Masterman and Woodpile Lakes Update

Presentation by Pat Conrad,
Emmons & Olivier Resources, Inc. on
behalf of

Brown's Creek Watershed District
Board of Managers

water | ecology | community

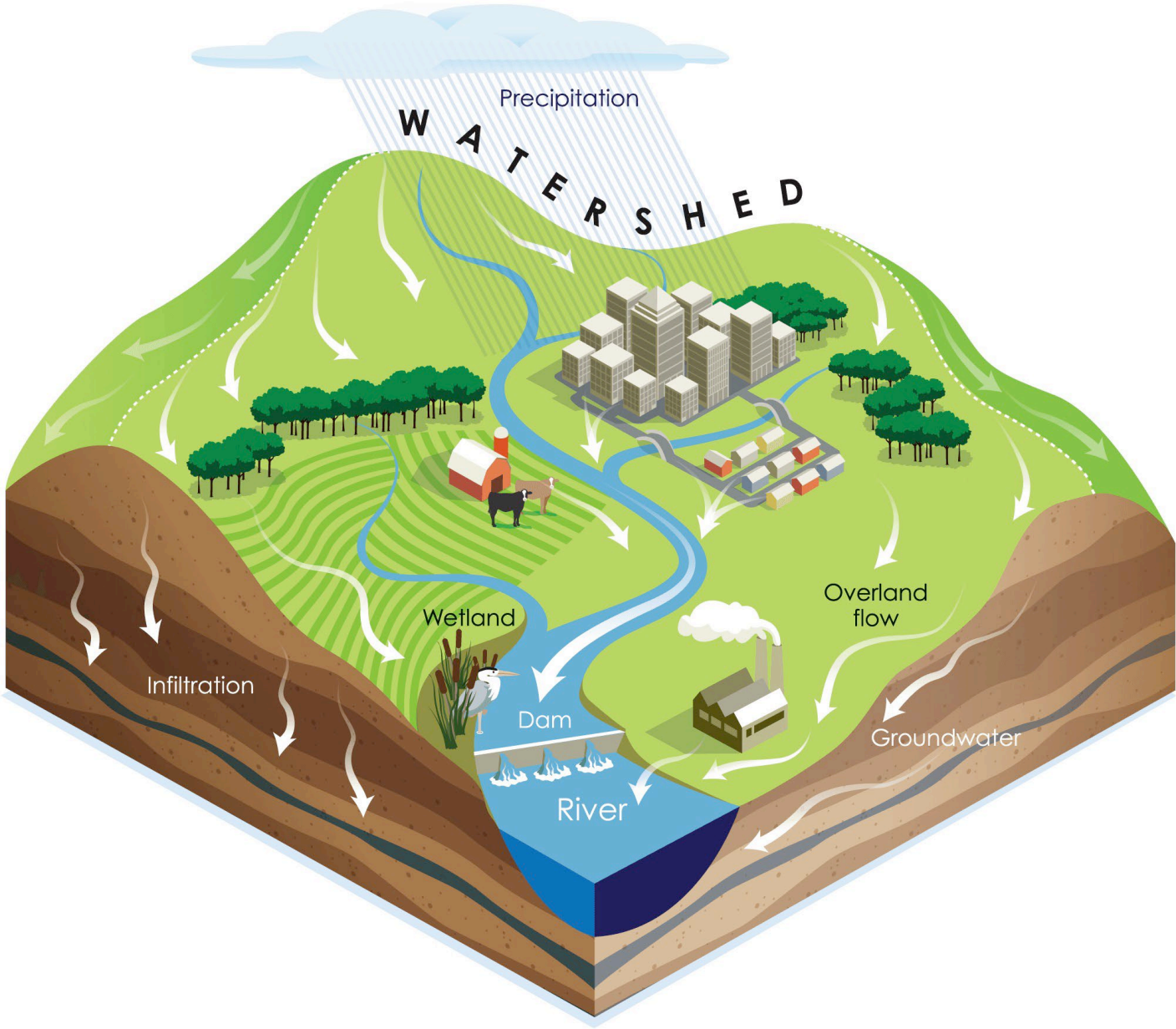
Outline

- Introduction to Lake Science
- Water Quality Update
- Flood Risk
- BMPs

Watershed Effect on Lake Dynamics

The natural characteristics of a watershed coupled with the land use in a watershed define the amount and quality of water reaching downstream resources

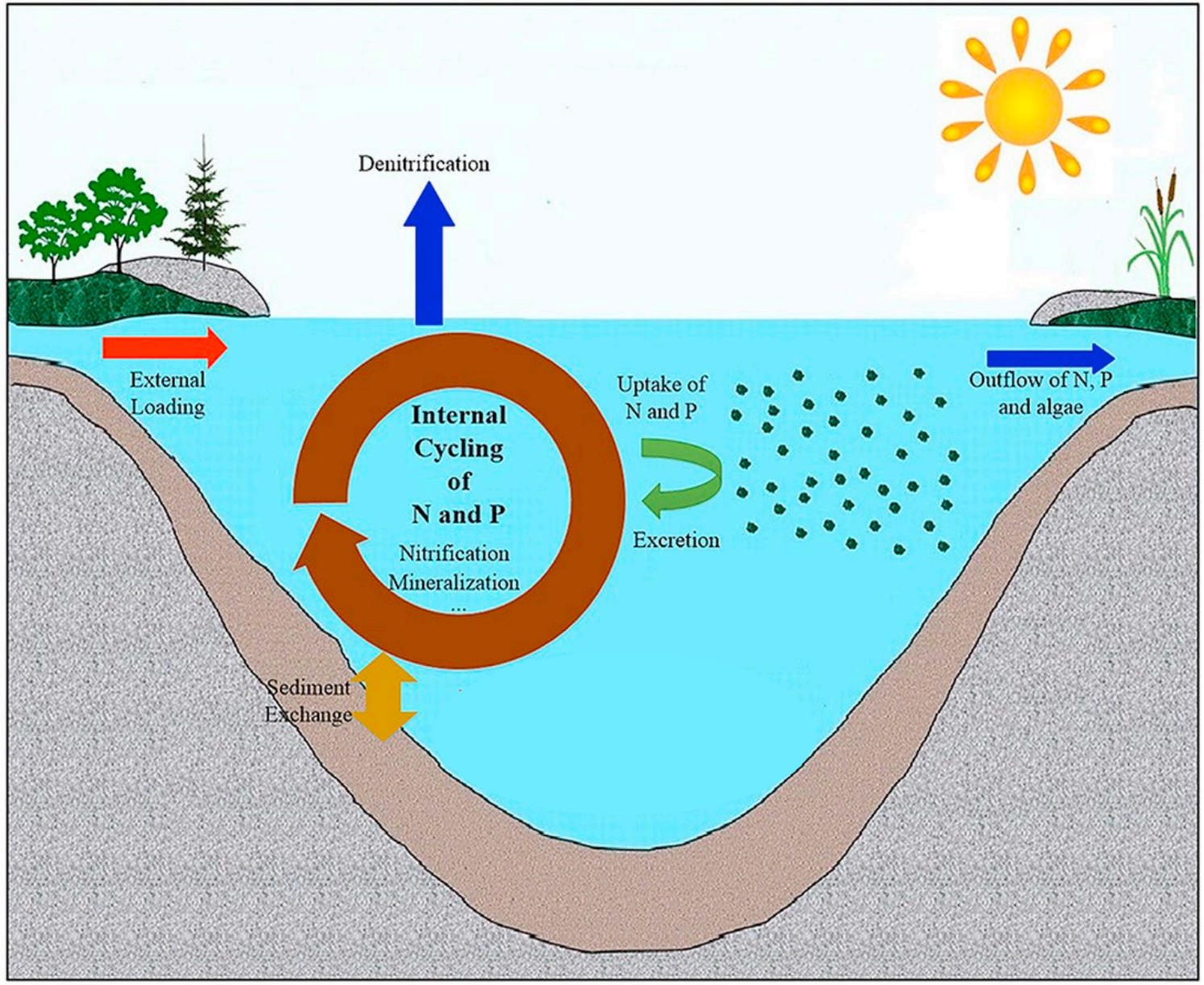
- **Size and Shape**
- **Topography**
- **Soils**
- **Vegetative Cover**
- **Land Uses**



Watershed Pollutant Loading

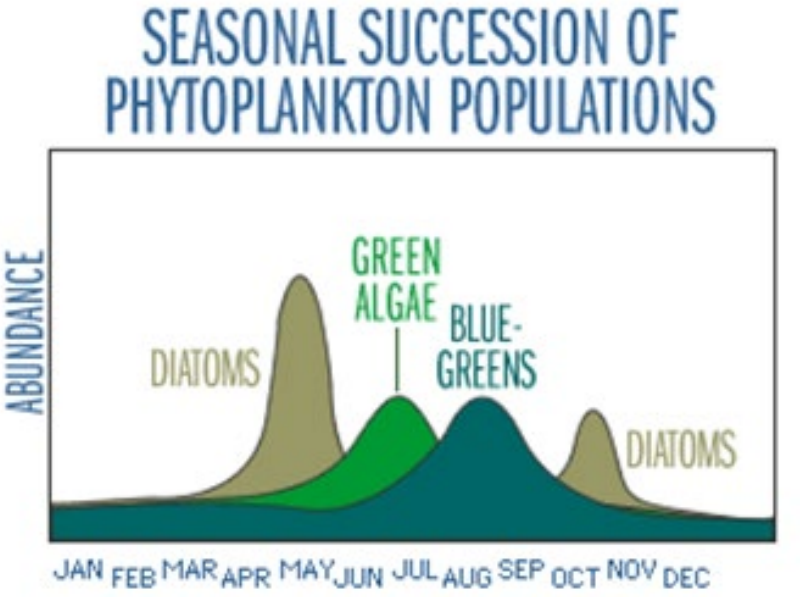
NUTRIENT FATE

- Outflow
- Algal growth
- Plant uptake
- Nitrification (gas)
- Mineralization (sediment)



Phytoplankton - Algae

- Need phosphorus and nitrogen to grow
- Phosphorus is typically ‘limiting’ nutrient
- Provide food for zooplankton, which in turn are food for fish
- Too much algae (‘algae blooms‘) cause water quality impairment
- Decaying algae consume oxygen – impact fisheries



Macrophytes – 'Weeds'

- Nursery area for fish
- Zooplankton refuge
- Wave break – reduce shoreline erosion
- Can utilize phosphorus and decrease algae levels
- Can be a nuisance: milfoil, curlyleaf pondweed

Bass Lake East

Two Stable Lake States

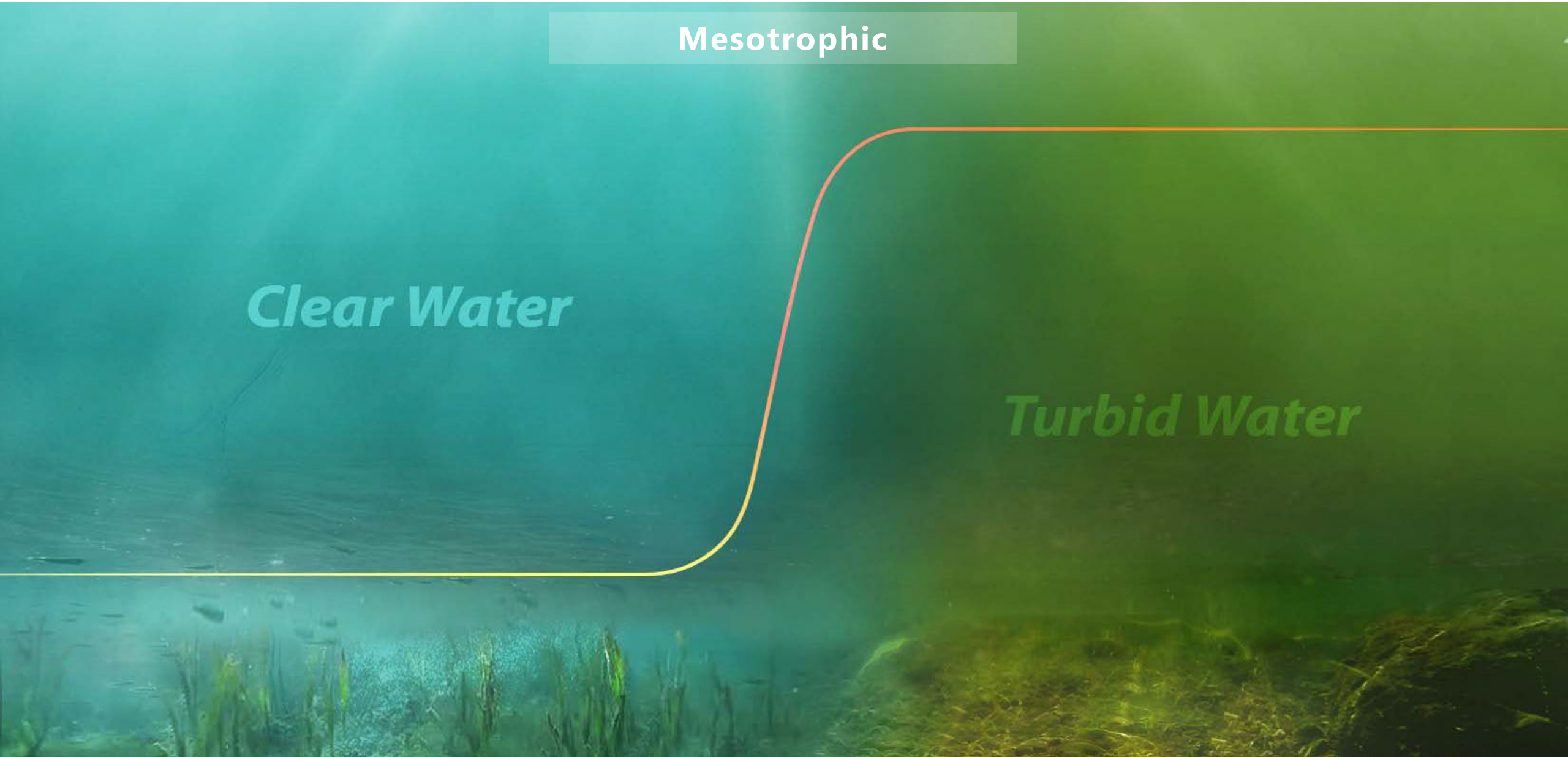
CLEAR-AQUATIC PLANT DOMINATED STATE

Balanced fish community and abundant aquatic plants keep water clear.

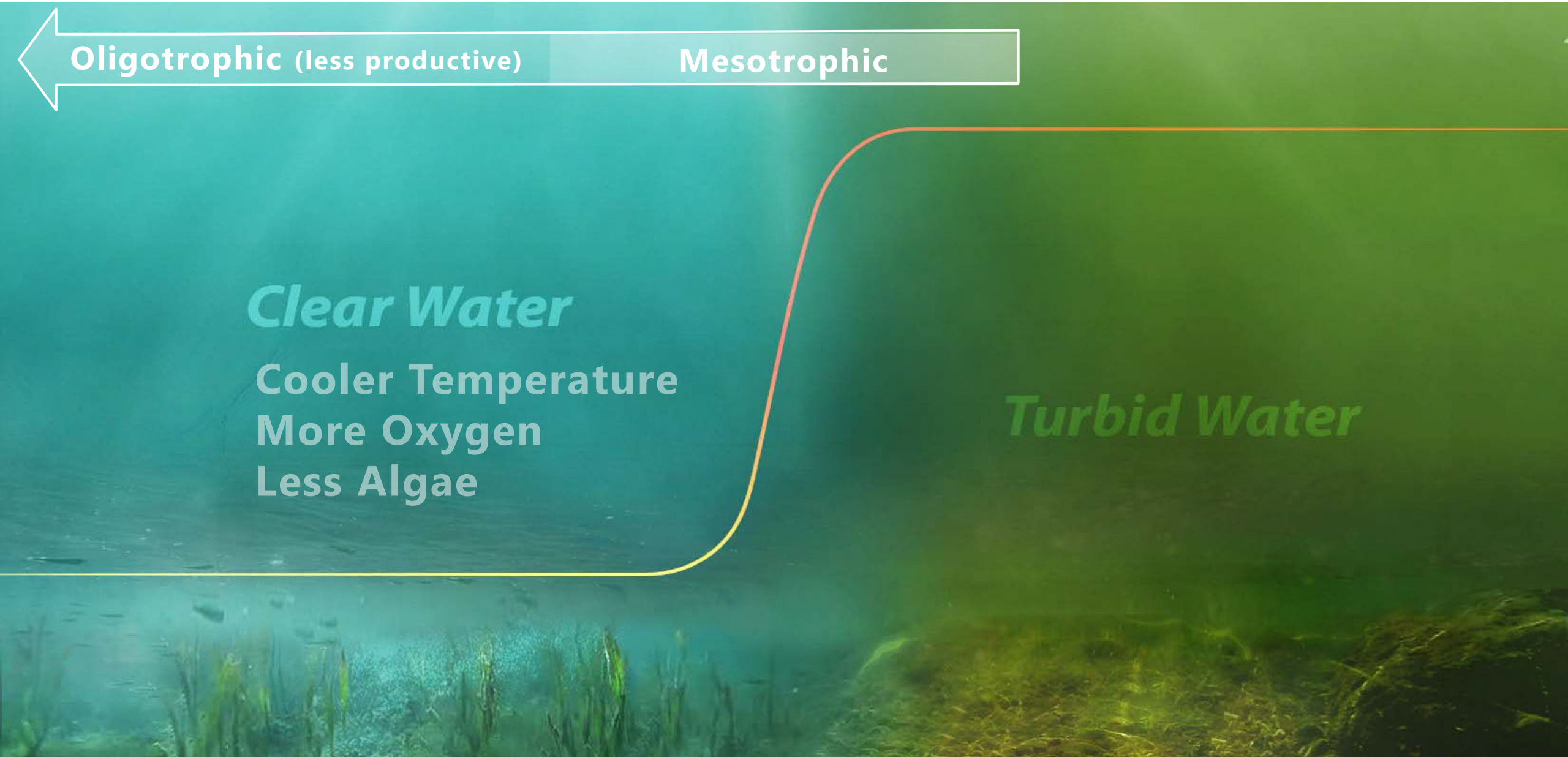
TURBID-ALGAE DOMINATED STATE

Too many pan fish and/or too few aquatic plants keep water turbid.

