

METHODS FOR DETERMINING VEGETATION & FISH HEALTH

Overview

Biodiversity is important in maintaining a healthy lake ecosystem. Biodiversity is considered to be a principle driver of ecosystem function and critical to ecosystem resilience and stability. A diverse ecosystem provides a number of services such as nutrient recycling, improved water quality, and increased recreational opportunities. Human disturbances often lead to a decrease in species diversity resulting in a weakening and/or loss of support to the ecosystem services provided by healthy biotic community.

The development of health assessment indices have provided a means in which natural resources managers can evaluate and monitor the health of a lake's biological community to help focus restoration and preservation efforts. The species that make up a community vary in their tolerance to human disturbances, therefore, as the episodic and cumulative disturbances occur to a system a decrease in species richness and a shift to species that are very tolerant to disturbance. Assessment tools developed by the MnDNR use these tolerance differences to relate the relative health of a given lake. Specifically, different sets of tools have been developed to relate the health of the fish community (Fish IBI) and another set of tools for the vegetation community (FQI).

Floristic Quality Index

The Floristic Quality Index (FQI) is a vegetation health assessment tool that is based on a metric of species richness and a Coefficient of Conservatism (C), which is a score (0 -10) that relates a species site fidelity and tolerance to disturbance. Thus, species that have narrow habitat ranges and/or low tolerance to stress have high C-values. Therefore, the more species observed in a lake and the greater the C-values the greater the system health.

FQI assessment was designed to allow for health assessment from various community sampling techniques. Three different survey methods can be used: Minnesota Biological Survey methods, MnDNR transects or point intercept surveys (most common). All three methods have limitations yet all are relatively good at capturing and evaluating the health of the vegetation community.

Due to natural differences in species composition between deep and shallow lakes and ecoregions, two unique sets of thresholds were developed for FQI scoring for the North Central Hardwoods ecoregion (Table 1). The MnDNR has performed at least one survey and FQI assessment on all of the CRWD lakes presented in this appendix. Each lake report card shows the most recent FQI score for each lake and how it relates to the impairment thresholds presented in Table 1. It should be pointed out that the report cards only show FQI assessments conducted by the MnDNR, and therefore do not include any FQI assessments based on surveys performed by CRWD or other parties.

Table 1: Minnesota Department of Natural Resources North Central Hardwoods ecoregion point intercept and transect sampling FQI impairment thresholds for deep and shallow lakes.

Classification	Deep	Shallow
Exceptional	32.4	26.0
Impaired	18.6	17.7

Fish Index of Biotic Integrity

The Fish IBI is comprised of multiple metrics that integrate aspects of species richness, community assemblage, and trophic composition. The combining of all individual metrics results in a single score that relates the relative health of the fish community with healthier systems having greater overall scores. Low scores are typically associated to imbalanced communities filled with tolerant species and high scores are typically received when communities are balanced and filled with intolerant species.

Fish IBI sampling includes trap and gill net surveys along with nearshore backpack electrofishing and beach seining. Together these various sampling gears are able to capture information from various habitats throughout a lake and also target all fish species.

Minnesota lakes that fall within lake classes 20 - 43 (Schupp lake classification) have been partitioned into four distinct Fish IBIs. Lake class groups are clustered together using eight lake attributes that account for the expected variability of a fish community due natural phenomenon (Table 2).

Table 2: Minnesota Department of Natural Resources fish IBI tool classification.

IBI Tool	Schupp's Lake Class	Lake Classification Group Description
2	22, 23, 24, 25, 27	Generally, deep lakes with high shoreline complexity (SDI) that are typically less than 80% littoral.
4	28, 29, 30, 31, 32	Compared to LCG 2 these lakes on average are smaller, have intermediate littoral area, have less shoreline complexity (typically rounder basins). They also typically have a low trophic status, low phosphorus levels, and clearer water compared to LCG2.
5	33, 34, 35, 36, 37, 39	Central and Northern MN lakes of shallow to moderate depths (mostly littoral). Generally, naturally eutrophic lakes with lots of vegetation and soft sediment.
7	38, 41, 42, 43	Shallowest lakes typically consisting of > 80% littoral area. Primarily in the southern half of the state. Excludes winterkill lakes (w/in 10 years) and riverine lakes

Due to these expected differences and unique IBIs each tool has its own set of thresholds to generalize the relative health of a lake's fish community (Table 3).

Table 3: Minnesota Department of Natural Resources impairment thresholds for fish IBI tools.

Classification	Tool 2	Tool 4	Tool 5	Tool 7
Exceptional	64	59	61	NA
Impaired	44	38	24	36

The MnDNR has performed Fish IBI assessments on six lakes throughout the CRWD: Cedar, Betsy, Louisa, Clearwater, School Section, and Bass. The lake report cards for each of these lakes present the Fish IBI score and how it relates to the impairment thresholds presented in Table 3.

More information on Fish IBI methodology can be found on the MnDNR's website:

http://www.dnr.state.mn.us/waters/surfacewater_section/lake_ibi/index.html

ALBION LAKE

QUICK FACTS

Littoral Area: 251 acres

Residence Time: 1477 days

Surface Area: 251 acres

Subwatershed Area: 1,094 acres

Maximum Depth: 9 feet

Upstream Waters: None

Common Fish

Common carp, black bullhead

Dominant Vegetation

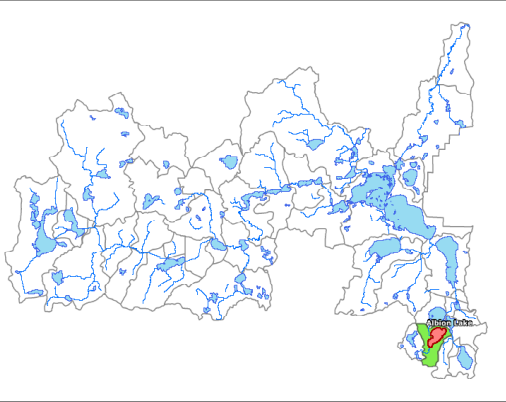
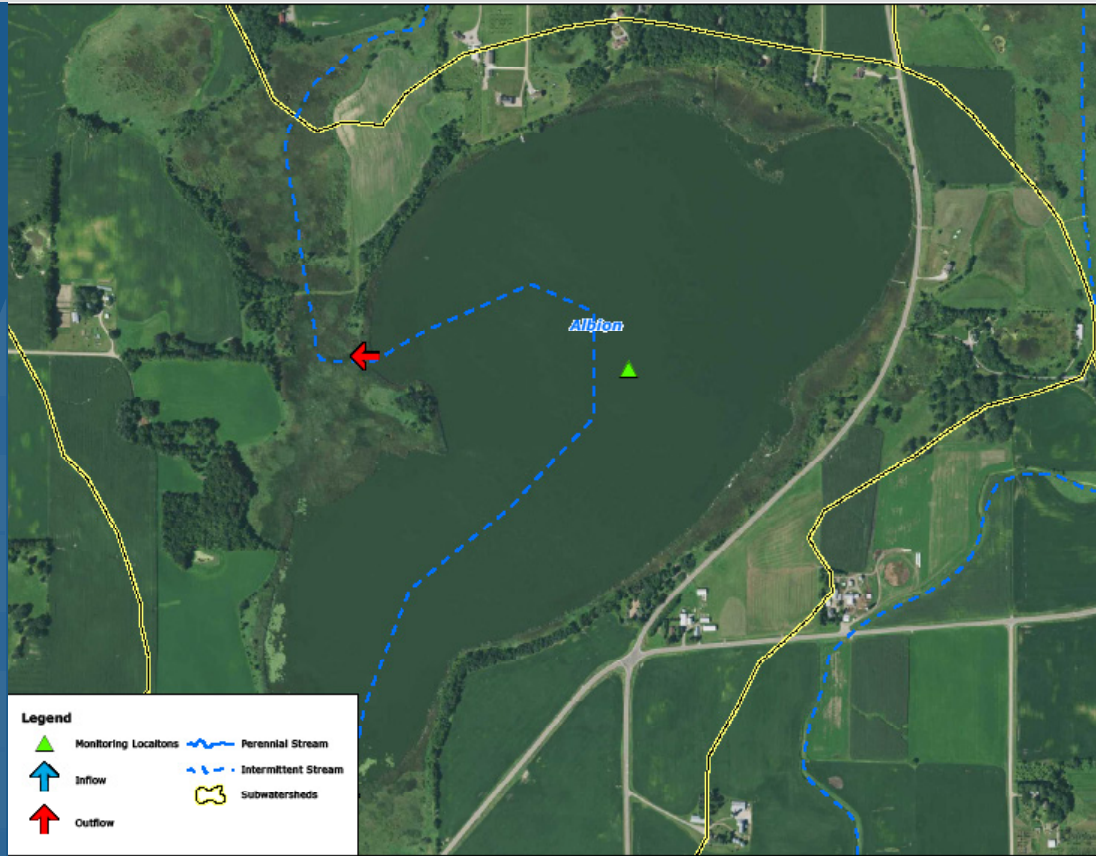
Sago pondweed

