Long Lake Update

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

Brown's Creek Watershed District
Board of Managers

water | ecology | community

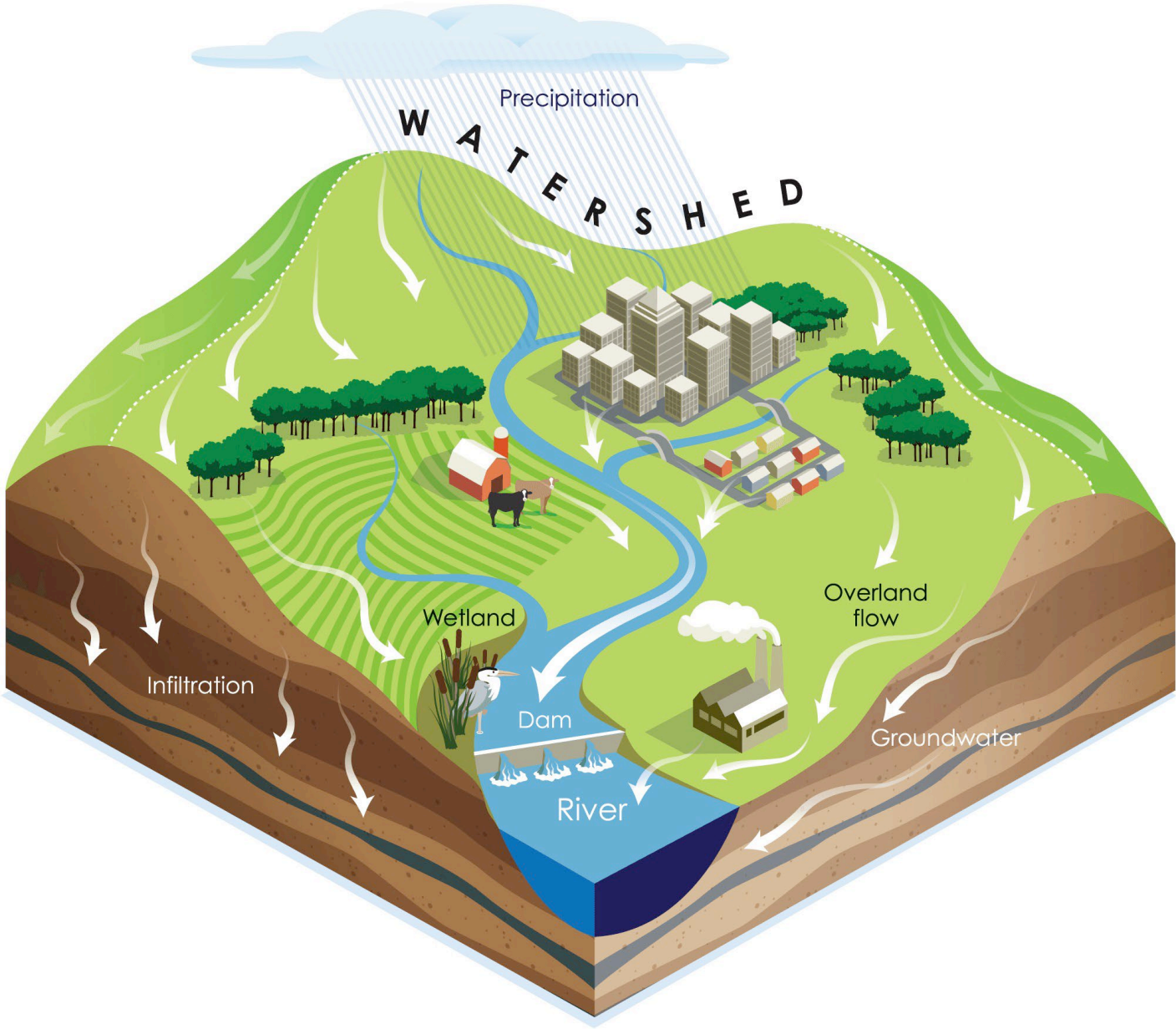
Outline

- 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

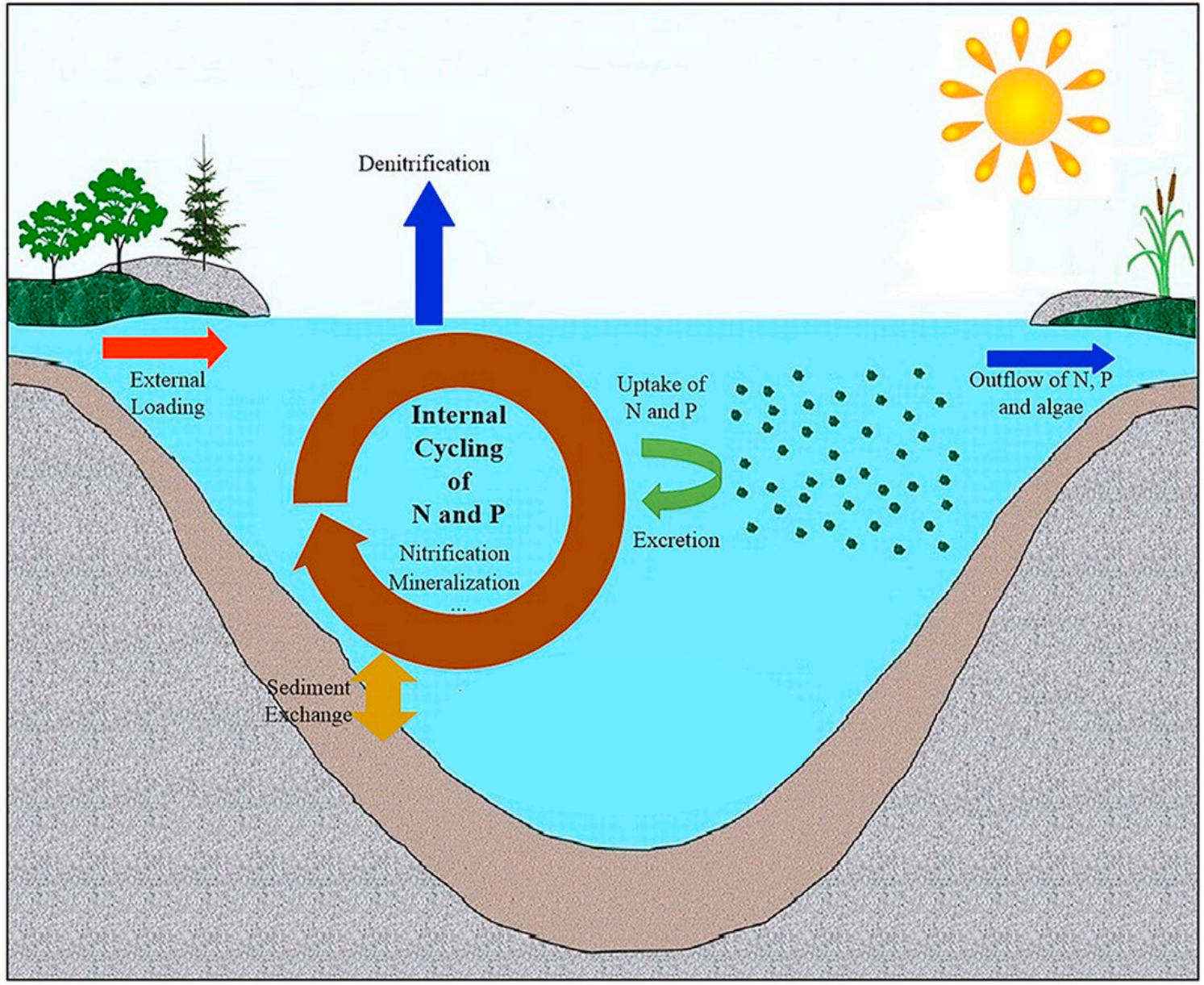
- **Size and Shape**
- **Topography**
- **Soils**
- **Vegetative Cover**
- **Land Uses**