TROPHIC STATES: measure of fertility/lake productivity

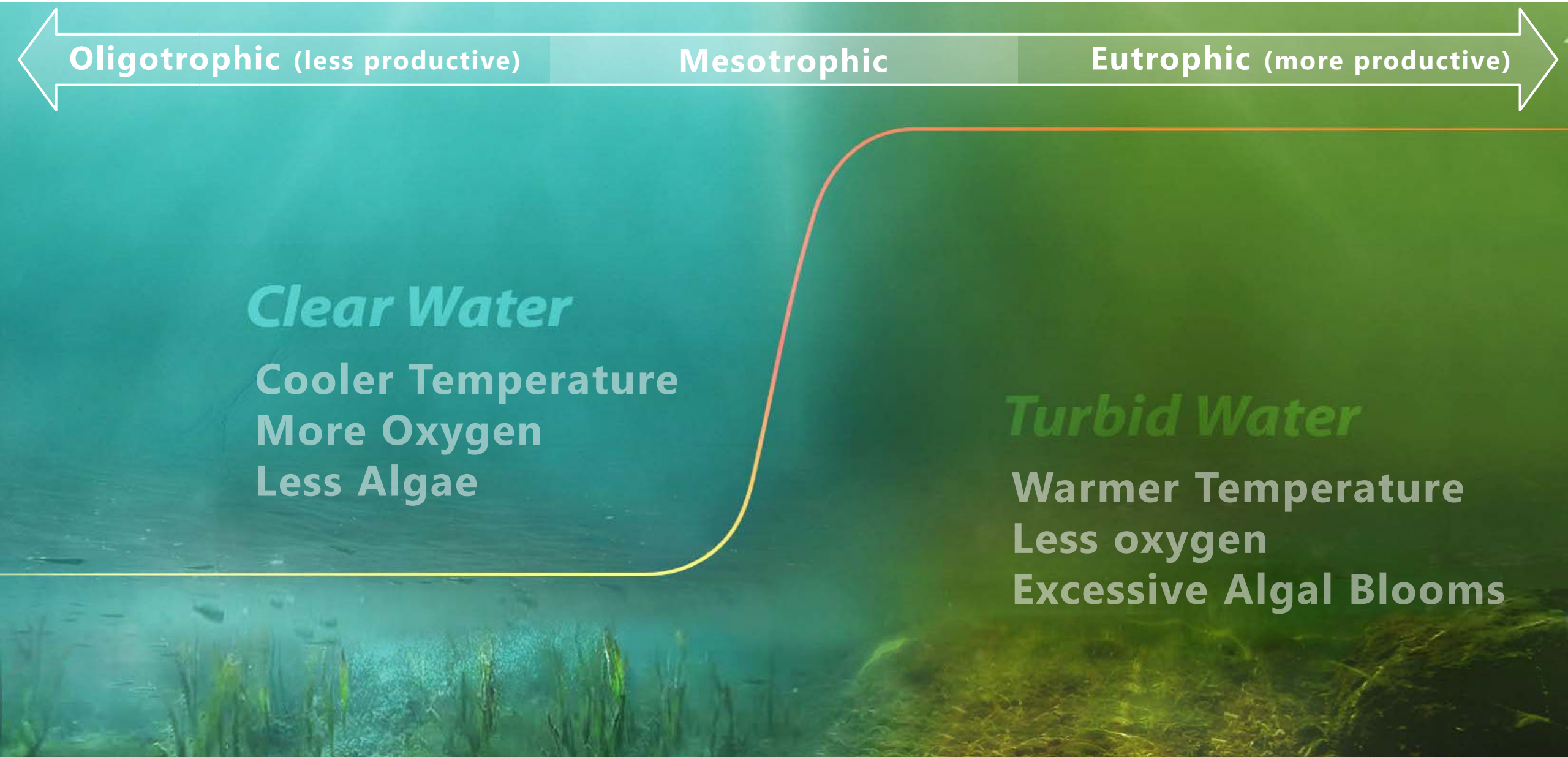


TROPHIC STATES: measure of fertility/lake productivity



TROPHIC STATES: measure of fertility/lake productivity

Oligotrophic (less productive) | Mesotrophic | Eutrophic (more productive)

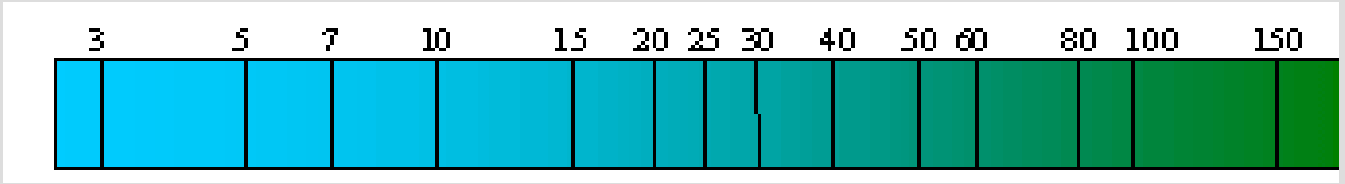


Trophic State: 3 Key Parameters

Phosphorus
'limiting' nutrient in lakes

Phosphorus (µg/l) related to Lake Trophic State

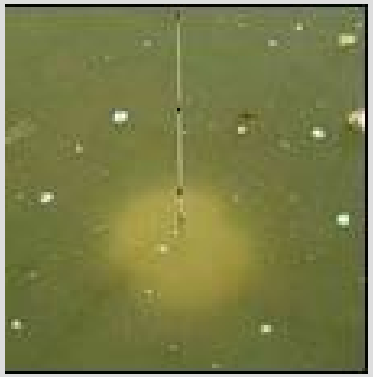
Oligotrophic Mesotrophic Eutrophic Hypereutrophic

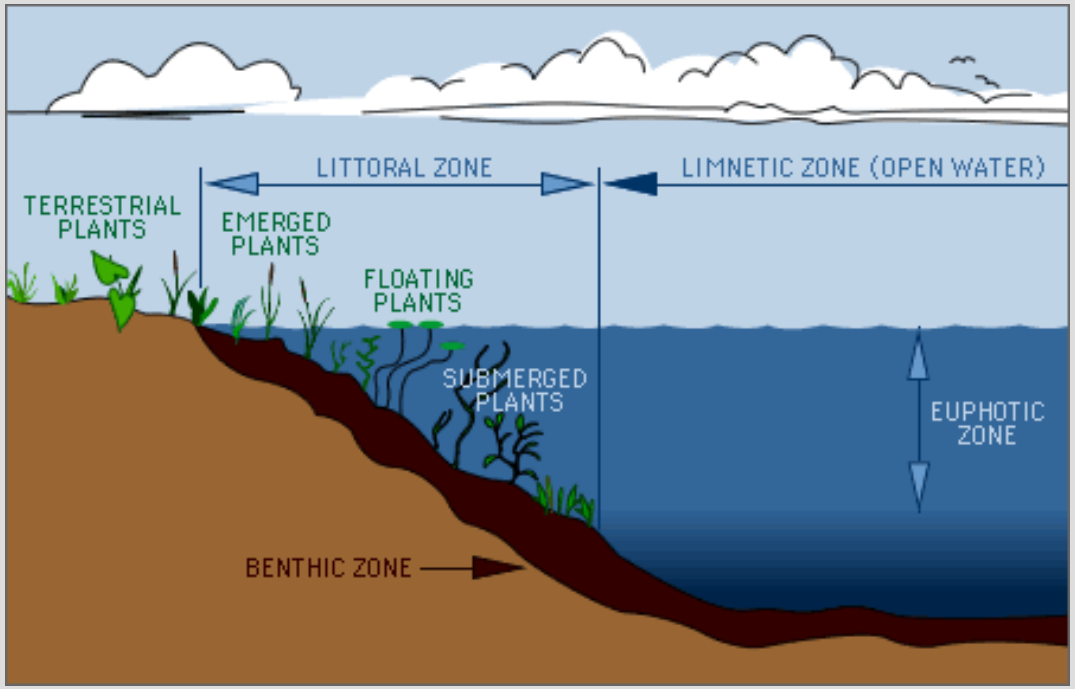


Trophic State: 3 Key Parameters

Transparency
measure of light penetration

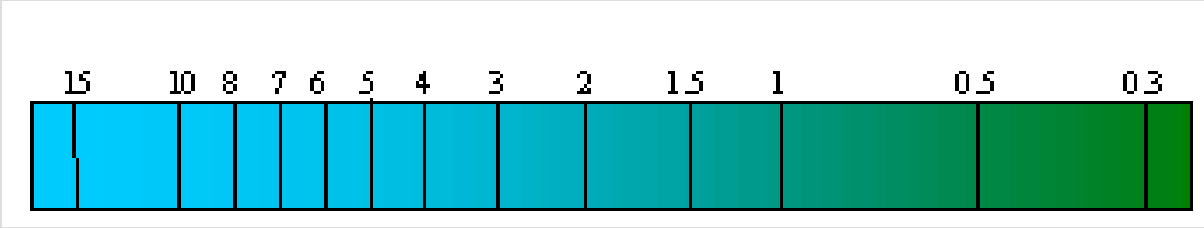






Transparency (m) related to Lake Trophic State

Oligotrophic Mesotrophic Eutrophic Hypereutrophic



Trophic State: 3 Key Parameters

Chlorophyll-a
measure of algae

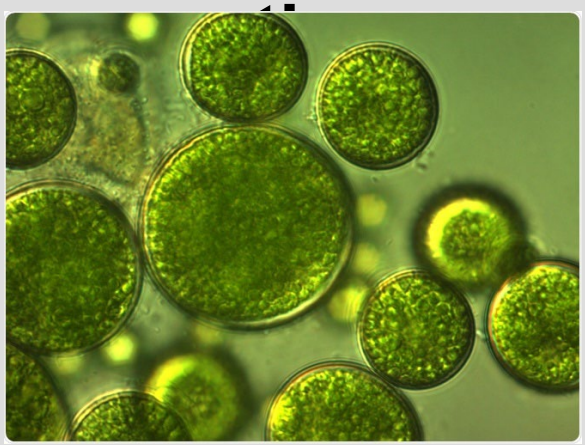
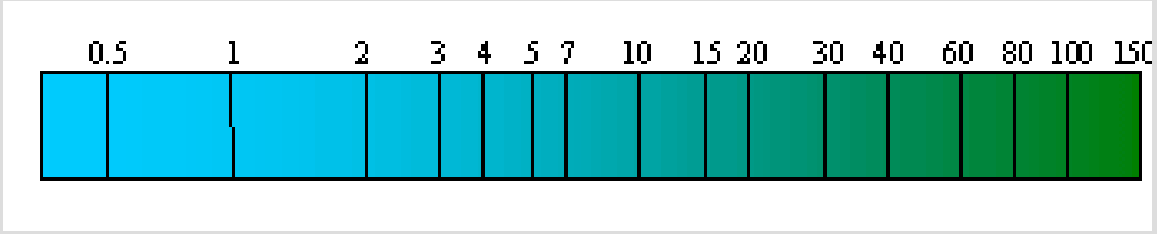


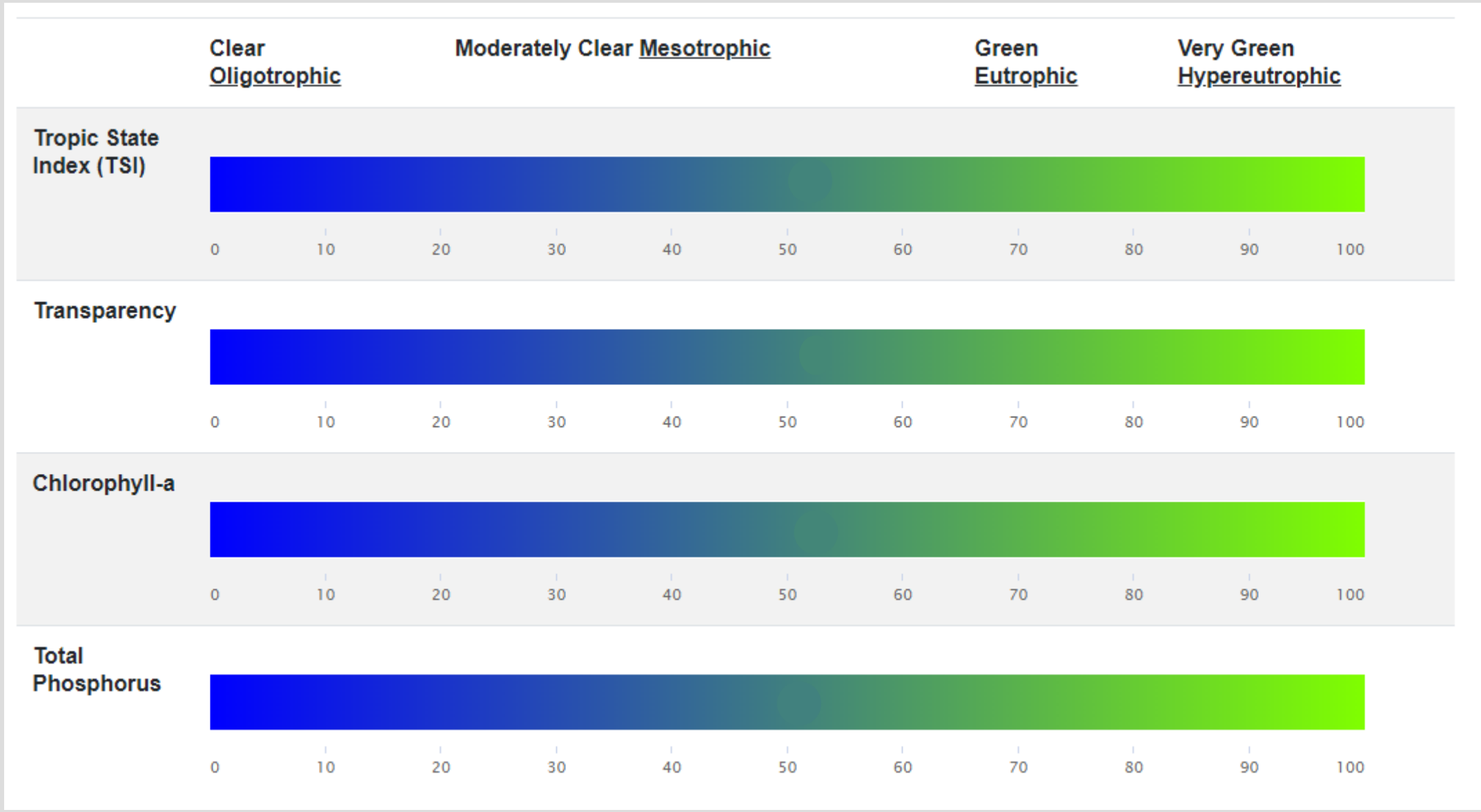
Image Credit: Ye.Maltsev/Shutterstock.com