Invasive Species

Curly-leaf pondweed

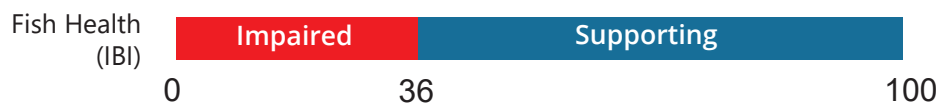
Status

Impaired; TMDL Completed 2010

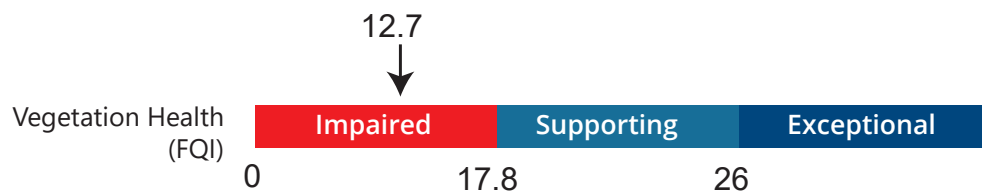


TO DO LIST

- ▲ Rough fish management
- ▲ AIS management
- ▲ Manage upstream loads



*Fish IBI has not been assessed



*Sample date: 8/14/2015



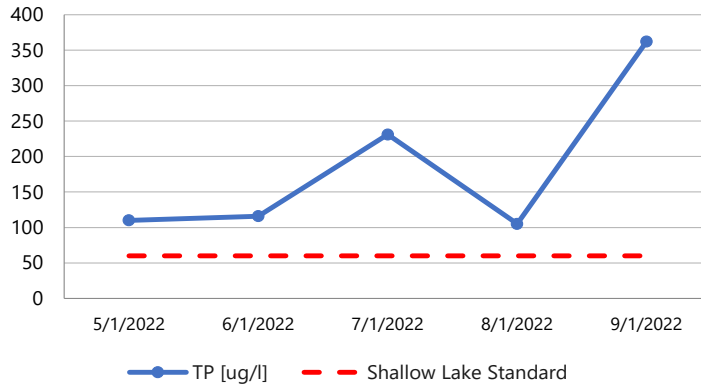
*Sediment release rate has not been assessed

ALBION LAKE

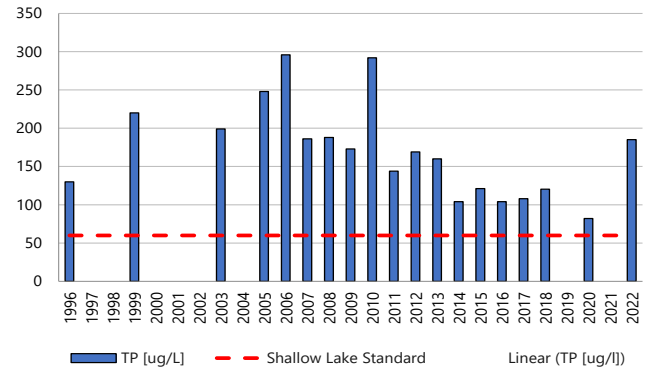
2022 Water Quality

Historic Water Quality

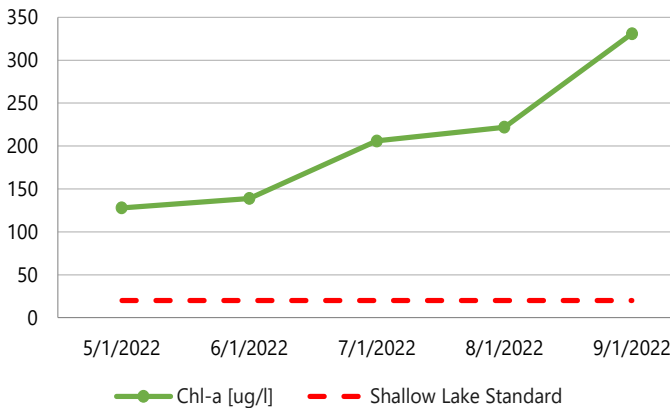
Albion - 2022 TP [ug/l]



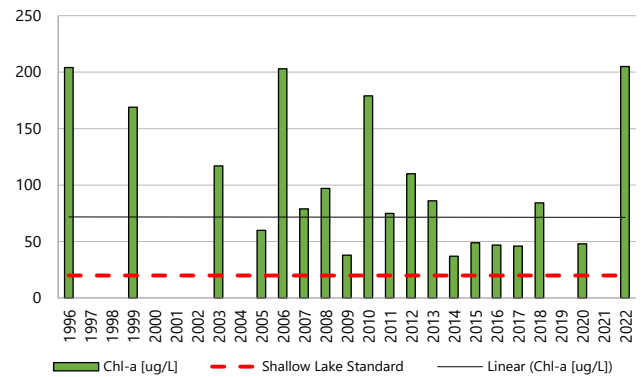
Albion - Historical TP [ug/l]



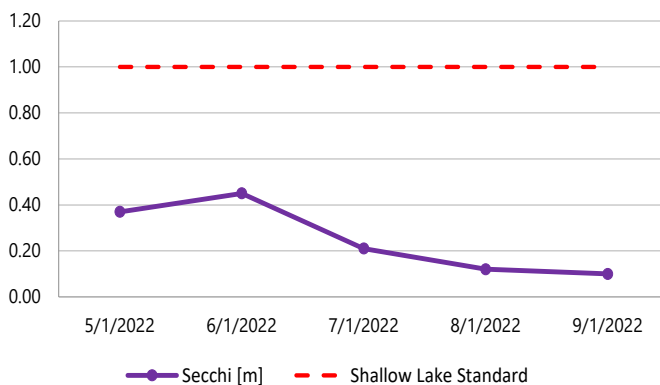
Albion - 2022 Chl-a [ug/l]



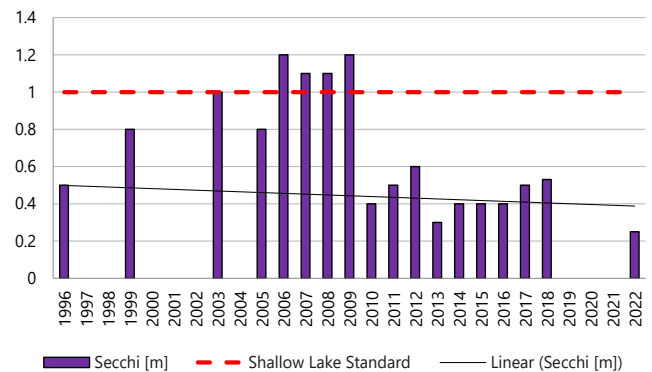
Albion - Historical Chl-a [ug/l]



Albion - 2022 Secchi Depth [m]



Albion - Historical Secchi [m]



BASS LAKE

QUICK FACTS

Littoral Area: 96 acres

Surface Area: 222 acres

Subwatershed Area: 796 acres

Maximum Depth: 34 feet

Upstream Waters: None

Common Fish

Bluegill, Northern Pike, Yellow Bull-head, Largemouth Bass

Dominant Vegetation

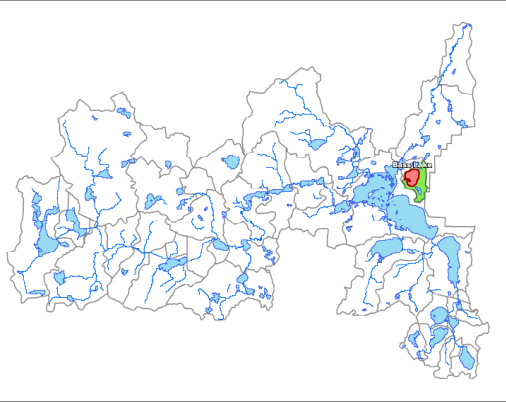
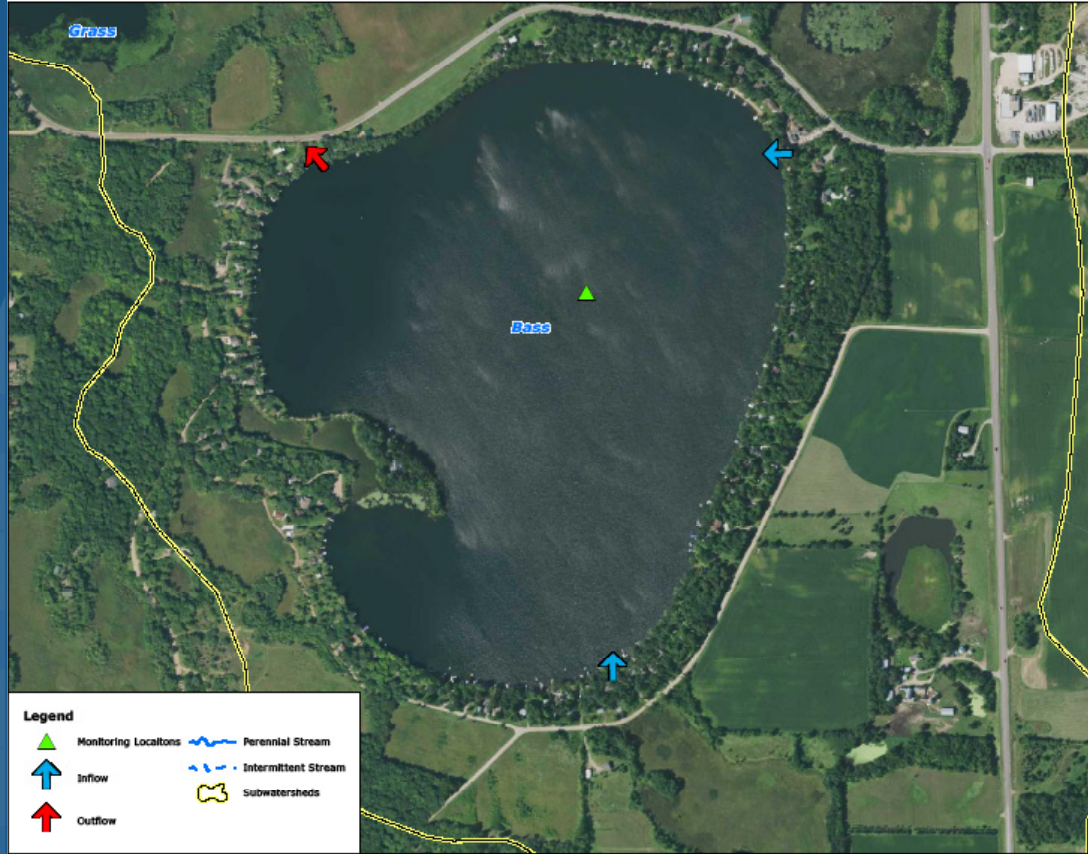
Currently obtaining vegetation info from DNR