Watershed Pollutant Loading

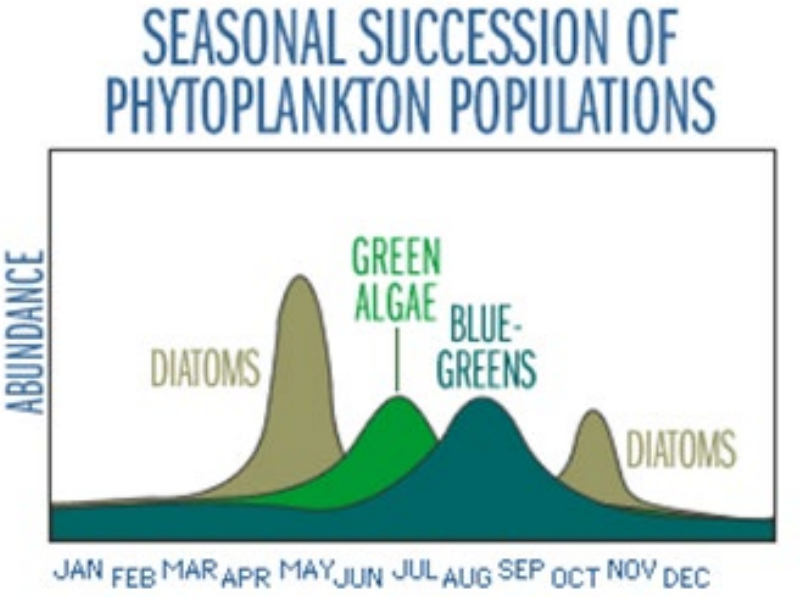
NUTRIENT FATE

- 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

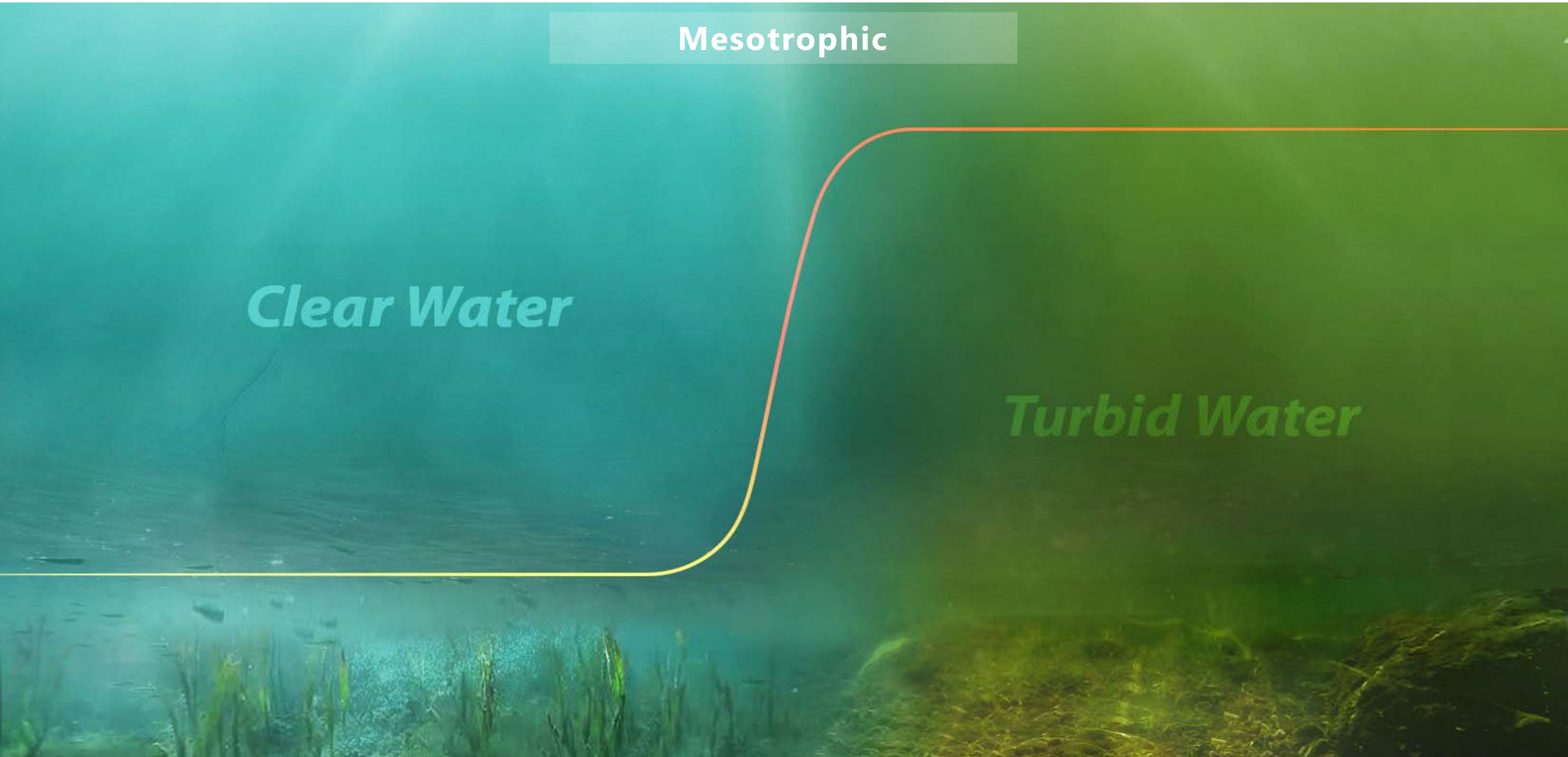
CLEAR-AQUATIC PLANT DOMINATED STATE

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



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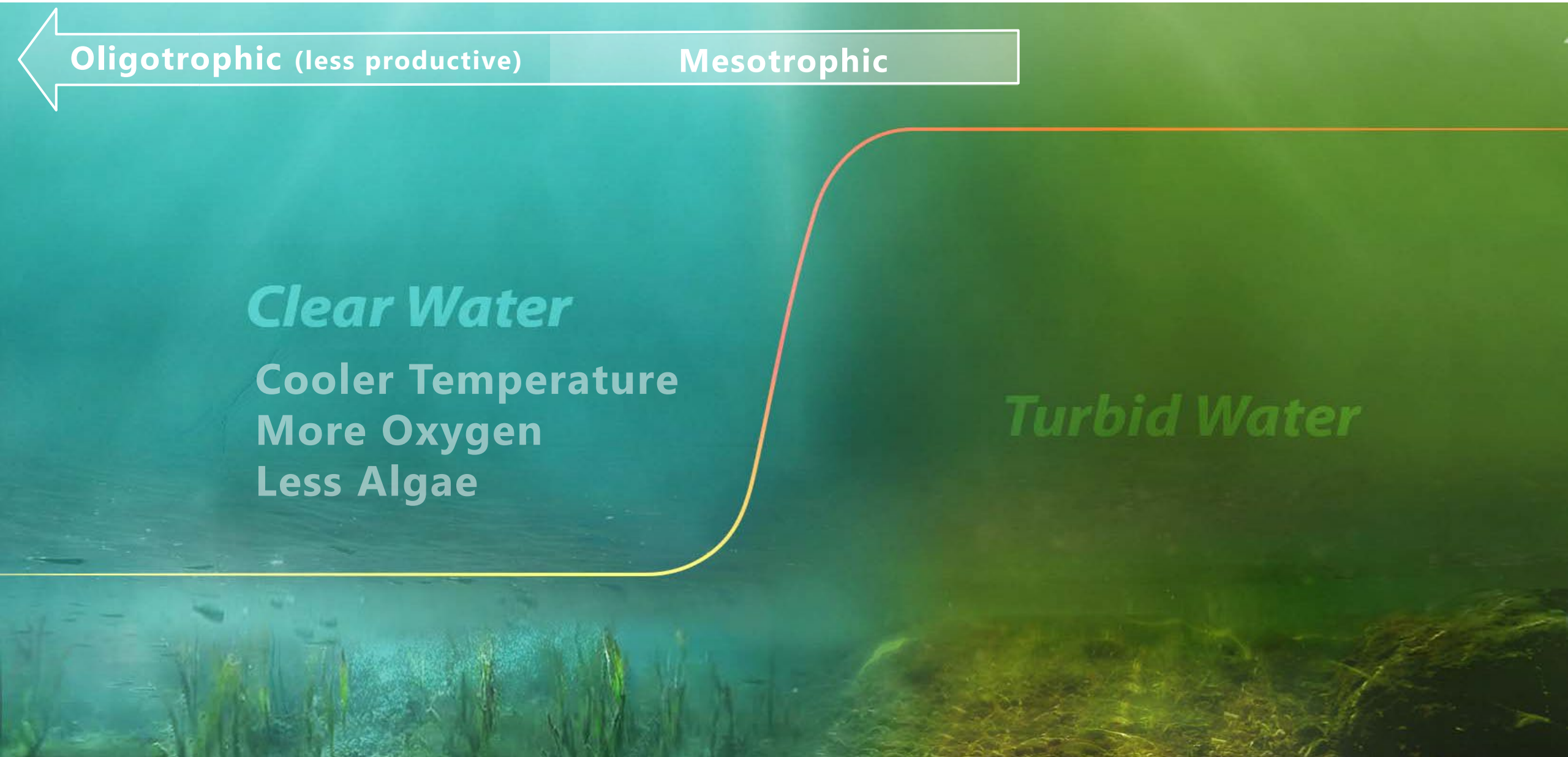
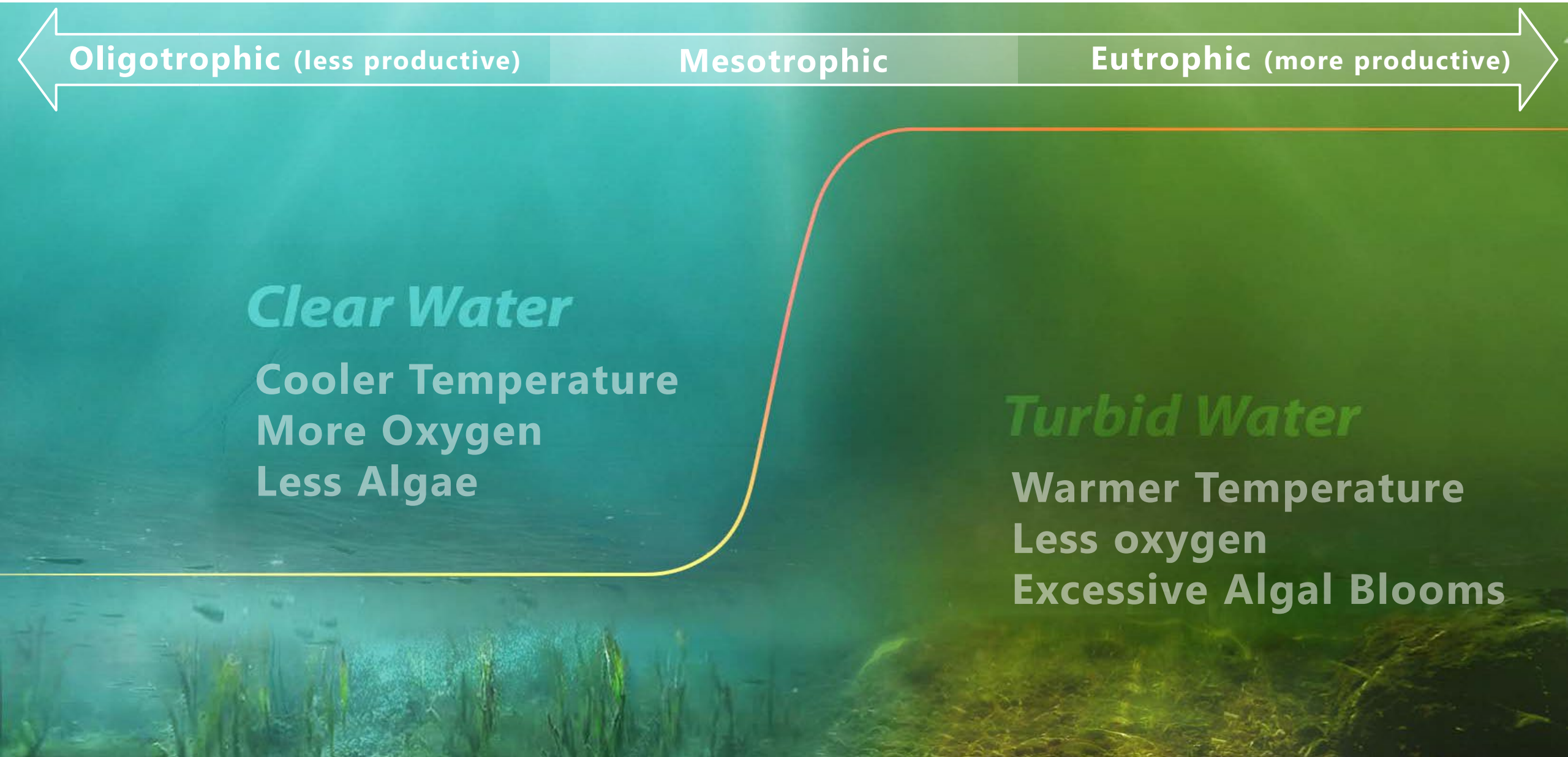


TROPHIC STATES: measure of fertility/lake productivity

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

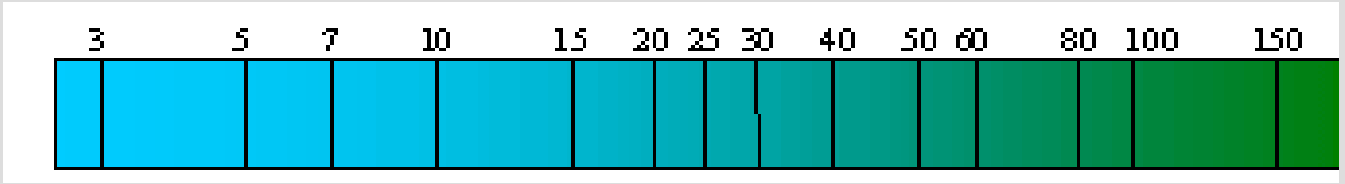


Trophic State: 3 Key Parameters

Phosphorus
'limiting' nutrient in lakes

Phosphorus (µg/l) related to Lake Trophic State

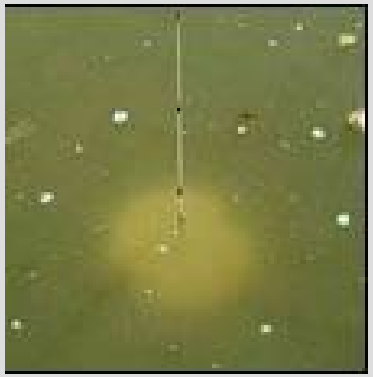
Oligotrophic Mesotrophic Eutrophic Hypereutrophic

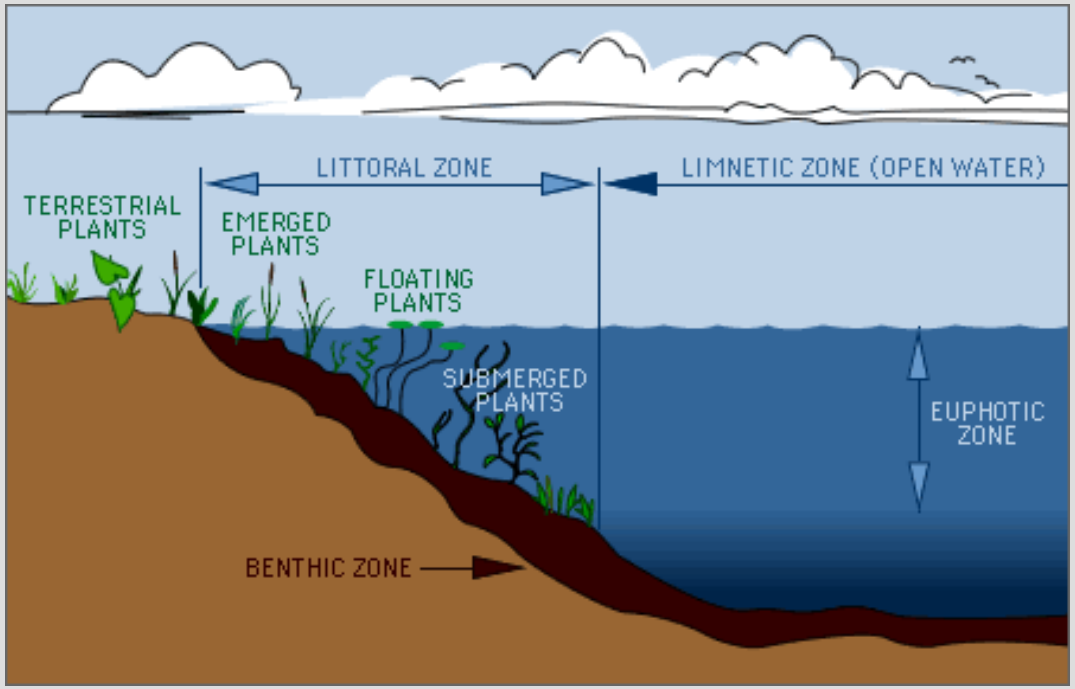


Trophic State: 3 Key Parameters

Transparency
measure of light penetration

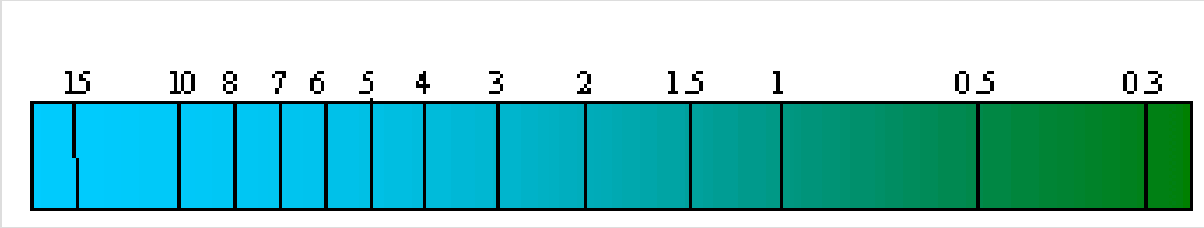






Transparency (m) related to Lake Trophic State

Oligotrophic Mesotrophic Eutrophic Hypereutrophic



Trophic State: 3 Key Parameters

Chlorophyll-a
measure of algae

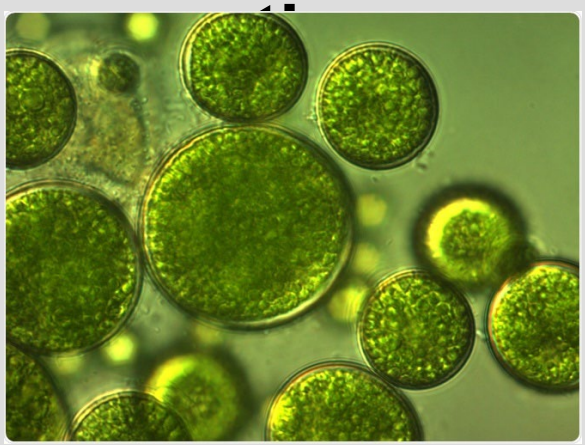
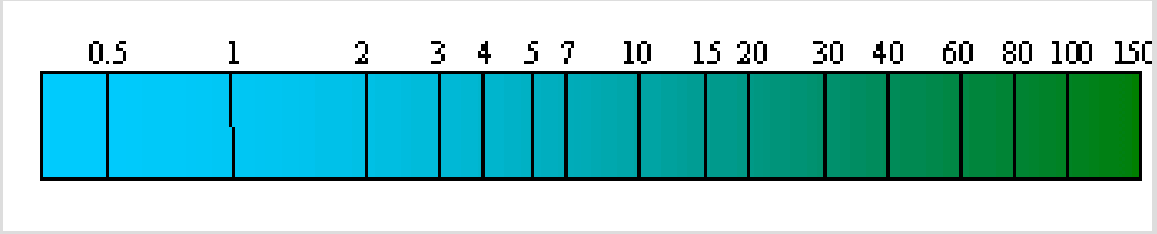