Chl-a (µg/l) related to Lake Trophic State

Oligotrophic **Mesotrophic** **Eutrophic** **Hypereutrophic**



Trophic State Index



Masterman Lake

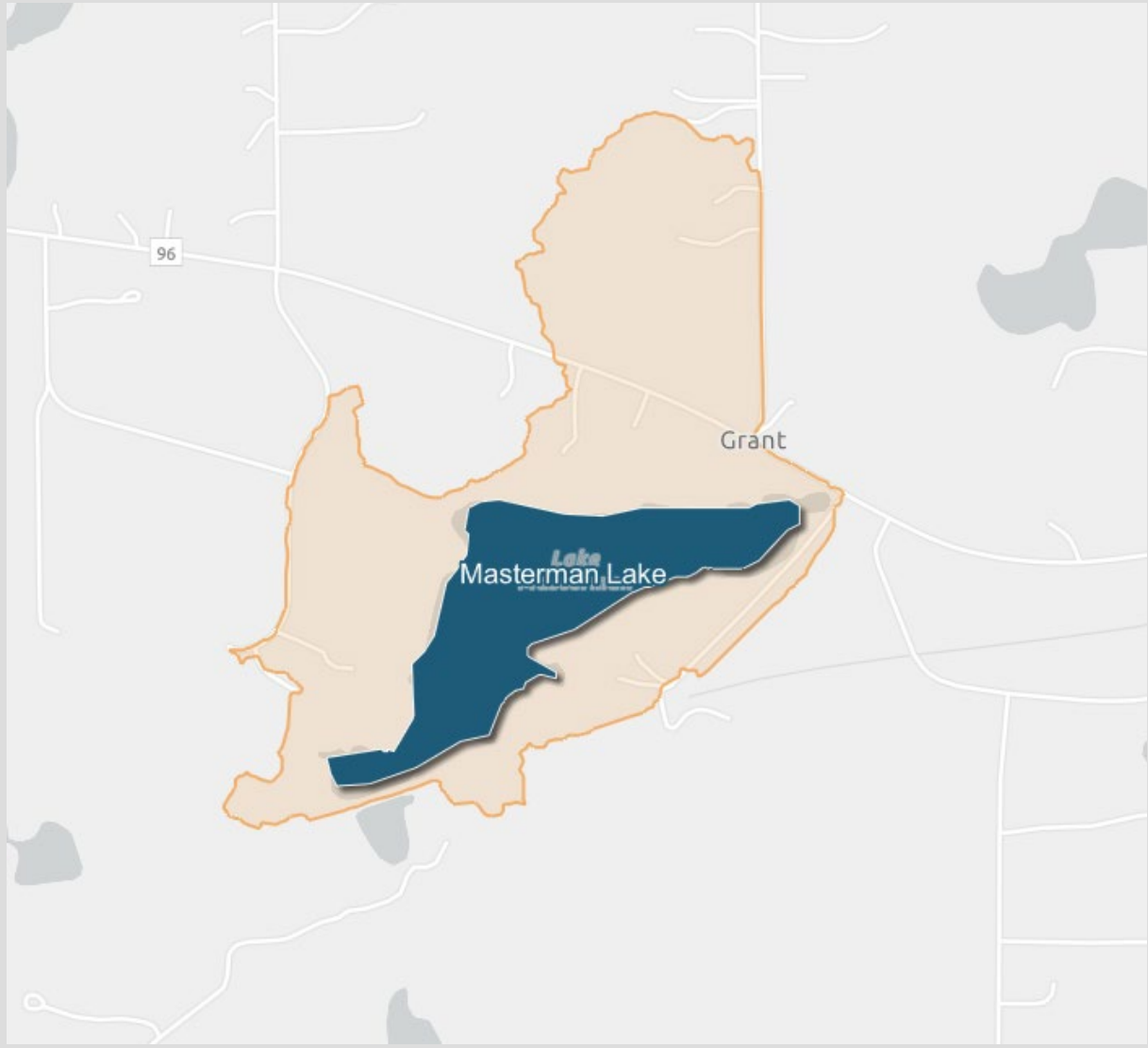
Lake Size: 40 acres

Maximum Depth (2023): 7 ft

Ordinary High Water Level Mark: 955.70 ft

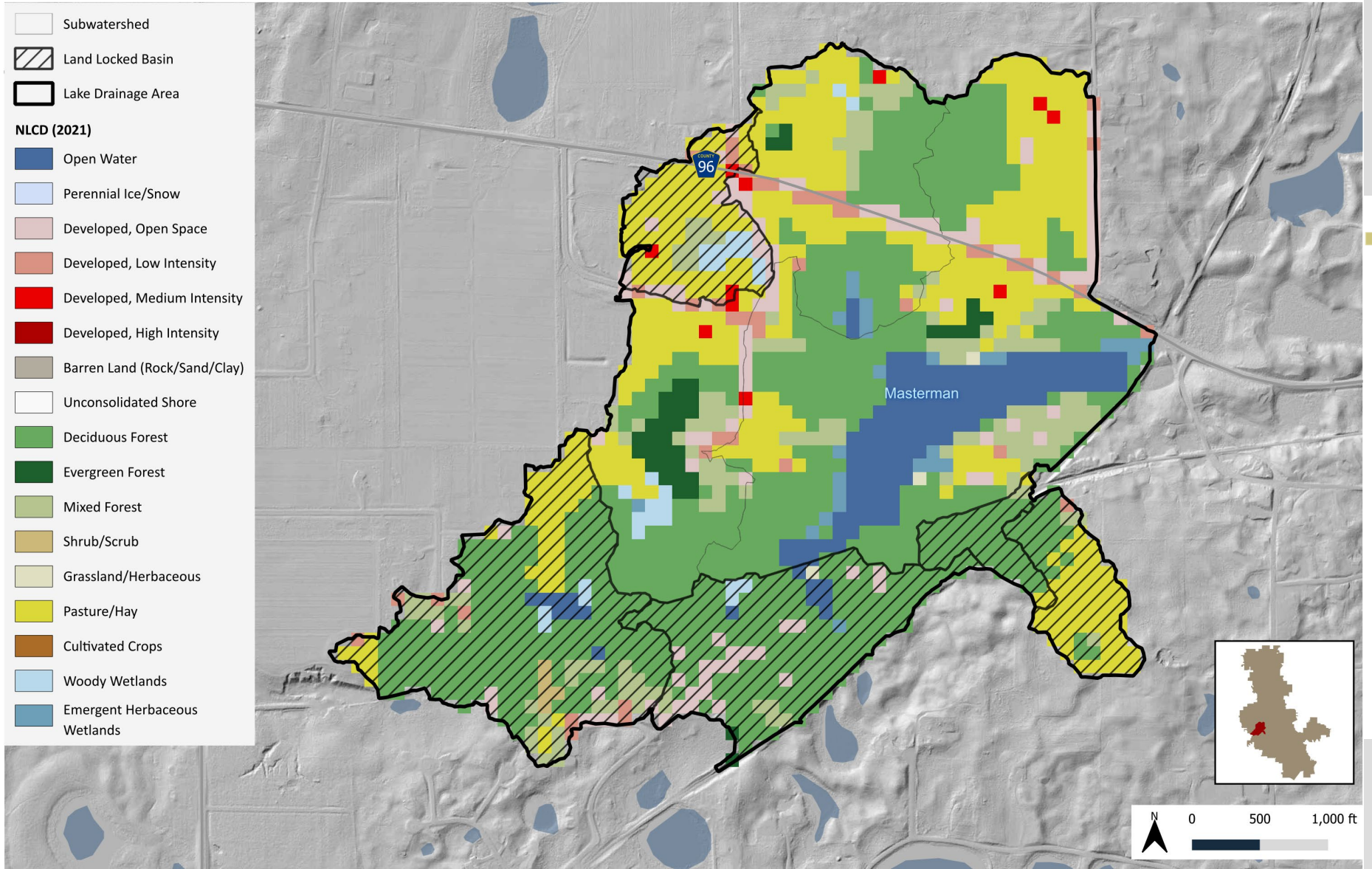
100% Littoral

~ Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation

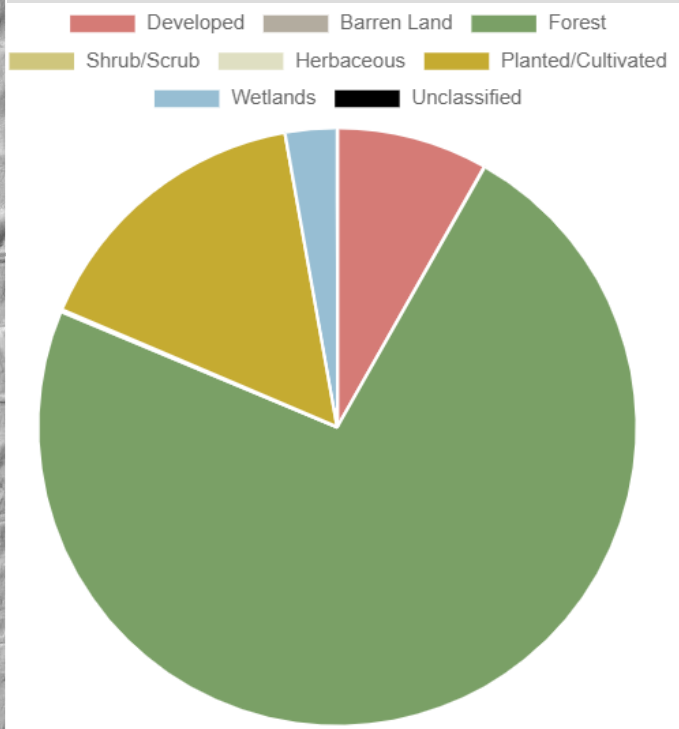


Masterman Lake

Masterman Lake - Land Cover



The watershed is primarily forested



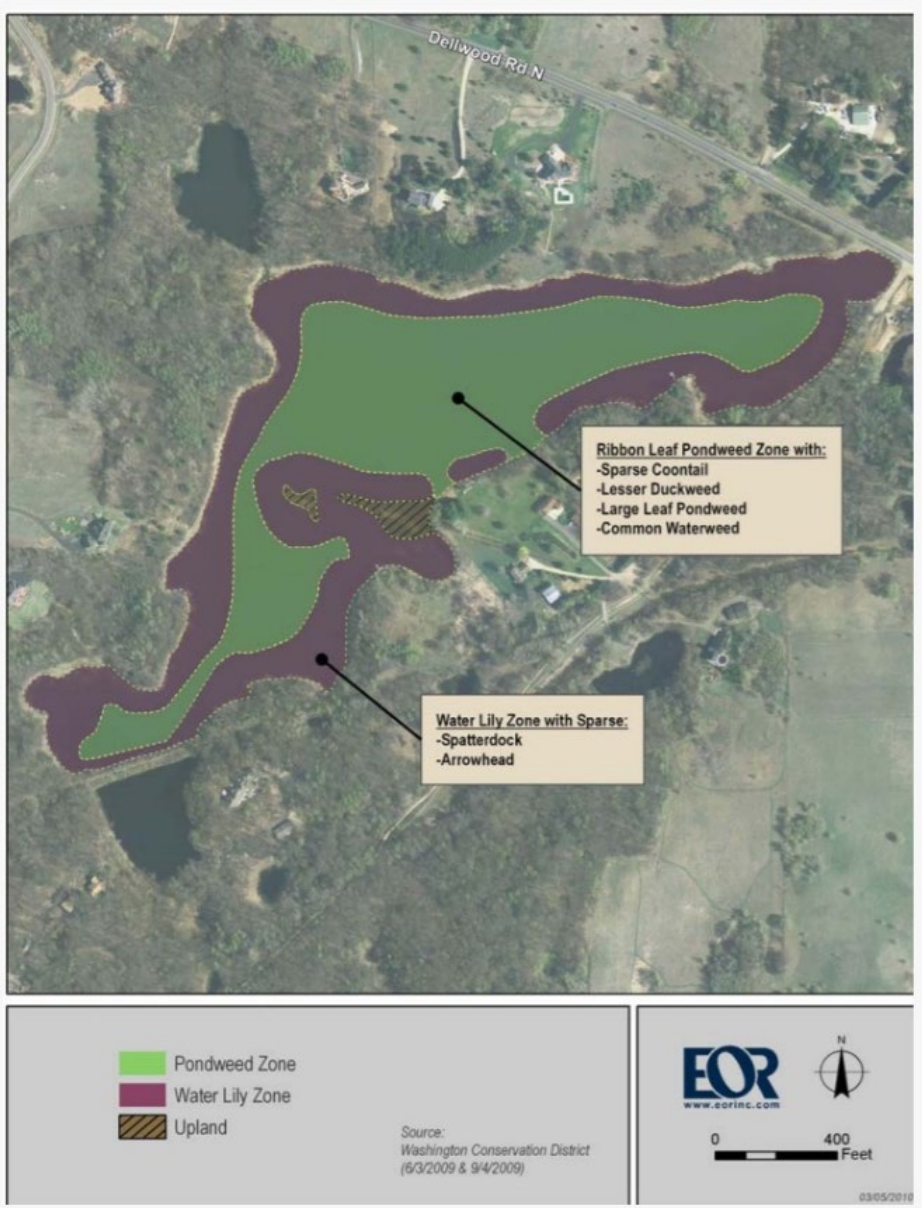
Masterman Lake

Aquatic Plants

- Masterman Lake contains the native species spatterdock, coontail, arrowhead sagittaria, and common waterweed.
- Masterman was generally dominated by native species, but one invasive species was observed during the surveys: Eurasian watermilfoil.

Fisheries Data

- Results suggested a healthy fish population with several size classes of large predatory fish, and a robust population of black bullheads.
- Snapping turtles and painted turtles were also found.