Invasive Species

Currently obtaining vegetation info from DNR

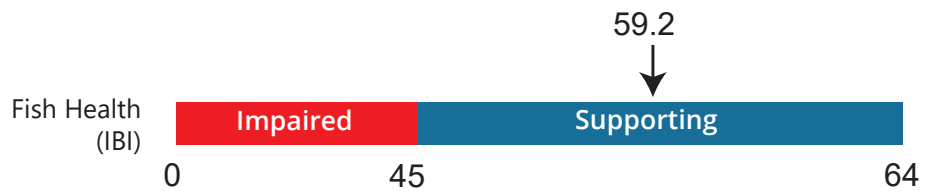
Status

Not impaired

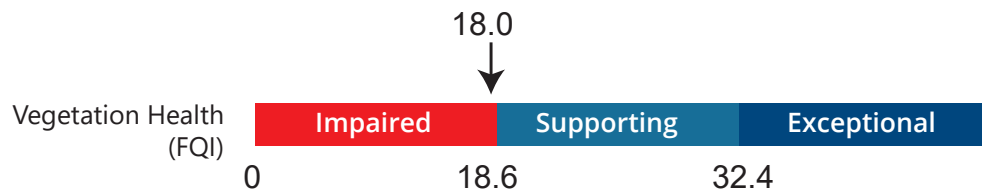


TO DO LIST

- Protect water quality
- Manage upstream loads
- AIS management and prevention



*Sample date: 8/09/2017



*Sample date: 8/10/2015



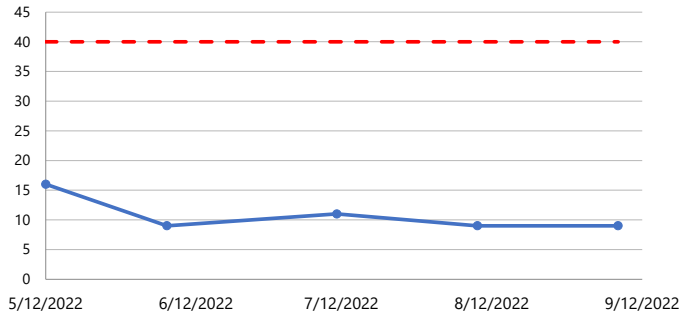
*Sediment release rate has not been assessed

BASS LAKE

2022 Water Quality

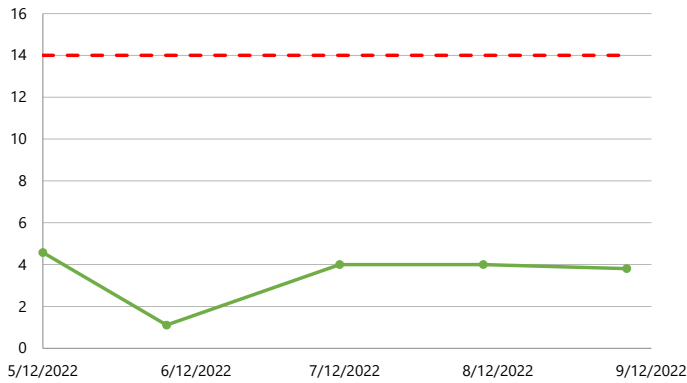
Historic Water Quality

Bass 2022, TP [ug/l]



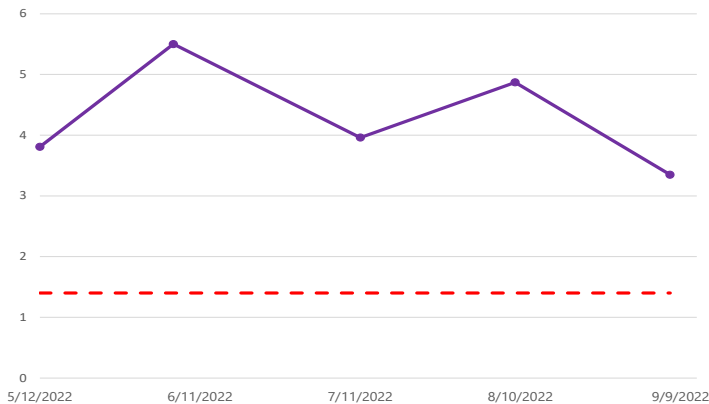
—●— Phosphorus as P [ug/l] - - - Deep Lake Standard

Bass 2022, Chlorophyll a [ug/l]



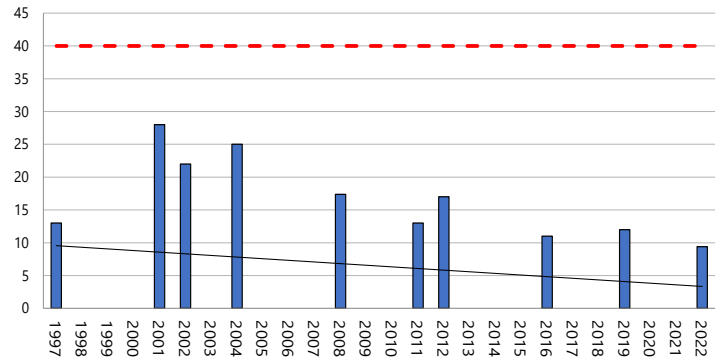
—●— Chlorophyll a [ug/l] - - - Deep Lake Standard

Bass 2022, Secchi [m]



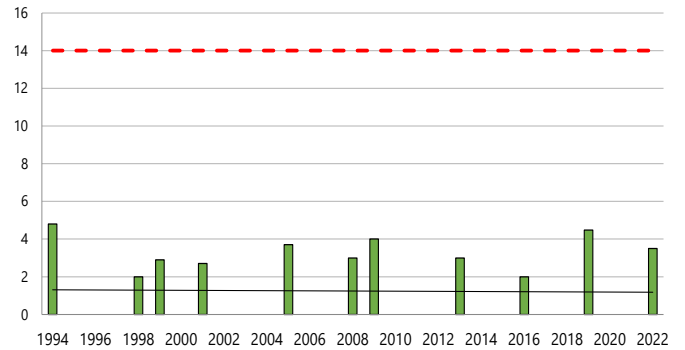
—●— Secchi [m] - - - Deep Lake Standard

Bass - Historical TP [ug/l]



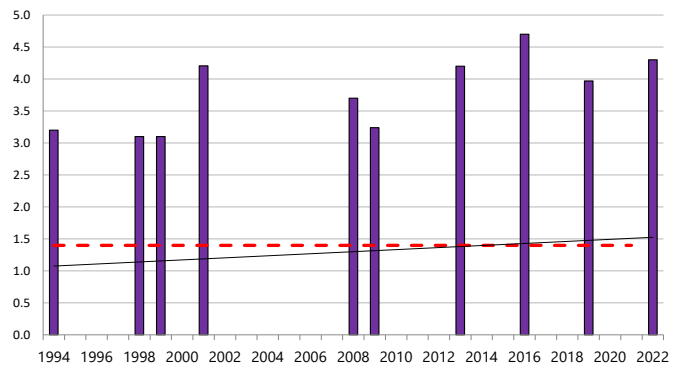
■ Phosphorus [ug/L] - - - Deep Lake Standard — Linear (Phosphorus [ug/L])

Bass - Historical Chl-a [ug/l]



■ Chlorophyll a [ug/L] - - - Deep Lake Standard — Linear (Chlorophyll a [ug/L])

Bass - Historical Secchi [m]



■ Secchi [m] - - - Deep Lake Standard — Linear (Secchi [m])