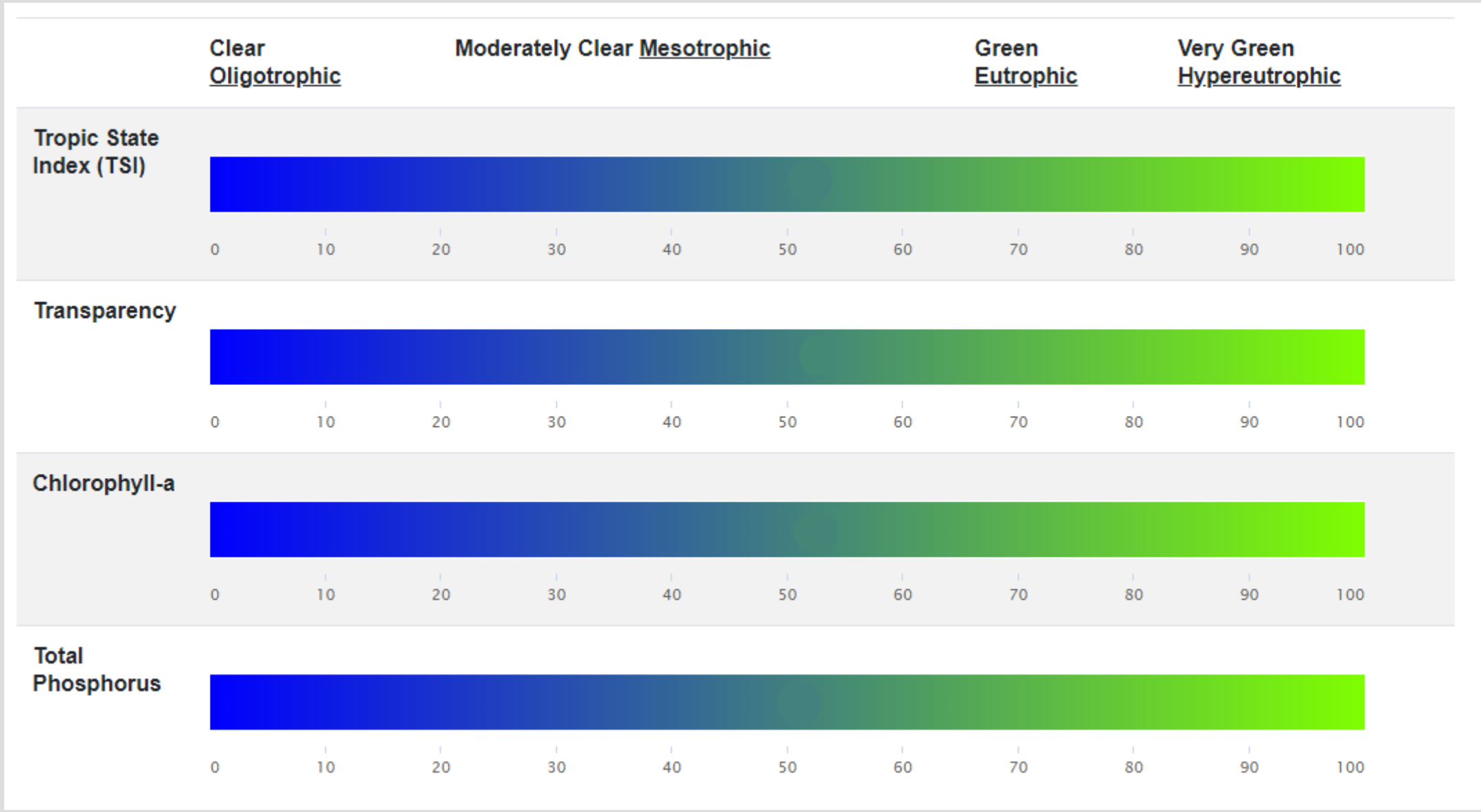
Image Credit: Ye.Maltsev/Shutterstock.com

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

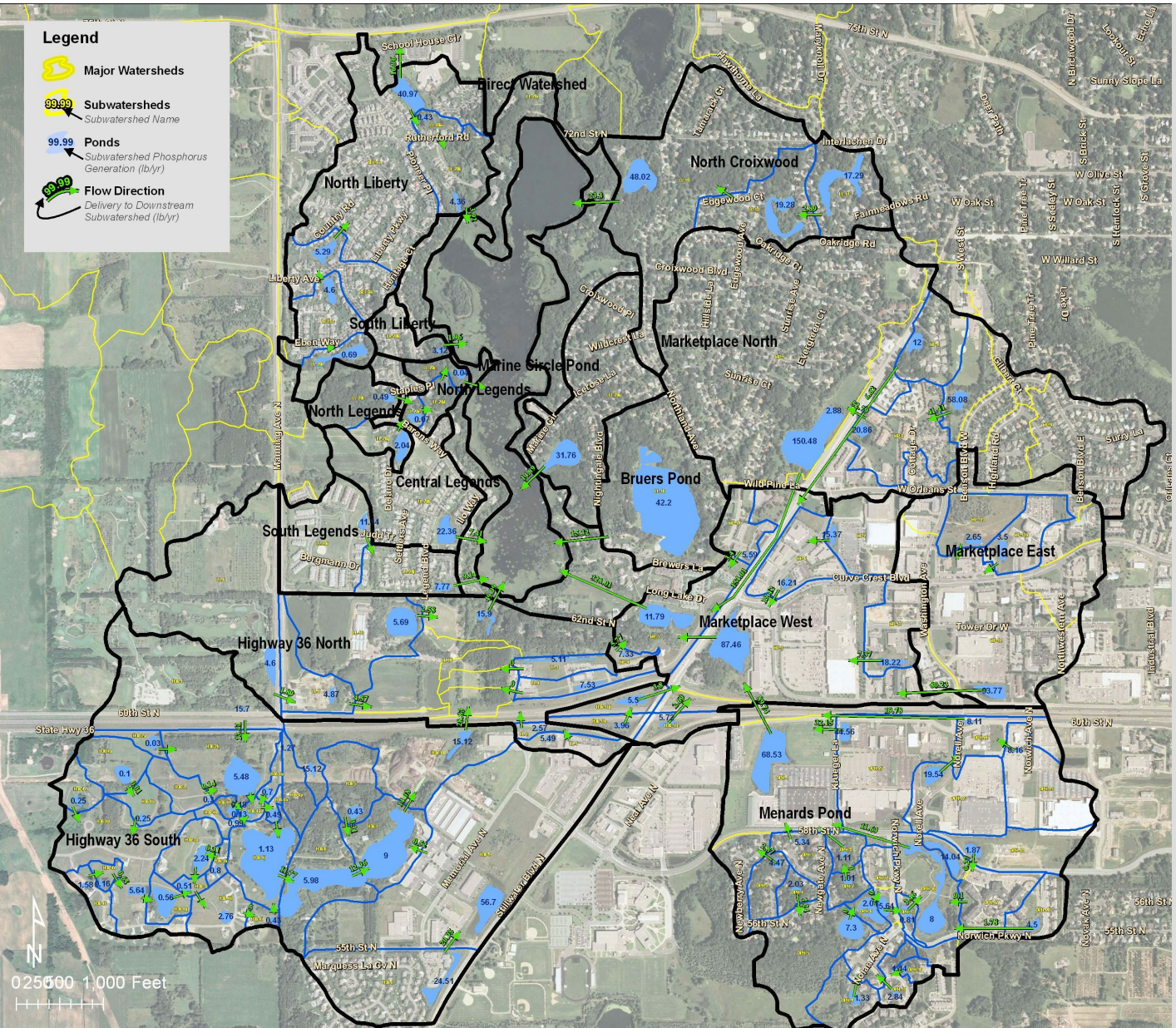
Oligotrophic **Mesotrophic** **Eutrophic** **Hypereutrophic**



Trophic State Index



Long Lake



Lake Size: 110 acres

Maximum Depth (2023): 21 ft

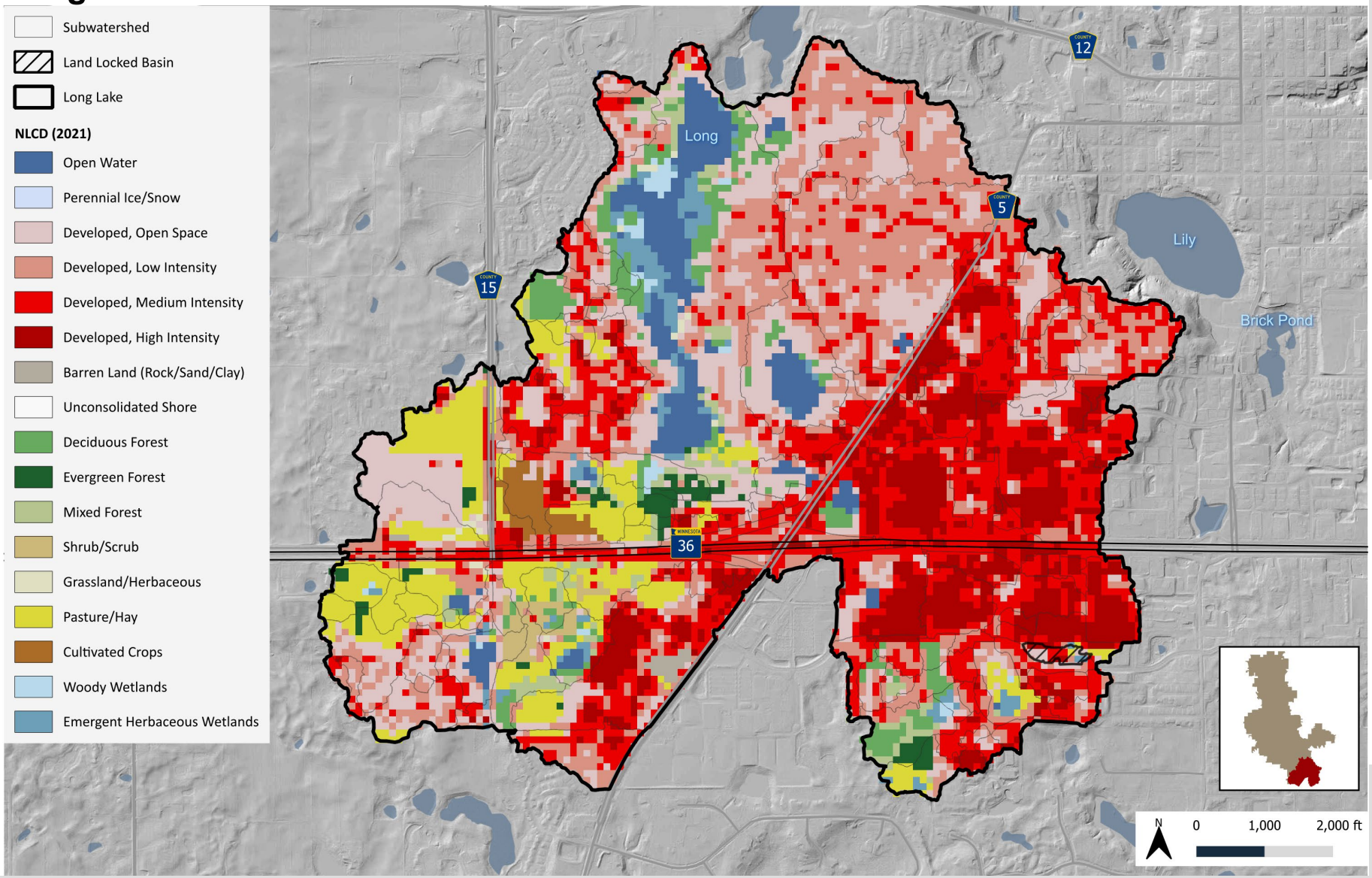
Ordinary High Water Level Mark: 891.5 ft

95% Littoral

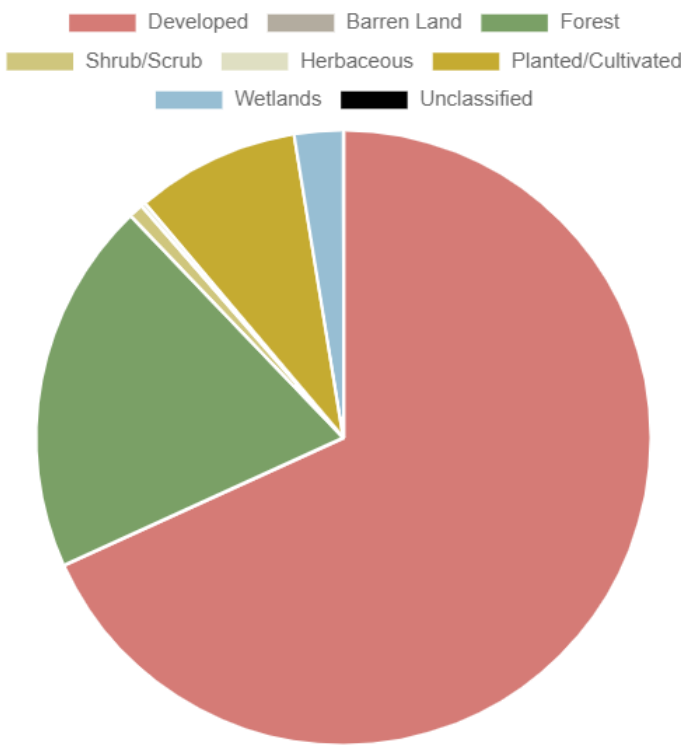
~ Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation

Long Lake

Long Lake - Land Cover



The watershed is primarily developed, 68%



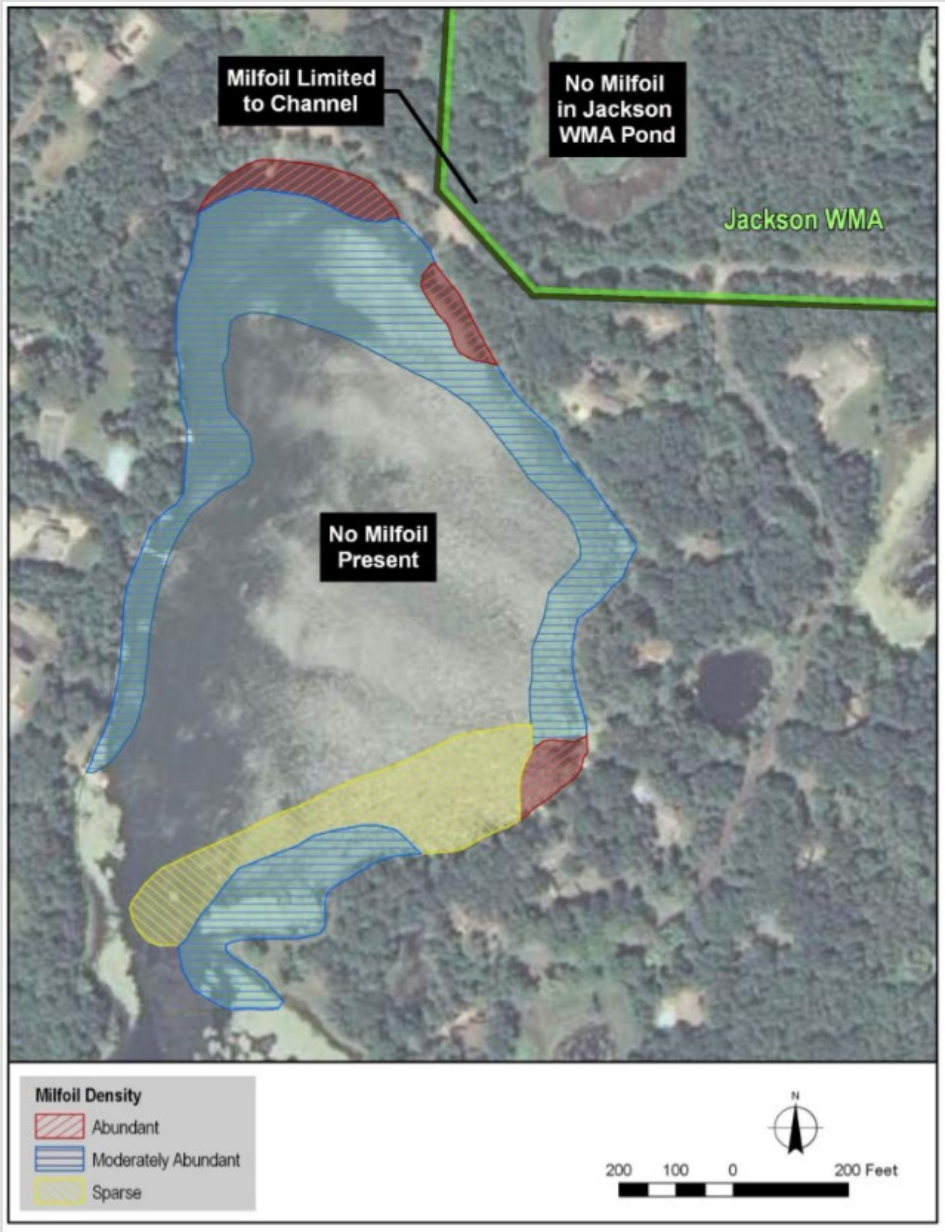
Long Lake

Aquatic Plants

- Middle & South Lobes – White Water Lily and Common Waterweed dominated
- Northern Lobe - Common Waterweed and Coontail dominated with White water lily and Eurasian Watermilfoil patches in shallower waters
- Jackson WMA Pond - Coontail and Common Waterweed dominated with White water lily patches in shallower waters