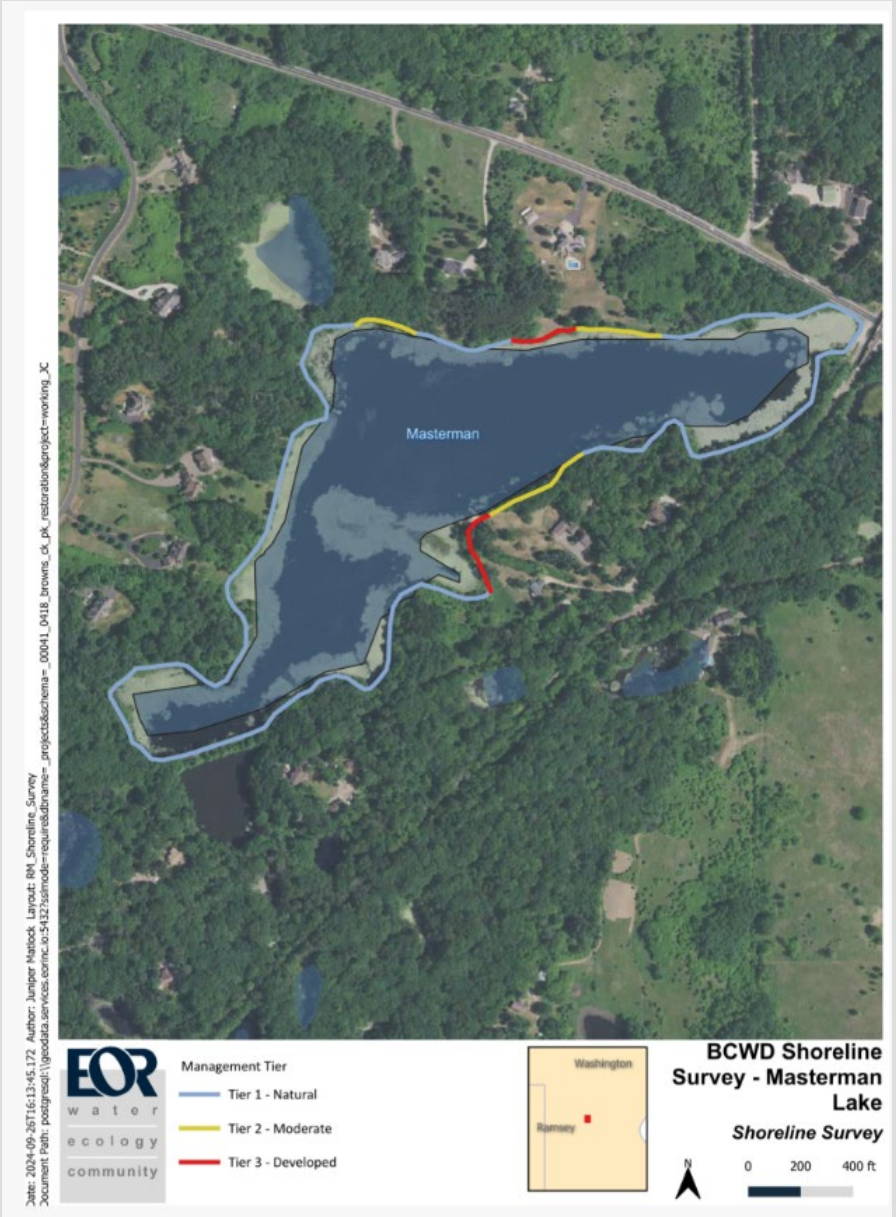


Masterman Lake

The majority of the shoreline is natural

Have some opportunities to work with landowners to improve priority areas

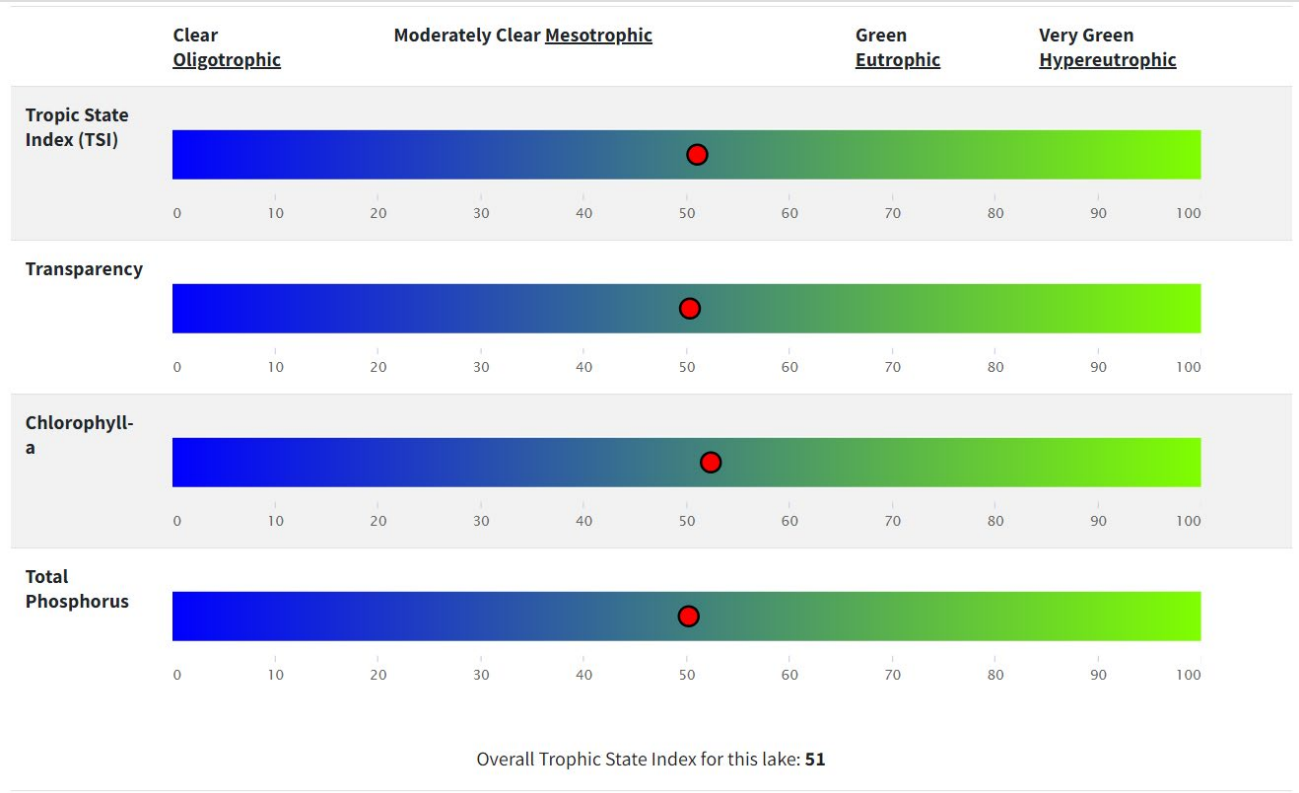
		Rating Criteria		
Shoreline Rating	***Description***	***Tree Canopy***	***Manicured Lawn***	***Impervious Area***
Tier 1- Natural	Parcel with low potential for nutrient export to lake	80-100%	0-20%	0-5%
Tier 2 - Moderate	Parcel with medium potential for nutrient export	40-80%	20-40%	5-20%
Tier 3 - Developed	Parcel with high potential for nutrient export to lake	0-40%	40-100%	20-100%



Masterman Lake

2023 Lake Grade: B

Overall Condition: Suitable for swimming and wading, with good clarity and low algae levels throughout the open water season.



Overall Trophic State Index for this lake: **51**

Parameters	10-Year average of all summer samples	Parameter TSI	Expected TSI range of lakes in same ecoregion	Number of samples
Transparency (meters)	2	50	43 - 54	77
Chlorophyll-a (parts per billion)	9	52	46 - 61	63
Total Phosphorus (parts per billion)	24	50	49 - 61	77

Water transparency is an excellent indicator of water quality, and the majority of these data are collected by volunteers. Join the MPCA's Citizen Lake Monitoring Program and help collect this important information for your lake.

