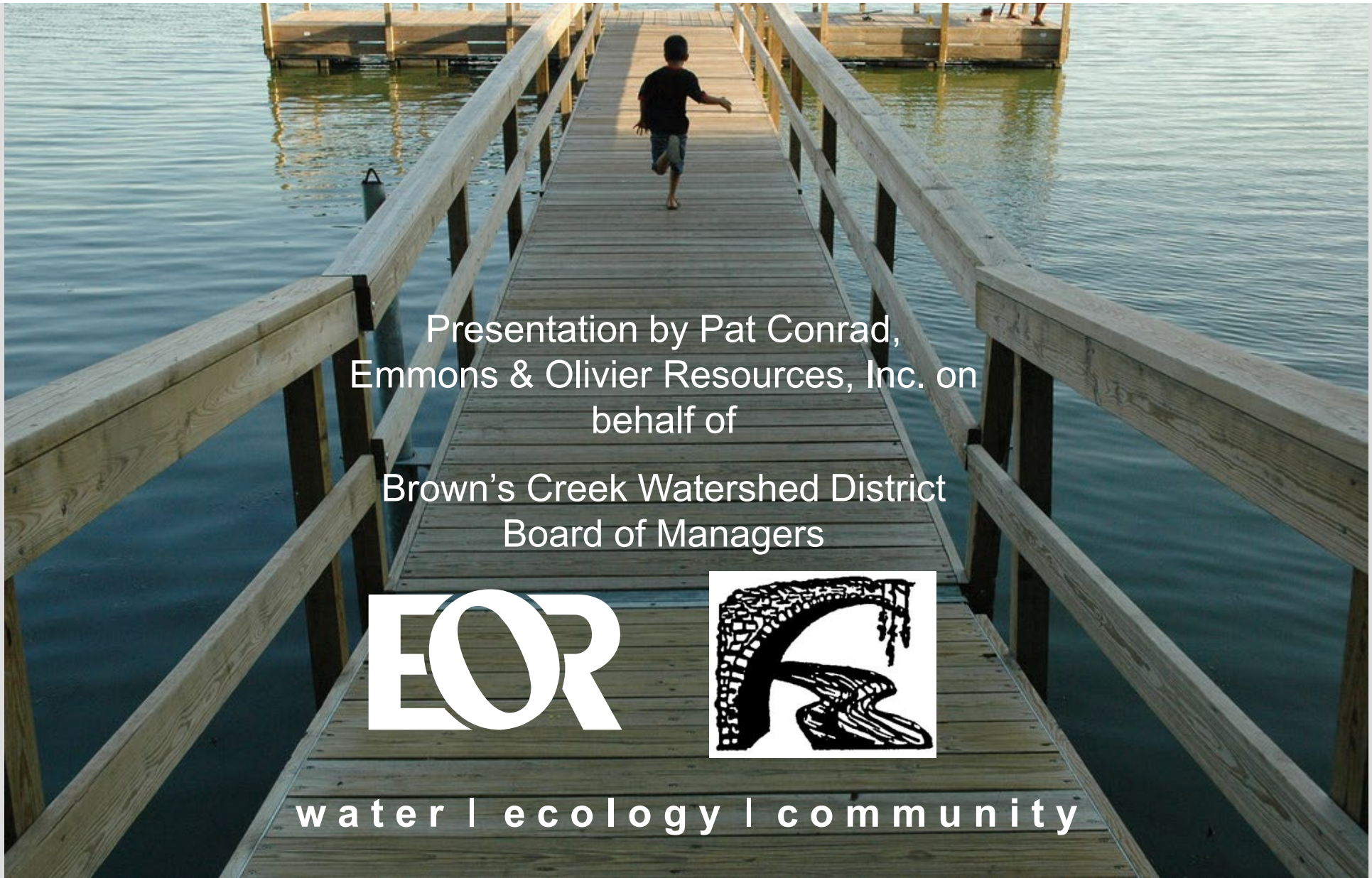
Bass Lakes Management Plan



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

Brown's Creek Watershed District
Board of Managers

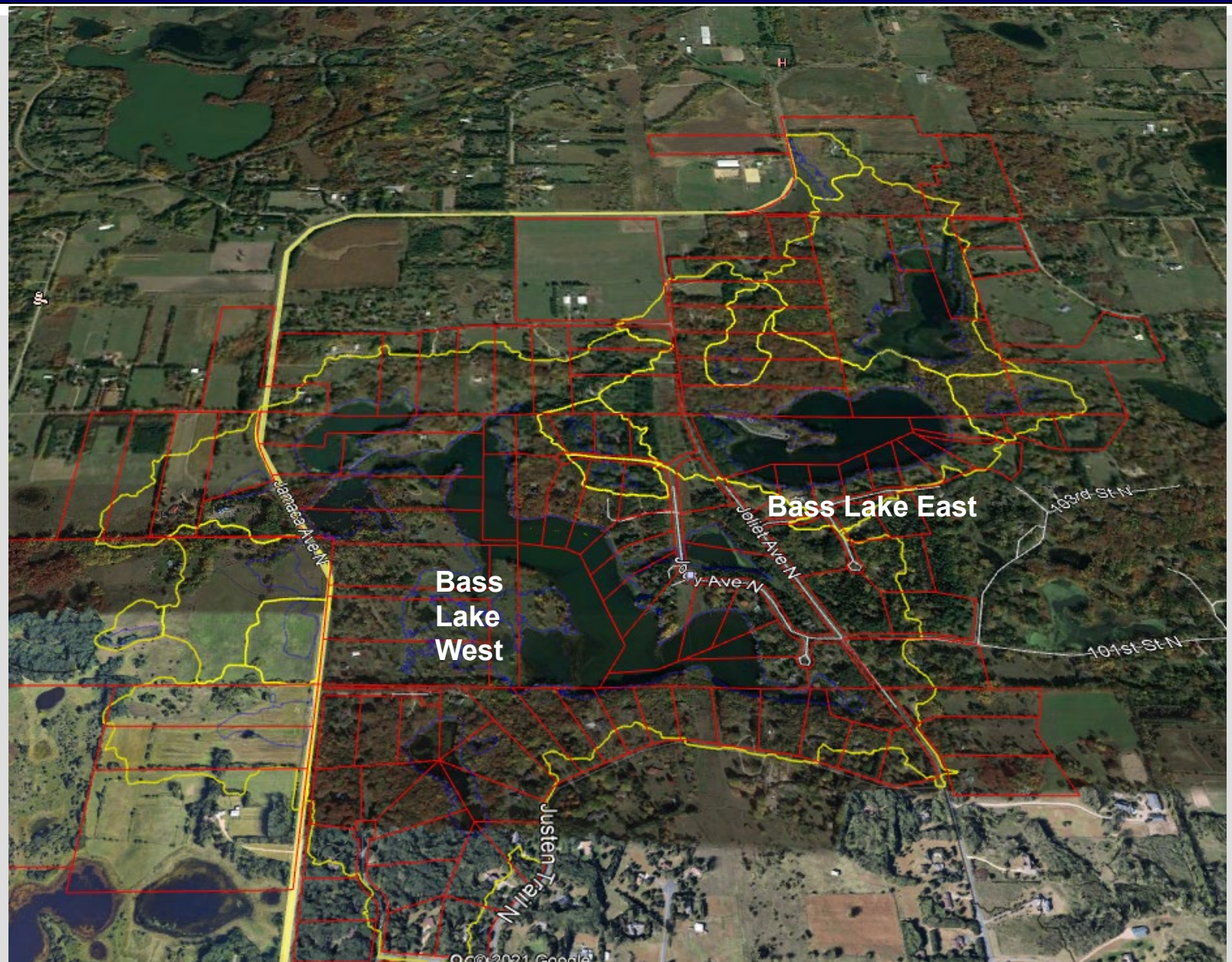
water | ecology | community

Introductions

Pat Conrad – EOR

Karen Kill – BCWD Administrator

WCD Staff



Lake Management Plan Components

1- Conduct lake condition assessment

2 - Identify issues and establish reasonable goals for future conditions

3 - Develop implementation plan to meet goals

Lake Condition Assessment

Lake and Watershed Data Collection

- Aquatic macrophyte survey
- Watershed conditions assessment
- Shoreline assessment**
- Flood assessment
- Lake resident input

Watershed & In-Lake Computer Modeling

- Determine pollutant loadings
- Define flood vulnerabilities

Lake Management Plan Development

Issues Identification and Goal Setting (today!)

- Issues, concerns, limitations
- Future conditions

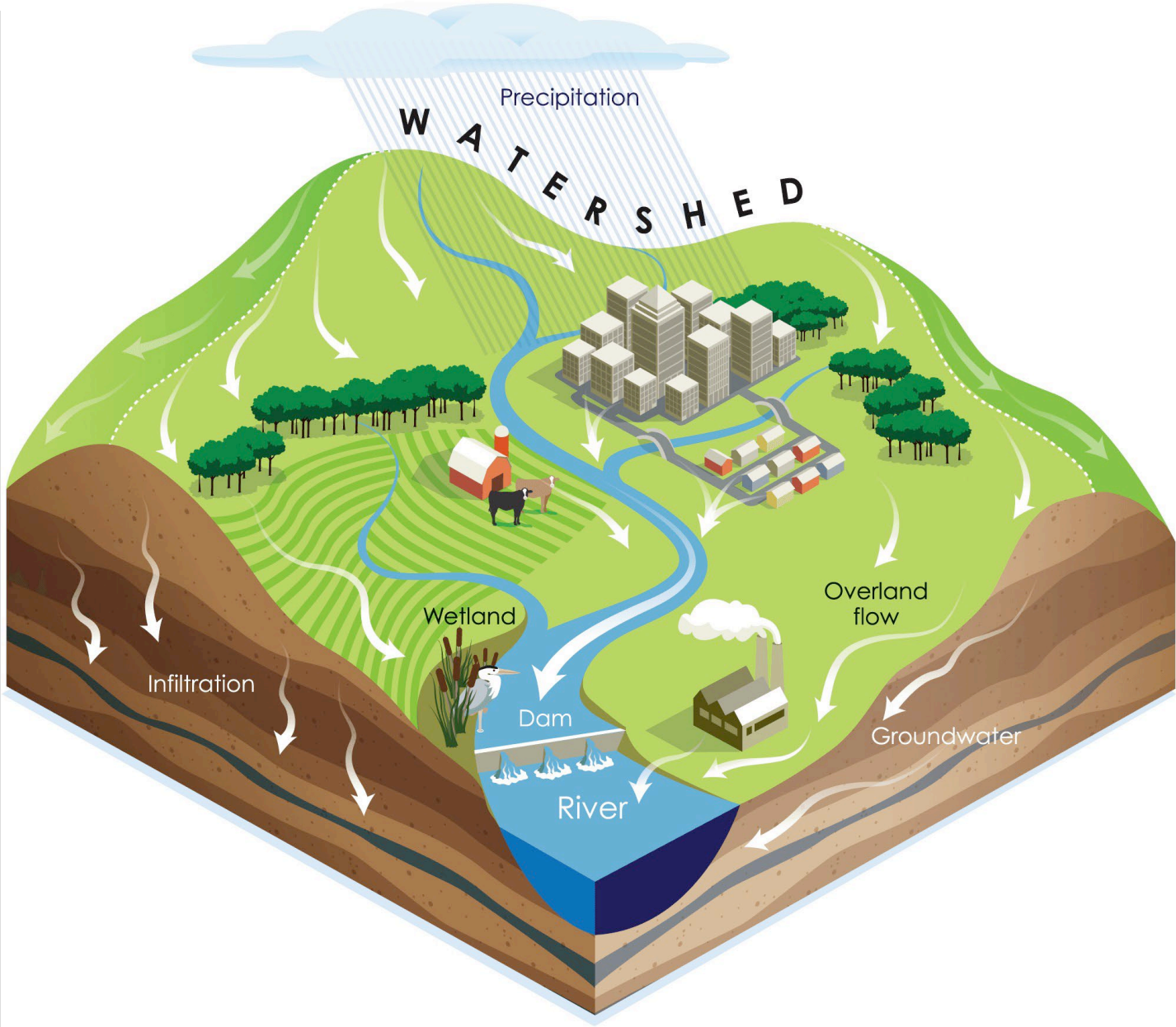
Plan Implementation

- Riparian zone restorations
- Stormwater runoff management
- Flood resiliency strategies
- Others?

Watershed Effect on Lake Dynamics

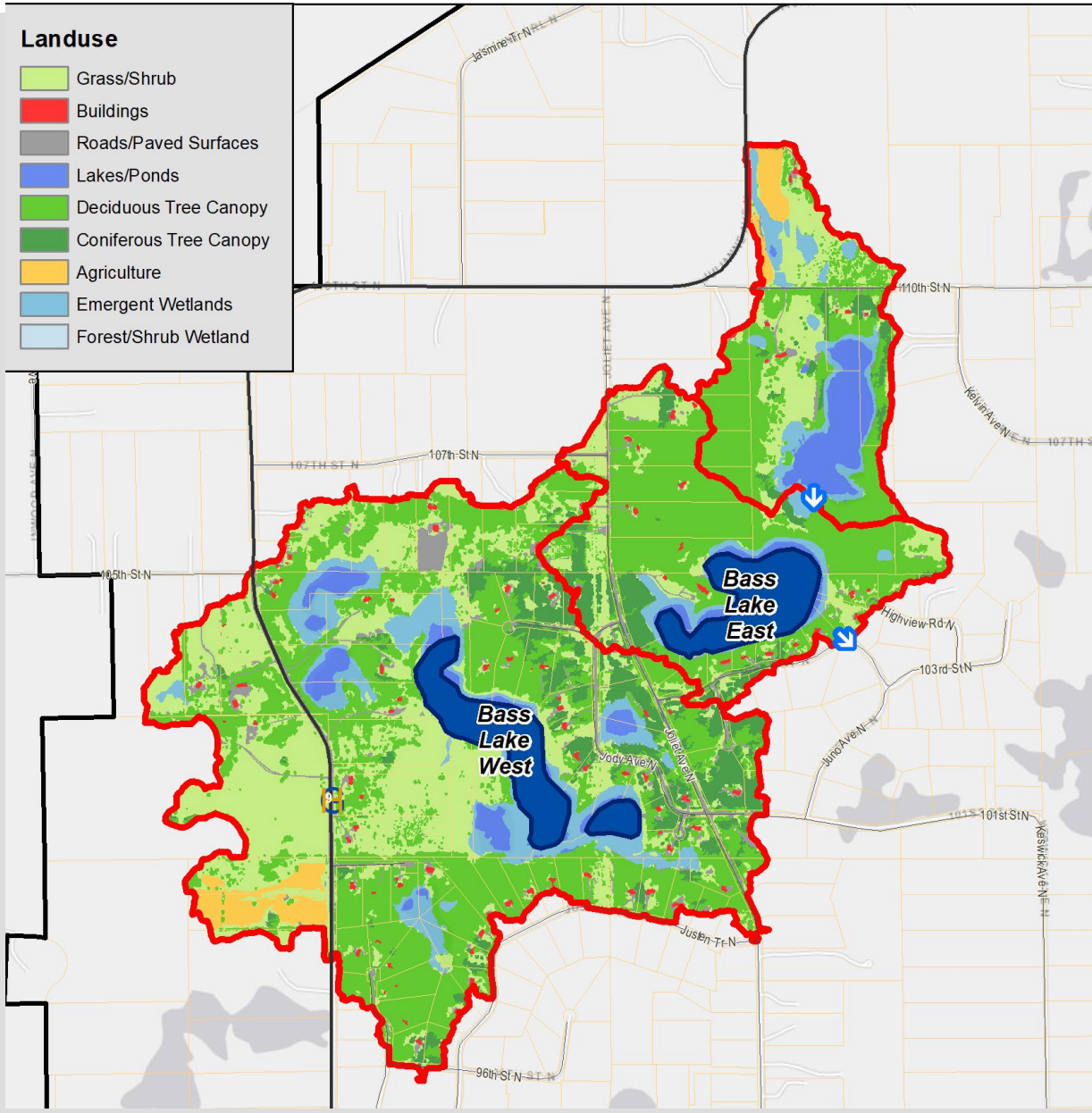
The natural characteristics of a watershed coupled with the land use in a watershed define the amount and quality of water reaching downstream resources