CEDAR LAKE

QUICK FACTS

Littoral Area: 315 acres

Surface Area: 790 acres

Subwatershed Area: 9,715 acres

Maximum Depth: 108 feet

Upstream Waters: Swartout, Albion, Henshaw

Common Fish

Bluegill, Northern Pike, Walleye, Largemouth Bass

Dominant Vegetation

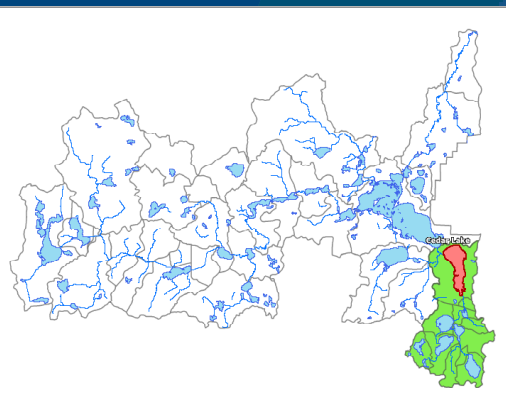
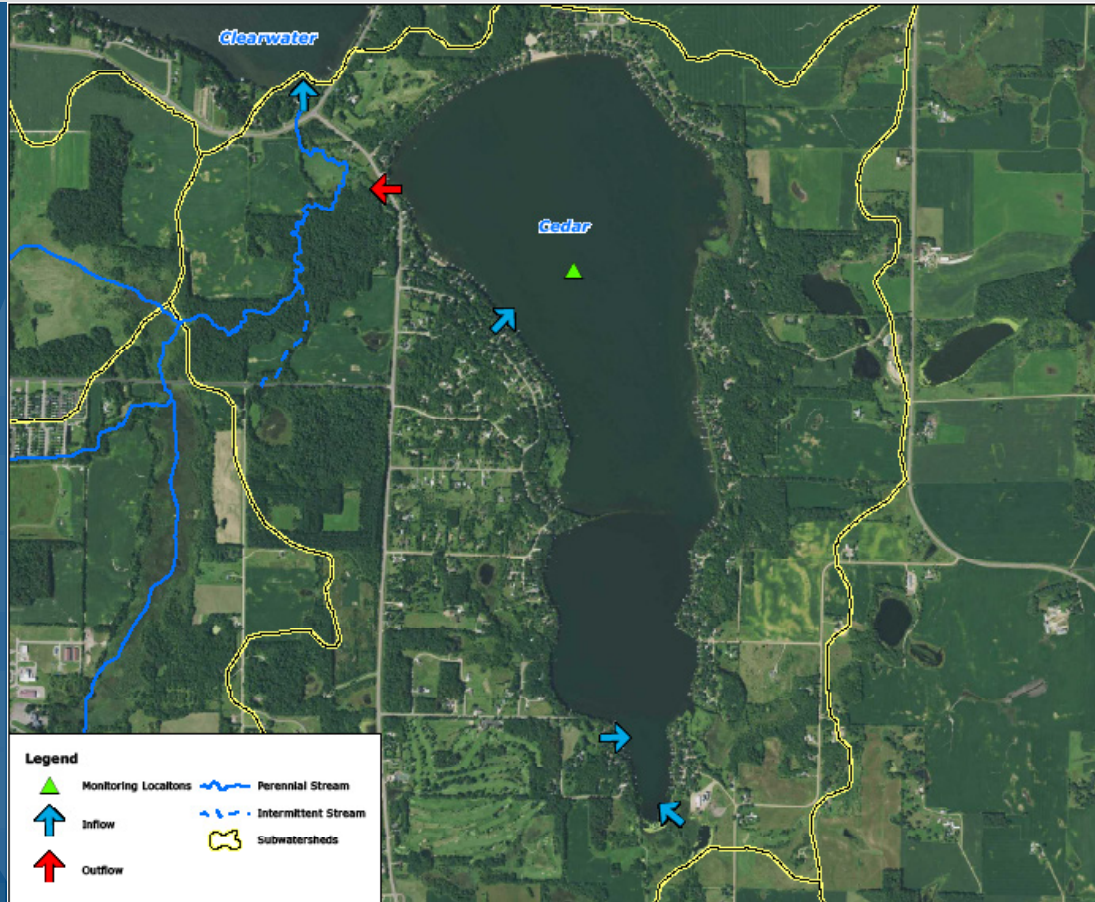
Coontail, northern water milfoil, chara

Invasive Species

Eurasian water milfoil, curly-leaf pondweed

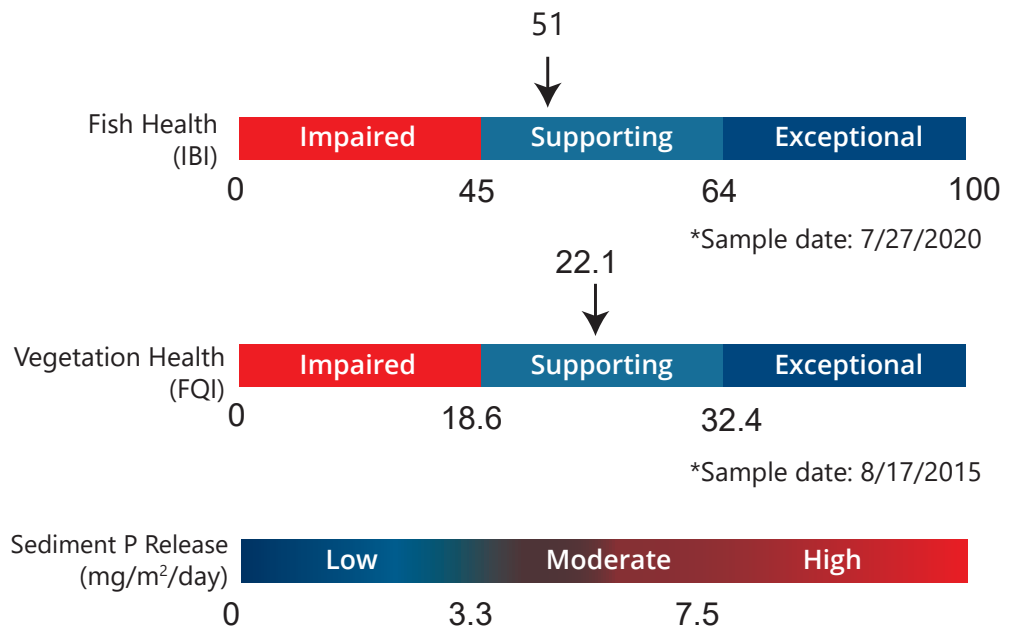
Status

Not Impaired

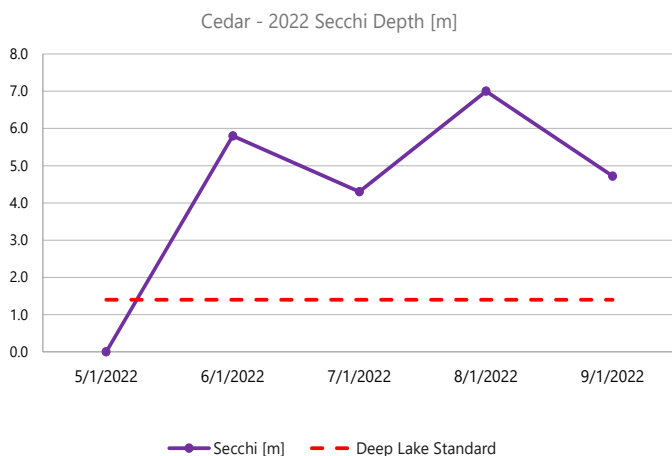
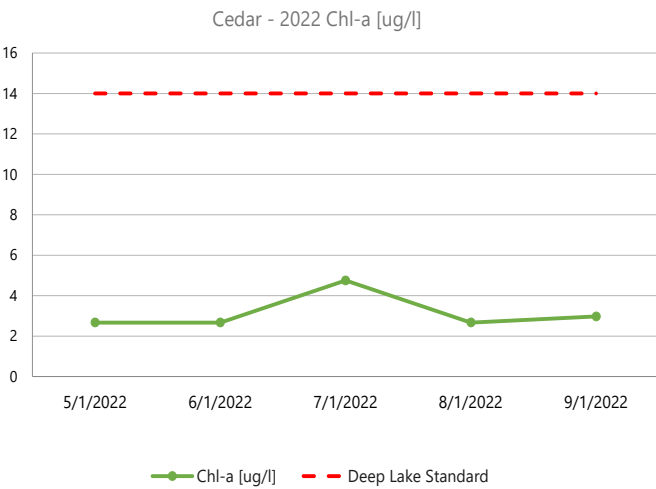
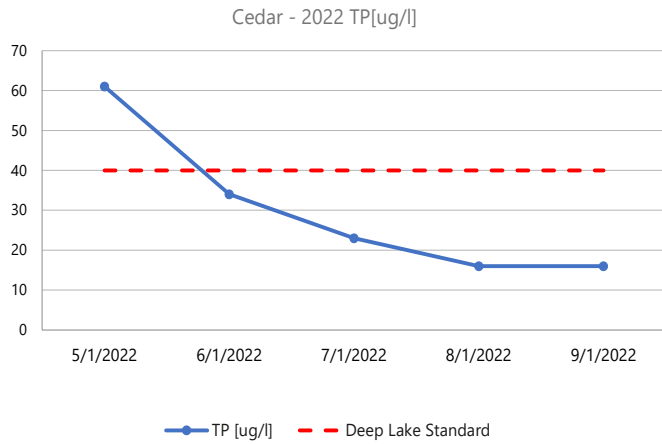


TO DO LIST

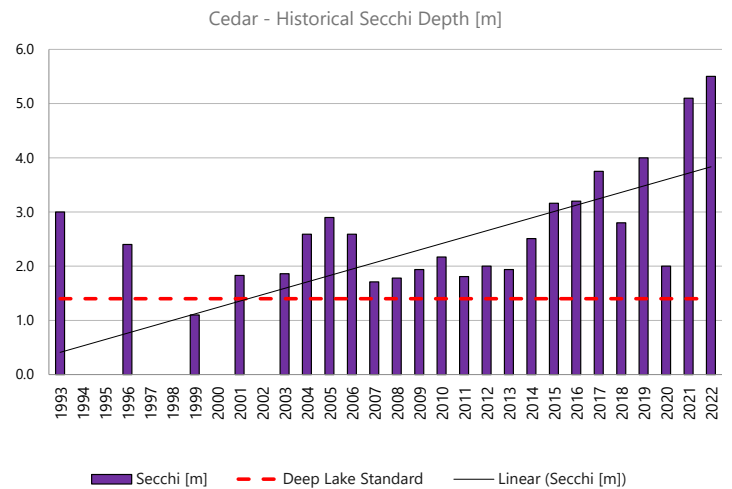
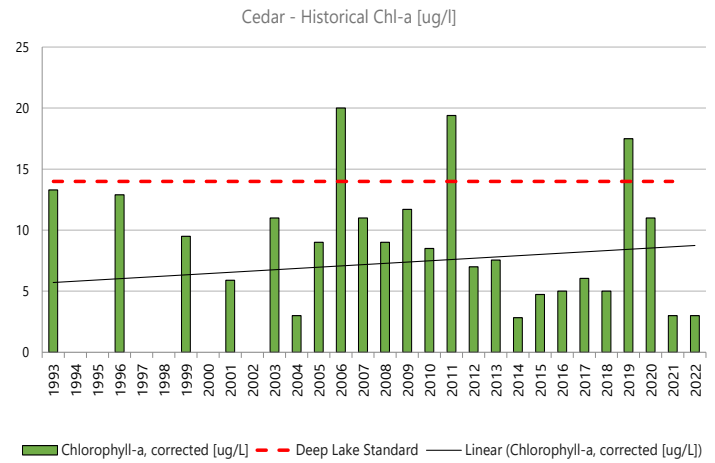
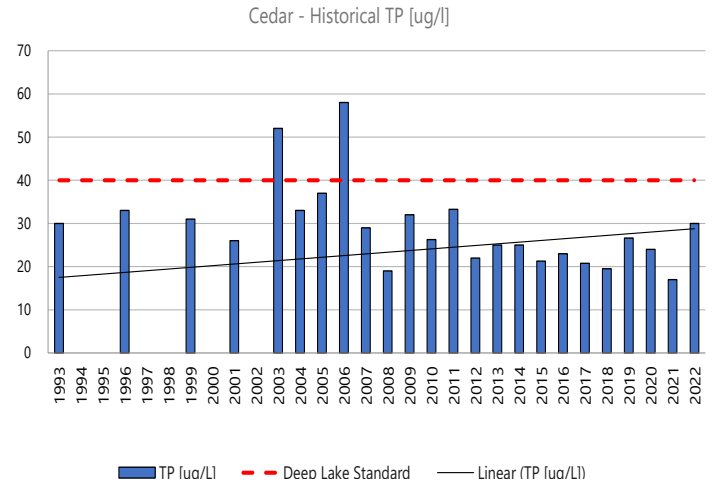
- ▲ AIS management
- ▲ Rough fish management in upstream lakes
- ▲ Manage upstream soluble P loads