Wood Pile Lake

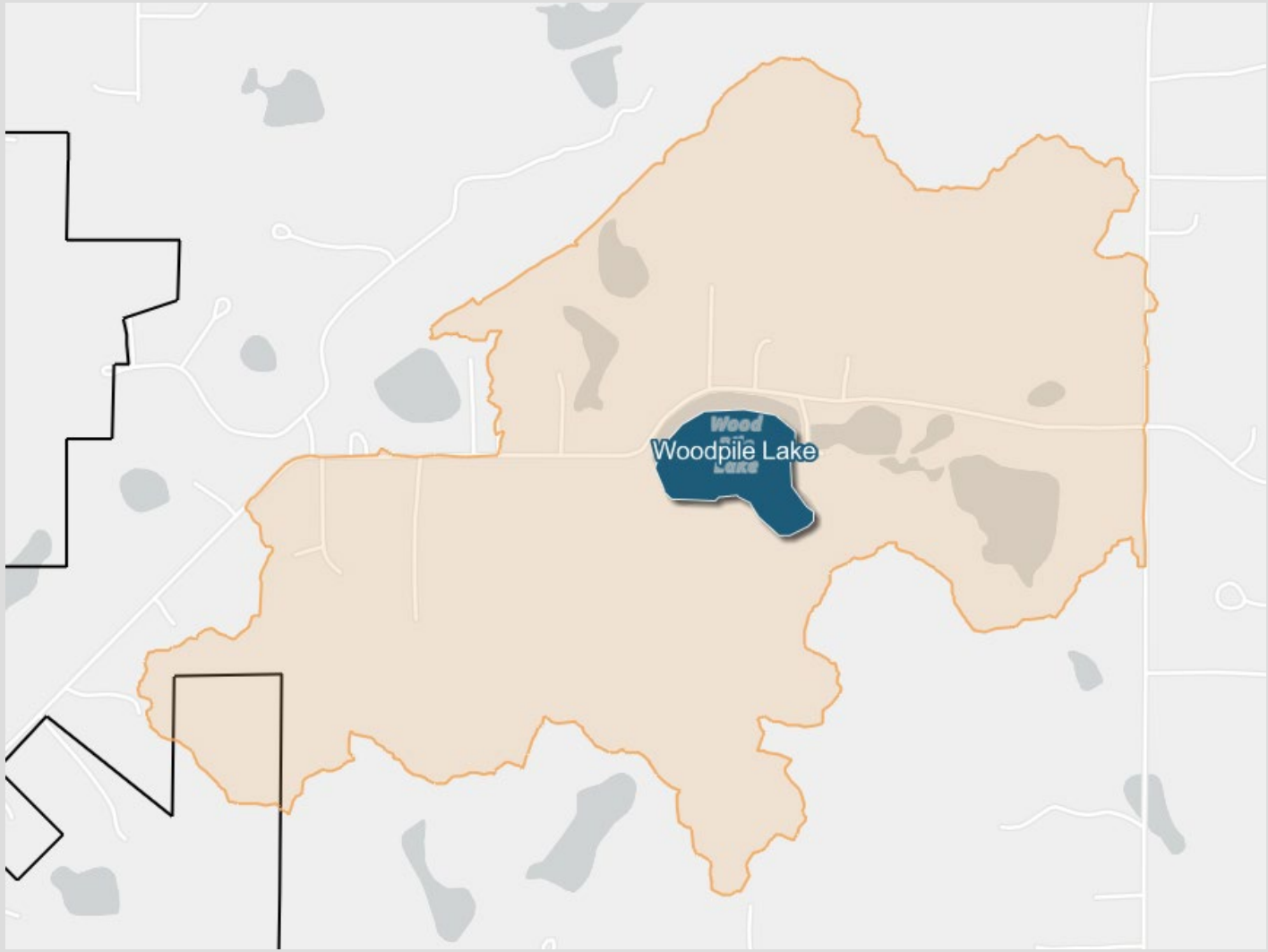
Lake Size: 15 acres

Maximum Depth (2021): 27 ft

Ordinary High Water Level Mark: 968.5 ft

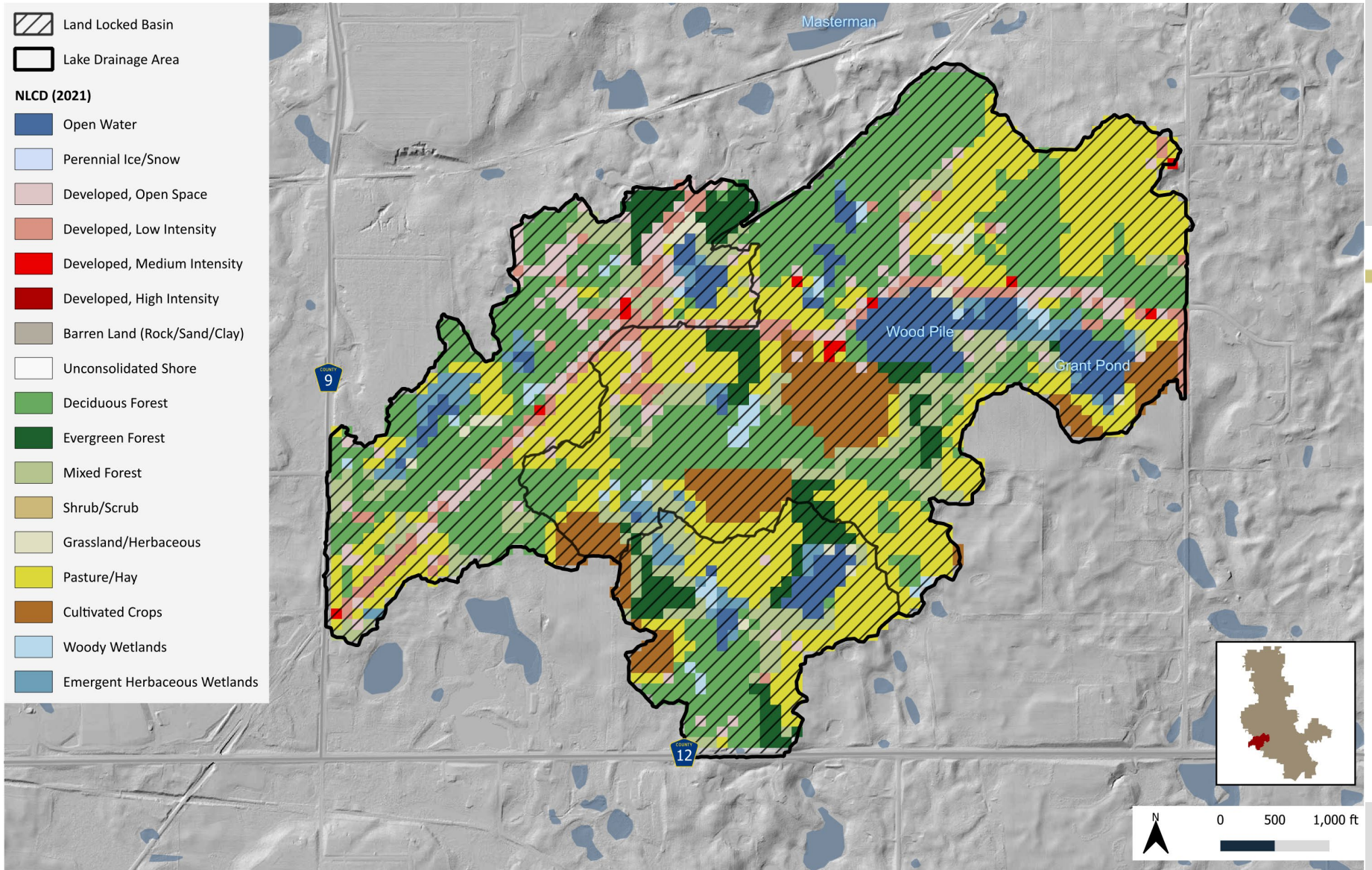
8% Littoral

~ Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation

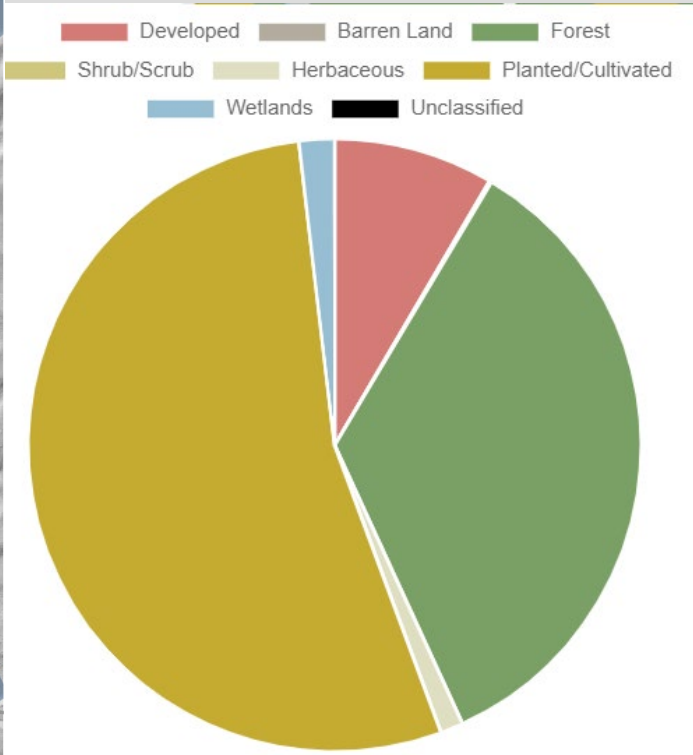


Wood Pile Lake

Wood Pile Lake - Land Cover



The watershed is heavily agriculture and forested with little development



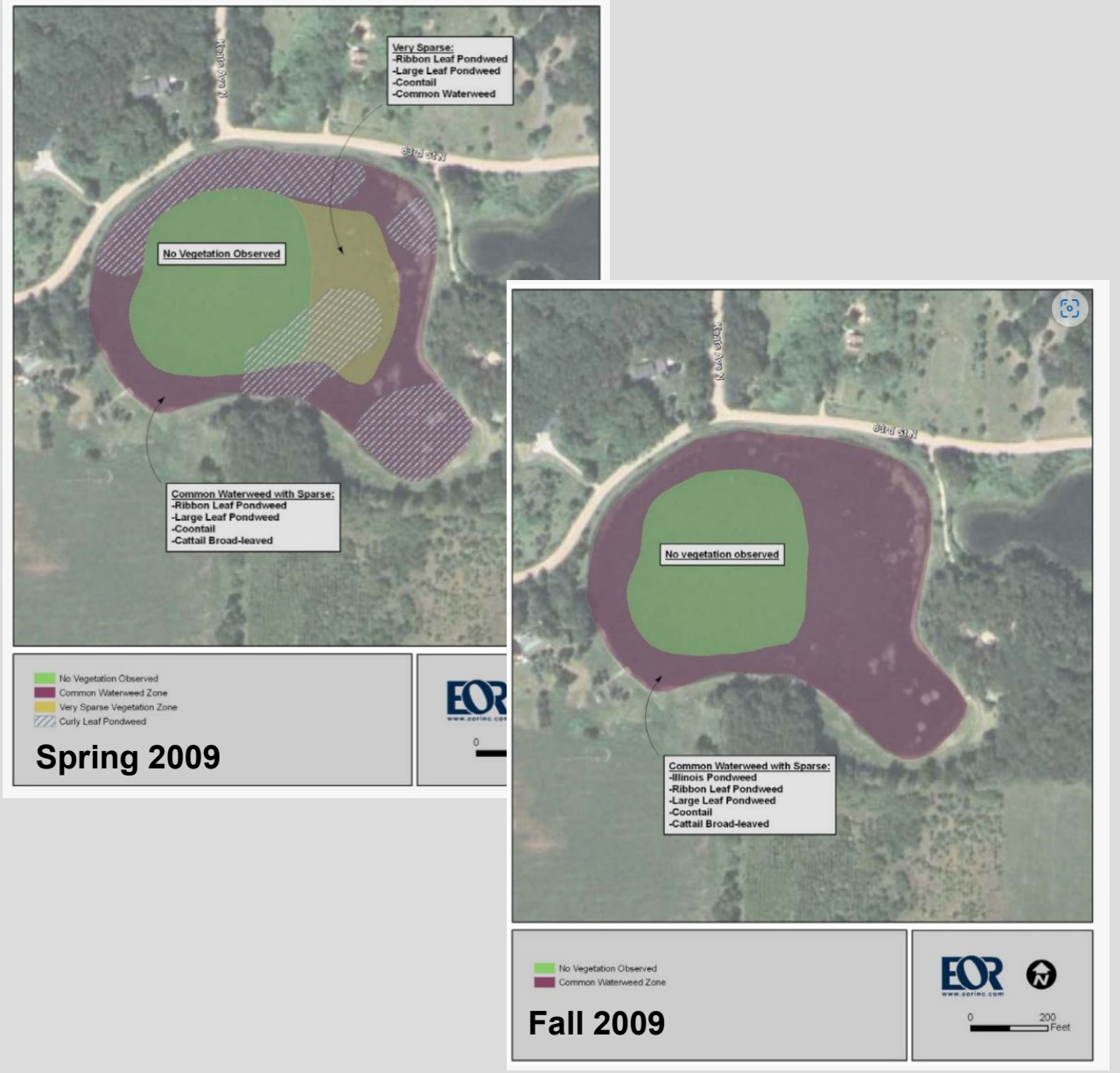
Wood Pile Lake

Aquatic Plants

- 6 aquatic or emergent species were observed, with common waterweed and coontail found to be most abundant.
- Woodpile was generally dominated by native species, broad-leaved cattail, ribbon leaf pondweed, and large leaf pondweed.
- One invasive species was observed during the surveys: curly-leaf pondweed.
- After the senescence of curly-leaf pondweed sparser vegetation, with Illinois Pondweed and greater abundance of algae present

Fisheries Data

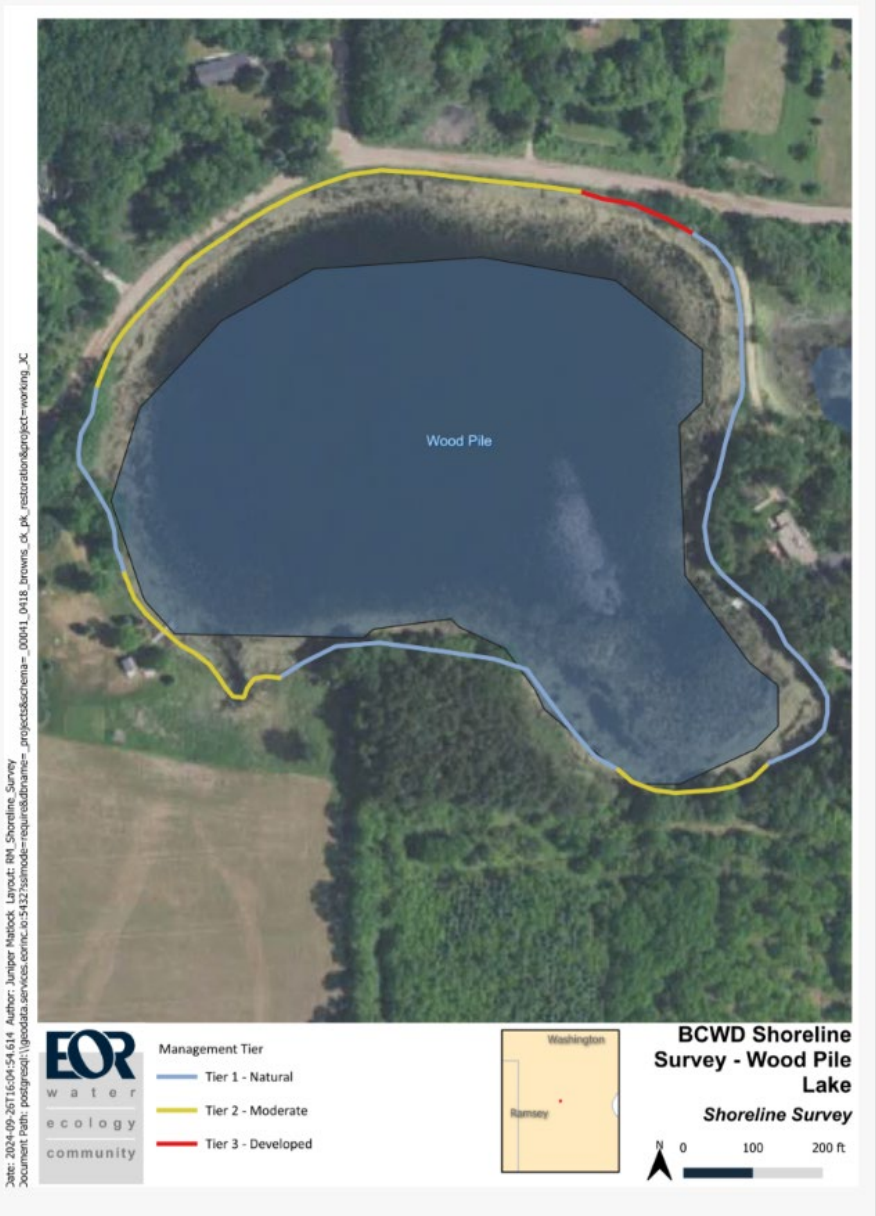
- A simple community structure dominated by pan fish. Bluegill, black crappie, pumpkinseed sunfish, hybrid sunfish, and northern pike were present.



Wood Pile Lake

- The majority of the shoreline is moderate or natural
- Have some opportunities to work with landowners to improve priority areas

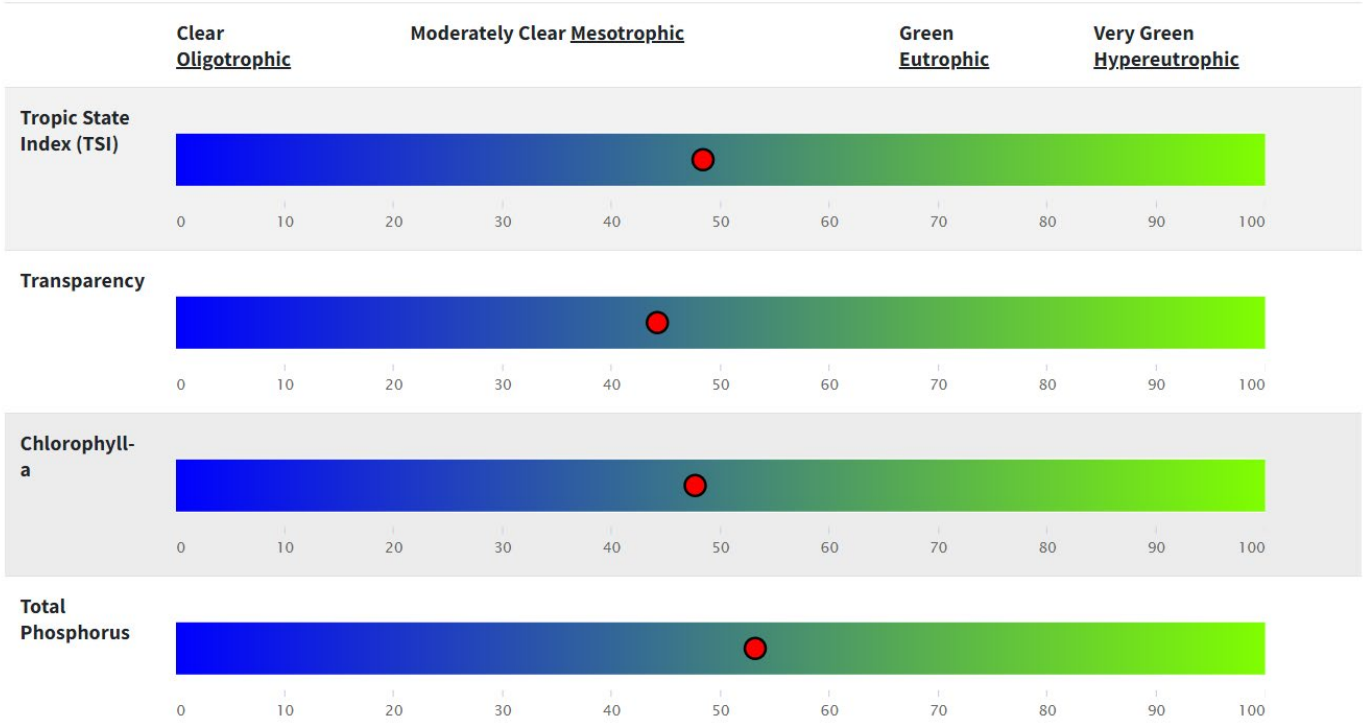
		Rating Criteria		
Shoreline Rating	***Description***	***Tree Canopy***	***Manicured Lawn***	***Impervious Area***
Tier 1- Natural	Parcel with low potential for nutrient export to lake	80-100%	0-20%	0-5%
Tier 2 - Moderate	Parcel with medium potential for nutrient export	40-80%	20-40%	5-20%
Tier 3 - Developed	Parcel with high potential for nutrient export to lake	0-40%	40-100%	20-100%



Wood Pile Lake

2023 Lake Grade: A

- Suitable for swimming and wading, with good clarity and low algae levels throughout the open water season.



Overall Trophic State Index for this lake: **48**

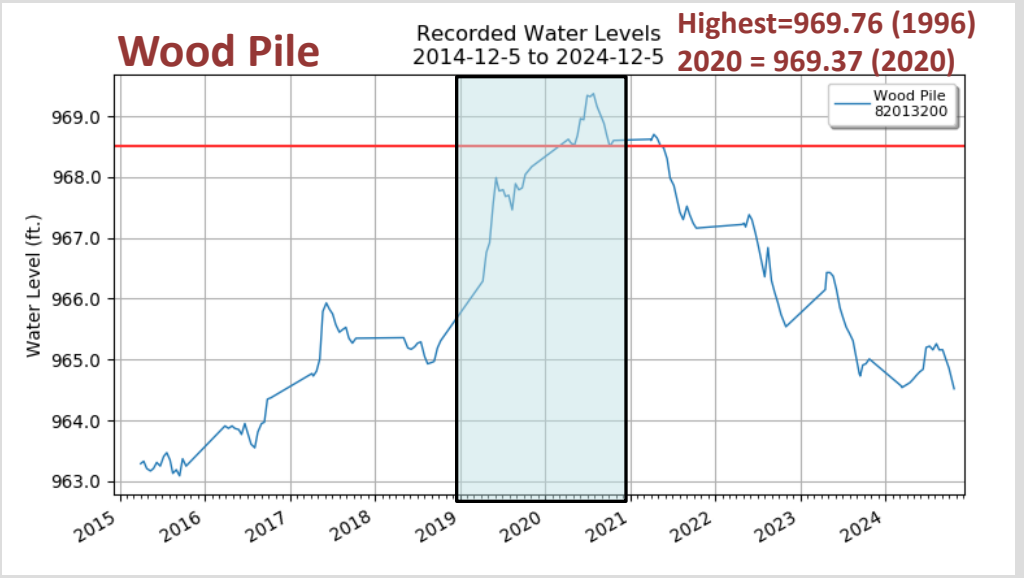
Parameters	10-Year average of all summer samples	Parameter TSI	Expected TSI range of lakes in same ecoregion	Number of samples
Transparency (meters)	3	44	43 - 54	77
Chlorophyll-a (parts per billion)	6	48	46 - 61	63
Total Phosphorus (parts per billion)	30	53	49 - 61	77

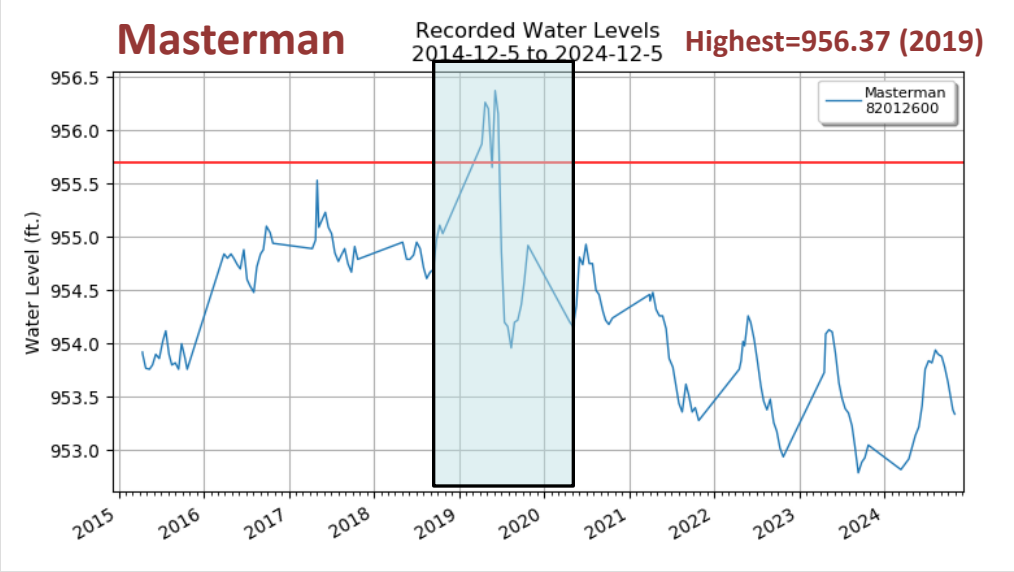
Flood Risk Review: Background

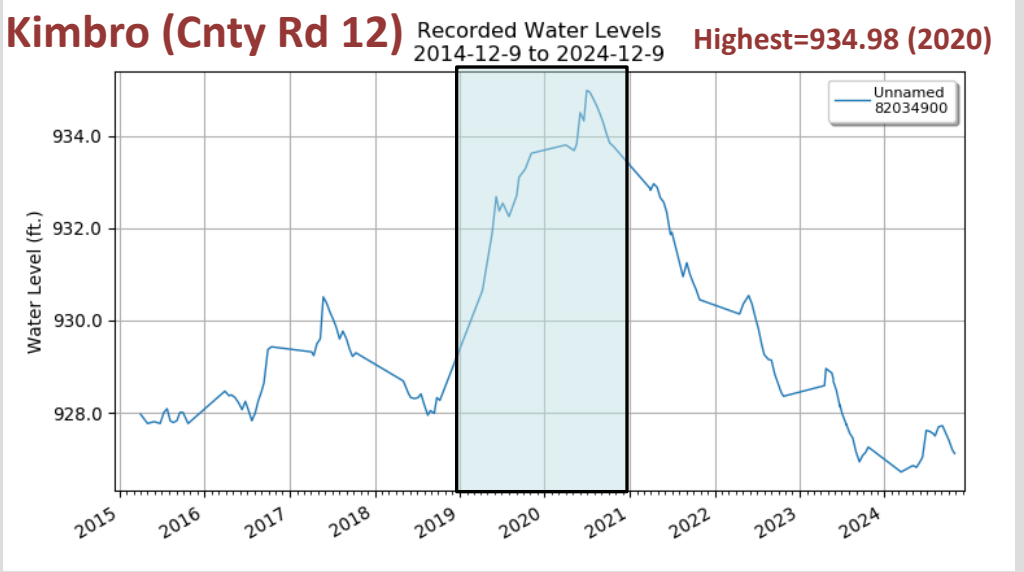
- What is the 100-Year Storm
  - Storm that has a 1% chance of happening in any given year
  - 1 in 4 chance of experiencing during a 30-year mortgage
  - 7.2” of rainfall in 24-hours – Most ponds & lakes
  - 7.2” of rainfall on frozen ground – Landlocked ponds and lakes