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

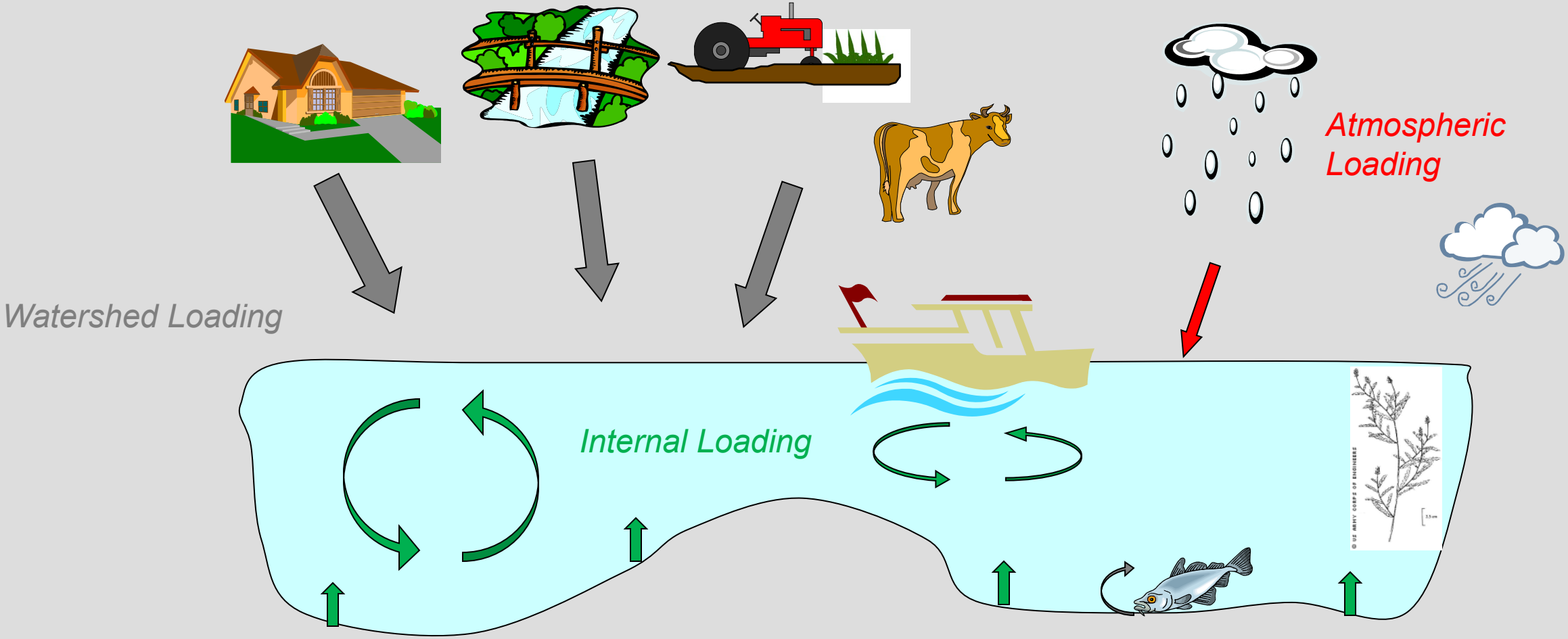


Bass Lake Land Cover

- Deciduous Trees
- Grasslands and Shrubs
- Coniferous Trees
- Rural Residential
- Wetlands
- Limited Row Crop Agriculture
- Minimal Impervious surfaces



Watershed Pollutant Loading



Nutrients – Phosphorus, Nitrogen, Chloride

Sediment

Pollutants – Metals, Pesticides, Bacteria

Bass Lake Watershed Pollutant Loading Assessment

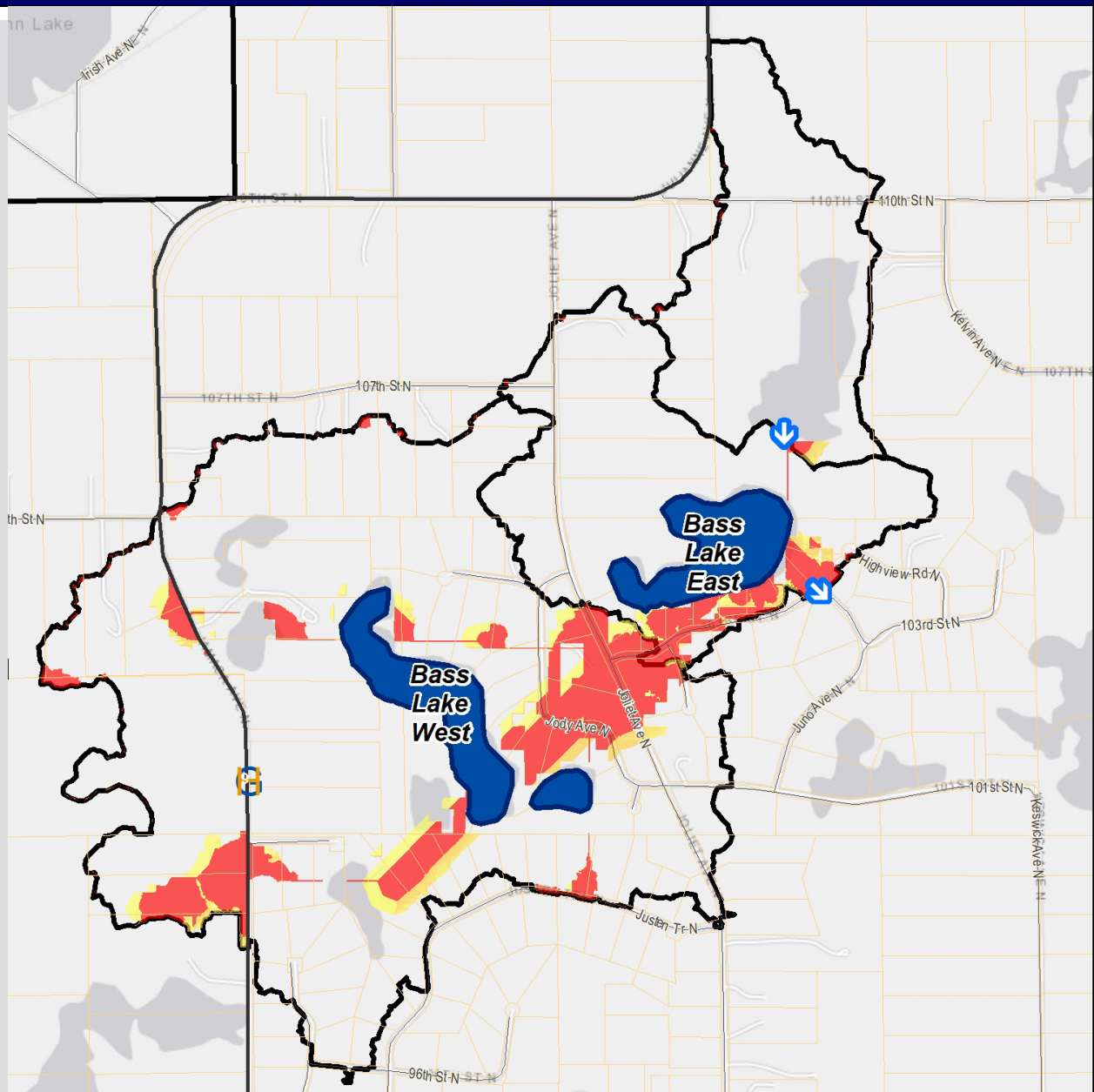
Pollutant “Hot-spots”

High contributing areas

Total Phosphorus & Sediment

Erosion prone, steep, bare soils

Potential restoration areas



Limnology – Lake Science

Physical

Size & Shape

Water temperature

Biological

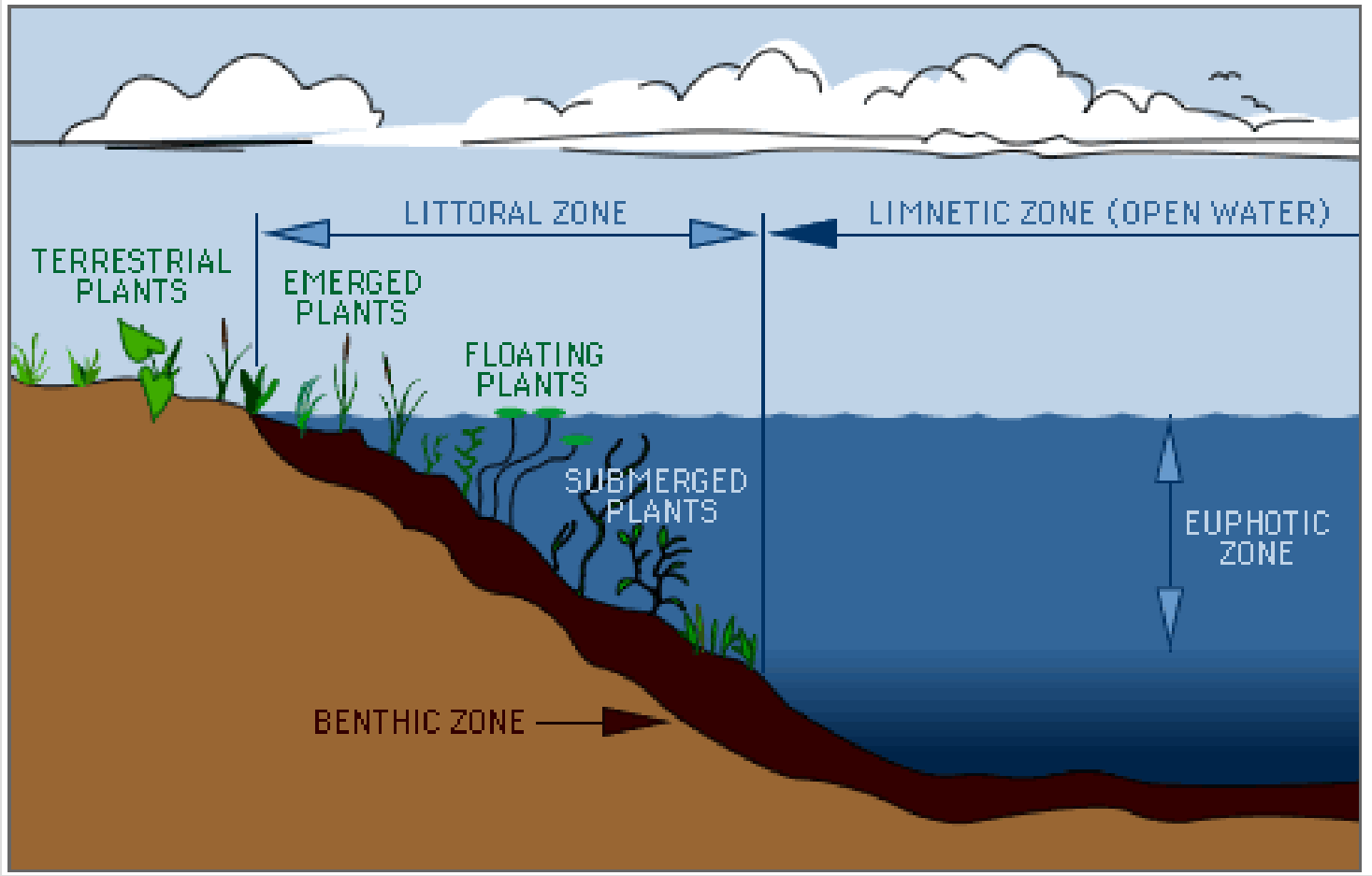
Food chain: algae, macrophytes, fish

Water Quality

Nutrients (phosphorus, nitrogen)

Transparency

Dissolved oxygen



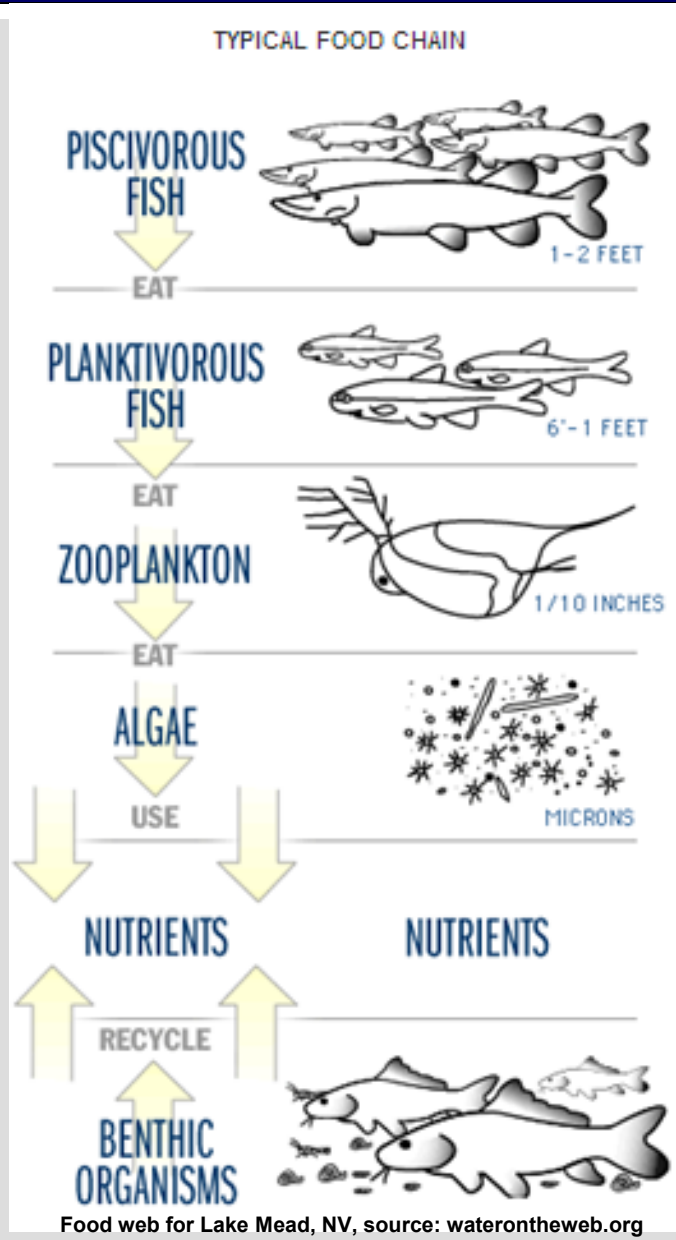
waterontheweb.org

Typical Lake Food Chain

Balanced food chain has smaller numbers of larger species at each level

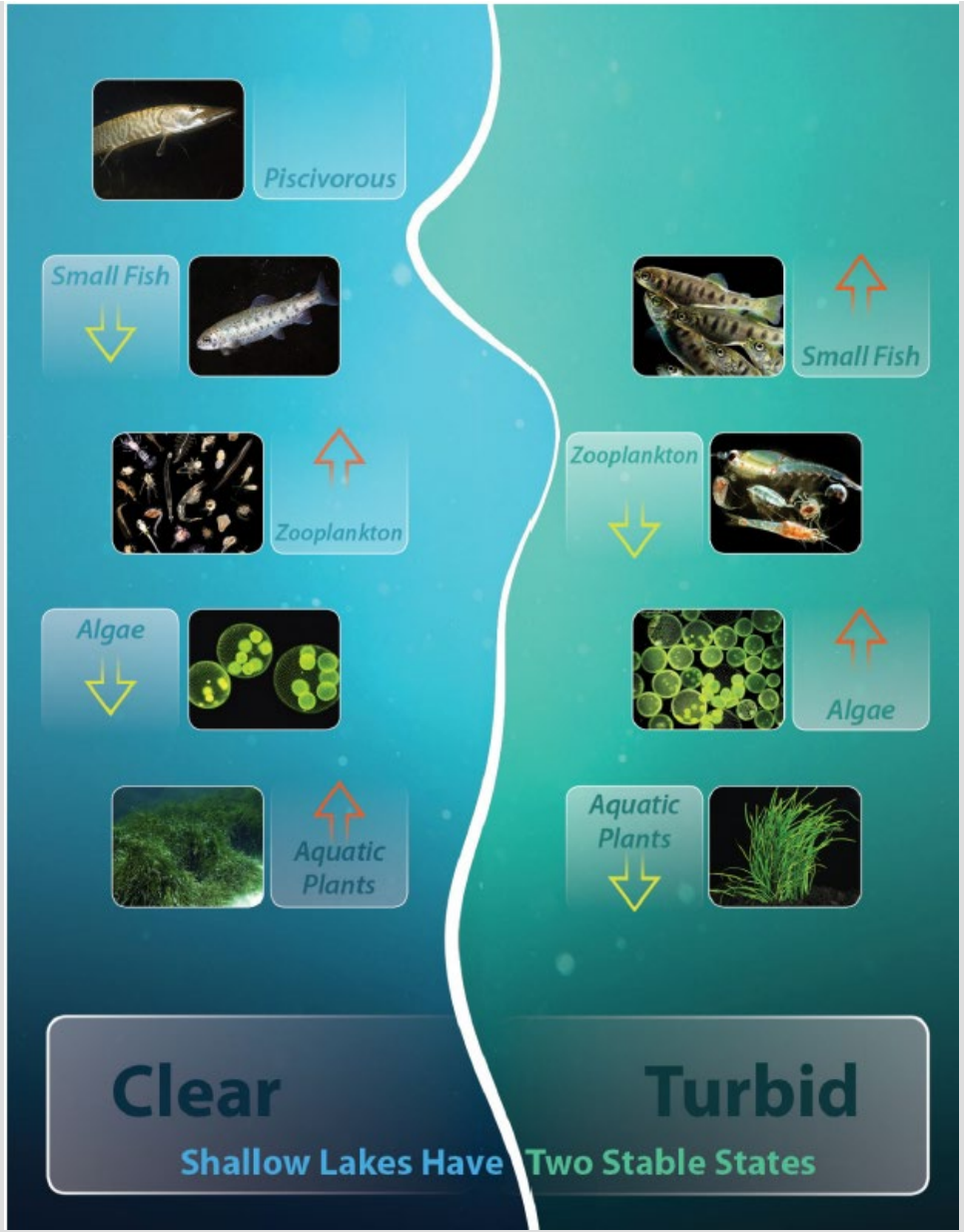
Each level preys upon the level(s) below