Fisheries Data

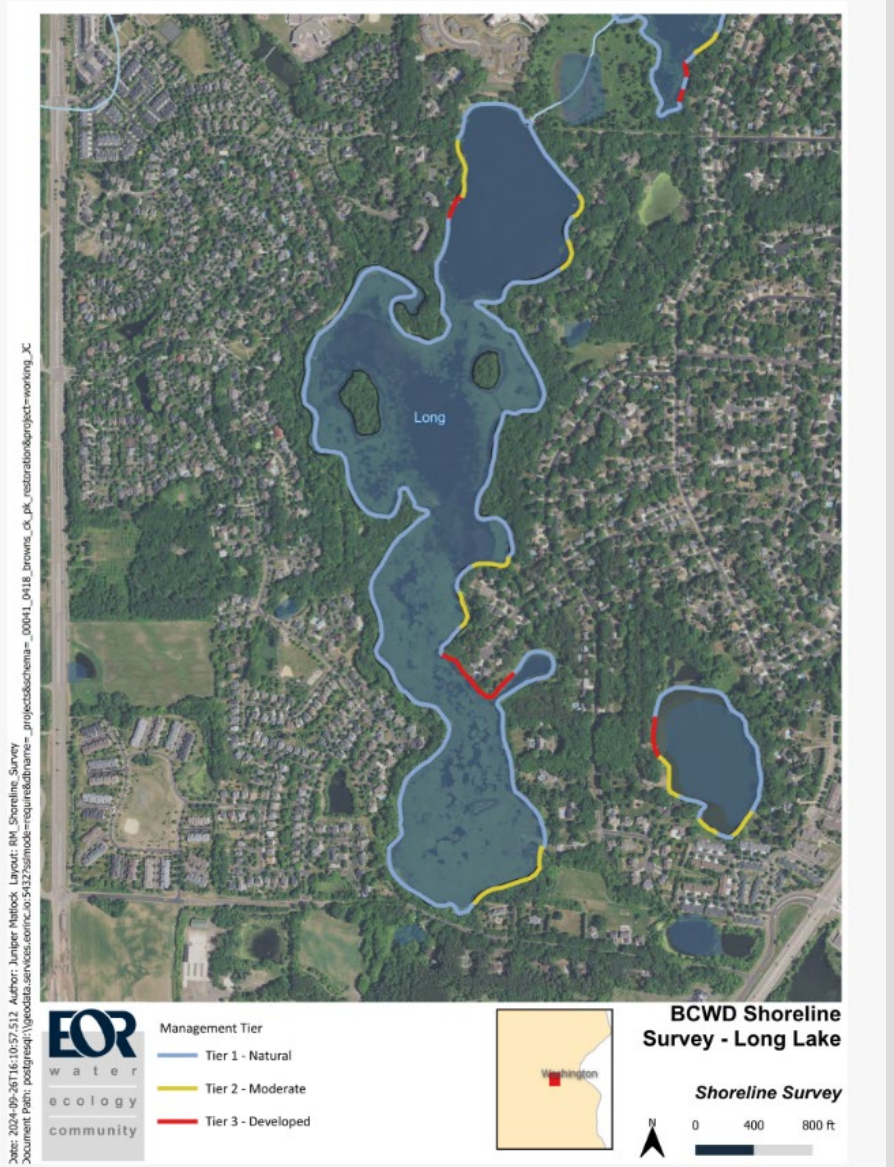
Black bullheads dominate the fish population, making up over 90% of the fish sampled. Golden shiner are the second most abundant species present. A few sunfish have been captured. One walleye was sampled.



Long Lake

- The majority of the shoreline is natural
- The heavily developed shoreline is along Maine Circle

		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%



Long Lake Chloride

- Recently, Long Lake was shown to have chloride concentrations above the chronic exposure threshold for aquatic life.
- The tributary to Long Lake exceeded the chronic chloride standard three times which contributes to the elevated chloride concentrations in Long Lake.
- Watershed is working to:
  - Reduce sources
  - Support Smart Salting
  - Encourage Limited Liability

Long Lake

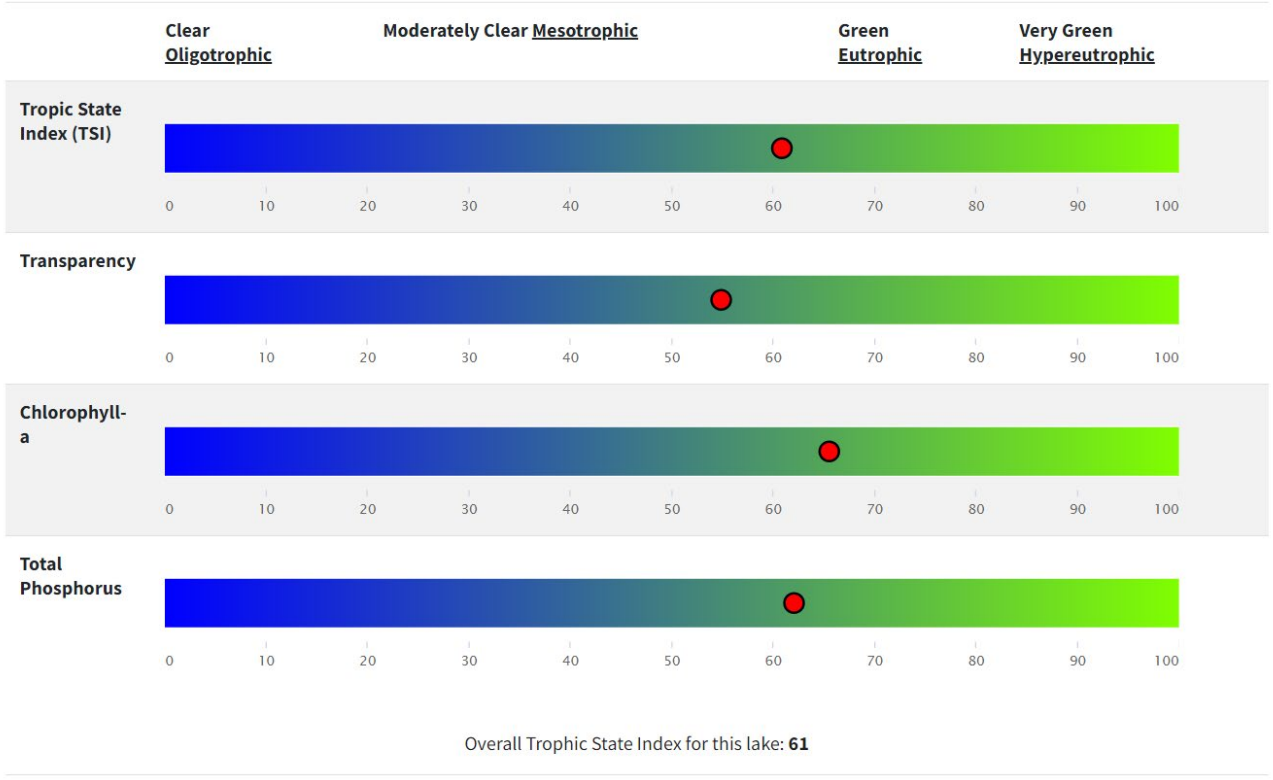
2023 Lake Grade: B+

- Total phosphorus (TP) and Secchi depth transparency meeting the standard.
- Trend analysis of TP, chlorophyll a, and Secchi depth transparency shows statistically significant improving trends.

On the road to Delisting from Impaired Waters List for excess nutrients

-Big thanks to the City of Stillwater for all the efforts in load reductions to Long Lake

Water Quality Improvements in Long Lake

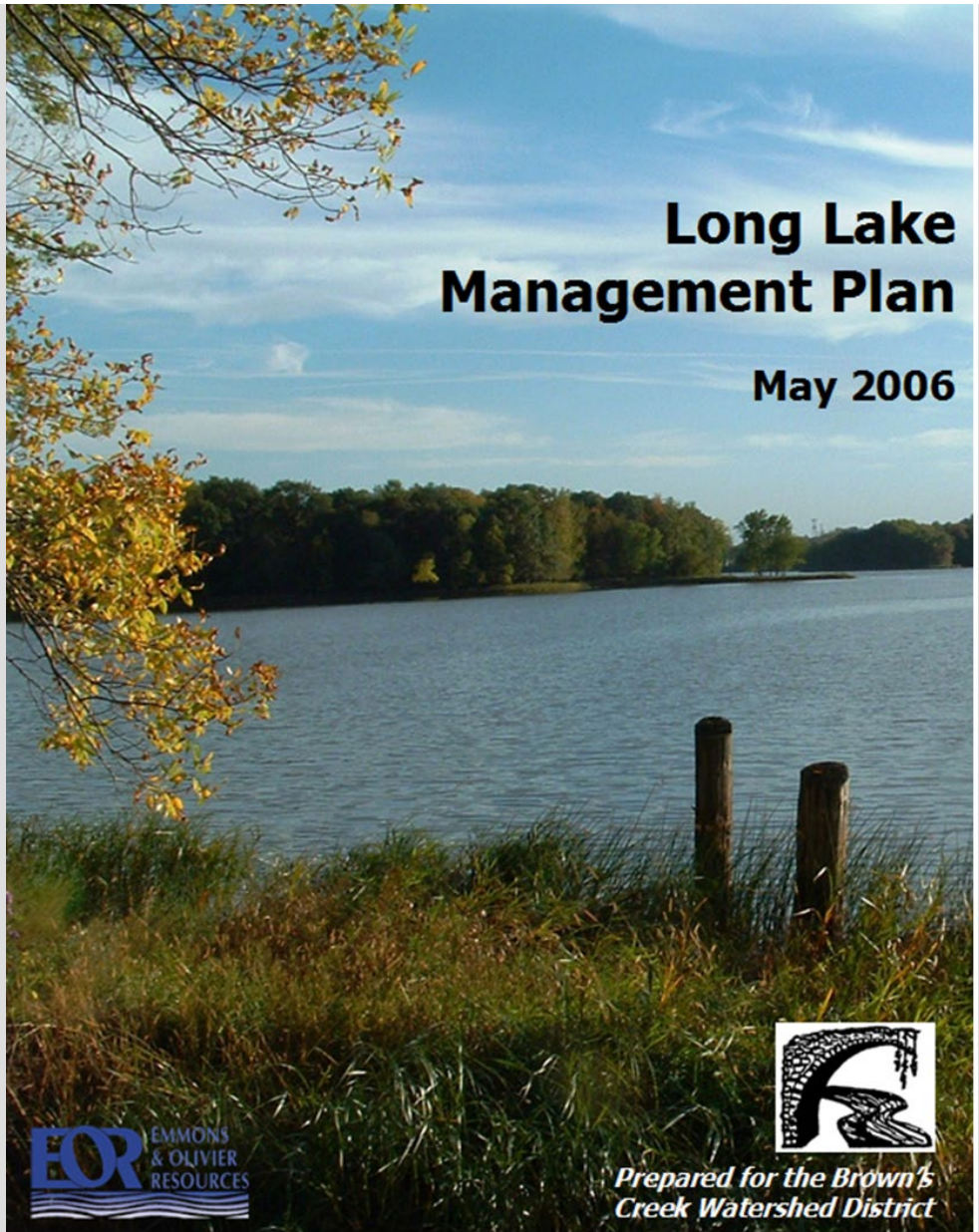


Overall Trophic State Index for this lake: **61**

Parameters	10-Year average of all summer samples	Parameter TSI	Expected TSI range of lakes in same ecoregion	Number of samples
Transparency (meters)	1	55	43 - 54	85
Chlorophyll-a (parts per billion)	35	66	46 - 61	63
Total Phosphorus (parts per billion)	55	62	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.

History of Long Lake Management – Water Quality

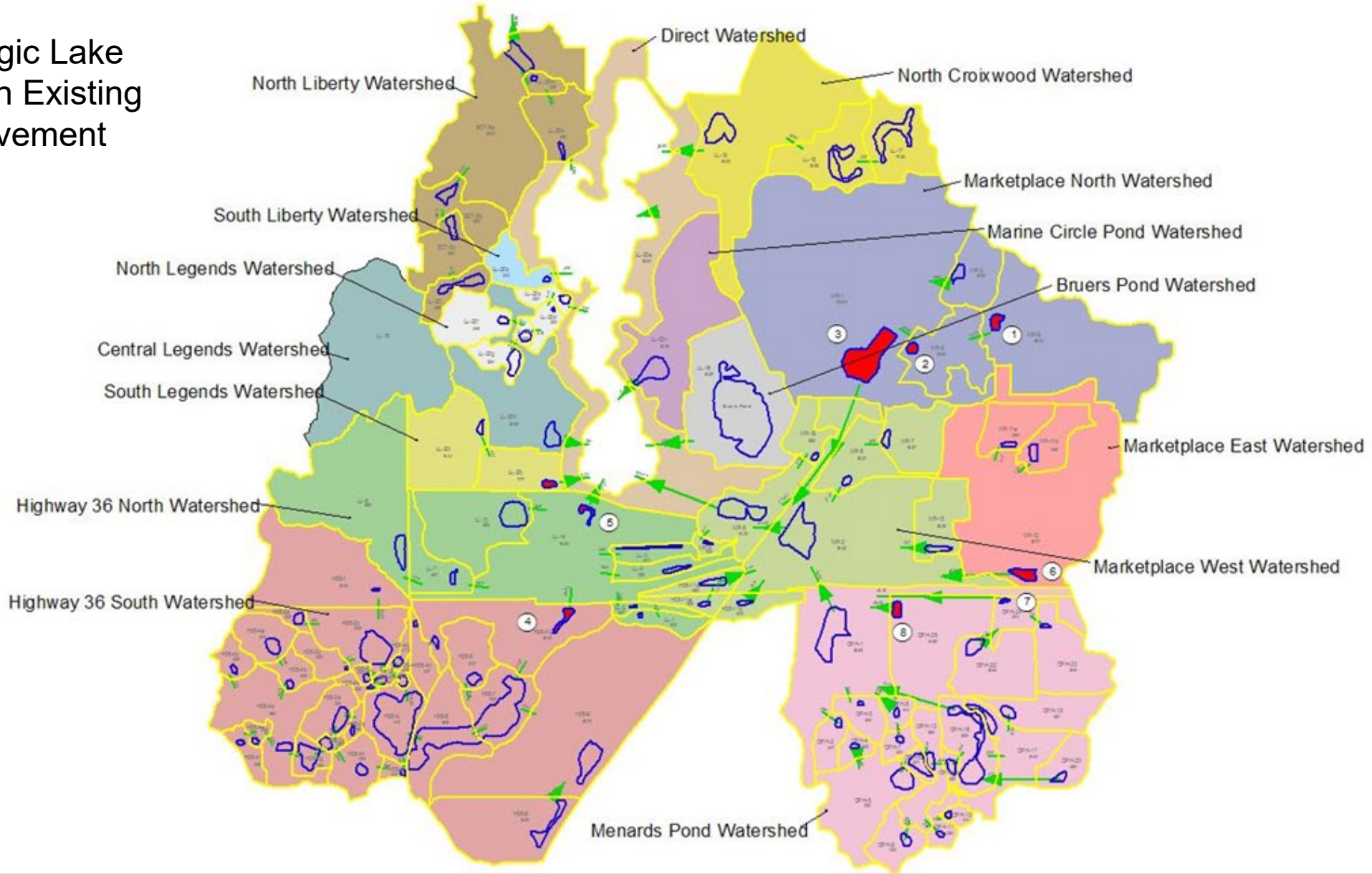


Long Lake Management Plan (2006)