2022 Water Quality



Historic Water Quality



CLEAR LAKE

QUICK FACTS

Littoral Area: 441 acres

Residence Time: 686 days

Surface Area: 529 acres

Subwatershed Area: 6,801 acres

Maximum Depth: 18 feet

Upstream Waters: None

Common Fish

Northern Pike,
Black Crappie,
Walleye, Bluegill

Dominant Vegetation

Coontail

Invasive Species

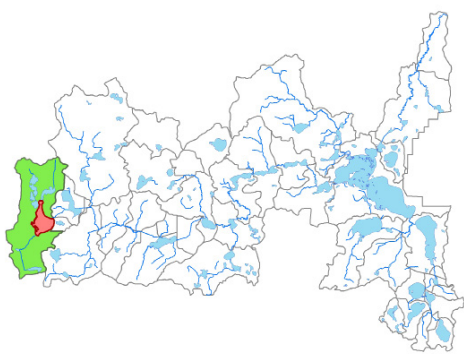
Eurasian water
milfoil, Curly-leaf
pondweed

Status

Impaired, TMDL
completed in 2009

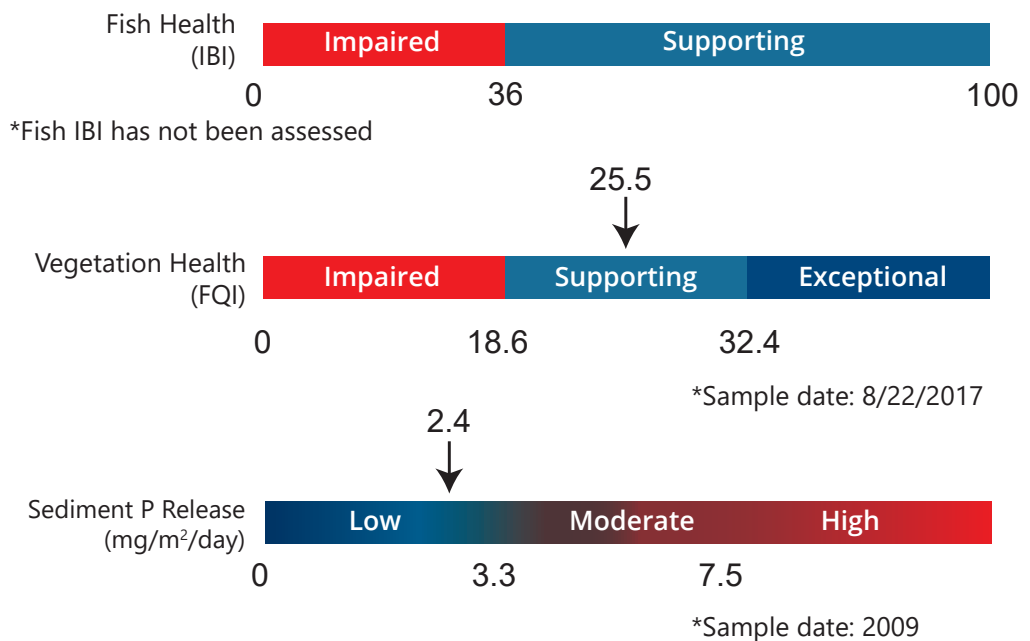


- ▲ Monitoring Location
- ↑ Inflow
- ↑ Outflow
- Direct Contributing Watershed



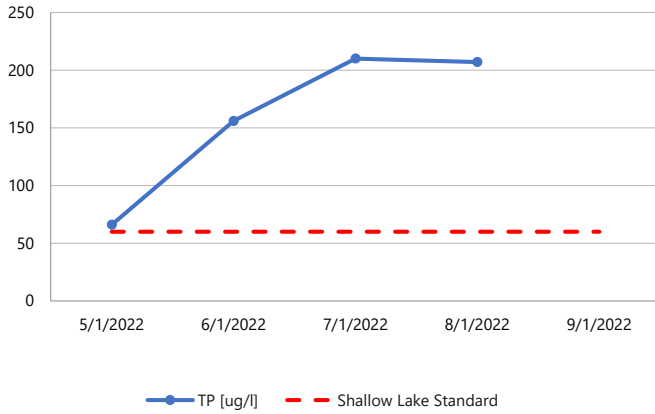
TO DO LIST

- ▲ AIS Management
- ▲ Manage rough fish
- ▲ Manage upstream soluble P loads



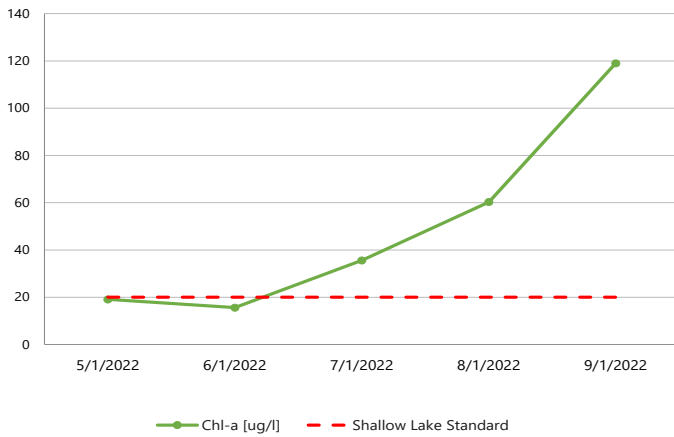
2022 Water Quality

Clear - 2022 TP [ug/l]



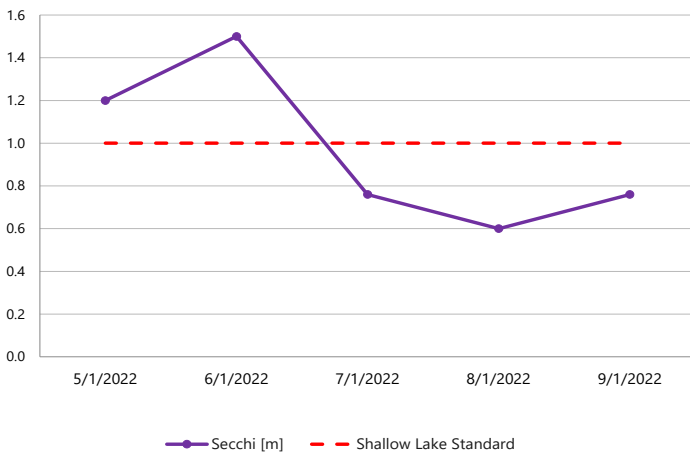
TP [ug/l] Shallow Lake Standard

Clear - 2022 Chl-a [ug/l]



Chl-a [ug/l] Shallow Lake Standard

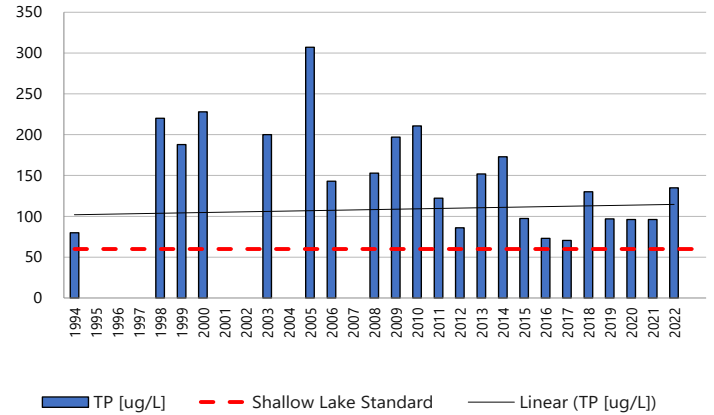
Clear - 2022 Secchi Depth [m]