Disruptions to chain can cause unintended consequences – ‘balance’



Food web for Lake Mead, NV, source: wateronthewebb.org

Two Stable Lake States



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.

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

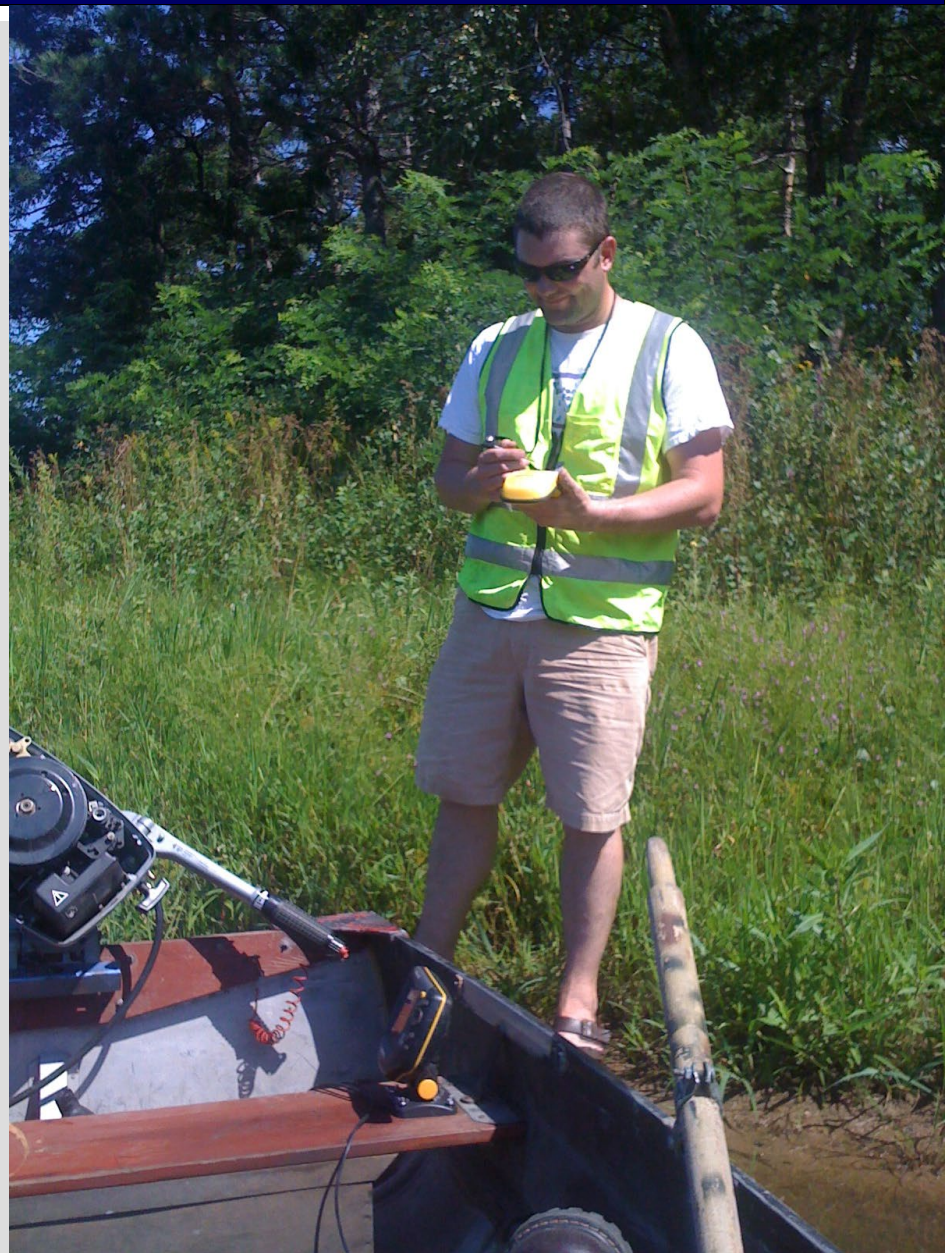
Macrophyte Survey - 2019

Aquatic plants were observed at over 95% of sampling points at both lakes

At depths of up to 17 feet at Bass Lake West and 10 feet at Bass Lake East = 100% Littoral

No submerged aquatic invasive plants

Purple loosestrife was observed along the shores of both lakes at low abundances.



Bass Lake West Macrophytes

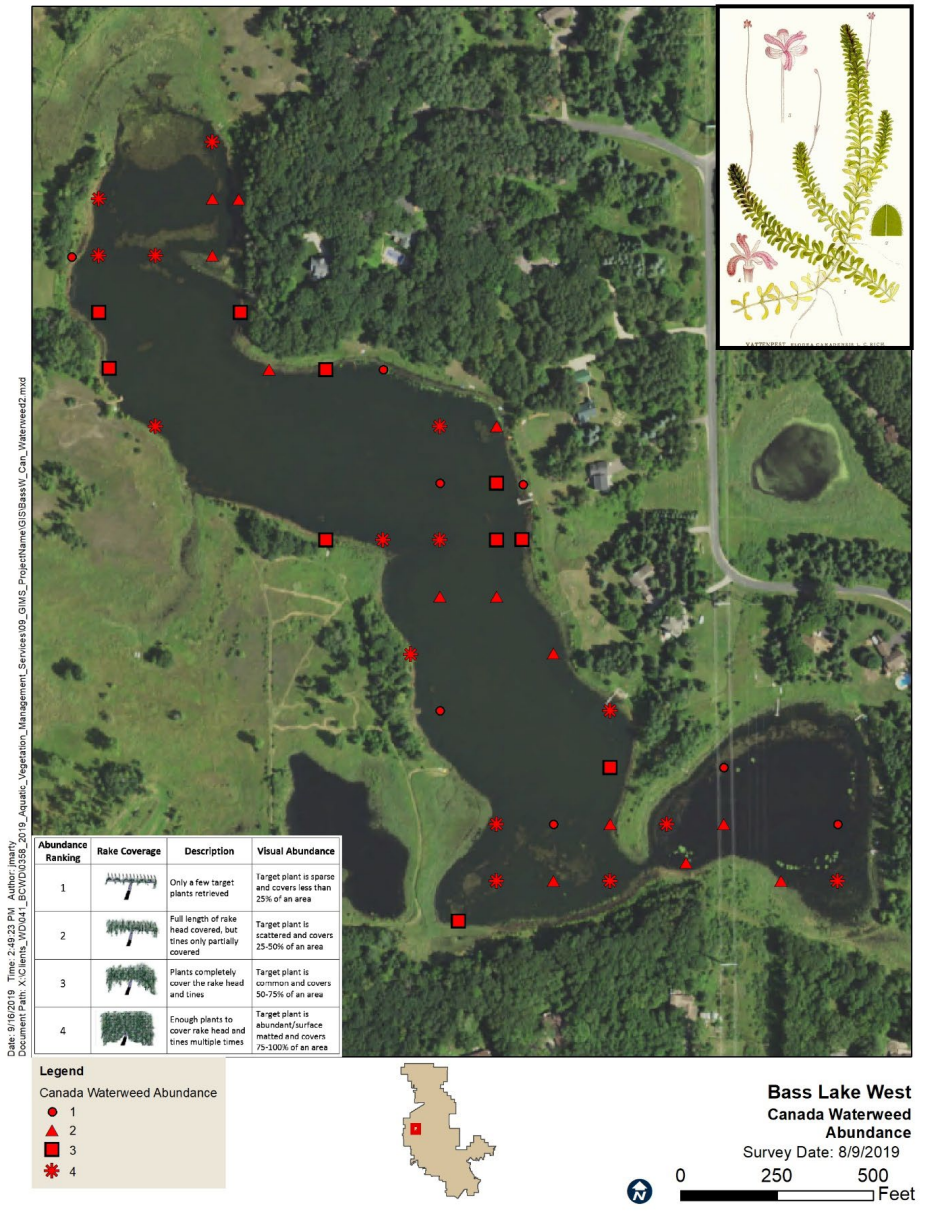
Canada waterweed
68.1% of sampling points

Fern-leaf pondweed
53.6% of sampling points

Coontail
43.5% of sampling points

3.1 species per site

Floristic Quality Index (FQI) = 22.5
ecoregion median - 22.5



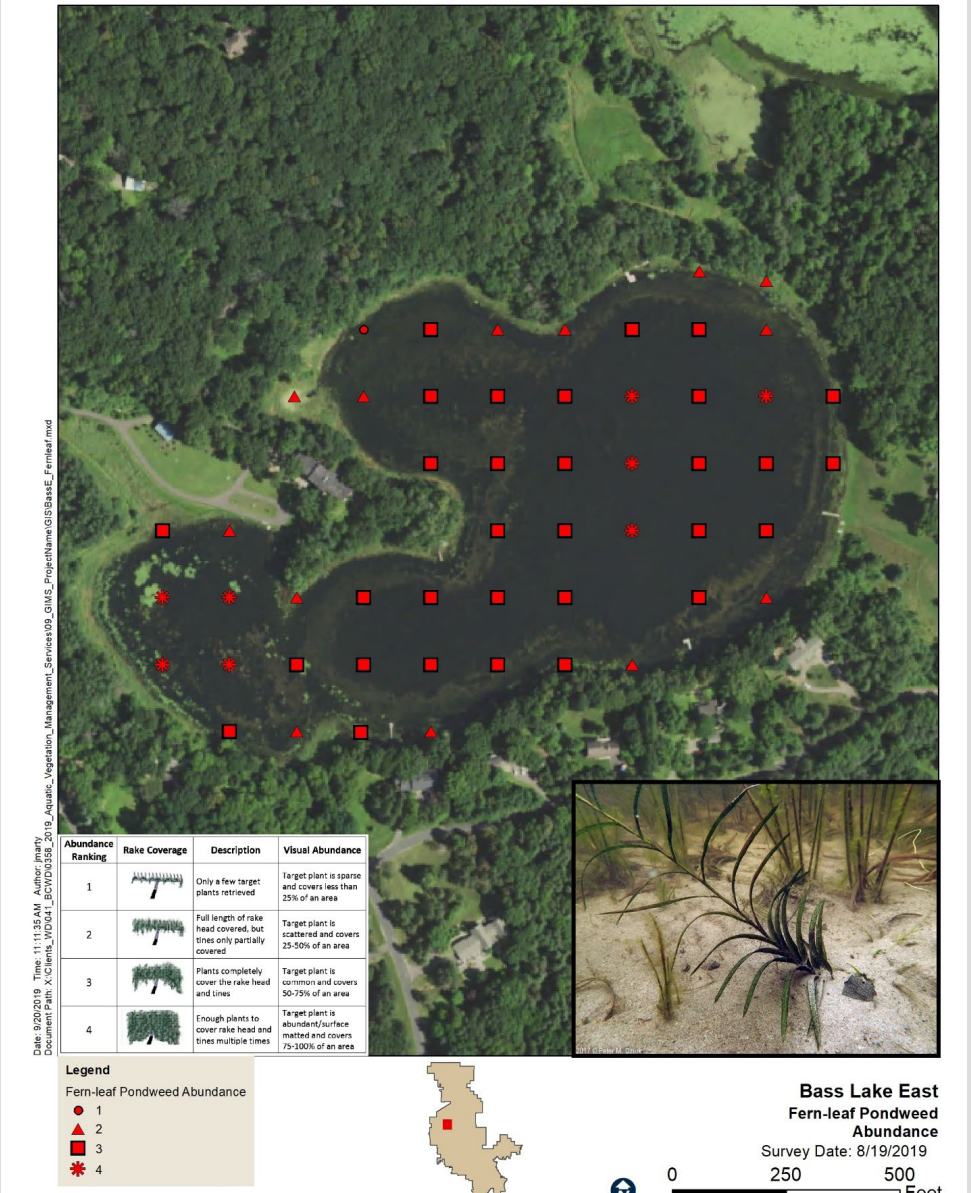
Bass Lake East Macrophytes

Fern-leaf pondweed
100% of sampling points

White-water-lily
30.2%of sampling points

2.5 species per site

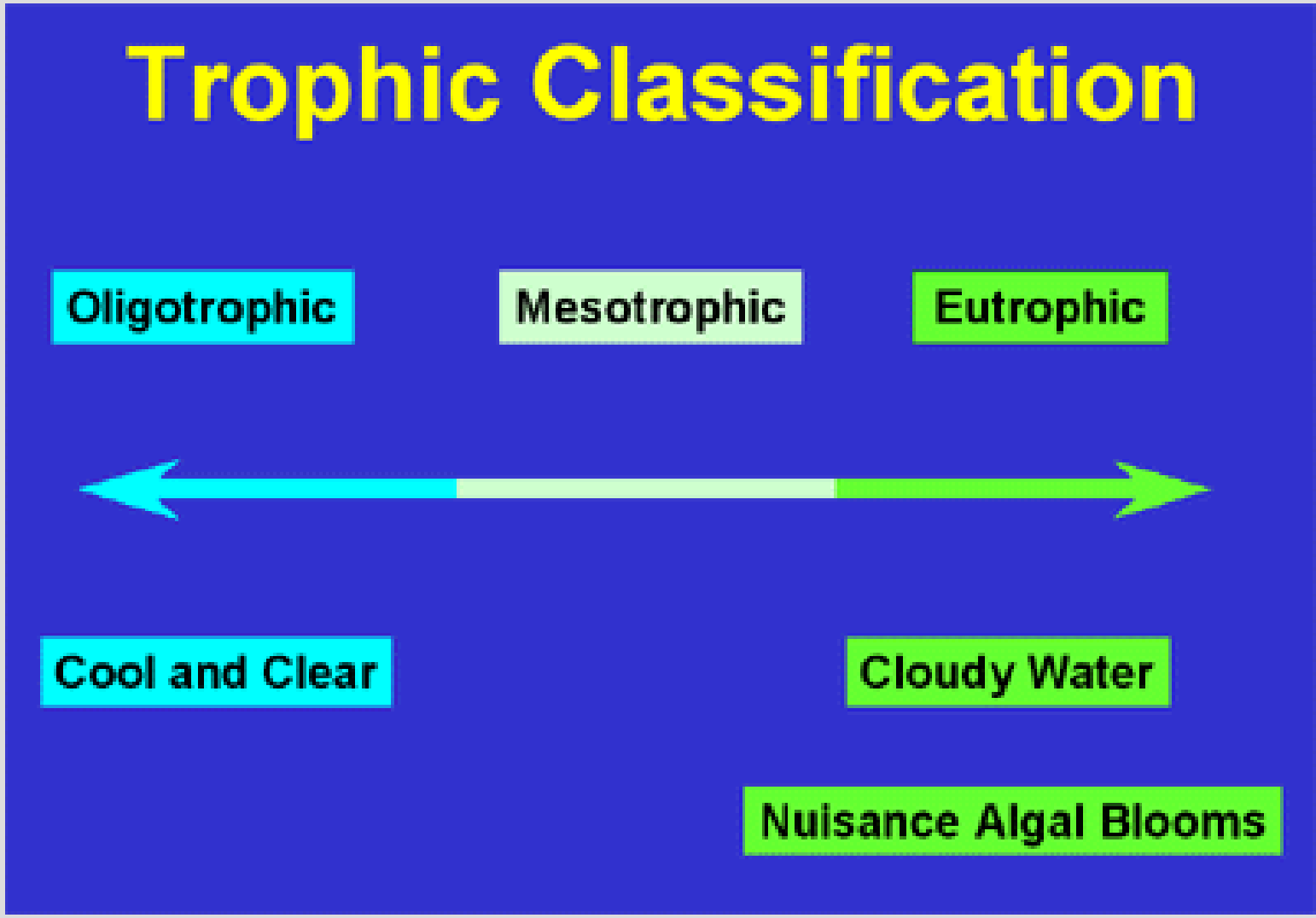
Floristic Quality Index (FQI) = 21.9
ecoregion median - 22.5



