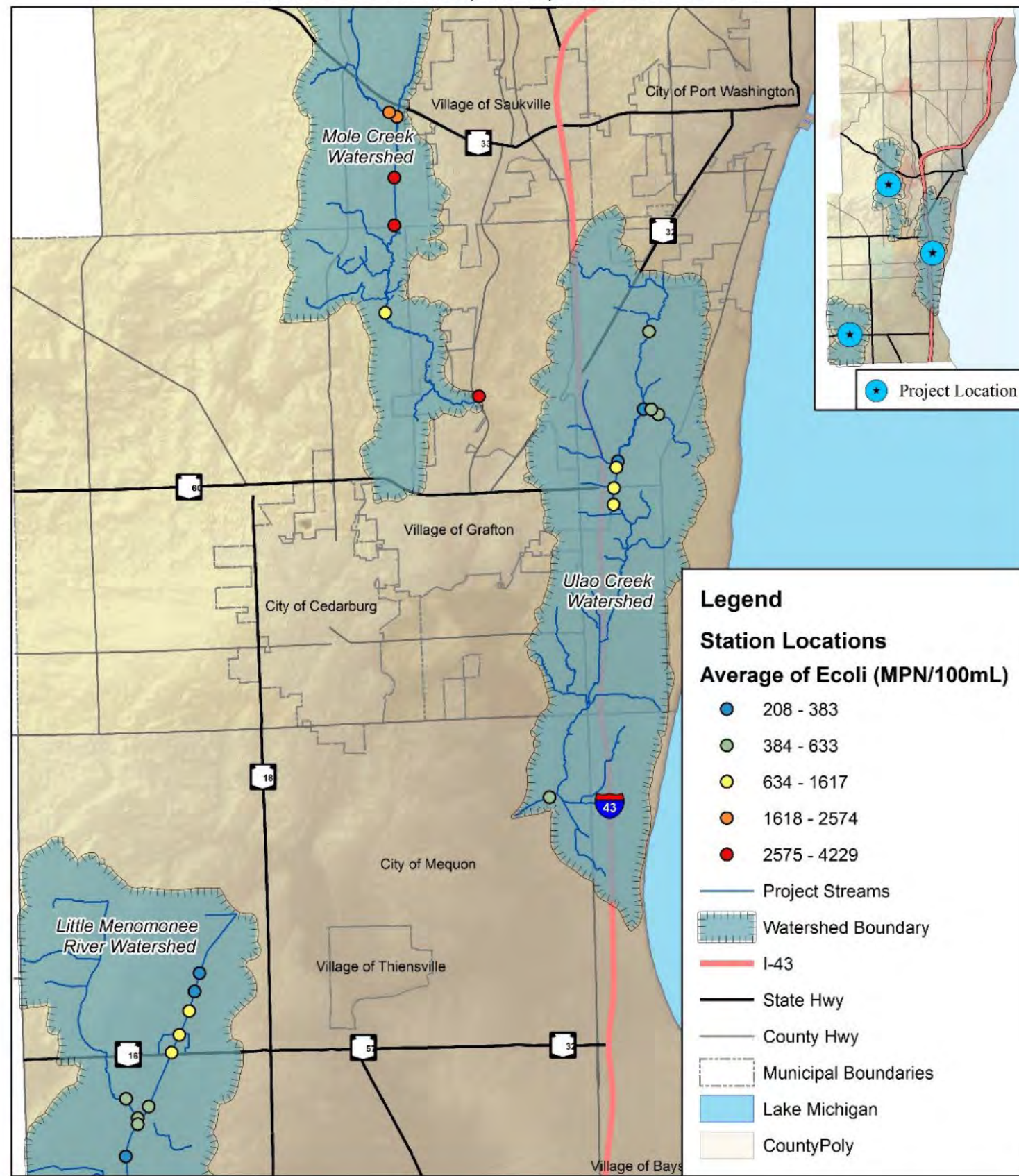


Electrofishing – Fisheries Community Sampling

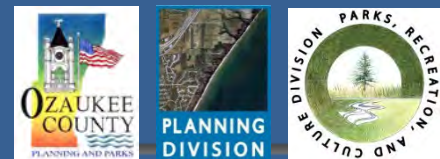


Assist in prioritizing the location and implementation of future restoration projects including additional channel remeandering, wetland restoration, floodplain reconnection, bank stabilization, and other best management practices (e.g. 9-Key Element Planning with MMSD on Fredonia Newburg Subwatershed).

### Water Quality Monitoring - Average of Ecoli Little Menomonee, Mole, and Ulao Creek



Map Produced By: Ozaukee County  
 Planning and Parks Department  
 2/14/2018





# SUMMARY – Little Menomonee River Fish & Wildlife Preserve

- Improve Stream Function and Habitat through Connectivity
  - Particularly for Species of Local Conservation Interest (SLCI)
- Improve Native Vegetative Diversity
  - Management of Invasive Species and Restoration of Native Plant Communities
- Maintain/Improve Flood Storage
  - Add Flood Storage Capacity
- Improve Water Quality
  - Management of Stormwater Contributions
  - Demonstrate improvement through Chemical and Biological Monitoring and Linkage
- Demonstrate the Utility of GIS Prioritization Tools for Planning
  - Prioritization of Projects (TMDL) and Ability to Seek Targeted Funding
  - Addition to the Ozaukee County Park System for Long-term Restoration & Preservation

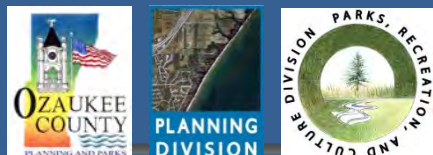


# Funding and Partners

## FUNDERS AND TECHNICAL PARTNERS



## OTHER COLLABORATORS AND TECHNICAL PARTNERS





# ~Making Connections Across Our Watersheds~



QUESTIONS?

Website:

[www.co.ozaukee.wi.us/540/Planning-Parks](http://www.co.ozaukee.wi.us/540/Planning-Parks)

Email: [astruck@co.ozaukee.wi.us](mailto:astruck@co.ozaukee.wi.us)