- **Established target in-lake concentration and set 35% P load reduction goal**
- **Subwatershed Imp. Plan 10 yr. - $1.5 million**
  - Improvements to 8 Existing BMPs
    - *MP-9 Pond*
    - *MP-8 Pond*
    - *MP-1 Pond*
    - *H36-10 Pond*
    - *LL-14 Pond*
    - *MP-12 Herberger's Pond*
    - *OPH-24 Applebee's Pond*
    - *OPH25 Kohl's Pond*
  - New Stormwater BMPs
    - Six Small to Medium Scale Raingardens
    - Five Community Scale Raingardens
    - Three Community Scale Infiltration Trenches
    - One Basin
    - 2,800 feet of Lakeshore Buffer
- **Improved Street & Parking Lot Sweeping**
- **Sediment Delta Removal**
- **Lake Restoration**

History of Long Lake Management – Water Quality

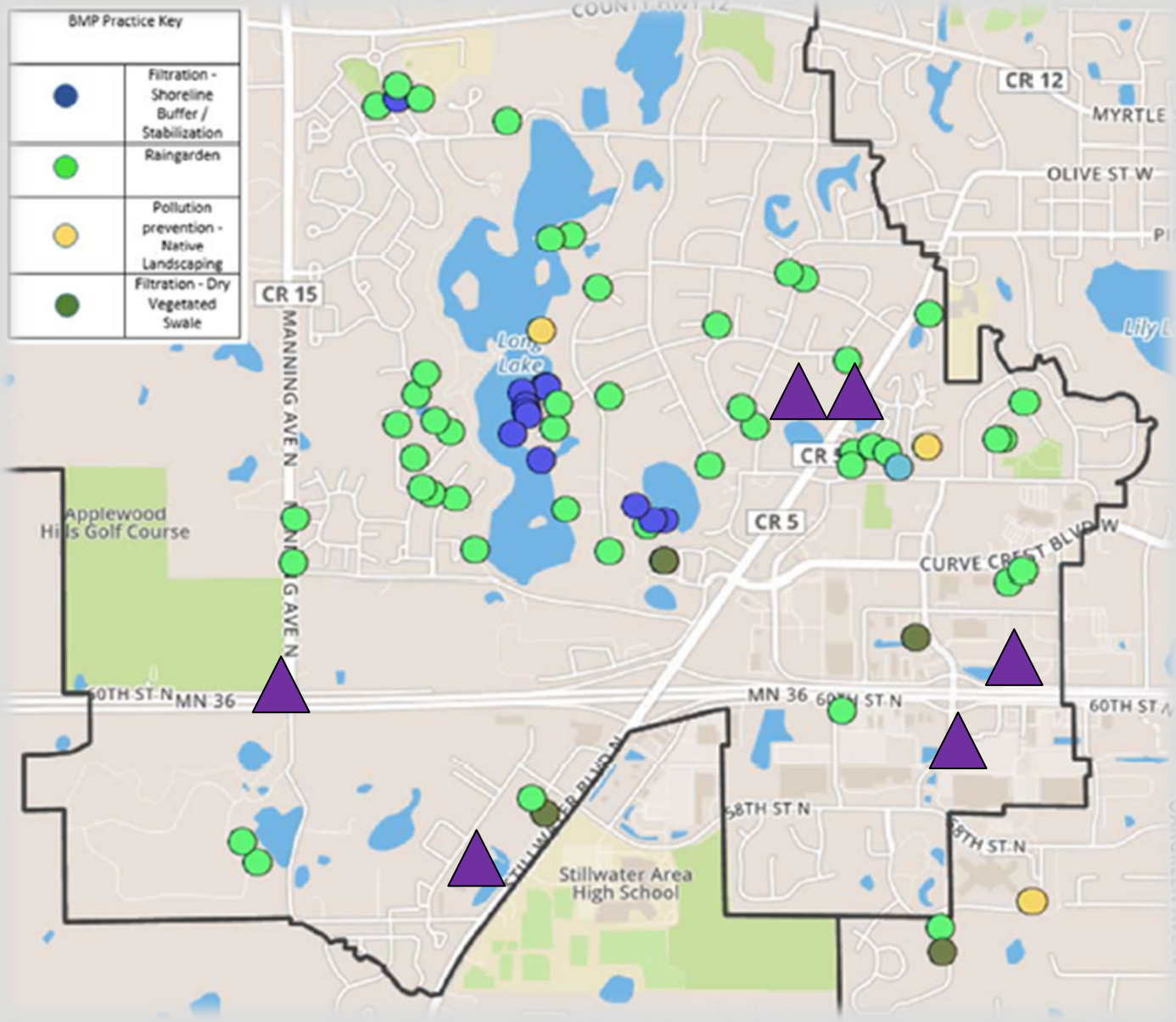
Long Lake Strategic Lake Management Plan Existing BMPs with Improvement Potential



Existing Pond Improvements

1 - MP-9 Pond
2 - MP-8 Pond
3 - MP-1 Pond
4 - H36-10 Pond
5 - LL-14 Pond
6 - Herberger Pond
7 - Applebees Pond
8 - Kohl's Pond

Long Lake Water Quality Projects

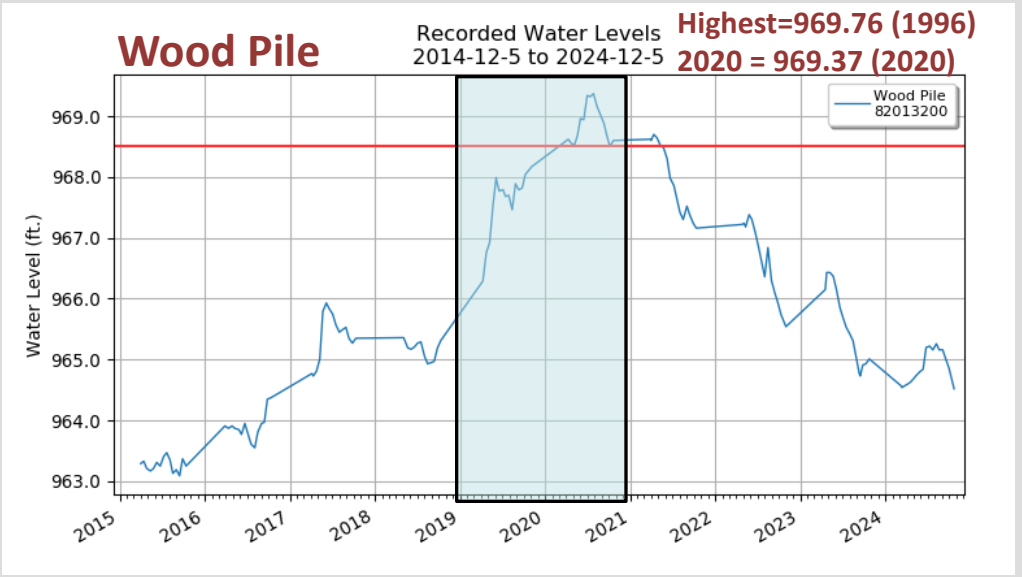


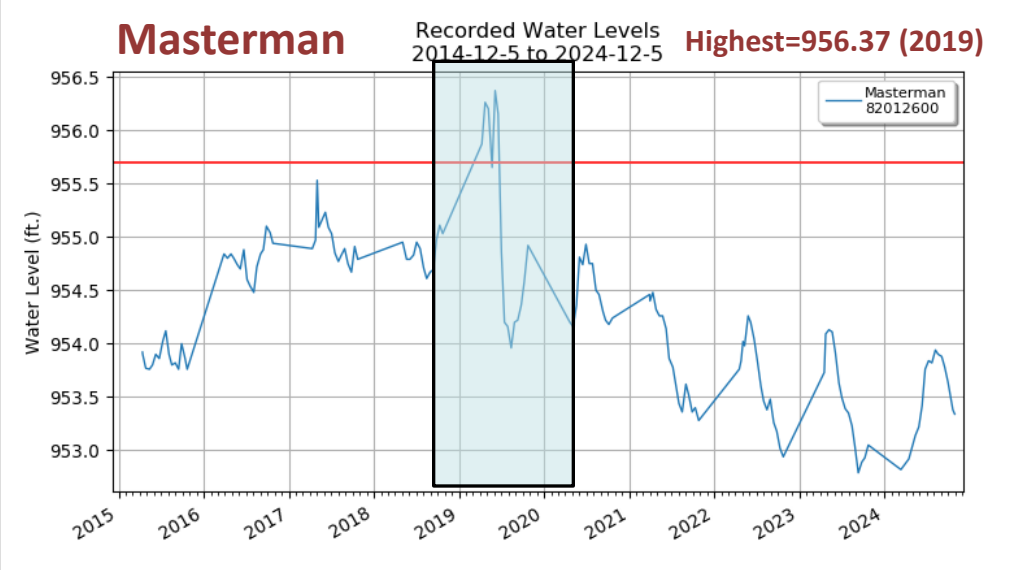
Flood Risk Review: Background

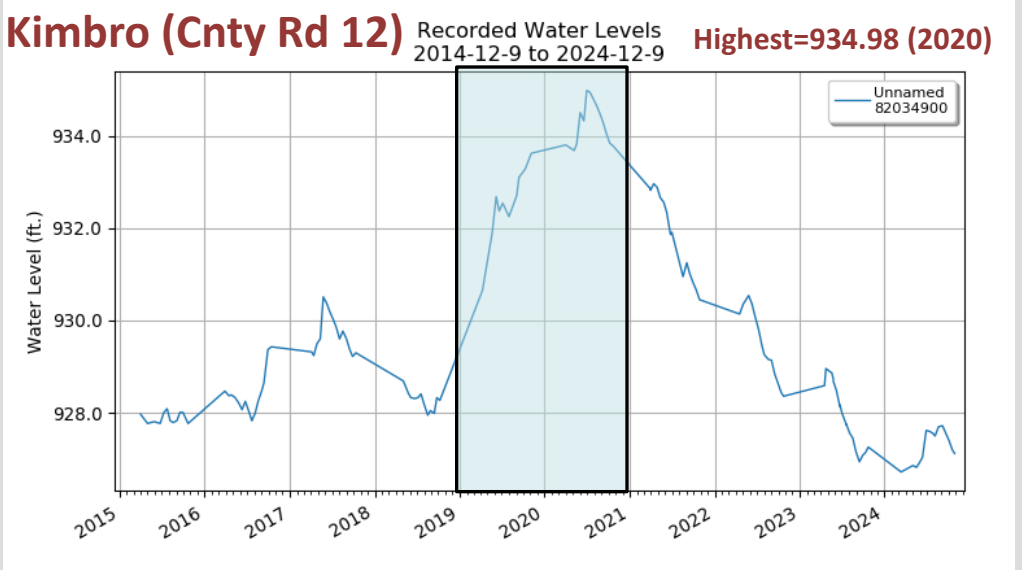
- What is the 100-Year Storm
  - Storm that has a 1% chance of happening in any given year
  - 1 in 4 chance of experiencing during a 30-year mortgage
  - 7.2” of rainfall in 24-hours – Most ponds & lakes
  - 7.2” of rainfall on frozen ground – Landlocked ponds and lakes