Water Quality

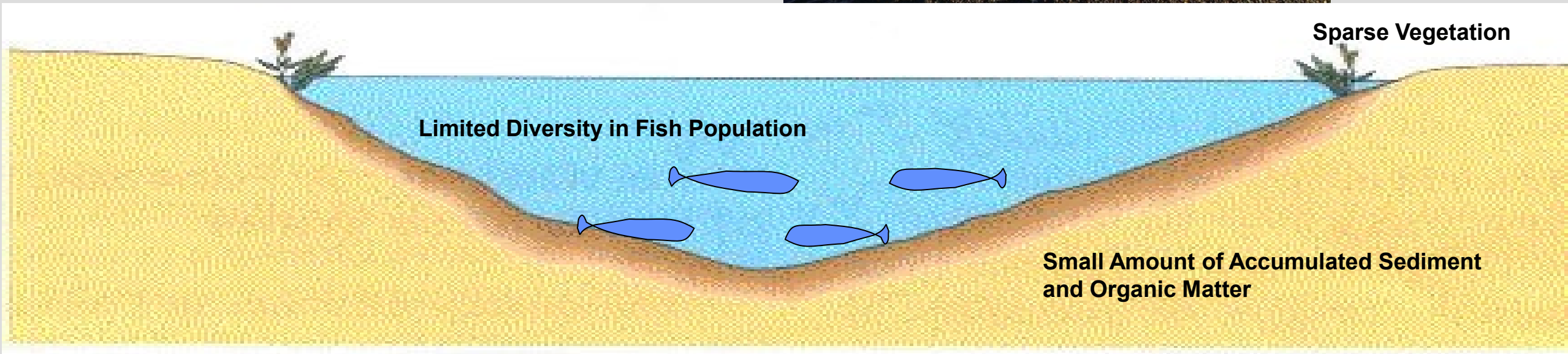
Trophic State

- Transparency
- Phosphorus
- Chlorophyll A

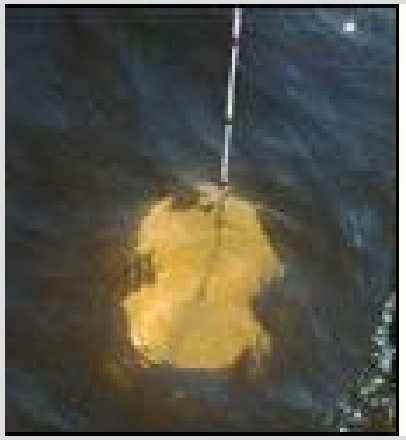


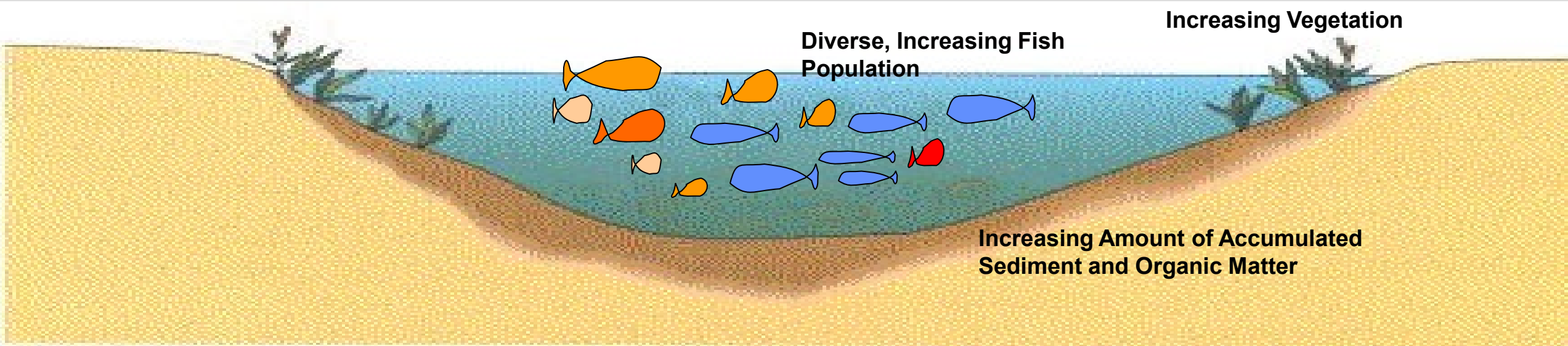
Oligotrophic Lakes

< 12 µg/L TP

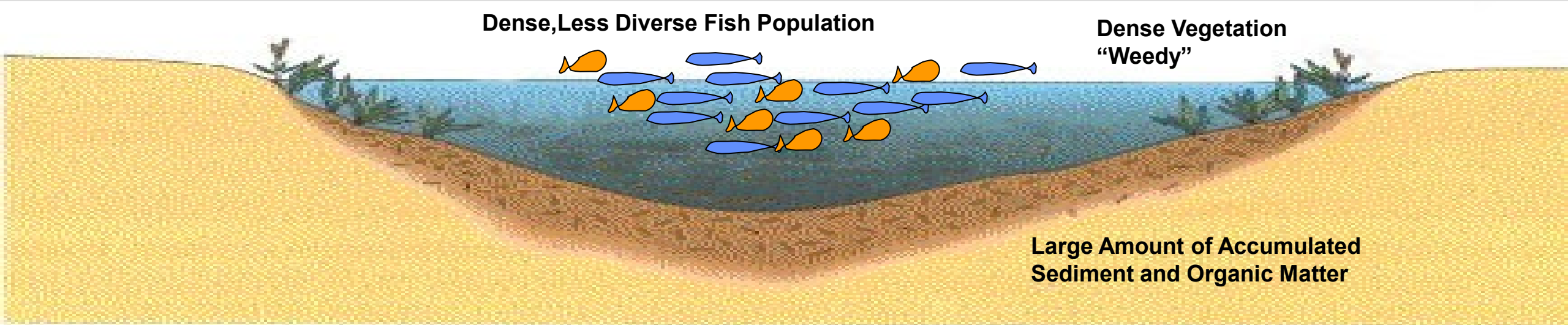


Mesotrophic Lakes

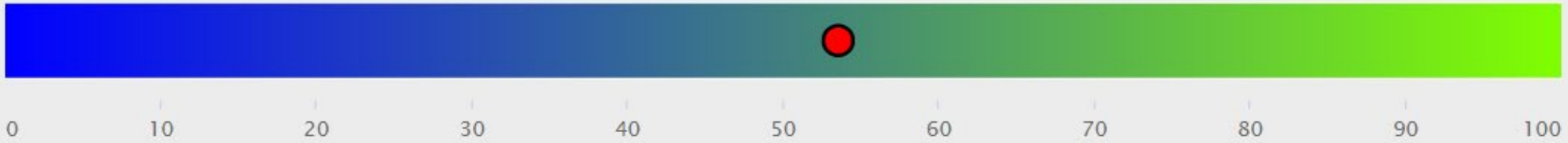
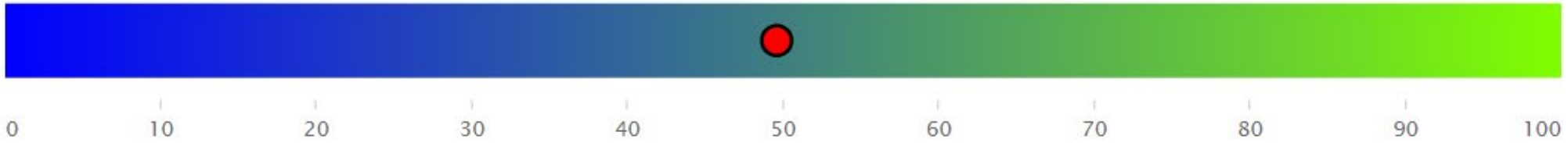
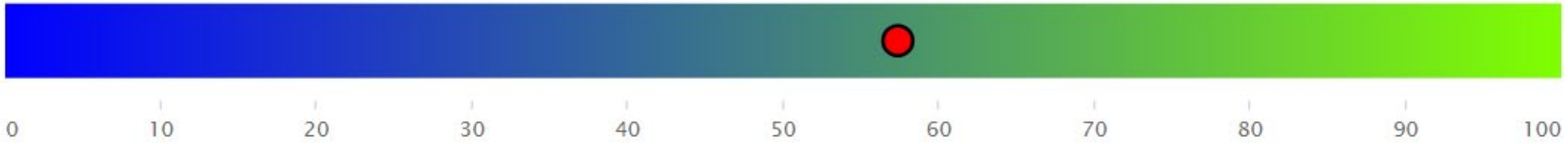