Secchi [m] Shallow Lake Standard

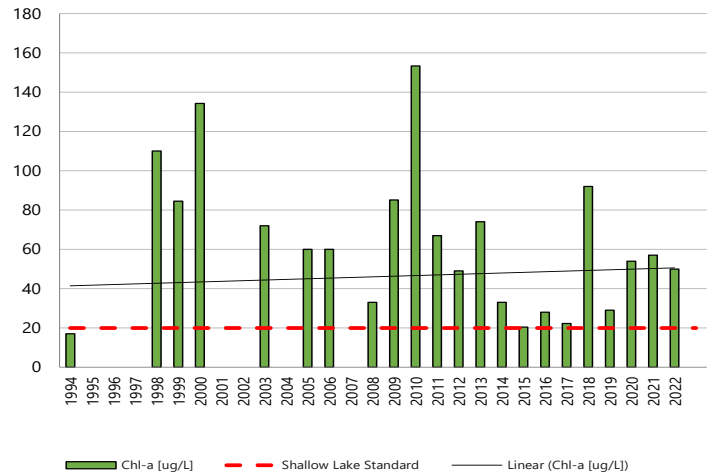
Historic Water Quality

Clear Lake - Historical TP [ug/l]



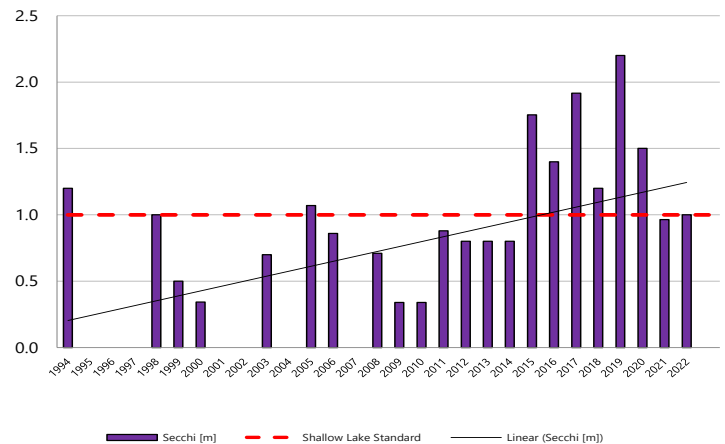
TP [ug/L] Shallow Lake Standard Linear (TP [ug/L])

Clear - Historical Chl-a [ug/l]



Chl-a [ug/L] Shallow Lake Standard Linear (Chl-a [ug/L])

Clear - Historical Secchi Depth [m]



Secchi [m] Shallow Lake Standard Linear (Secchi [m])

CLEARWATER LAKE

QUICK FACTS

Littoral Area: 1,596 acres

Surface Area: 3,158 acres

Subwatershed Area: 100,232 acres

Maximum Depth: 73 feet

Upstream Waters: Clearwater River, Augusta, Cedar, Otter, and Pleasant Lake

Common Fish

Bluegill, Northern Pike, Walleye, Largemouth Bass, Yellow Bullhead

Dominant Vegetation

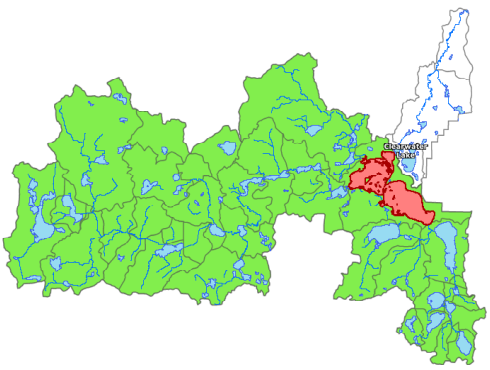
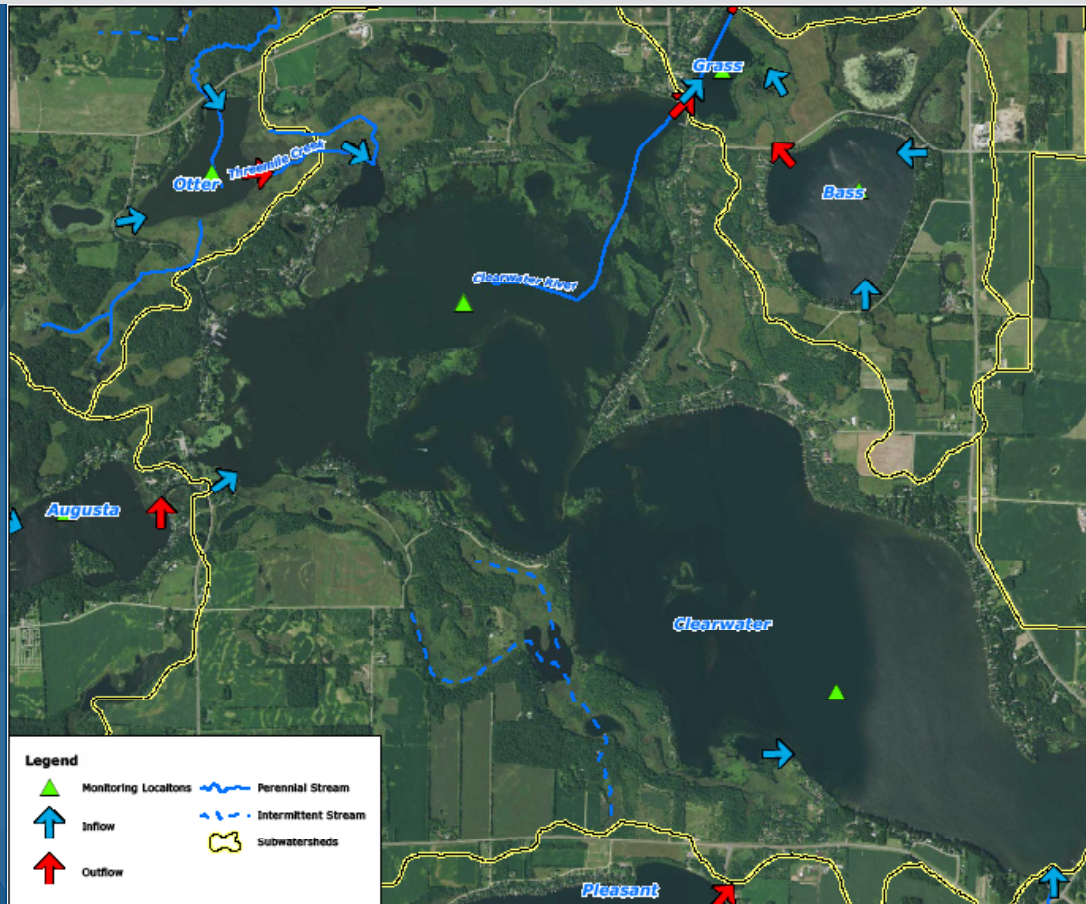
Obtaining Recent Survey from DNR

Invasive Species

Eurasian water milfoil, curly-leaf pondweed, zebra mussels

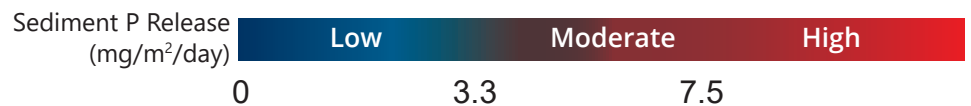
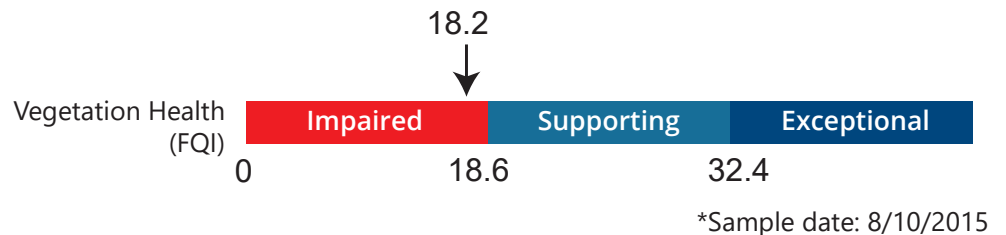
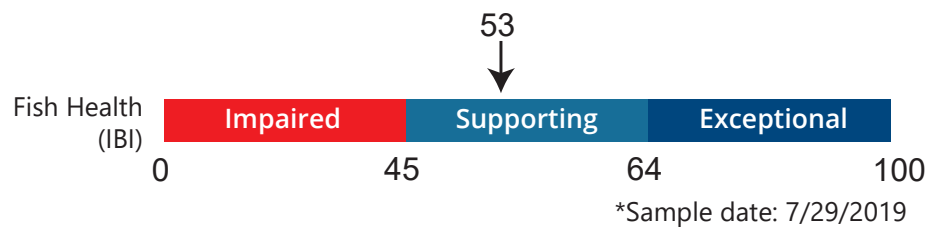
Status

Not Impaired



TO DO LIST

- Protect water quality
- Manage upstream loads
- AIS management

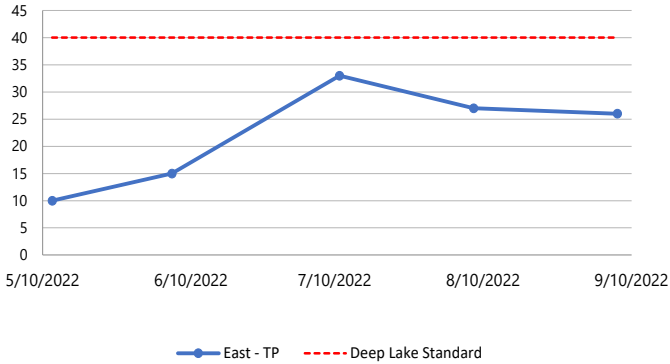


*Sediment release rate has not been assessed

CLEARWATER LAKE

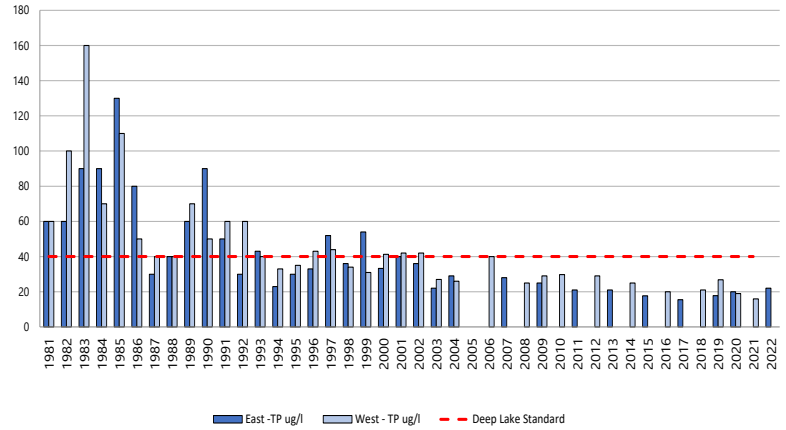
2022 Water Quality

Clearwater East - 2022 TP [ug/l]