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

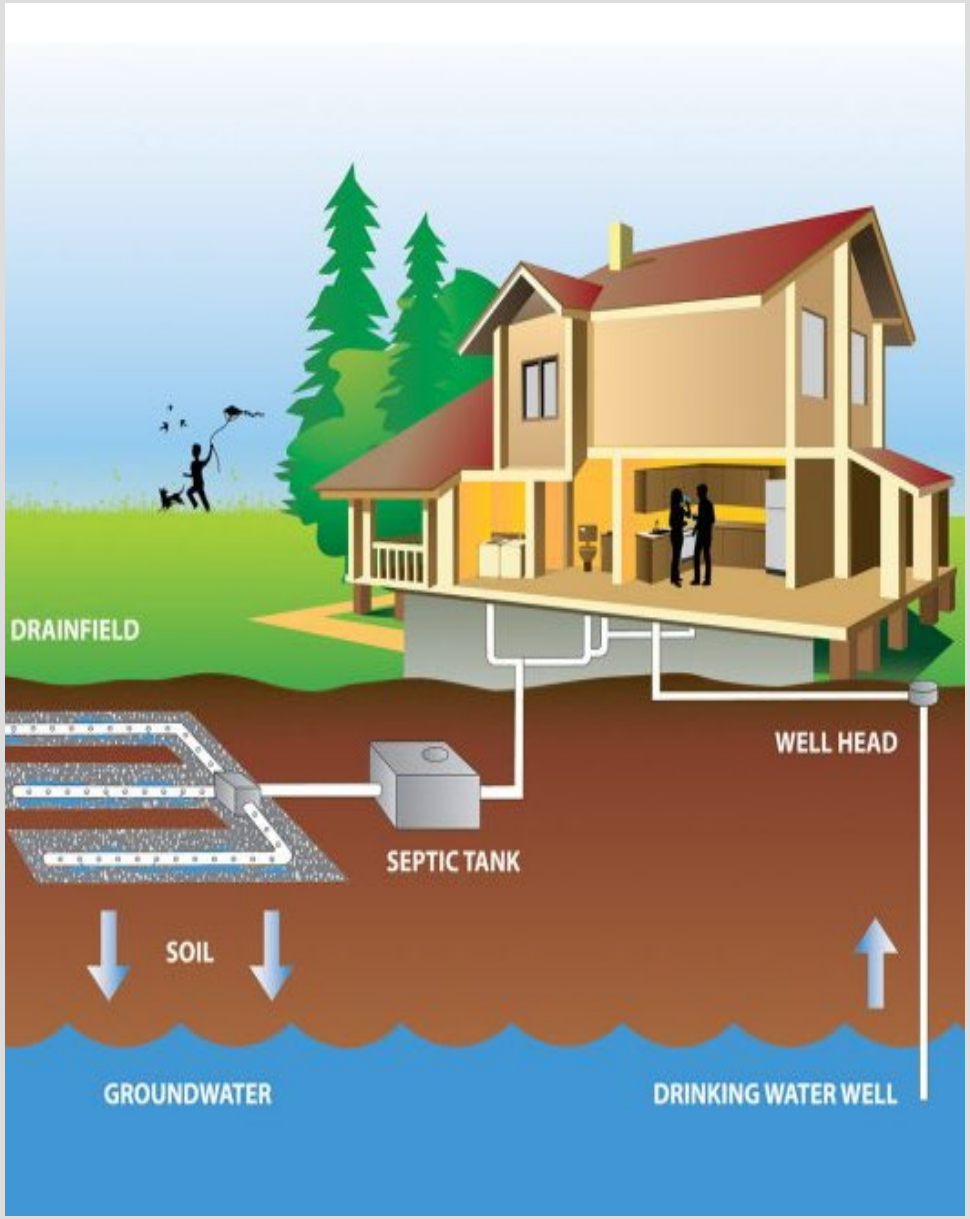






Flood Risk Review: Analysis

Flood Risk Review: Well & Septic



Drinking Water Well

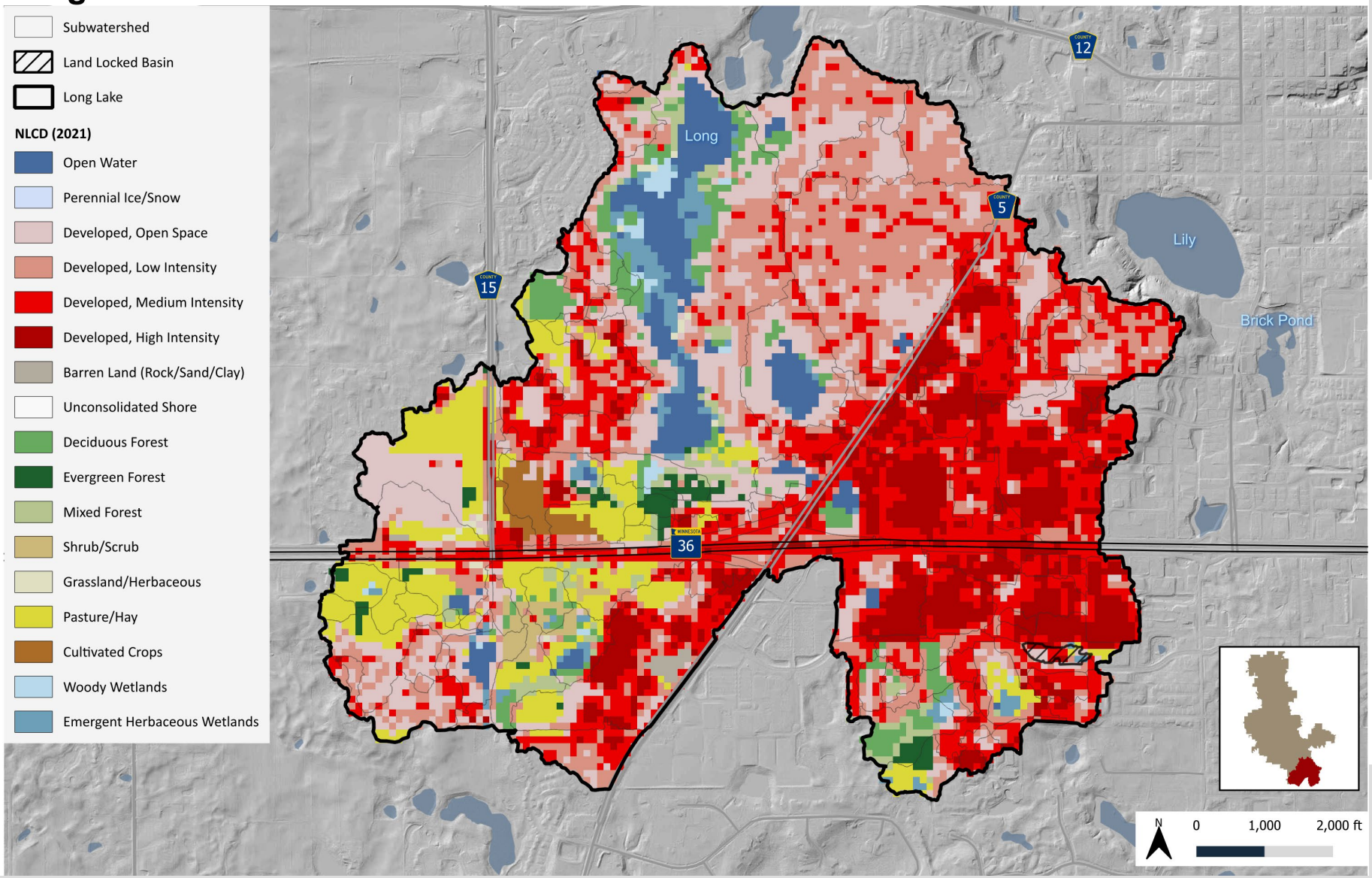
- Inundation by surface water
  - Pathogens & contaminants get into water
    - Short Term: Boil water
    - Long Term: Disinfect, pump & test

Septic System

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

Long Lake - Background

Long Lake - Land Cover



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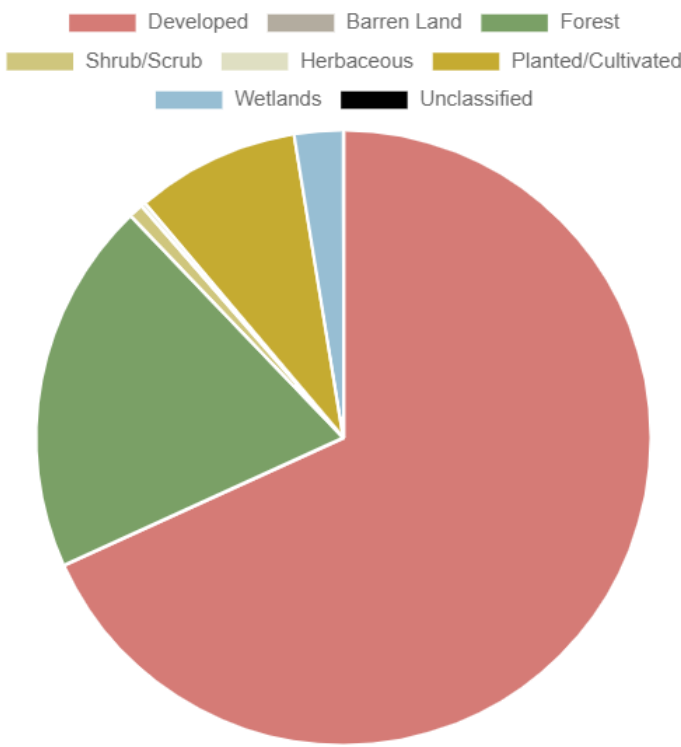
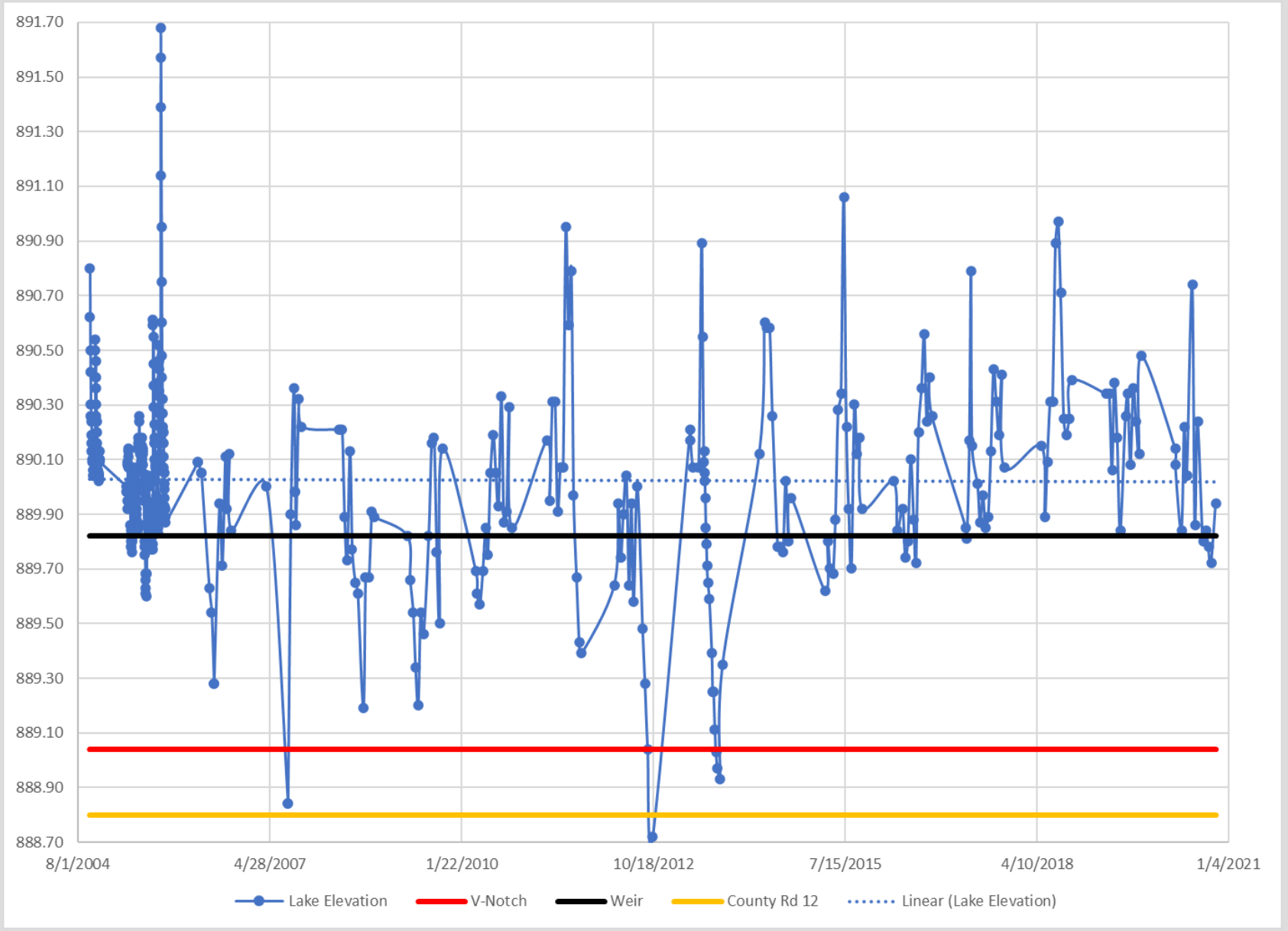


Long Lake – Background

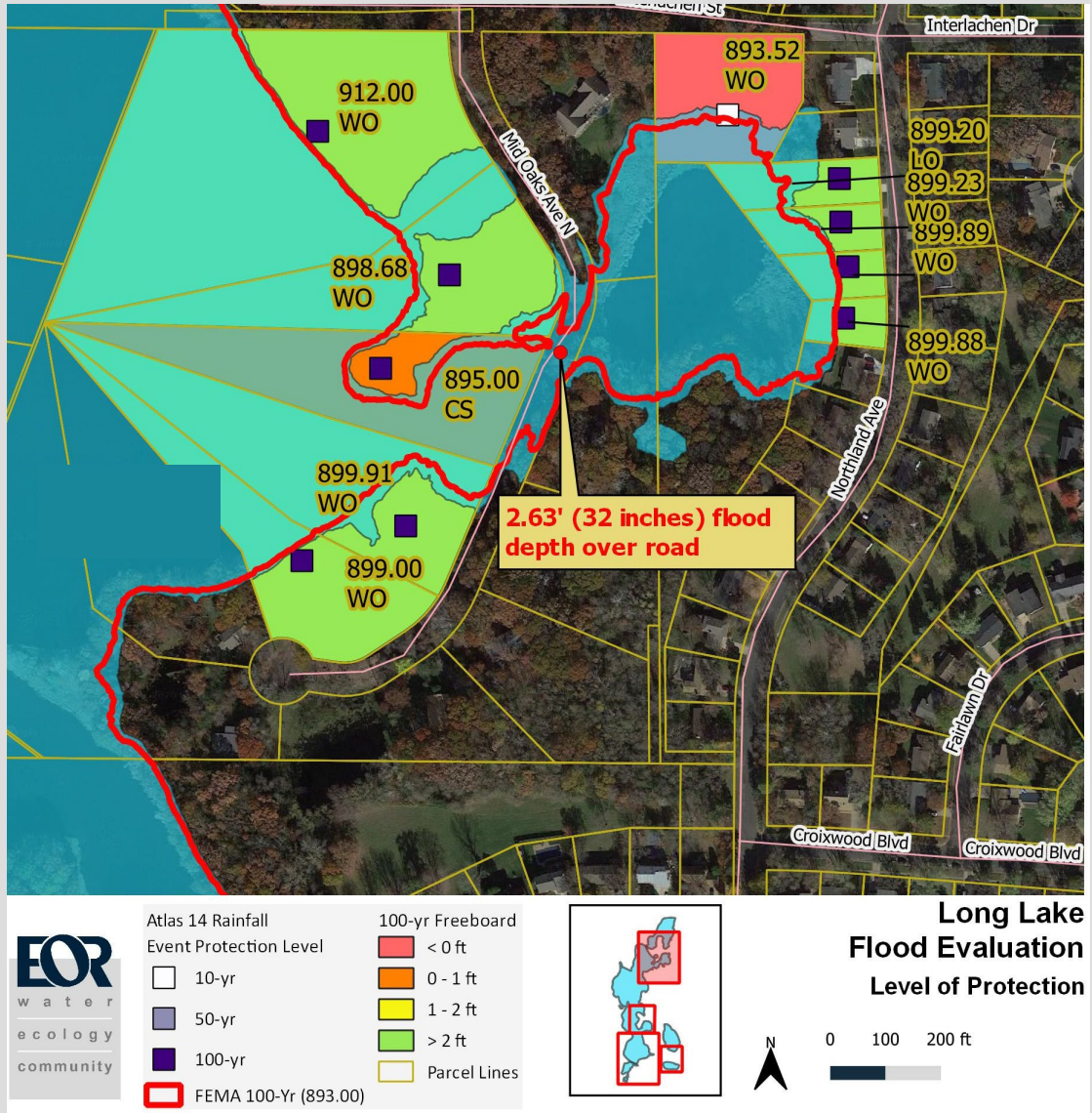


Long Lake – Background

- **Updated Surveying and Computer Modeling**
  - **Total of 44 homes with surveyed elevations**
  - **More detailed topographic and pipe data in BCWD Model**
  - **Modeled 2 through 500-Year events**
  - **Mapped properties based on flood risk and level of protection**
  - **Identified risk of road flooding**