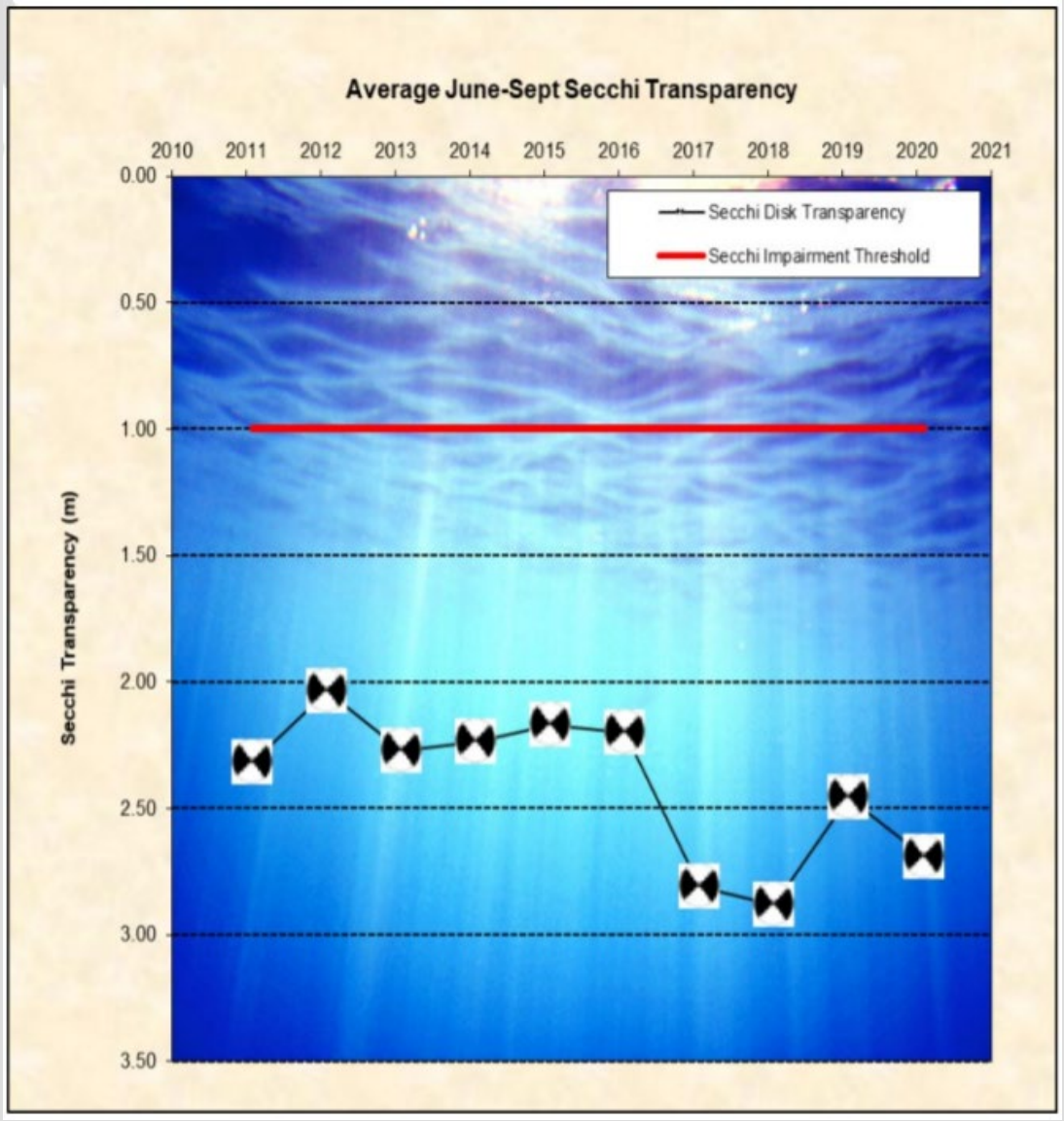
Eutrophic Lakes

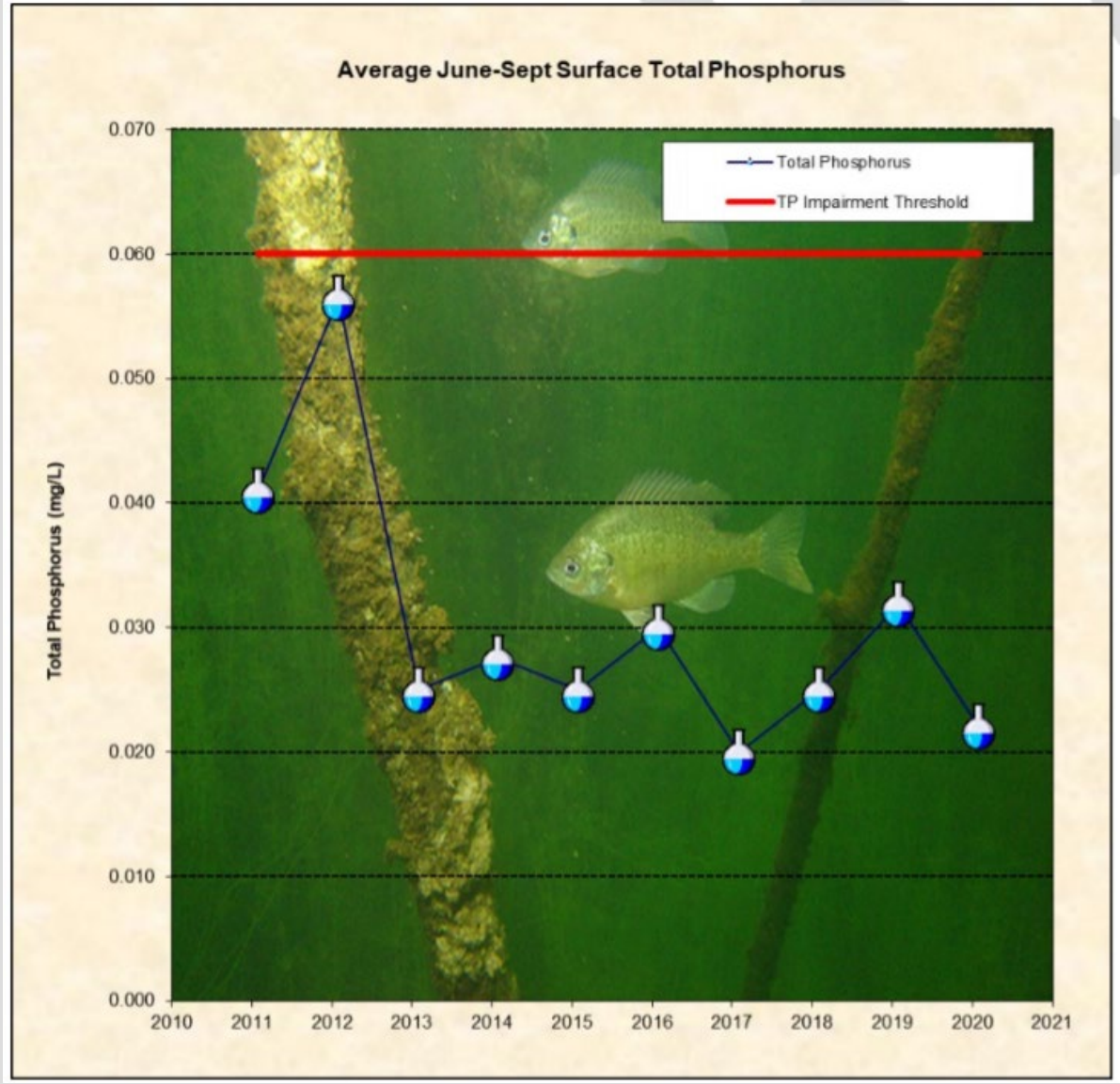


Carlson Trophic State Index Bass Lake West

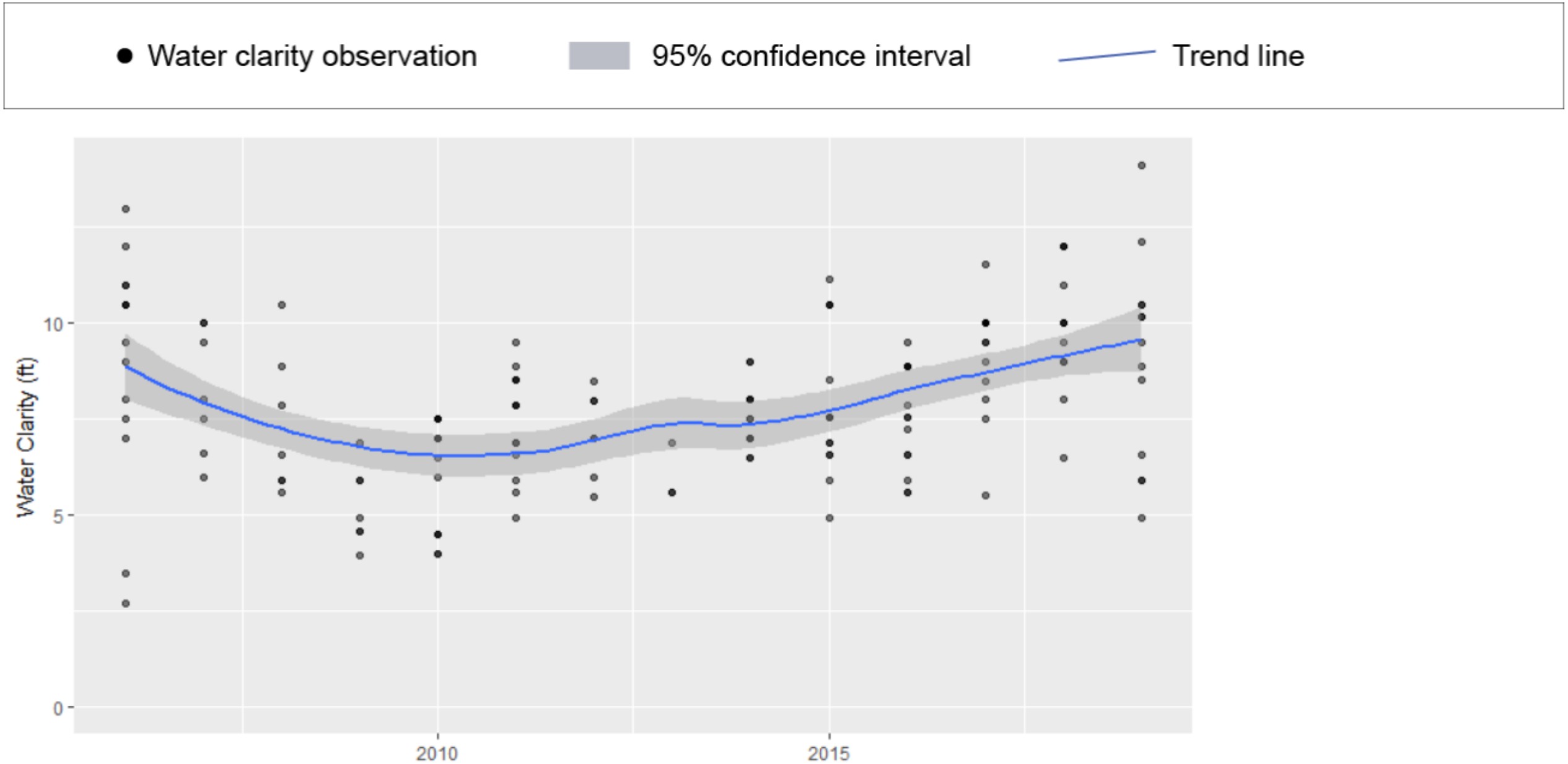
	Clear Oligotrophic	Moderately Clear Mesotrophic	Green Eutrophic	Very Green Hypereutrophic
Tropic State Index (TSI)				
Transparency				
Chlorophyll-a	N/A			
Total Phosphorus				

Bass Lake West: Secchi Transparency & TP

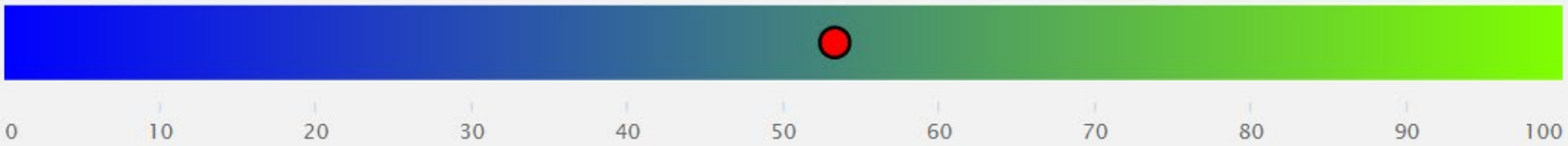
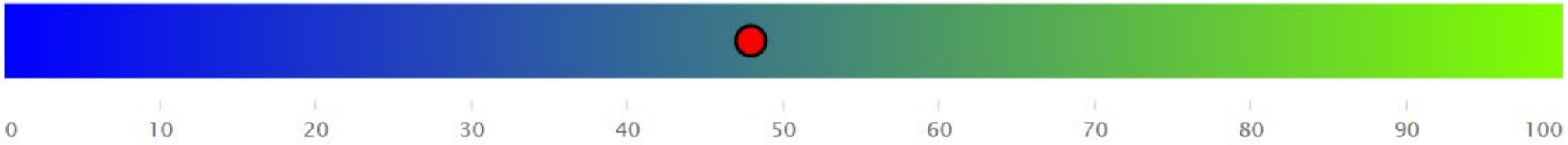
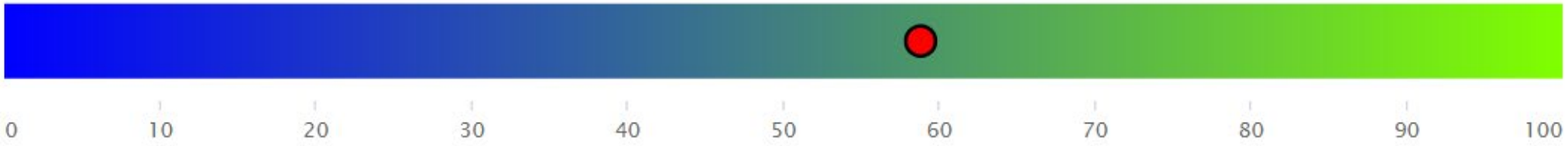




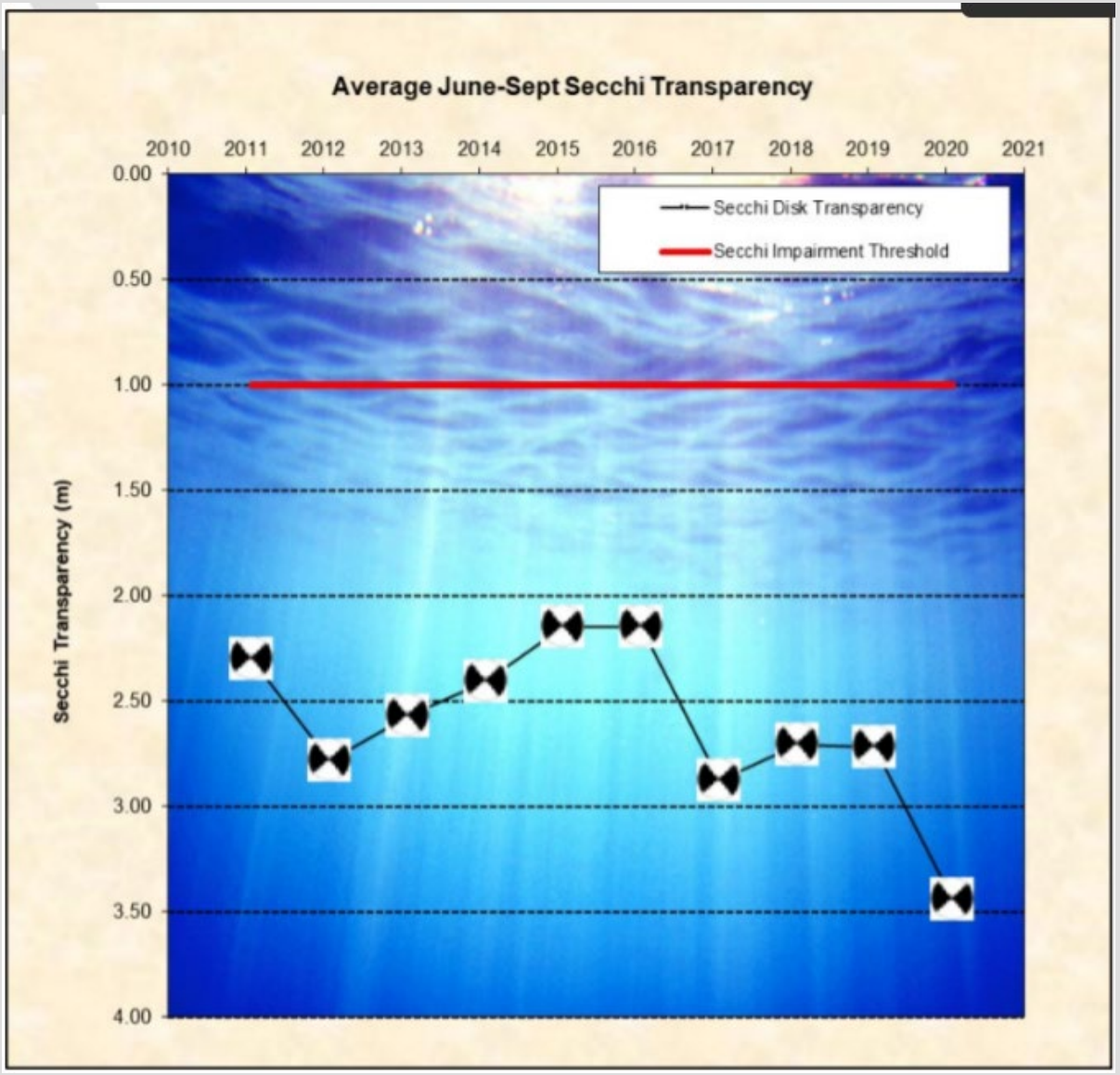
Bass Lake West

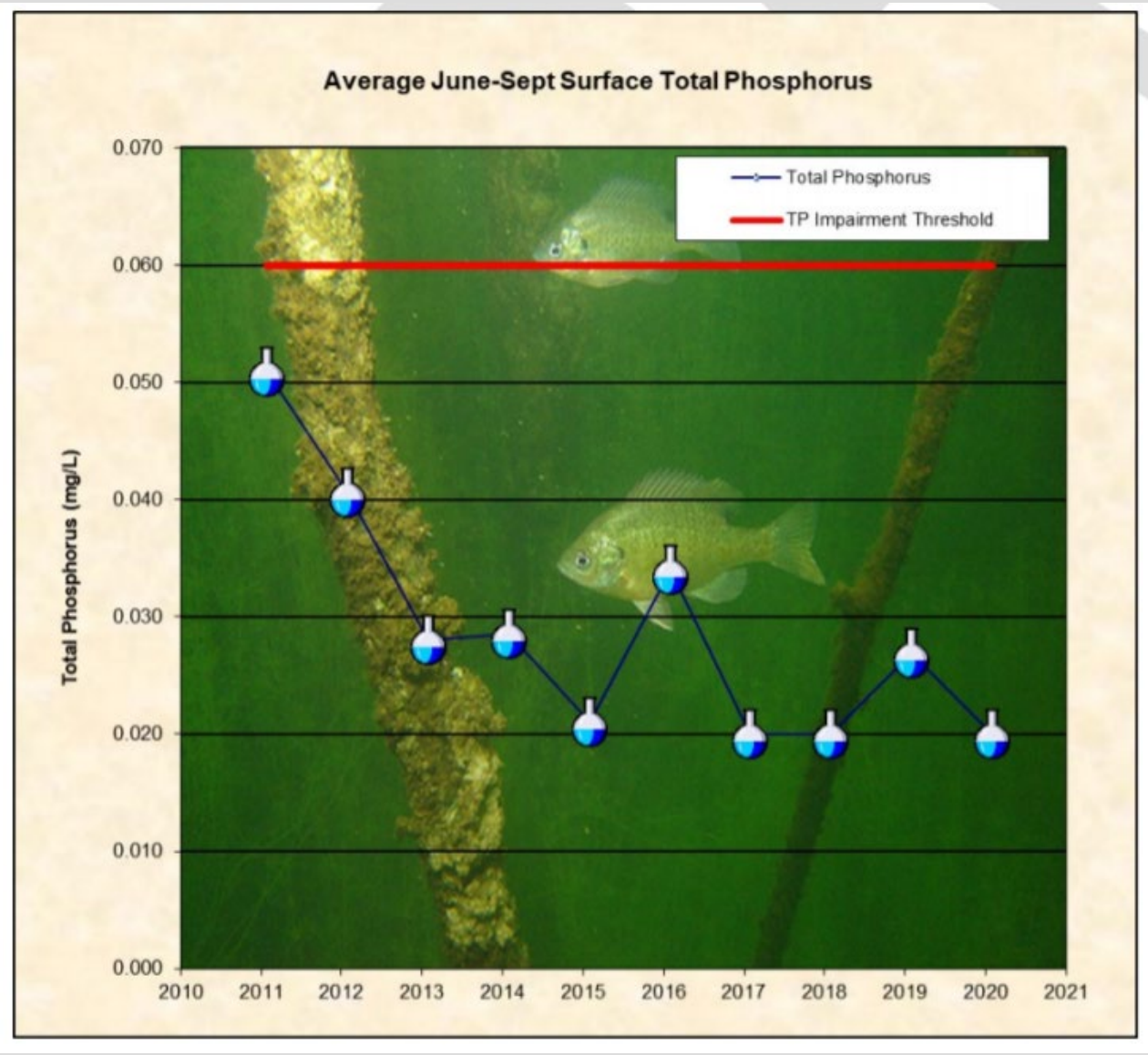


Carlson Trophic State Index Bass Lake East

	Clear Oligotrophic	Moderately Clear Mesotrophic	Green Eutrophic	Very Green Hypereutrophic
Tropic State Index (TSI)				
Transparency				
Chlorophyll-a	N/A			
Total Phosphorus				