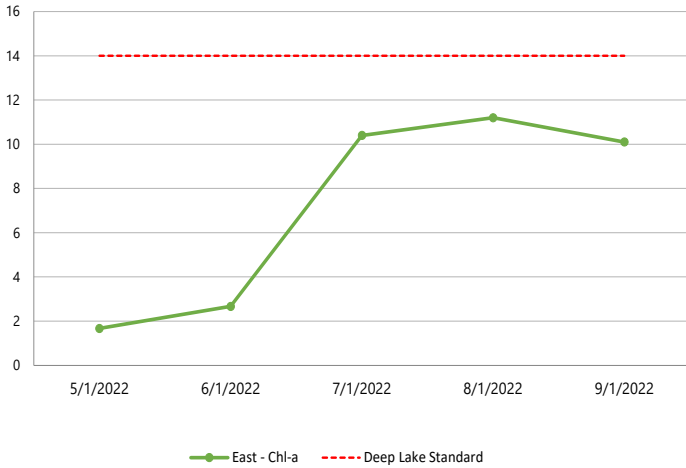


Historic Water Quality

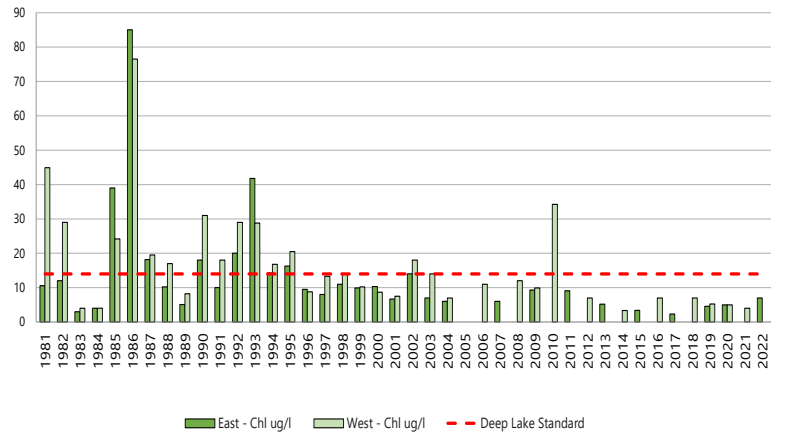
Clearwater - Historical TP [ug/l]



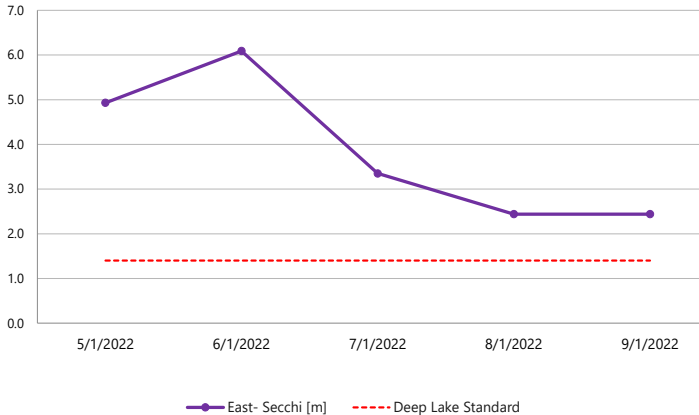
Clearwater East - 2022 Chl-a [ug/l]



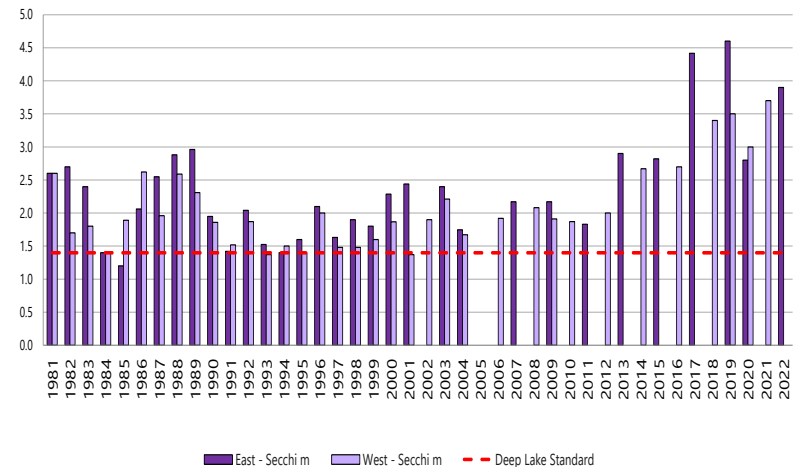
Clearwater - Historical Chl-a [ug/l]



Clearwater East - 2022 Secchi Depth [m]



Clearwater - Historical Secchi [m]

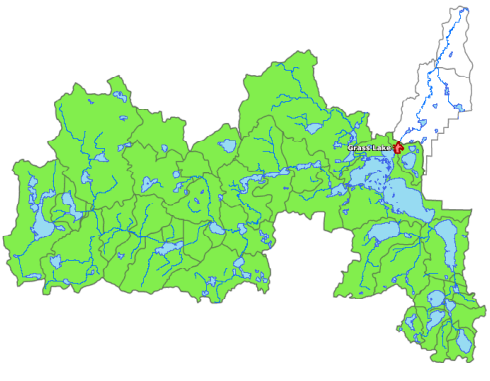
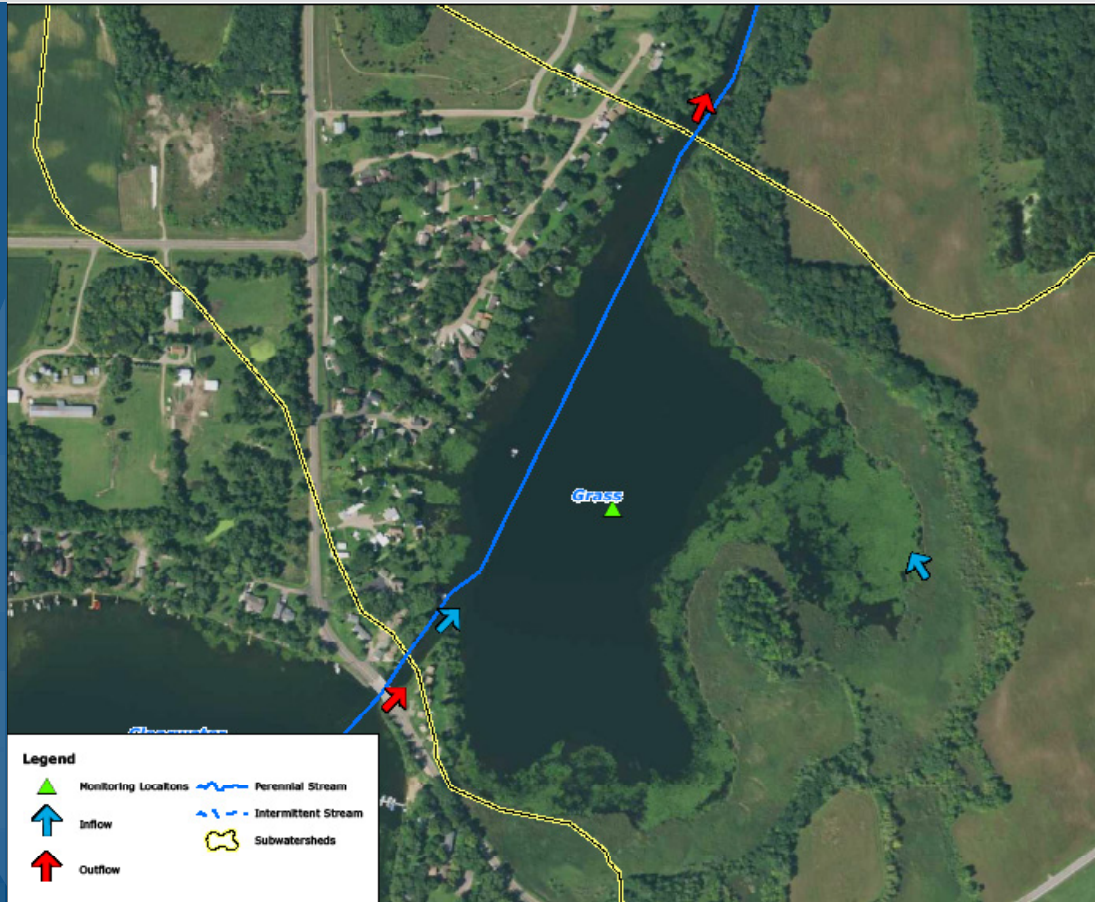