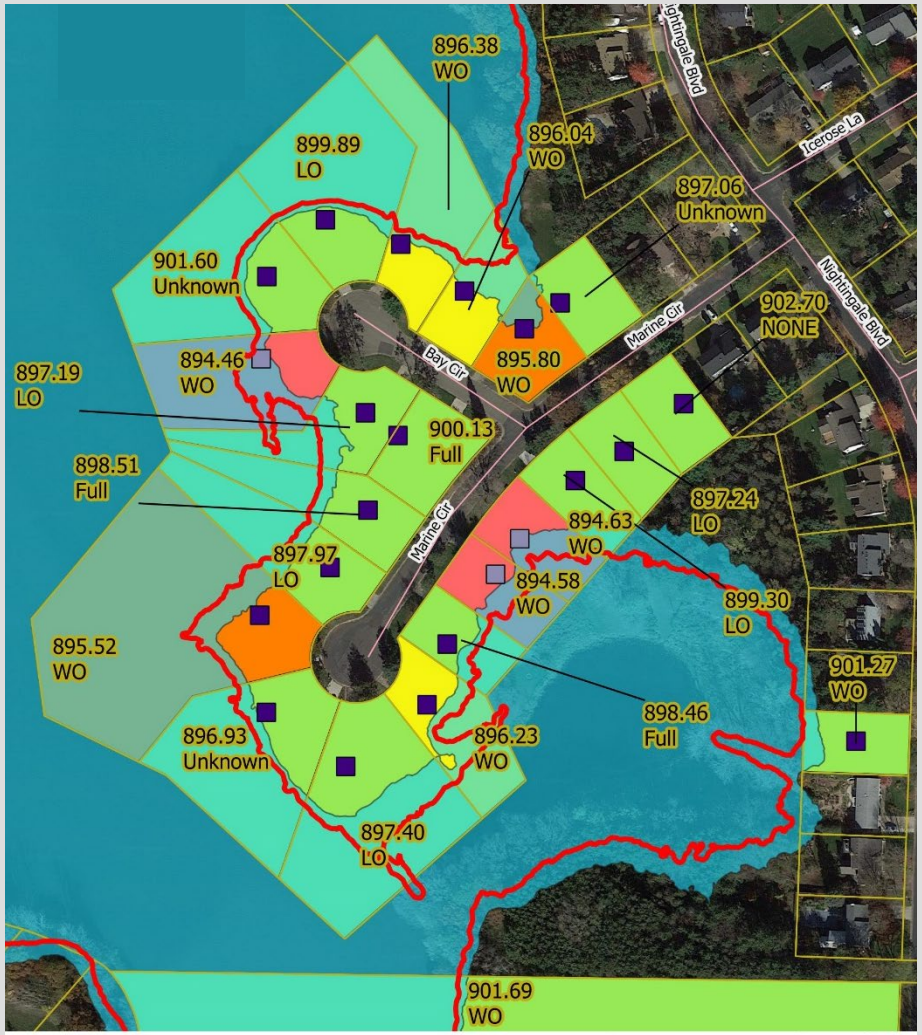
Long Lake – 100-YR HWL = 895.1

- **Mid Oaks Ave, Interlachen St. and Northland Ave.**



Long Lake – 100-YR HWL = 895.1

- **Marine Circle & Bay Drive**

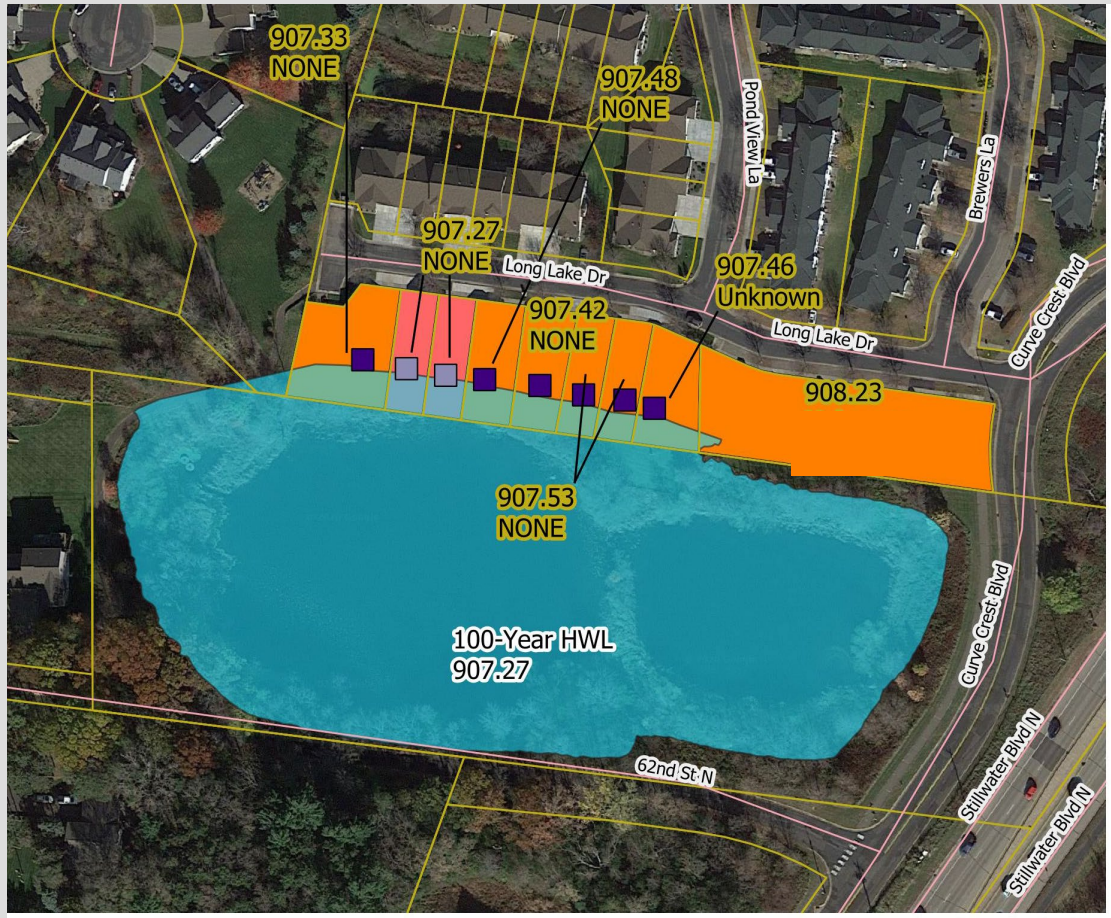


Long Lake – 100-YR HWL = 895.1

- Nightingale Blvd & 62nd St.

Long Lake – Study Findings

- **Long Lake Villas**



Long Lake – 100-YR HWL = 895.1

- **Road Flooding and Access**
  - **Mid Oaks Avenue floods for 10-Year; 100-Year = 2.6 feet**
  - **Nine properties no access**
  - **Exceeds 0.5’ depth for 10 to 25-Year event**

Long Lake – 100-YR HWL = 895.1

- **Road Flooding and Access**
  - **72nd Street floods for 50-Year; 100-Year = 0.93 feet**
  - **No foreseen access implications**
  - **Exceeds 0.5’ depth for ~75-Year event**

Long Lake – 100-YR HWL = 895.1

- **Road Flooding and Access**
  - **62nd Street floods for 25-Year; 100-Year = 1.4 feet**
  - **Potentially one property no access**
  - **Exceeds 0.5’ depth for 50-Year event**

Long Lake – Study Findings

- **Long Lake Building Impacts**
  - 100-Year = 895.1 – 4 Homes* (3 in 2022 – Homeowner project)
  - 50-Year = 894.3 – 1 Home
  - 25-Year = 893.6 – 1 Home
  - 10-Year = 892.7 – None (Pzinger <1 foot of freeboard)
- **62nd Street Pond Building Impacts**
  - 100-Year = 894.9 – 2 Homes* (0 in 2024 – City project)
- **Road Impacts**
  - Mid Oaks = 2.6’ depth* (2022 road raised to improve – City project)
  - 62nd Street = 1.4’ depth
  - 72nd Street = 0.9’ depth

*Note: Improvements that followed 2021 flood risk study

Long Lake – Study Findings

- **Additional Potential Infrastructure Improvement**
  - **Long Lake Weir Removed Scenario**
    - 100-Year = 894.4 – 1 Home at Risk
    - 50-Year = 893.6 – 1 Home at Risk
    - 25-Year = 892.8 – None (Pzinger <1 foot of freeboard)
    - 10-Year = 891.9 – None (Pzinger 1.6 feet of freeboard)

24-Hour Design Storm [NRCS MSE3 distribution]	Scenario A: Current Conditions			Scenario B: Weir Removed		
	Mid Oaks Depth [Feet]	62nd Street Depth [Feet]	72nd Street Depth [Feet]	Mid Oaks Depth [Feet]	62nd Street Depth [Feet]	72nd Street Depth [Feet]
10-Year	0.37	0	0	0	0	0
25-Year	1.27	0.04	0	0.54	0	0
50-Year	1.98	0.75	0.28	1.34	0.11	0
100-Year	2.63	1.4	0.93	2.06	0.83	0.36

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

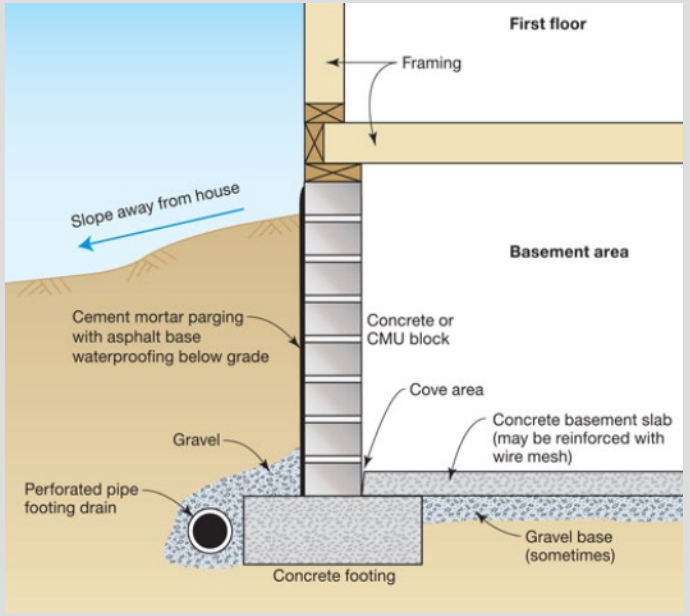
- In addition to other mitigation strategies

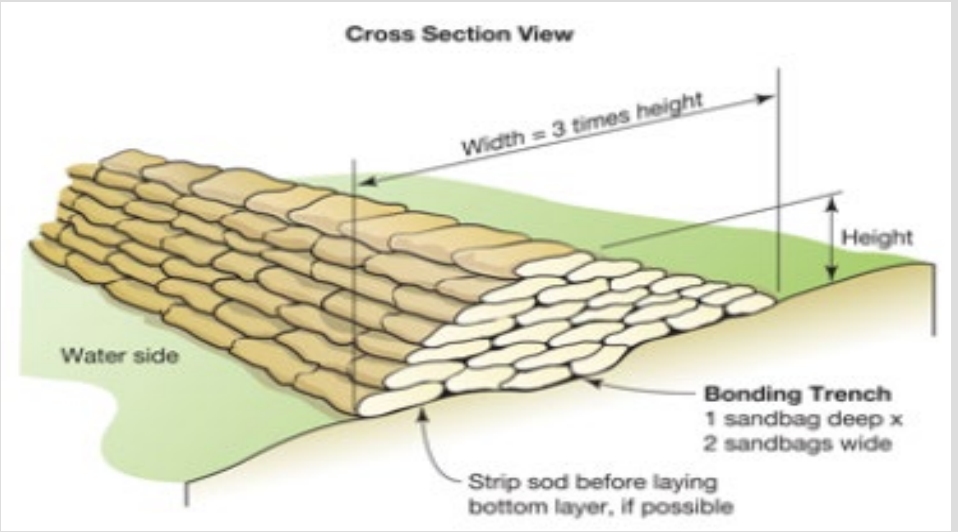
Sandbag Barrier

- Temporary & requires advance notice
- Address internal drainage

Purchase Flood Insurance

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





Project Example – Marine Circle, Stillwater

- Foundation reinforcement & waterproofing
- Sanitary backflow preventer
- Walkout door flood box protection
- Sump pumps
- Compensatory storage excavation in floodplain
- Landscaping
- Protection to 200-year Event

Project Examples

- **Opening Flood Planking**

Project Examples

- **Block Walls**

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

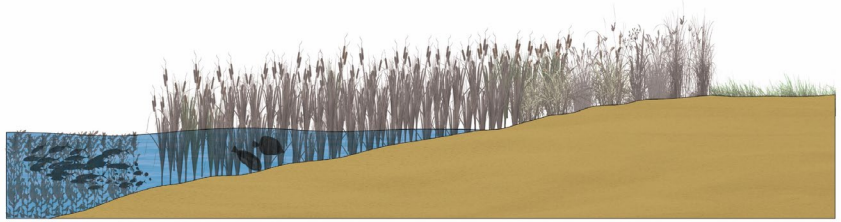
Flood Risk Review - Questions?