Bass Lake East: Secchi Transparency & TP





Bass Lake East

Conclusions

Overall good water quality and biological communities

Stability of existing water quality is dependent upon:

Maintaining macrophyte population

Maintaining low disturbance of sediment

- Minimize motor boat disruption
- Keep rough fish out

Reducing watershed phosphorus loading:

- Turf management
- Healthy lakeshore buffers

Flood Risks - Background

Studies & Observations

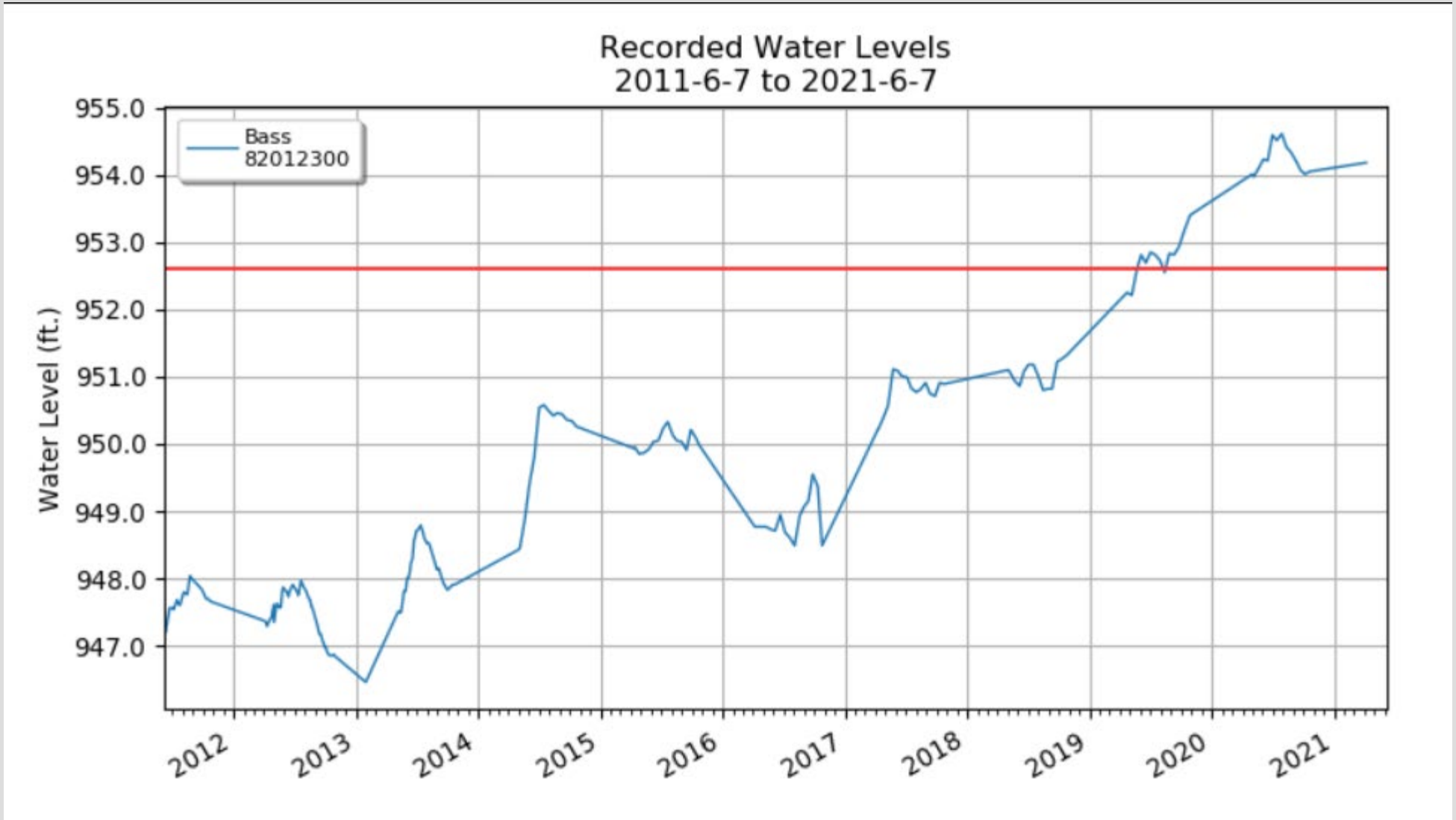
2010 FEMA Map and Insurance Study published (Based on 2004 analysis)

2014 NOAA revised statistical rainfall depths (Example:100-Year Storm went from 5.9 inches to 7.2 inches)

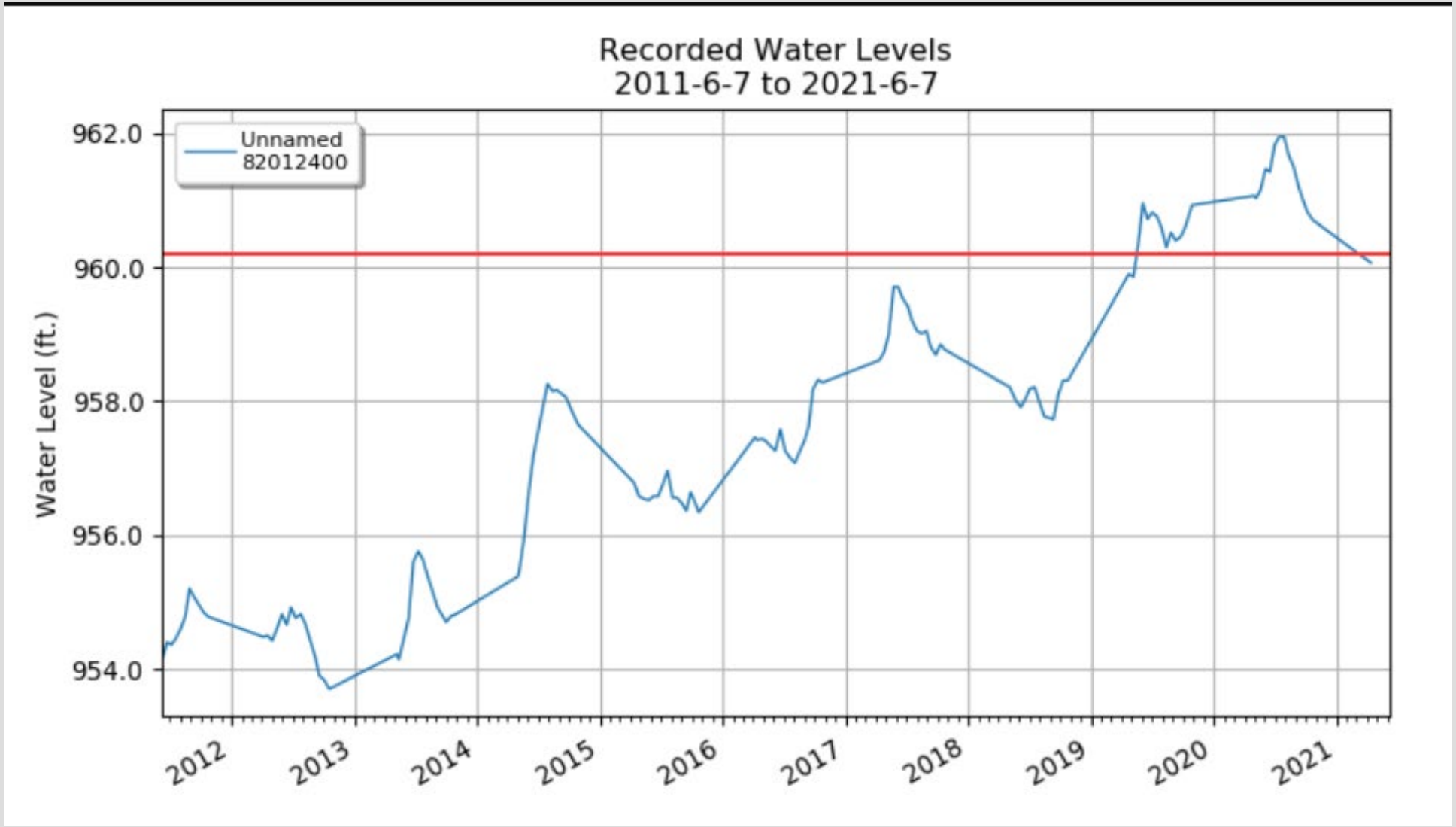
2019+ Observed high water levels throughout BCWD

2021 Revised BCWD rainfall model with current water levels to assess flood risks around Bass Lakes

Bass Lake West – Water Levels



Bass Lake East – Water Levels



Flood Risks – Background

What is the 100-Year Storm?

7.20" of Rainfall falls in 24-hours

Storm that has a 1% chance of happening in any given year

1 in 4 chance of experiencing during a 30-year mortgage

Flood Risks - Background

NOAA Revised Rainfall

- 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”
- 10-Day Snowmelt (Landlocked Systems – Bass Lakes)
  - 100-Year = 7.20” of rainfall on Frozen Ground