Flood Risk Review: Background

- 2019+ Observed high water levels throughout BCWD
- Unprecedented precipitation in 2020
- New 100-Year Rainfall (5.9” to 7.2”)
- Revised computer modeling to determine pond water level response and impact from this event

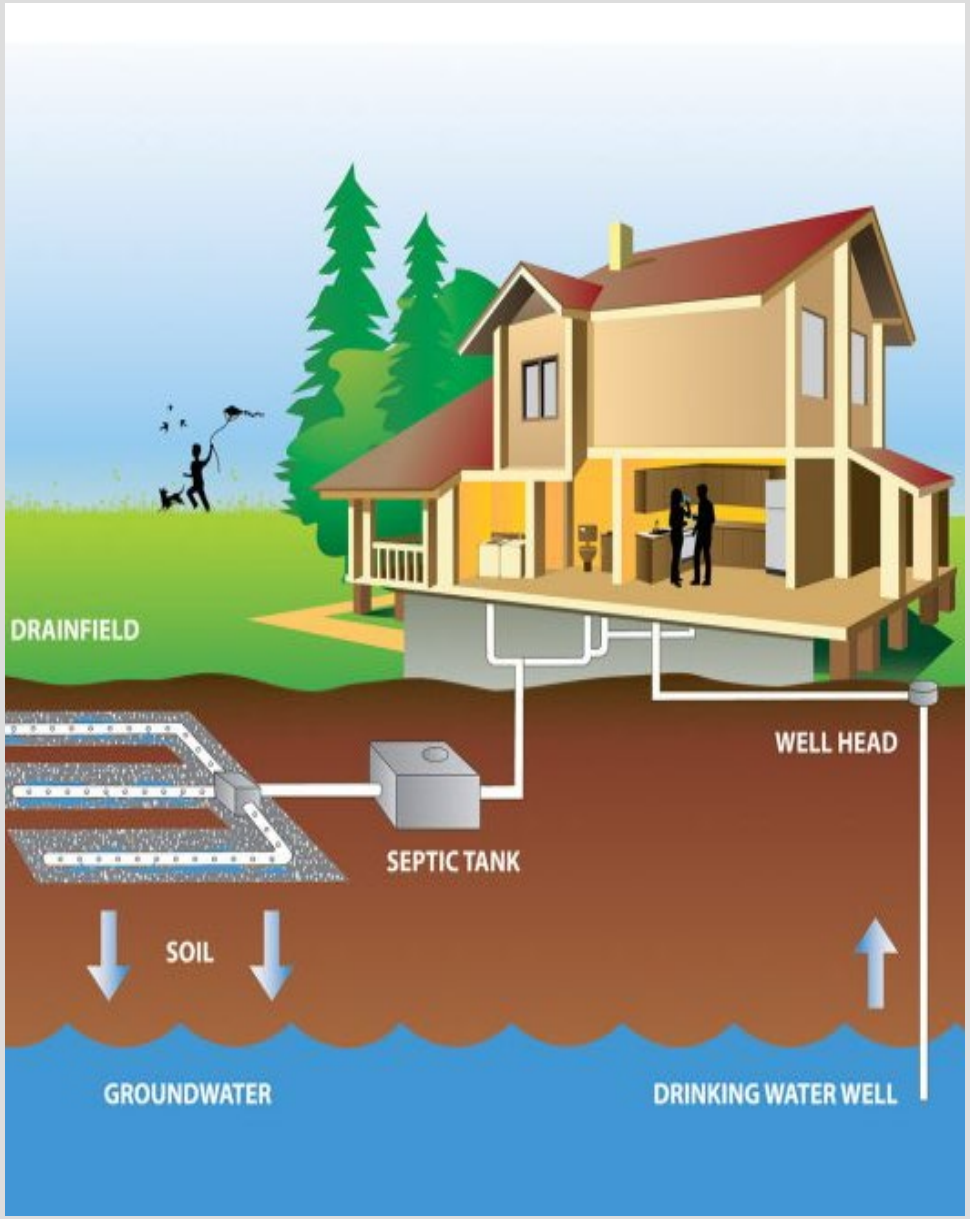






Flood Risk Review: Analysis

Flood Risk Review: Well & Septic



Drinking Water Well

- Inundation by surface water
  - Pathogens & contaminants get into water
    - Short Term: Boil water
    - Long Term: Disinfect, pump & test

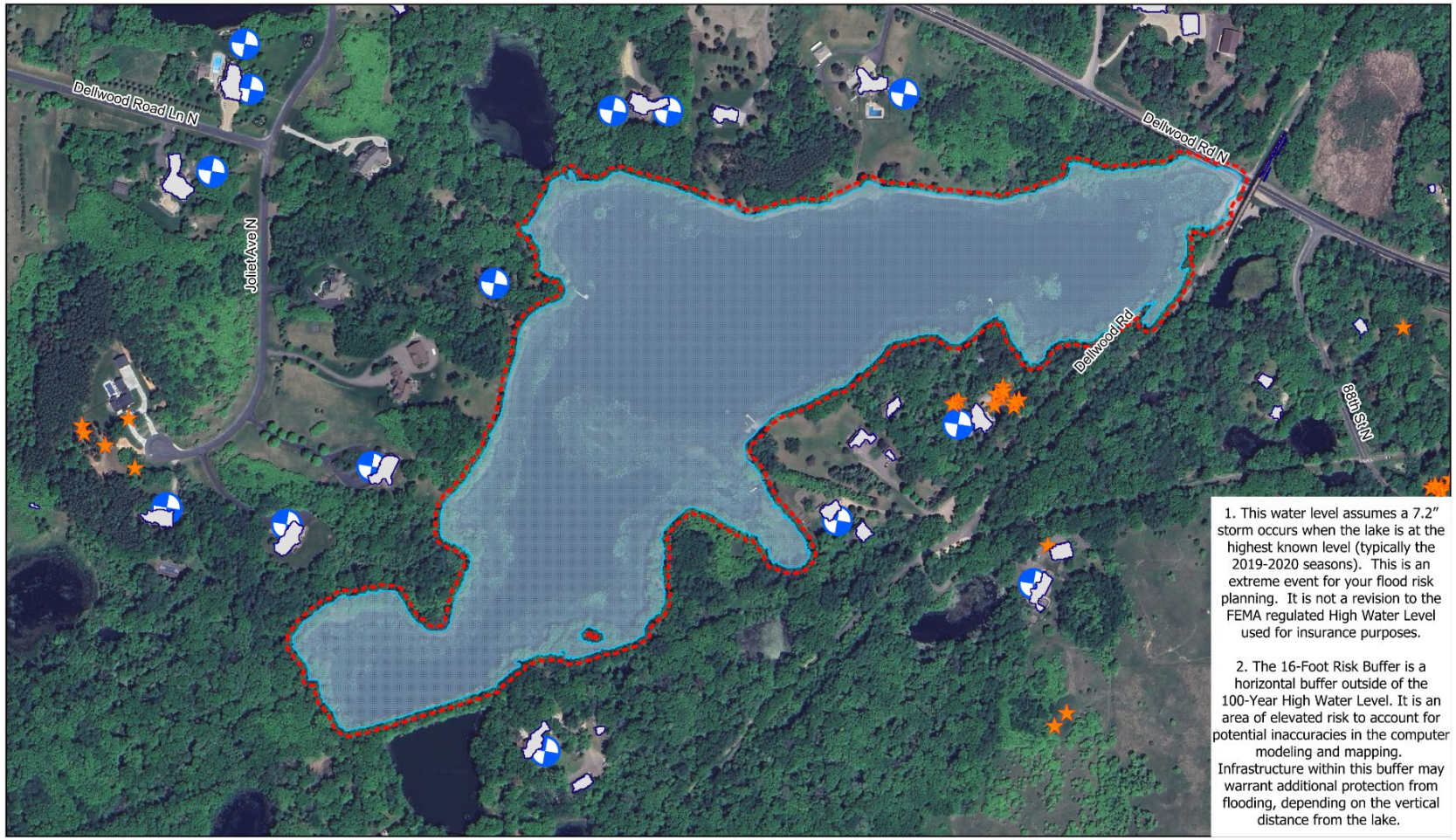
Septic System

- Inundation by surface water
  - System will backup
- Groundwater within 3 feet
  - Groundwater contamination
- Lake contamination

Lake Masterman – High Water Level 958.29 ft

Summary:

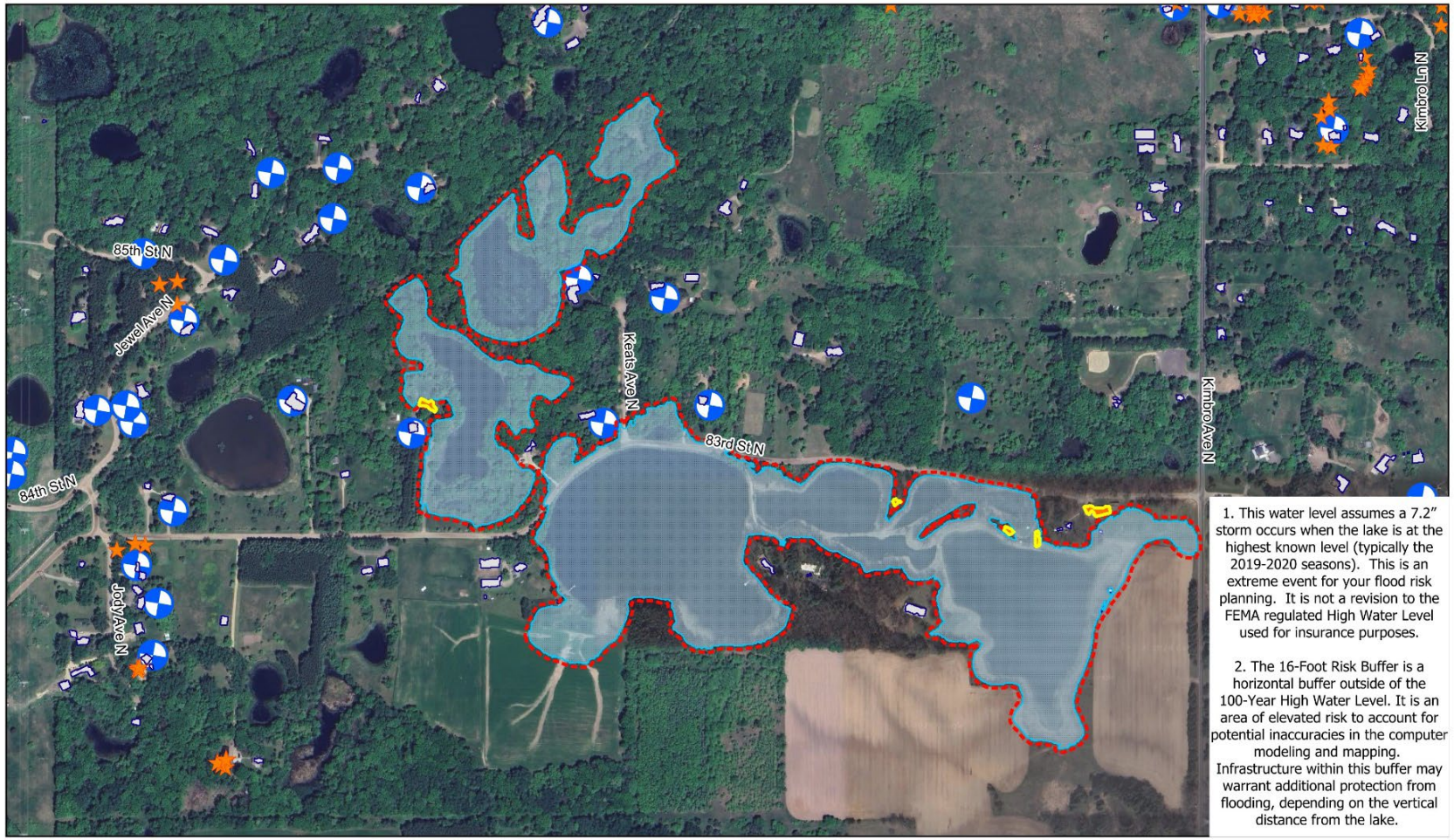
- 1 Road Flooded (1.6’)
- 0 Buildings Impacted
- 0 Septic & Well Impacted
- 14 Parcels Lacking Data



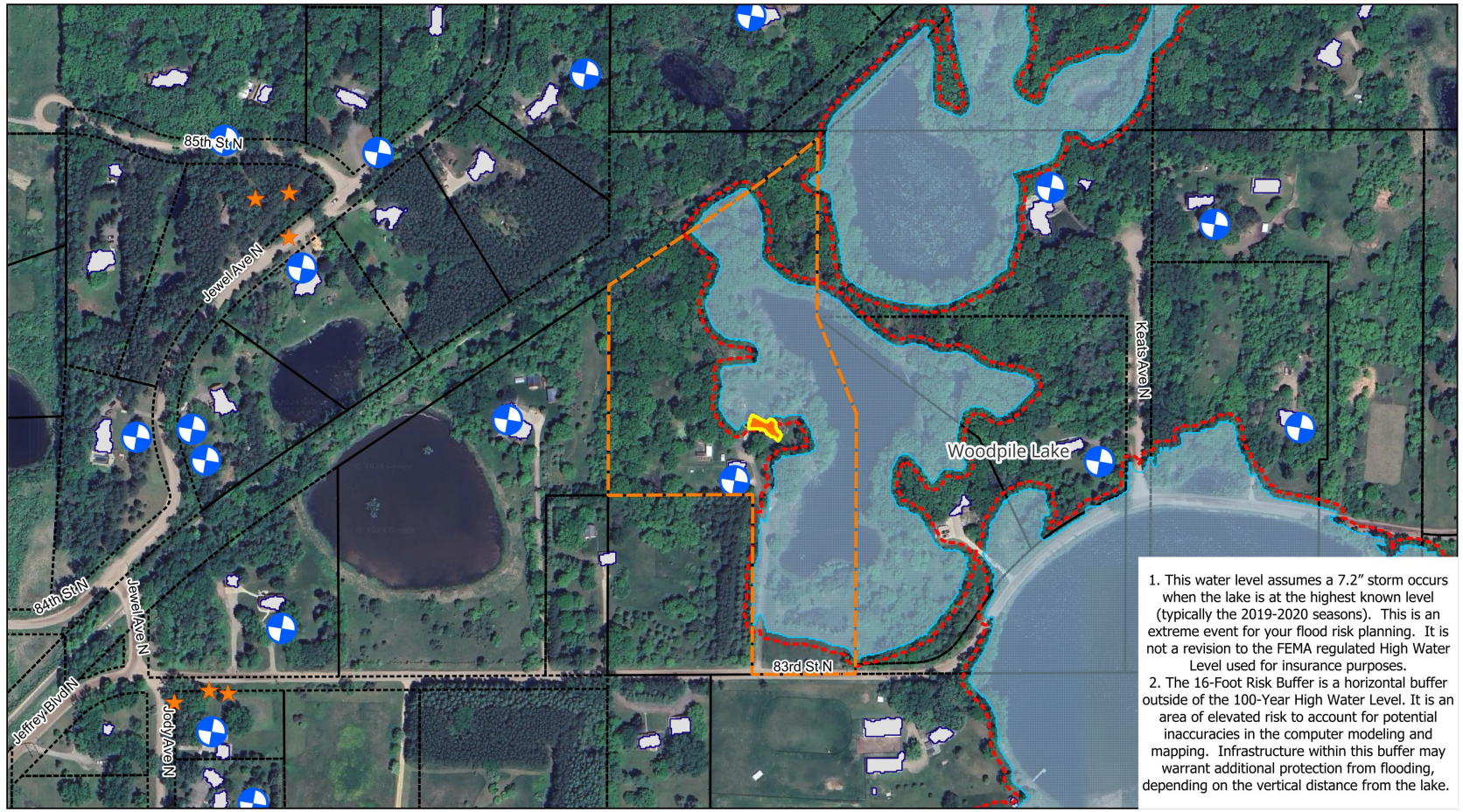
Woodpile Lake – High Water Level 972.5 ft

Summary:

- 1 Road Flooded (2.5’)
- 5 Buildings Impacted
- 0 Septic & Well Impacted
- 11 Parcels Lacking Data



Woodpile Lake – 9810 83rd St N



1. This water level assumes a 7.2" storm occurs when the lake is at the highest known level (typically the 2019-2020 seasons). This is an extreme event for your flood risk planning. It is not a revision to the FEMA regulated High Water Level used for insurance purposes.
2. The 16-Foot Risk Buffer is a horizontal buffer outside of the 100-Year High Water Level. It is an area of elevated risk to account for potential inaccuracies in the computer modeling and mapping. Infrastructure within this buffer may warrant additional protection from flooding, depending on the vertical distance from the lake.