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

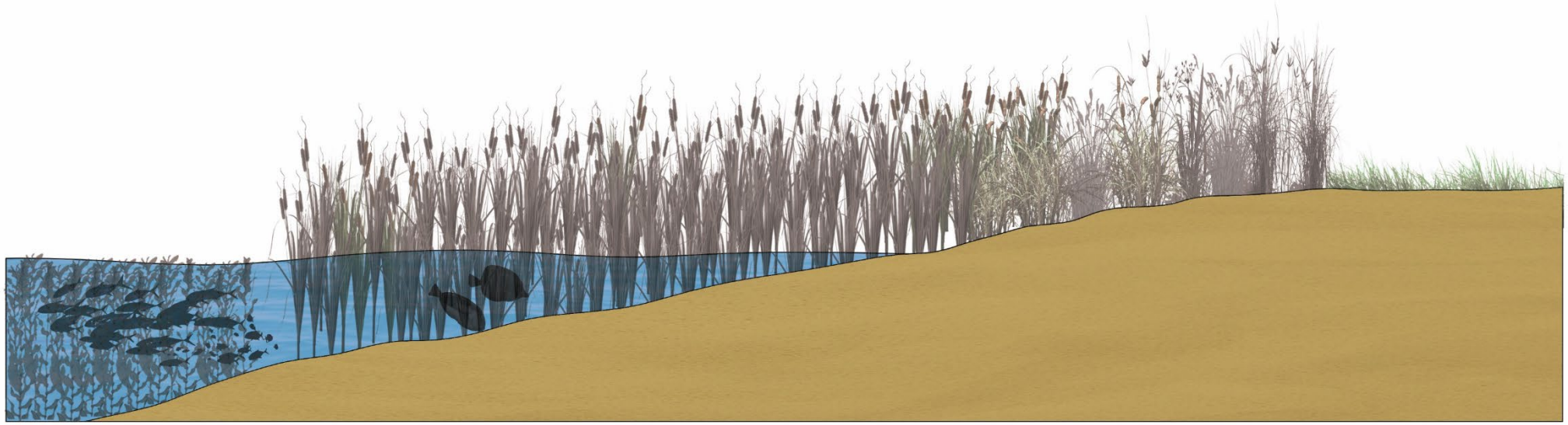
- 24-Hour Storm Depths
  - 1-Year = 2.44"
  - 5-Year = 3.49"
  - 10-Year = 4.17"
  - 25-Year = 5.23"
  - 50-Year = 6.17"
  - 100-Year = 7.20"
  - 200-Year = 8.35"
  - 500-Year = 10.00"
  - 1000-Year = 11.40"

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.

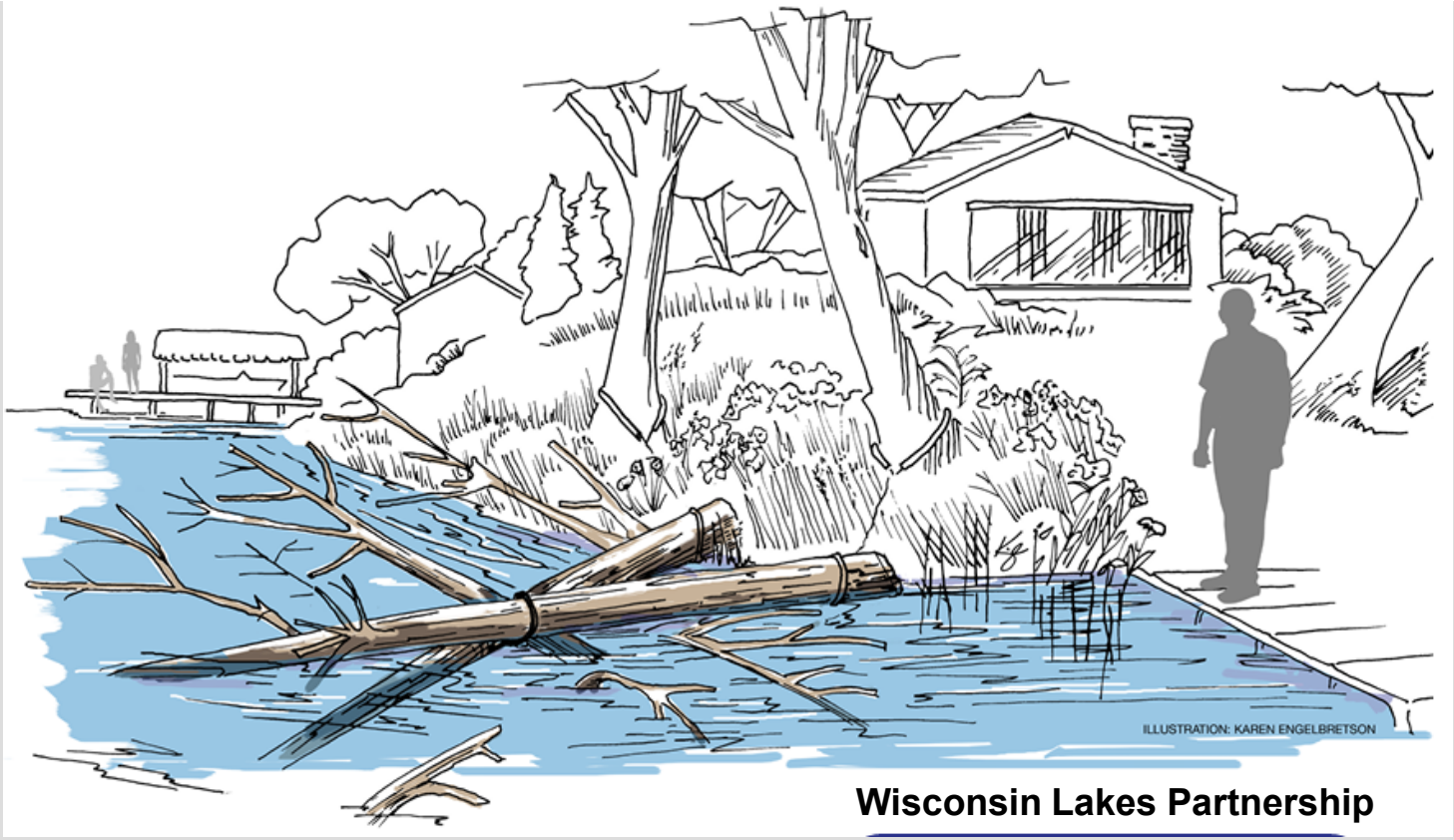


Natural Lake Shoreline



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.

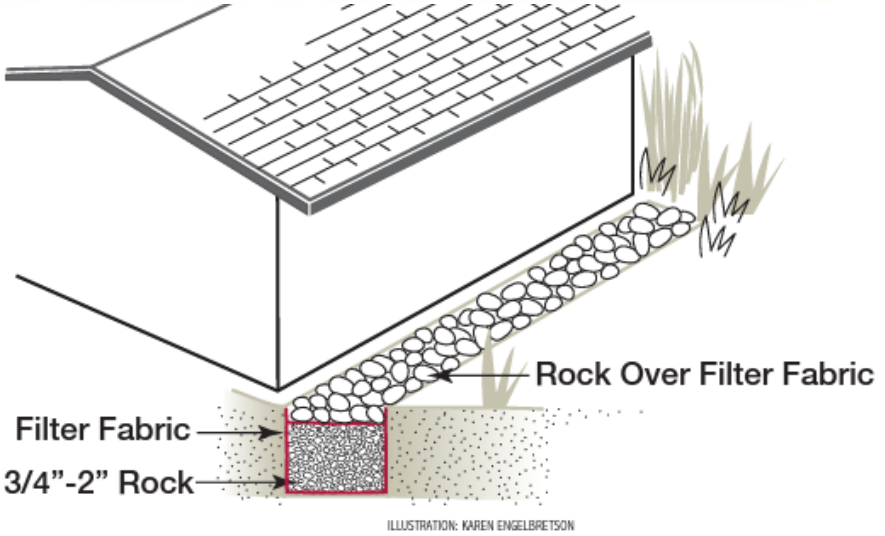
Low-mow lawn in Stillwater, MN

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.

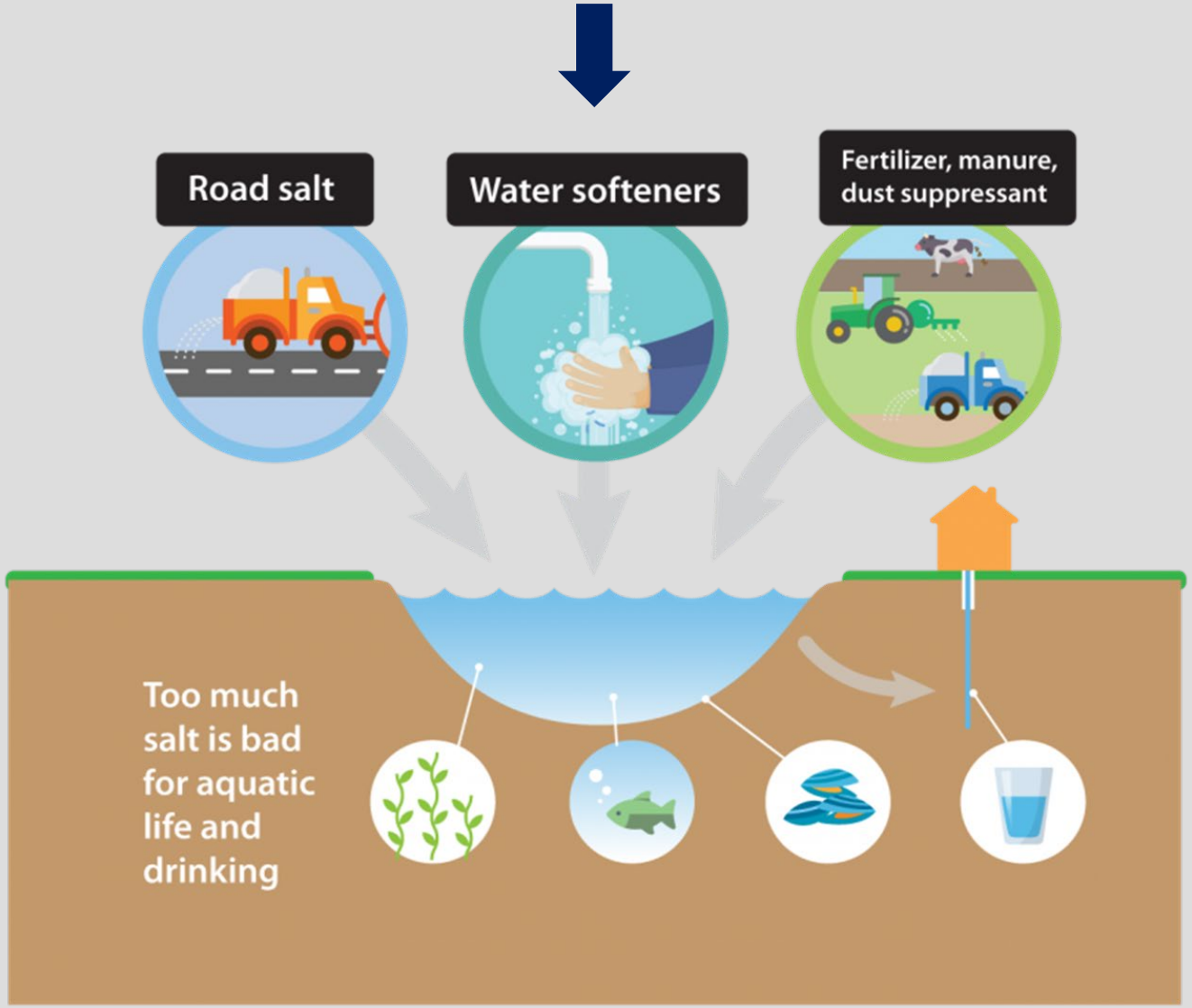
4. Sweep

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 $CaCO_3$ (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

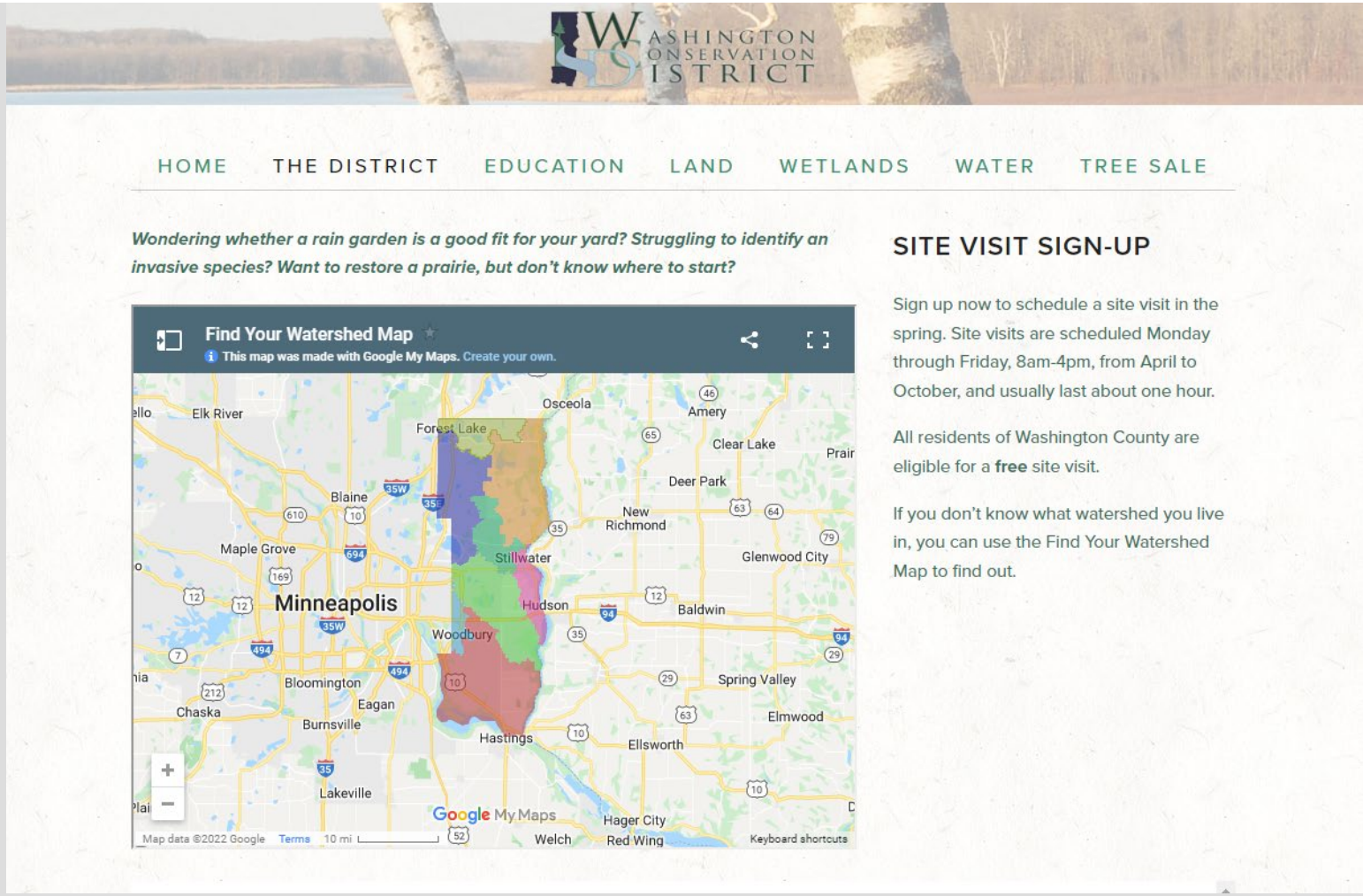
https://files.dnr.state.mn.us/publications/waters/shoreline_alterations_riprap.pdf

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/