Flood Risks – Modeling

Findings

Buildings

- **2 at Risk**
  - *Inundation & access issues*

Roads/Driveways

- **1 at Risk**
  - *Inundated Driveway*

Wells

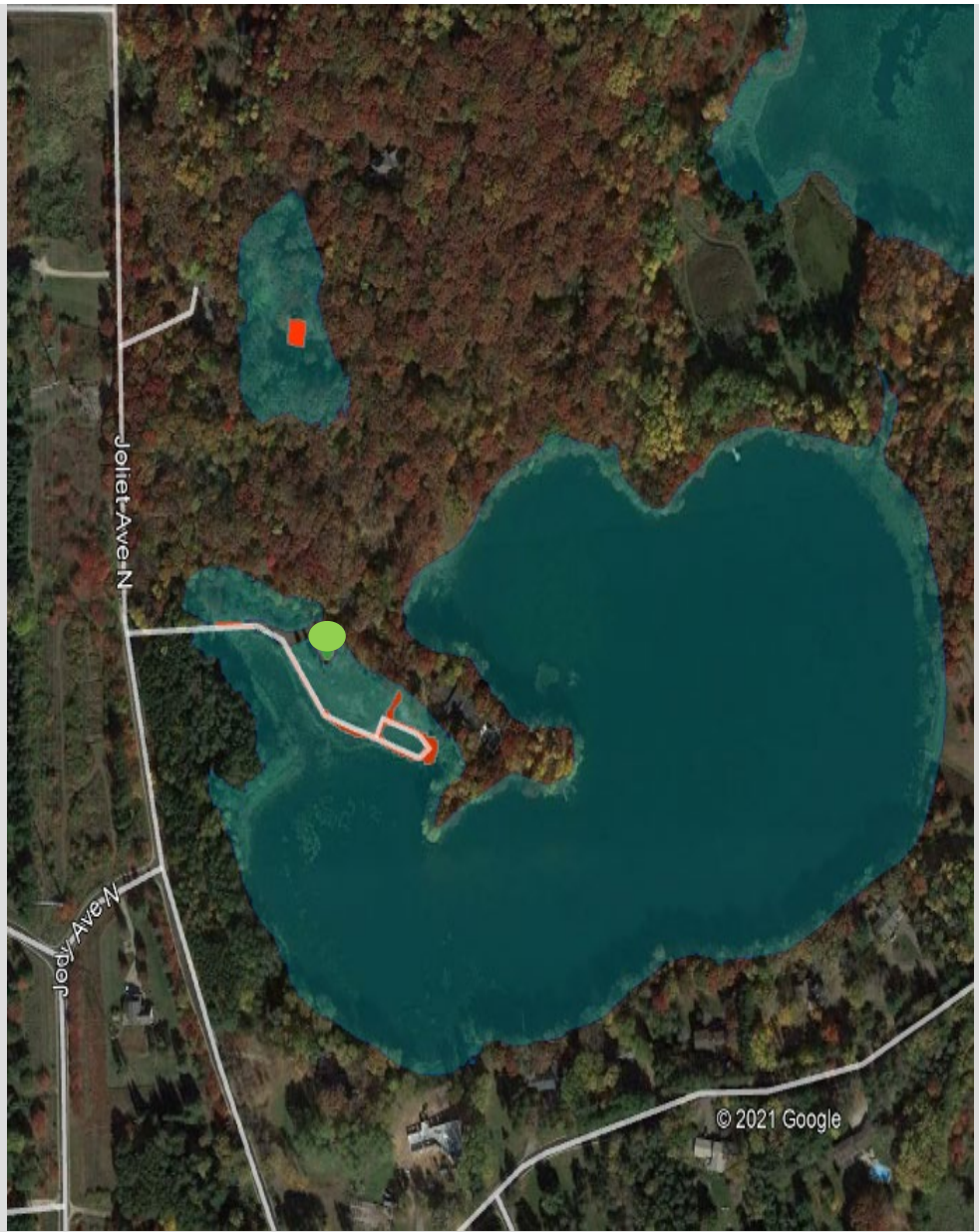
- **3 at Risk**

Septic Systems

- **13 at Risk**
  - *Questionable location data*

No Data on Parcels

- **41 Wells**
- **23 Septic Systems**



Flood Risks

Drinking Water Well

Inundation by surface water

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

Septic System

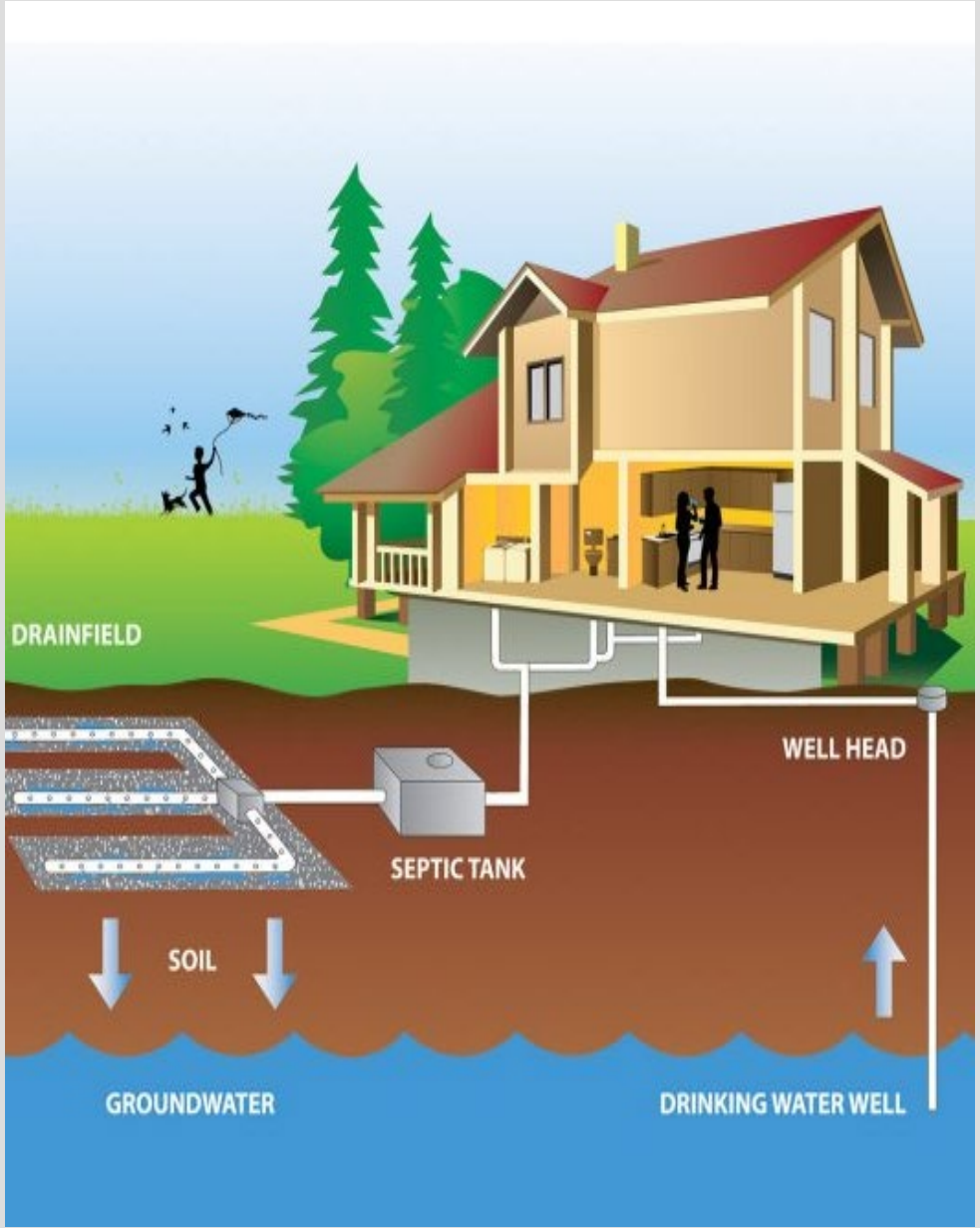
Inundation by surface water

- **System will backup**

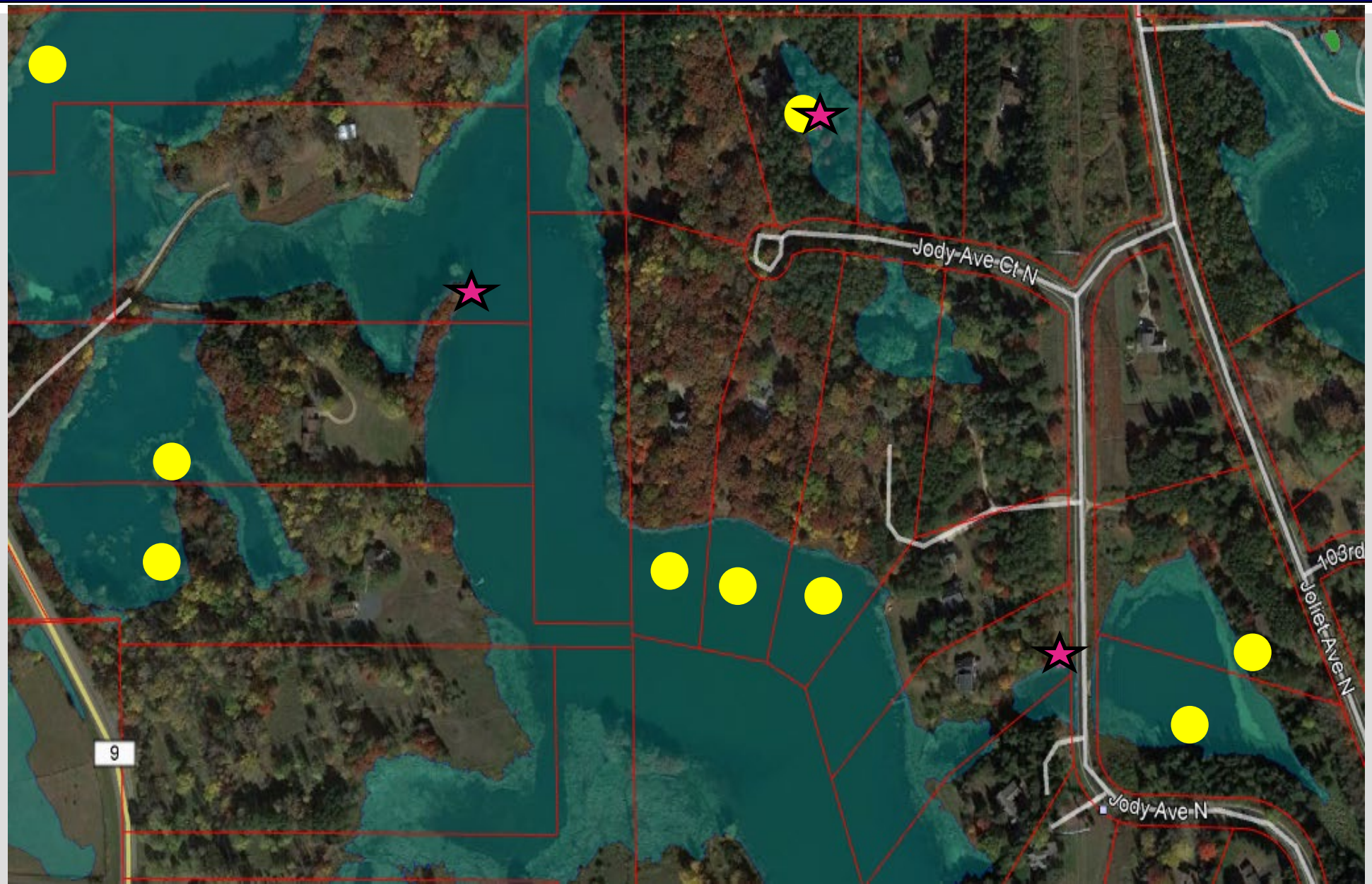
Groundwater within 3 feet

- **Groundwater contamination**

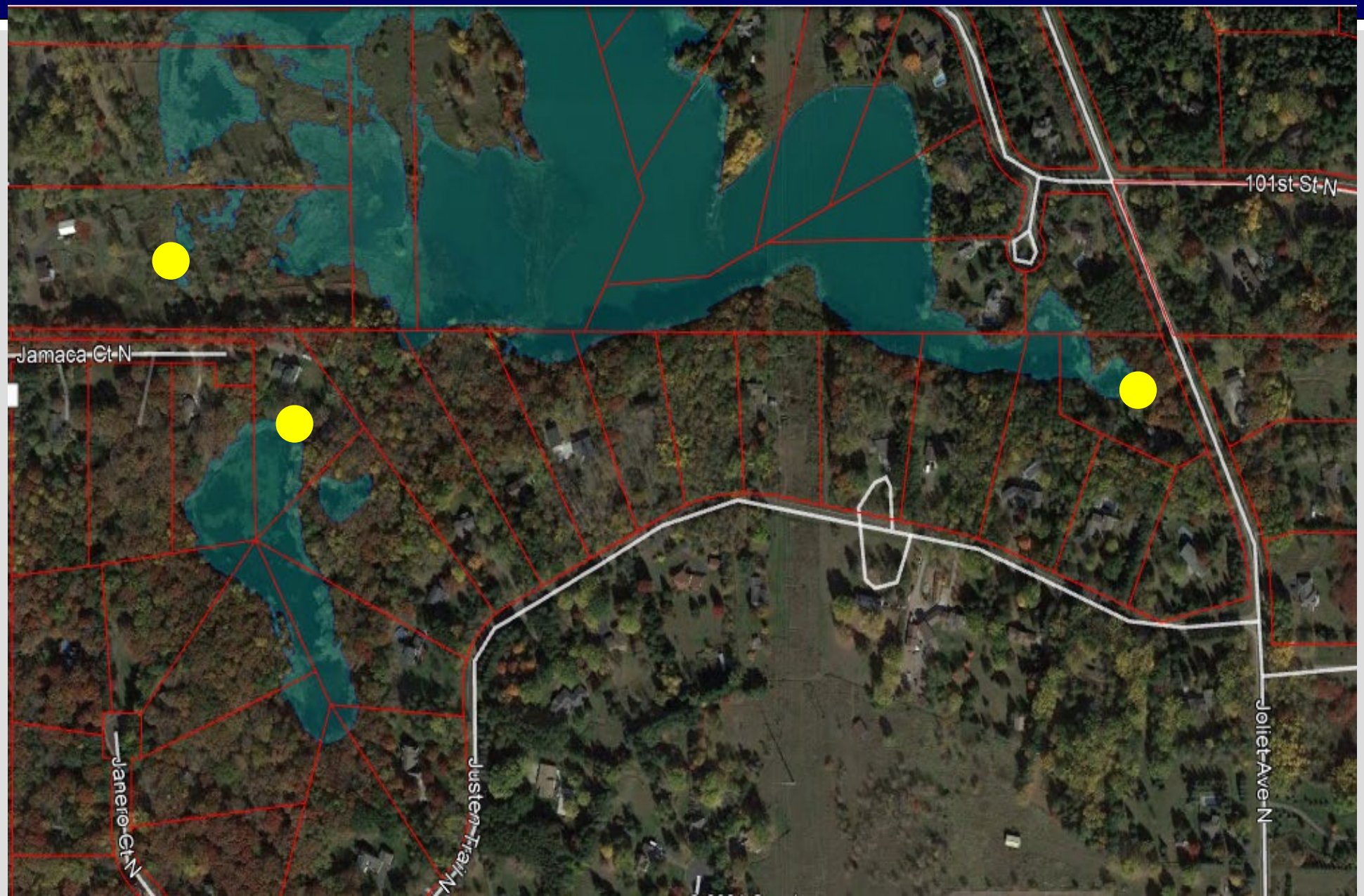
- Lake contamination



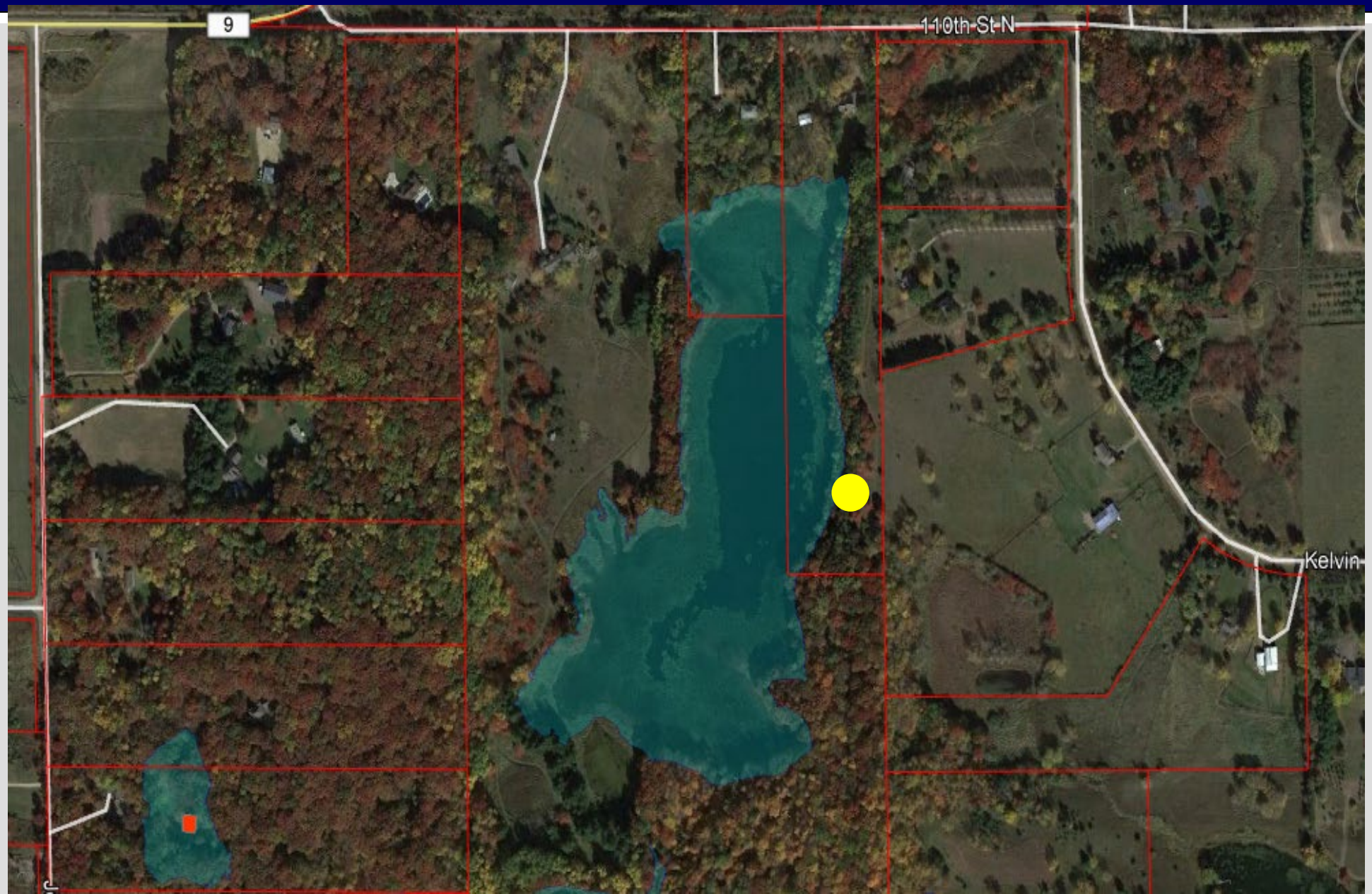
Flood Risks – Findings



Flood Risks – Findings



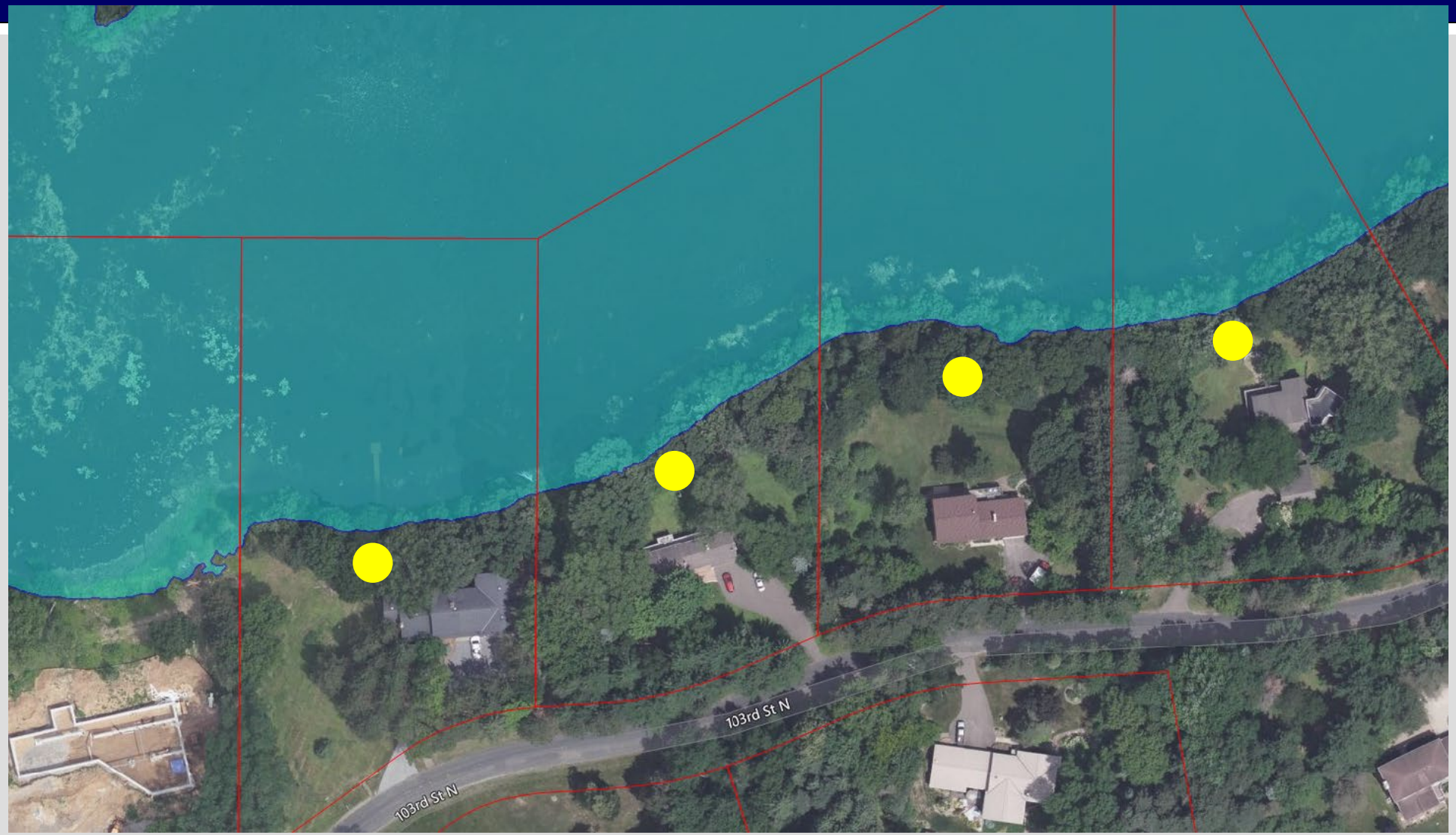
Flood Risks – Findings



Flood Risks – Findings

FRUCI – Septic located in depression – not likely accurately located

Flood Risks – Findings



GUTZMANN – No Well Data (Likely drilled prior to 1975)