N

- Parcel Require Survey
- Parcels
- Well
- Septic System
- Buildings
- Buildings Proximate to Flood Footprint
- 100-Year High Water Level [1]
- 16-Foot Risk Buffer [2]

Flood Risk Planning
Property Data Request

Woodpile Lake
PIN: 2203021410001
9810 83RD ST N

0 300 600 ft

Woodpile Lake – 10241 83rd St N

N

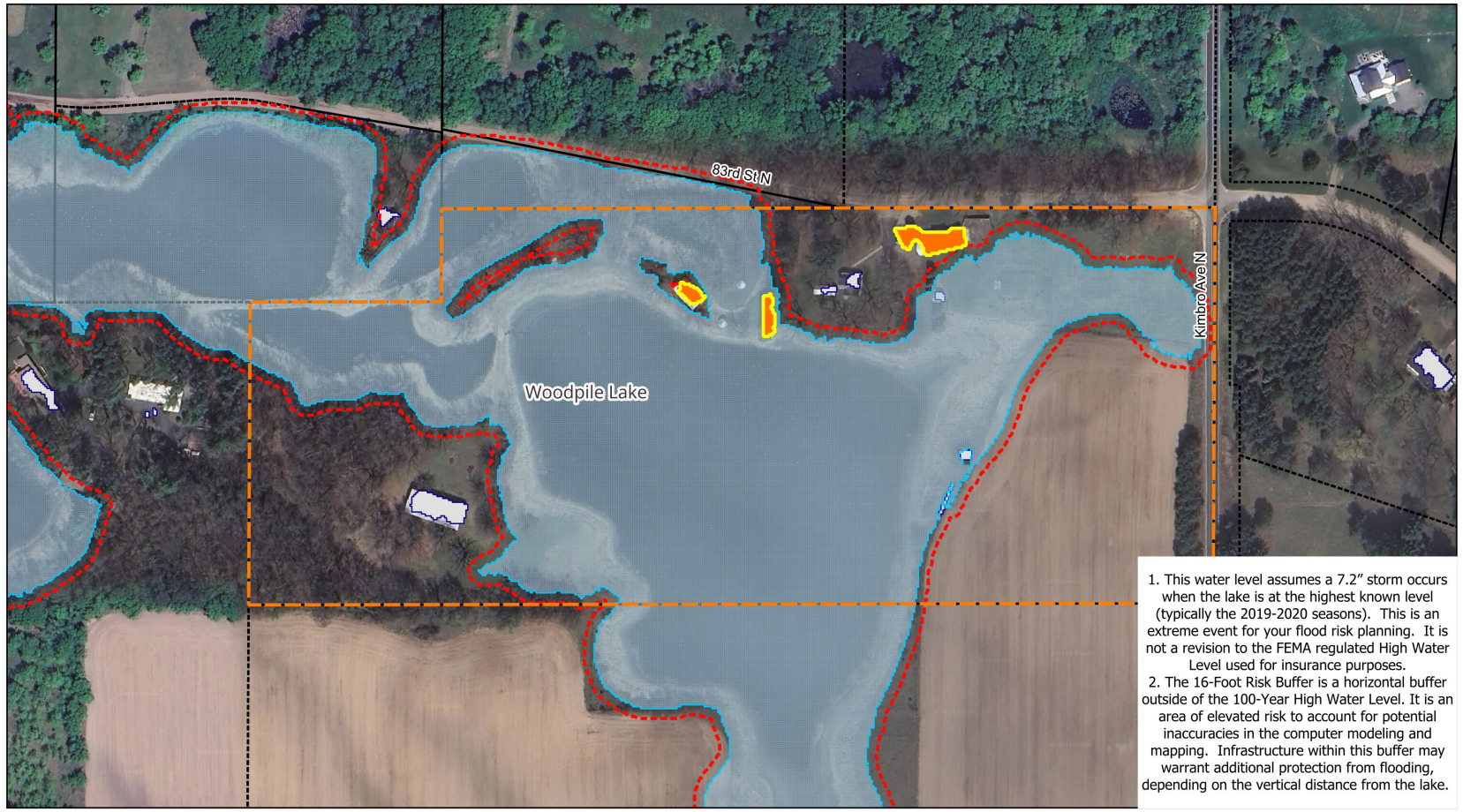
- Parcel Require Survey
- Parcels
- Well
- Septic System
- Buildings
- Buildings Proximate to Flood Footprint
- 100-Year High Water Level [1]
- 16-Foot Risk Buffer [2]

Flood Risk Planning
Property Data Request

Woodpile Lake
PIN: 2303021320004
10241 83RD ST N

0 80 160 ft

Woodpile Lake – 10381 83rd St N



N

- Parcel Require Survey
- Parcels
- Well
- Septic System
- Buildings
- Buildings Proximate to Flood Footprint
- 100-Year High Water Level [1]
- 16-Foot Risk Buffer [2]

Flood Risk Planning
Property Data Request

Woodpile Lake
PIN: 2303021310004
10381 83RD ST N

0 200 400 ft

Flood Risk Review: What Can You Do

When to Take Action?

100-year water increase is 2-5 feet depending on watershed and pond

Water level drawdown varies depending on whether there is an outlet

- Greater vertical distance from the water is better (Building Freeboard)
- Desired – Six feet between events for Long Lake & Woodpile Lake (Flashy & Landlocked)
- Four feet between events (Masterman Lake)

If the water level is greater than your comfort level in a given year –

- Consider enacting a flood action plan for your property
  - Identify low areas that will flood & areas prone to erosion
  - Plan protection measures for infrastructure & to prevent water intrusion
  - Estimate time to implement
  - Quantify and source protection measures
    - *Know what's on-hand within short notice – County, landscape supply, hardware store*
    - *Identify items with long lead time, e.g. landscaping, sump pump secondary power source*

Flood Risk Review: What Can You Do

Flood Mitigation Strategies (Low Tech):

Runoff/Snow & Ice Management

- Direct/store away from the structure where it will not cause erosion
- Clean and maintain conveyances (gutters, ditches, culverts)

Landscape to Protect Structure

- Hold/direct water away from structures

Sump Pump with Secondary Power Source

- Consider a secondary portable pump for removing water more quickly

Exterior French Drain

- Direct water away from structure

Apply Waterproof Sealants or Membranes

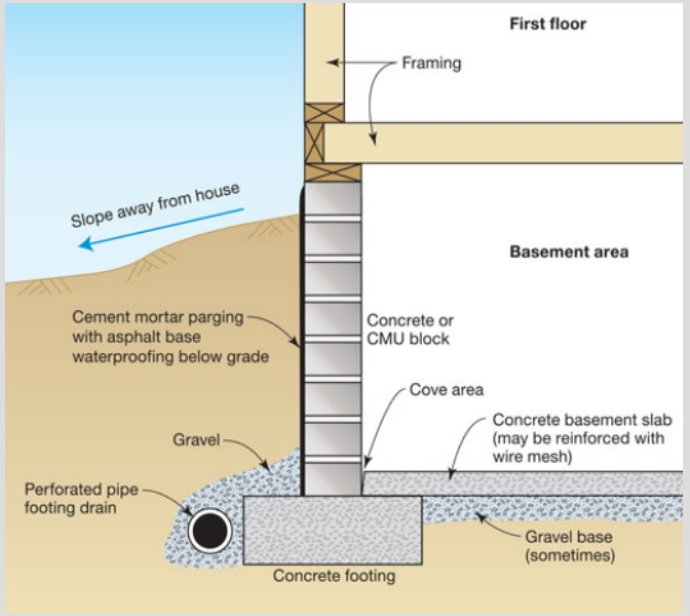
- In addition to other mitigation strategies

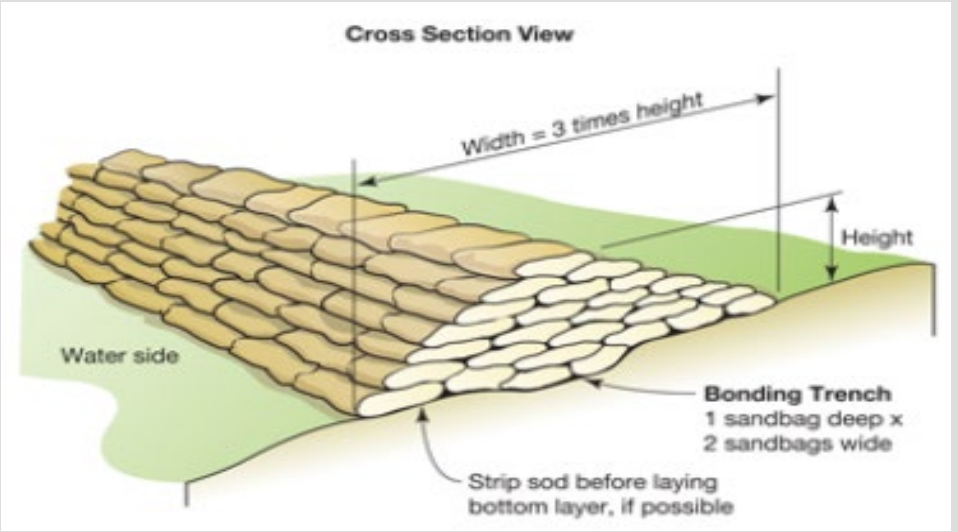
Sandbag Barrier

- Temporary & requires advance notice
- Address internal drainage

Purchase Flood Insurance

- Note this flood risk analysis is not remapping FEMA floodplain boundaries





Flood Risk Review: What Can We Do

Work with Local Government:

Regulate new & re-development to adhere to stormwater runoff standards

Anticipating water level increases –

- Increase level monitoring during periods of high water
- Localized groundwater measurements

Knowledge sharing –

- Current state of the science in flood response planning
- Linking residents with available guidance & informational resources

Flood Risk Review: What Can We Do

Knowledge Share:

- WCD Flooding
  - Links to local flood preparation information
- MnDNR LakeFinder Website
  - Lake levels updated monthly
- MnDNR Floodplain Management Group
  - Technical & Non-technical resources on mapping, insurance, flood preparation
- Lake & Flood Elevations Online
  - Interactive map with FEMA & MnDNR flood related layers
- FEMA Map Service Center
  - Official floodplain map, study, insurance
- ASFPM Reduce Flood Risk
  - Flood facts & mitigation resources for all audiences

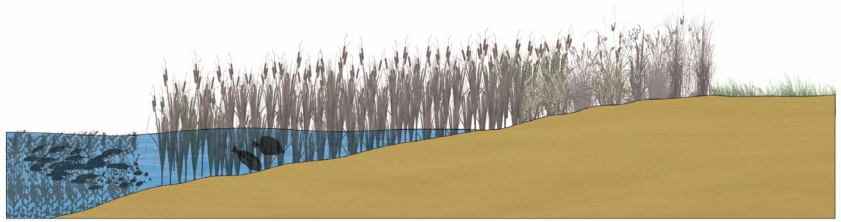
Flood Risk Review - Questions?

Low risk doesn't mean no risk – Everyone is in a floodplain, it's just a matter of for what event…

- 24-Hour Storm Depths
  - 1-Year = 2.44"
  - 5-Year = 3.49"
  - 10-Year = 4.17"
  - 25-Year = 5.23"
  - 50-Year = 6.17"
  - 100-Year = 7.20"
  - 200-Year = 8.35"
  - 500-Year = 10.00"
  - 1000-Year = 11.40"

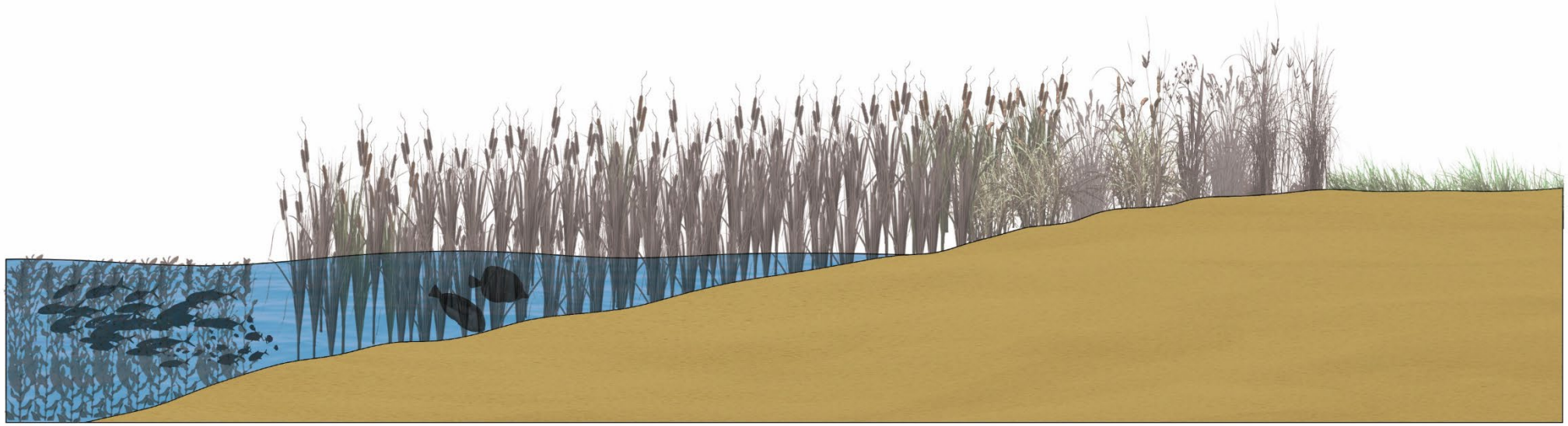
Shoreline Restoration

- Restore your shore!
- Natural shorelines can:
  - Prevent shoreline erosion.
  - Intercept and filter pollutants from upland sources.
  - Provides valuable habitat for a variety of wildlife.



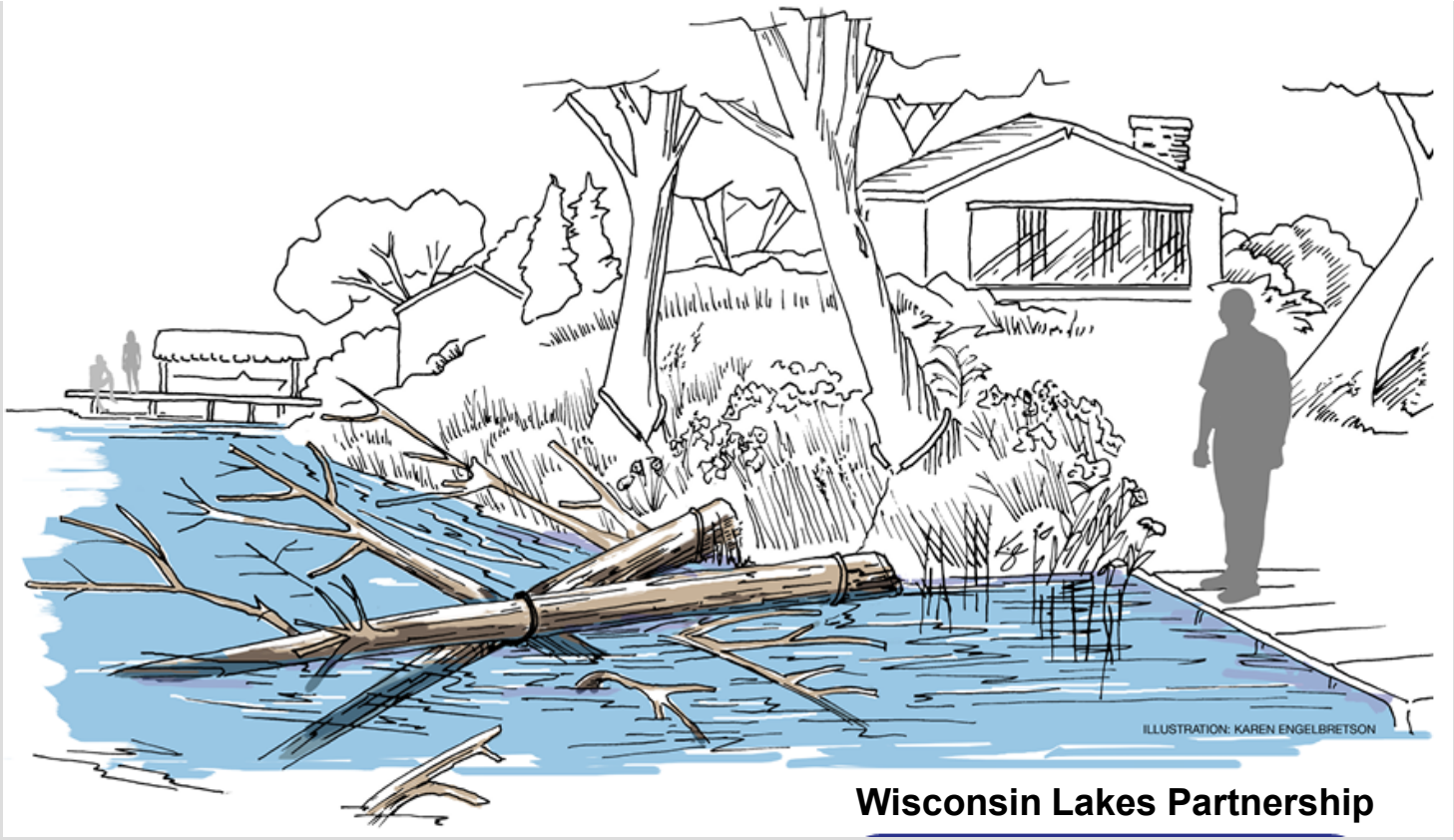
Rice Creek Watershed

Natural Lake Shoreline



Aquatic Habitat Practices

- "Loafing logs" or "fish sticks" -- preserve that woody debris!
  - Important fish & wildlife habitat best management practice (BMP)
  - Beneficial to a variety of organisms from small aquatic insects, to fish, turtles, ducks, and songbirds
  - Creates food, shelter, and breeding areas.
  - Can also help prevent bank erosion – protecting lakeshore properties and your lake.



Wisconsin Lakes Partnership

Turf Management

- Mow and fertilize less!
- Maintain a healthy and environmentally friendly yard by:
  - Mow to a height of 3 inches to promote deeper roots.
  - Remove no more than 1/3 of turf height when you mow.
  - Use sharp mower blades.
  - Alternate mowing pattern 90 degrees.
  - Leave clippings in the lawn (enhances soil quality, improves C sequestration, and reduces runoff.)
- Consider low-input turf alternatives that fit your site.

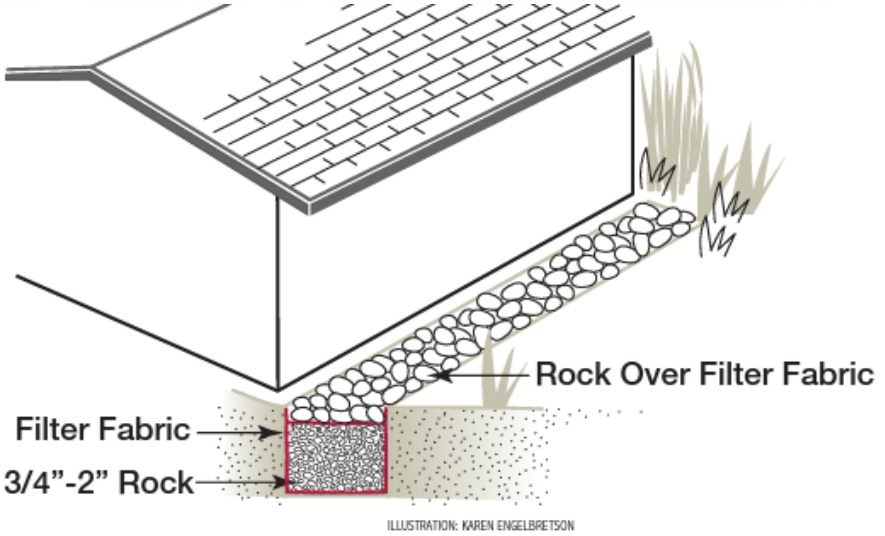
Low-mow lawn in Stillwater, MN

Bioretention: Raingardens & Swales

- Small depressions in the landscape designed to collect and treat stormwater runoff
- Reduce pollution to lakes, rivers and streams
- Allows water to soak into the soil, recharging groundwater and reducing runoff volume.
- Planted with native vegetation to provide habitat for birds, insects and other wildlife.
- Can be an aesthetic enhancement to your landscape!

Rock Infiltration

- Shallow excavated trenches backfilled with coarse aggregate for temporary storage & infiltration.
- Like a raingarden, these BMPs capture and clean stormwater while reducing runoff.
- Appropriate for sandy to loamy soils only (not clay!) in small drainage areas.
- May require a catch basin or diversion practice to redirect runoff water to it



Chloride Reduction

- It takes just one teaspoon of salt to **permanently** pollute just five gallons of water.
- High chloride levels are toxic to fish, aquatic bugs, mussels and amphibians.
- Practice Smart Salting!
  - Shovel first.
  - Do not over-apply salt (~12 oz. per 1,000 ft2).
  - Use sand in temperatures below 15°F.
  - Sweep up excess salt.

1. Shovel

Clear walkways before snow turns to ice, and before you apply salt. The more snow you clear manually, the less salt you'll need.

2. Select

Salt doesn't melt ice if the pavement is below 15 degrees, so use sand for traction when it's too cold, or choose a different de-icer.

3. Scatter

Use salt only where it's critical. When you apply salt to pavement, leave plenty of space between granules. A 12-ounce coffee cup of salt is enough to cover 10 sidewalk squares or a 20-foot driveway.

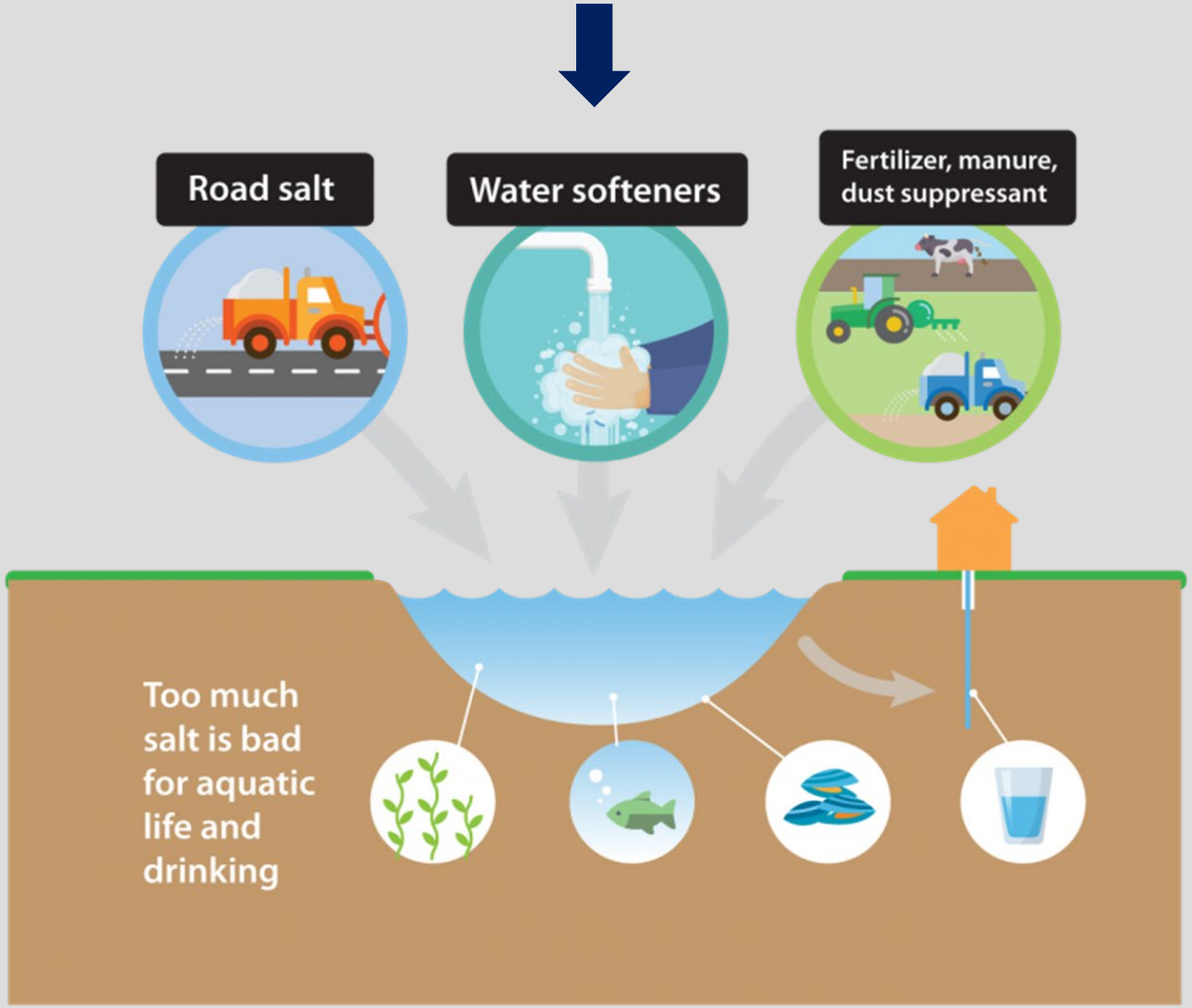
4. Sweep

Clean up leftover salt, sand, and de-icer to save and reuse as needed.

Protect our water!

Chloride Reduction

- Water Softeners:
  - Soft water goes to your tap while the minerals and the brine solution go down the drain.
  - Is your water softener necessary? Stop using your water softener if hardness is less than 120 mg/L CaCO3 (7 grains per gallon).
  - Switch from a timer-based to a demand-based system.
  - Install a bypass for your outside spigot so that you aren't softening water for irrigation.
  - Consider a non-salt-based system as an alternative (e.g. reverse osmosis)



Useful Links

Chloride Reduction Strategies

Eco Living – Use less salt in your water softener to cut pollution and save money

https://www.pca.state.mn.us/news-and-stories/eco-living-use-less-salt-in-your-water-softener-to-cut-pollution-and-save-money

Eco Living – Apply de-icing salt correctly to protect our lakes and streams

https://www.pca.state.mn.us/news-and-stories/winter-is-finally-here-apply-de-icing-salt-correctly-to-protect-our-lakes-and-streams

UMN Water Resource Center - Residential Softening

https://wrc.umn.edu/residentialsoftening

MN Statewide Chloride Management Plan

https://www.pca.state.mn.us/business-with-us/statewide-chloride-resources

Useful Links

Turf Management

What to do with lawn clippings
https://extension.umn.edu/lawn-care/what-do-lawn-clippings

Mowing practices for healthy lawns
https://extension.umn.edu/lawn-care/mowing-practices-healthy-lawns

Water-saving strategies for home lawns
https://extension.umn.edu/lawn-care/water-saving-strategies-home-lawns

Fertilizing lawns
https://extension.umn.edu/lawn-care/fertilizing-lawns

Planting and maintaining a fine fescue lawn
https://extension.umn.edu/lawns-and-landscapes/planting-and-maintaining-fine-fescue-lawn

Useful Links

Do I need a permit:

https://www.dnr.state.mn.us/permits/water/needpermit.html

Aquatic Vegetation

https://www.dnr.state.mn.us/apm/index.html

Beach Sand Blanket

https://files.dnr.state.mn.us/publications/waters/shoreline_alterations_sand_blanket.pdf

Boat Ramp

https://files.dnr.state.mn.us/publications/waters/shoreline_alterations_boat_ramps.pdf

Riprap

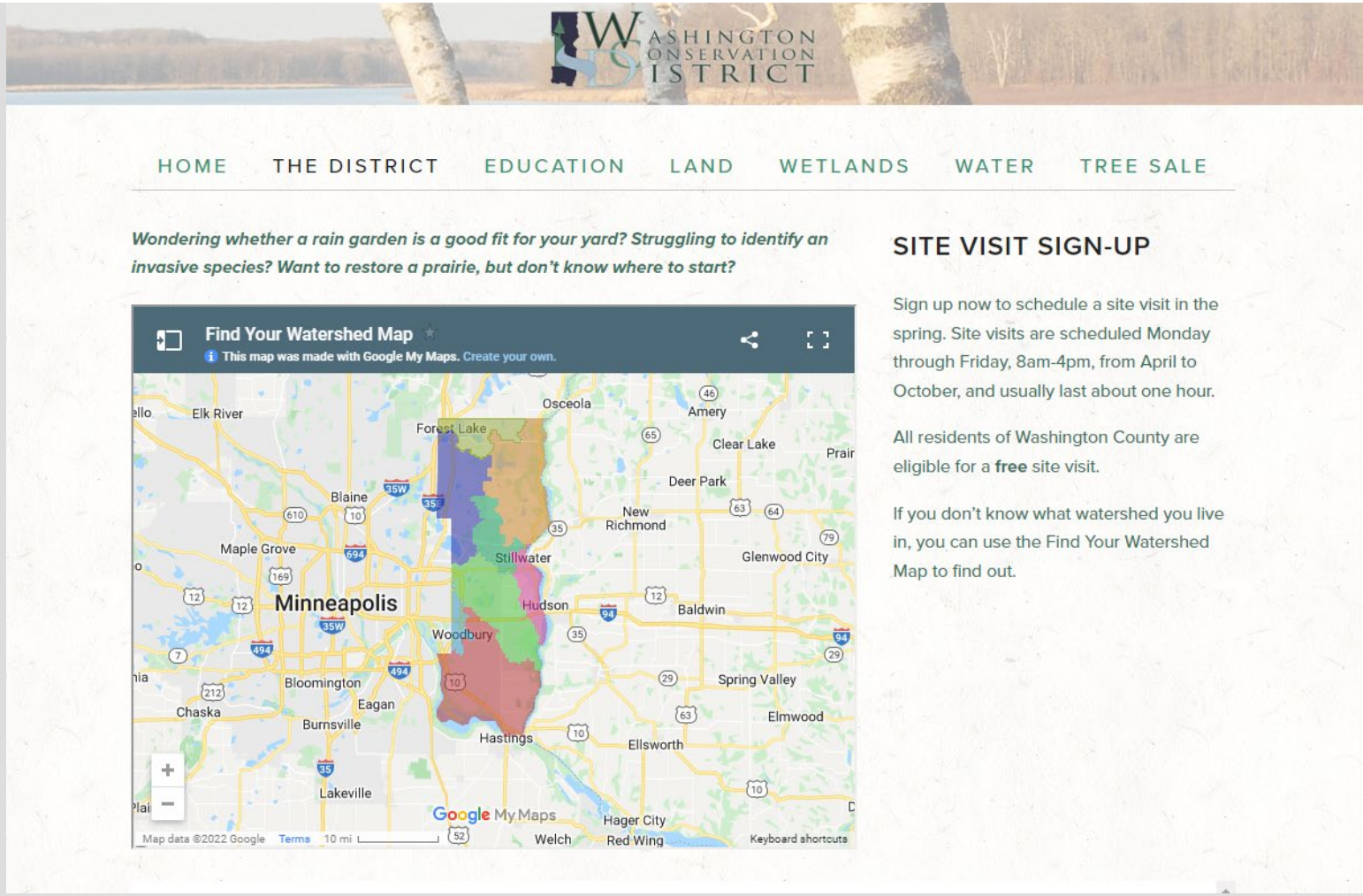
https://files.dnr.state.mn.us/publications/waters/shoreline_alterations_riprap.pdf

For More Information

Contact the WCD for a free site visit:
http://www.mnwcd.org/site-visit-signup-form

Learn more about the District's Stewardship Grant Program:
https://bcwd.org/stewardship-grants/

Brett Stolpestad
Landscape Restoration Specialist
bstolpestad@mnwcd.org
T: (651) 393-4395



Thank you

Contact for the District

Karen Kill, District Administrator

651-330-8220

karen.kill@mnwcd.org

Recording location:

- bcwd.org/long-lake/
- bcwd.org/lake-masterman/
- bcwd.org/woodpile-lake/