Questionable Septic location

Flood Risks – Findings

HELMER – No Well or Septic Data

Flood Risks – Findings

REINKE – Well in Flood Footprint

Issues Identification and Goal Setting

Current Lake Uses

Issues/Concerns/Limitations to Uses

Thank you

Pat Conrad

651.770.8448 / www.eorinc.com

Impervious Surfaces

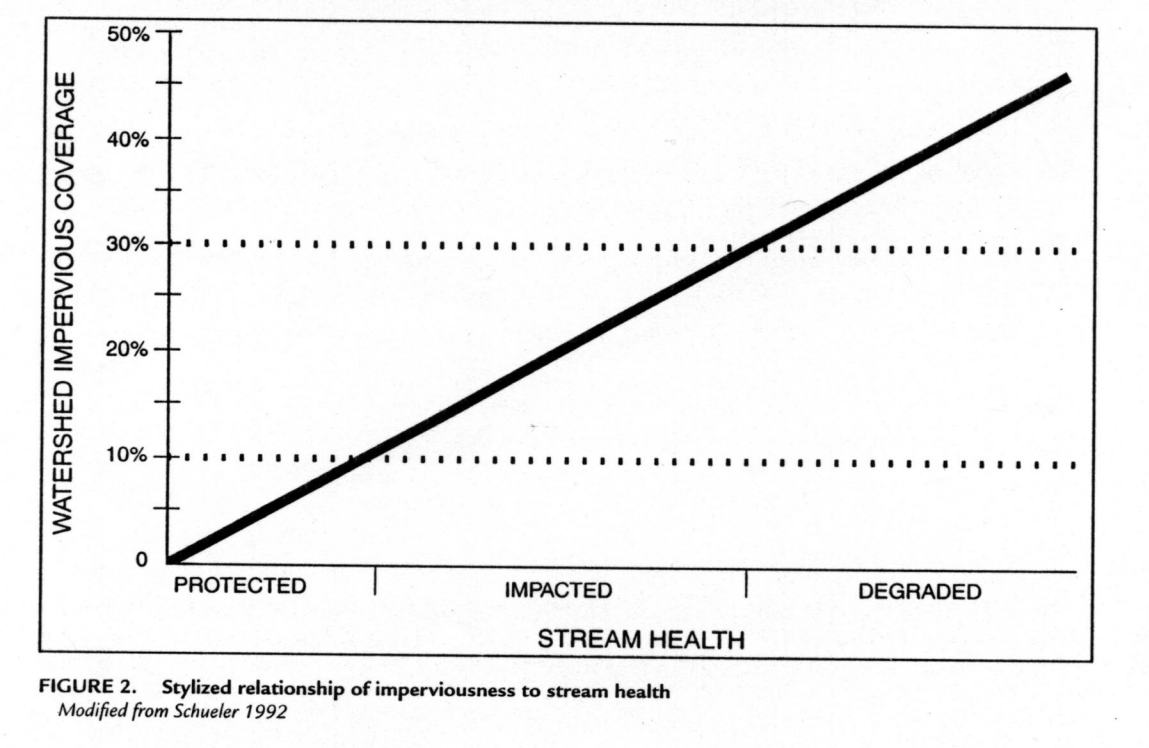
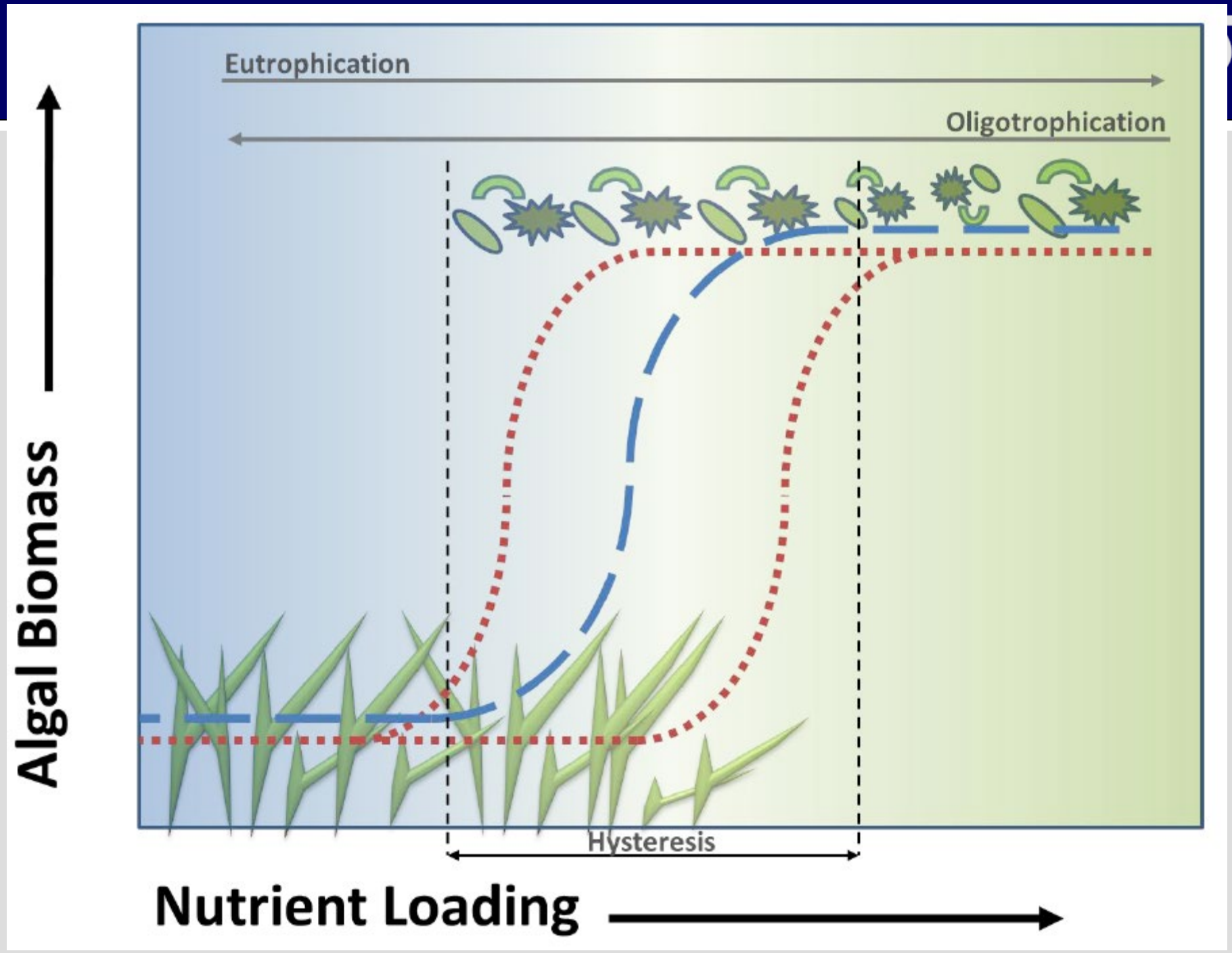


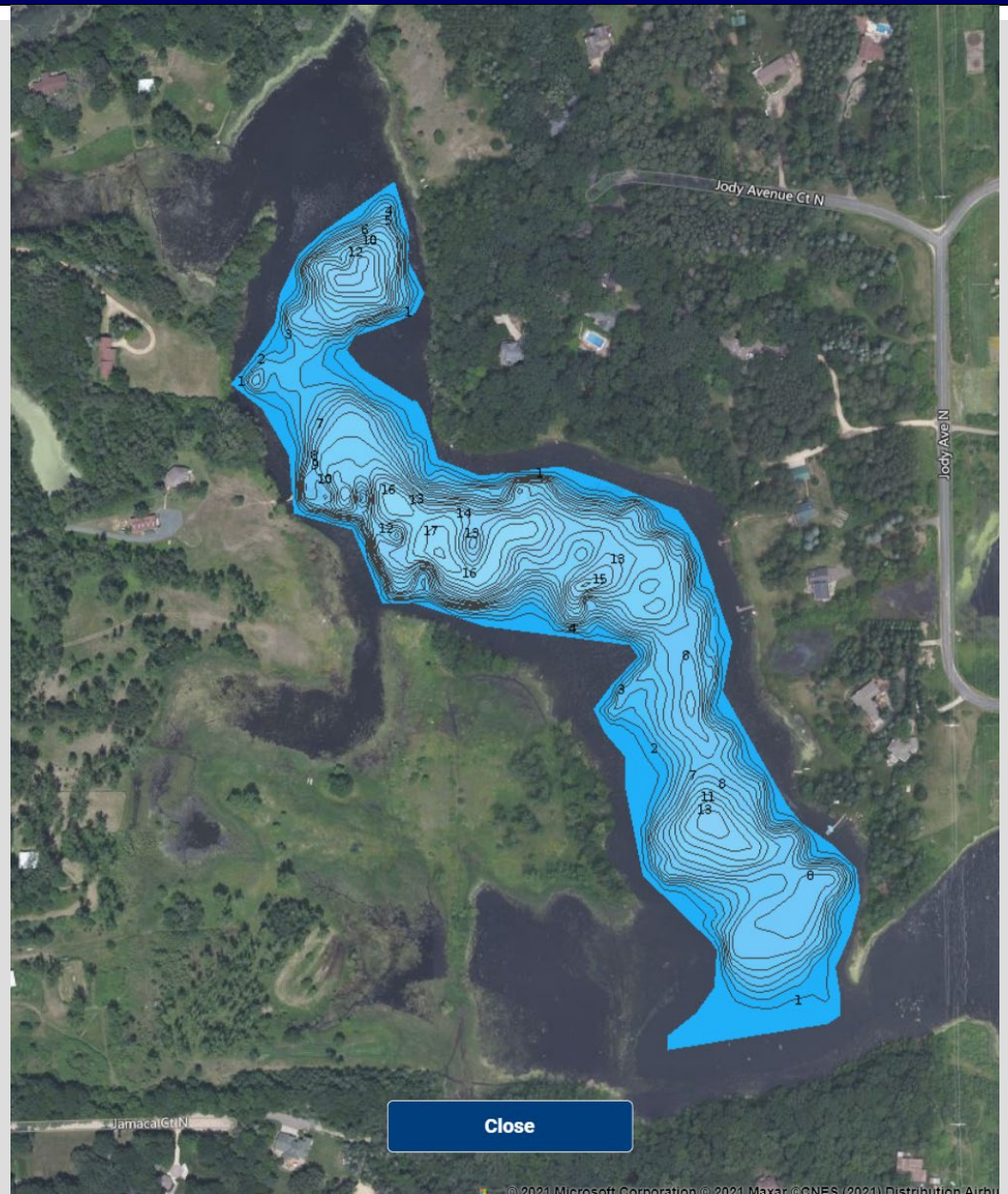
FIGURE 2. Stylized relationship of imperviousness to stream health
Modified from Schueler 1992

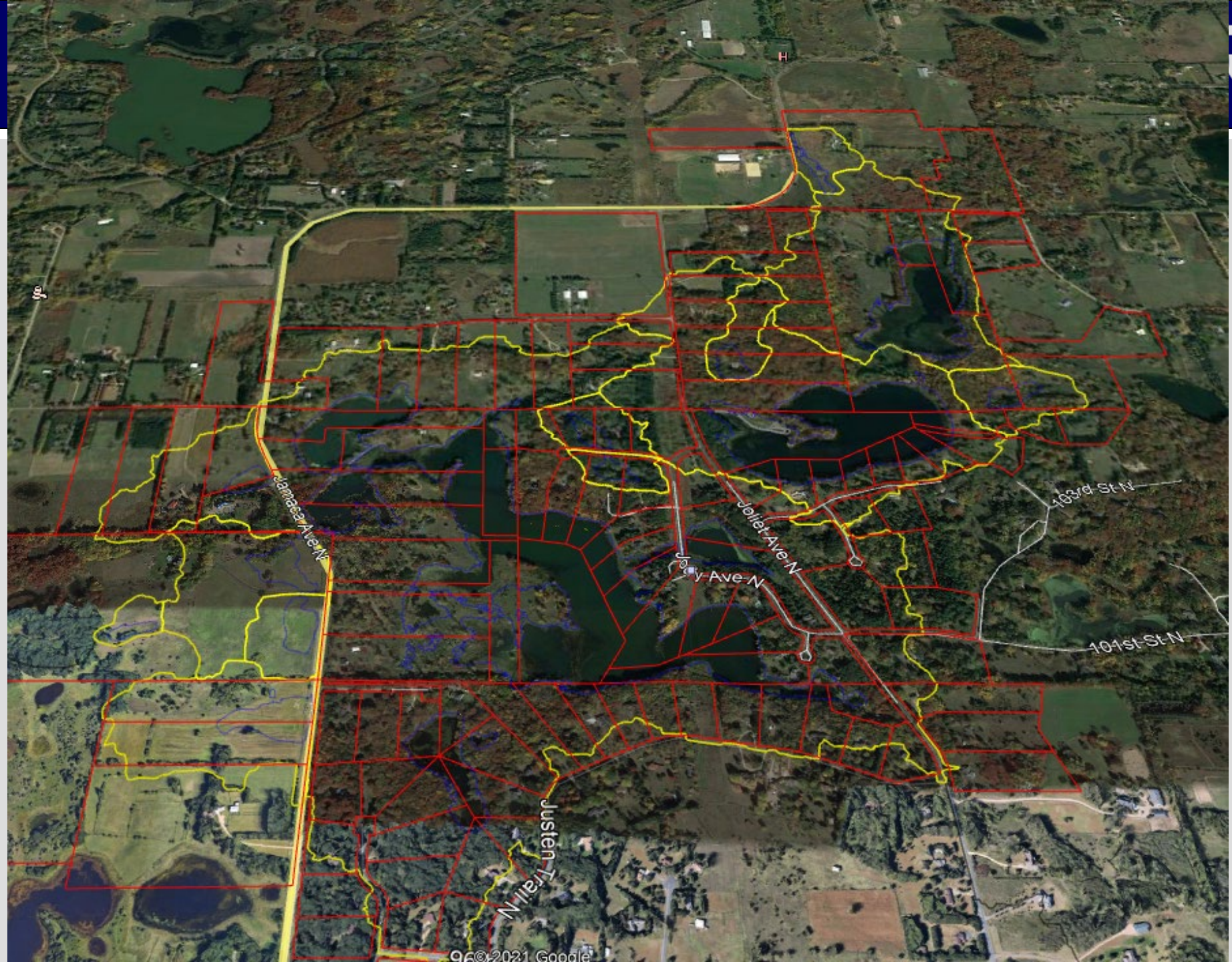
Hard surfaces (roads, houses) that do NOT allow water to soak in

Streams are impacted at levels as low as 10%


Eutrophication
Oligotrophication
Algal Biomass
Hysteresis
Nutrient Loading

Bass Lake West Bathymetry




Joliet Ave N
103rd St N
101st St N
Justen Trail N
©2021 Google

Flood Risks - Background

Computer Modeling

- What is a rainfall model (Hydrologic and Hydraulic)?
  - **Drainage size, slope, direction, soil, vegetation, evaporation, rainfall**
  - **Storm sewer pipes, manholes, channels, ponds, lakes, and depressions**
  - **Solves complex mathematical flow and momentum equations to determine water elevation, flow, and timing**
  - **Based on a set Lake elevation when the storm starts**
    - **October 2020 water elevation for Bass Lakes modeling**