GRASS LAKE

QUICK FACTS

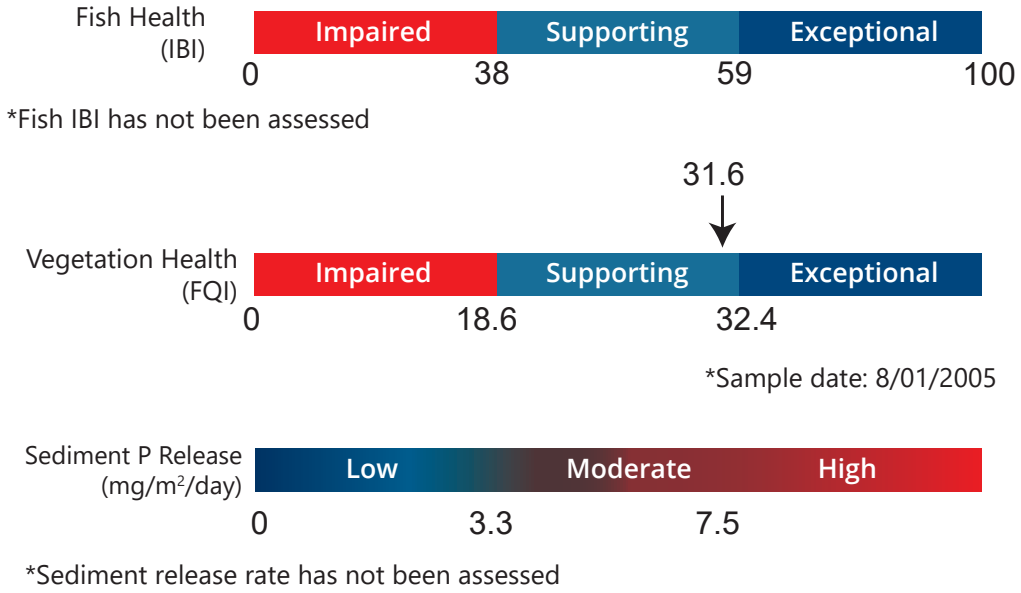
- Littoral Area:** 62 acres
- Surface Area:** 71 acres
- Subwatershed Area:** 101,508 acres
- Maximum Depth:** 35 feet
- Upstream Waters:** Clearwater Lake, Clearwater River, Bass Lake

- Common Fish:** Bluegill, Northern Pike, Yellow Bullhead
- Dominant Vegetation:** No Recent Survey
- Invasive Species:** Zebra Mussels
- Status:** Not Impaired



TO DO LIST

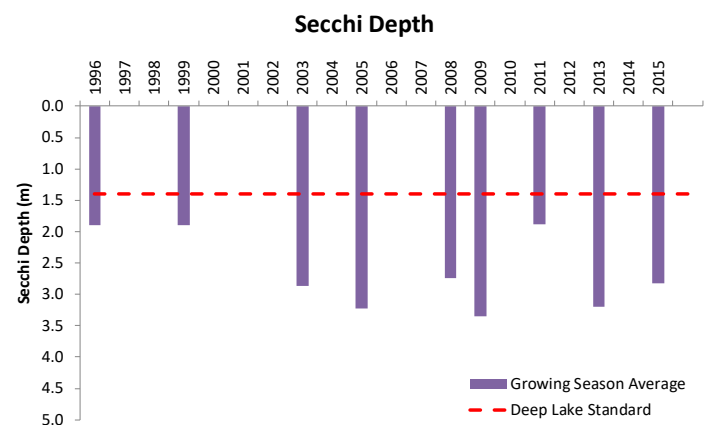
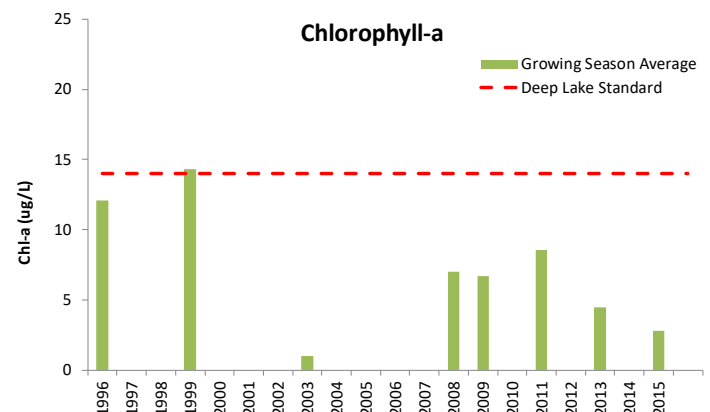
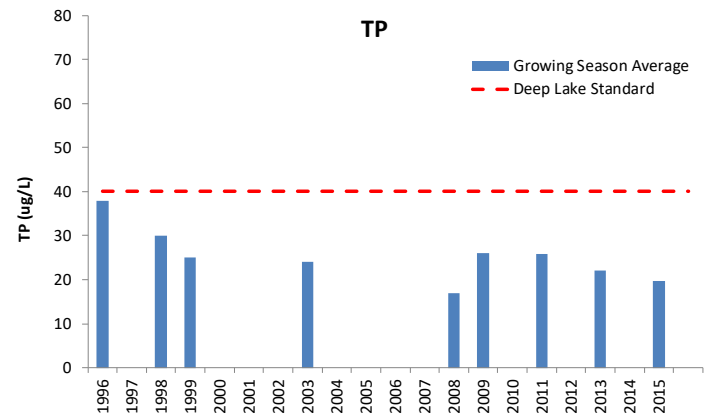
- ▲ Protect water quality
- ▲ Manage upstream loads
- ▲ AIS Management



2022 Water Quality

Lake not sampled

Historic Water Quality



HENSHAW LAKE

QUICK FACTS

Littoral Area: 271 acres

Residence Time: 1,697 days

Surface Area: 272 acres

Subwatershed Area: 903 acres

Maximum Depth: 8 feet

Upstream Waters: None

Common Fish

Black Bullhead,
Common Carp

Dominant Vegetation

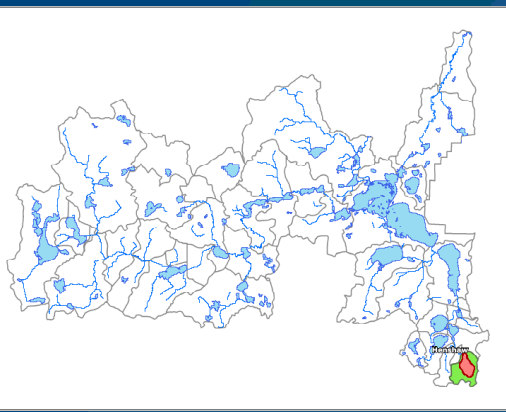
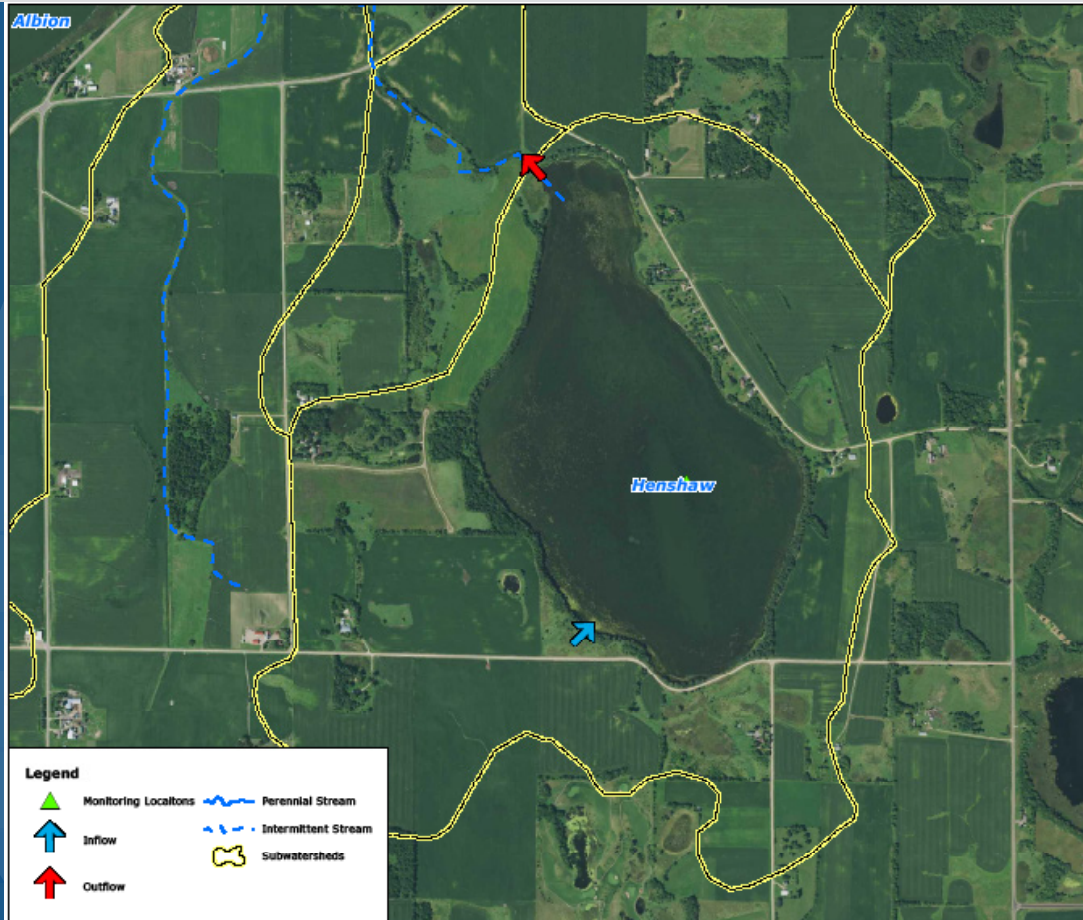
Sago pondweed,
Coontail, Bushy
pondweed

Invasive Species

Curly-leaf
pondweed

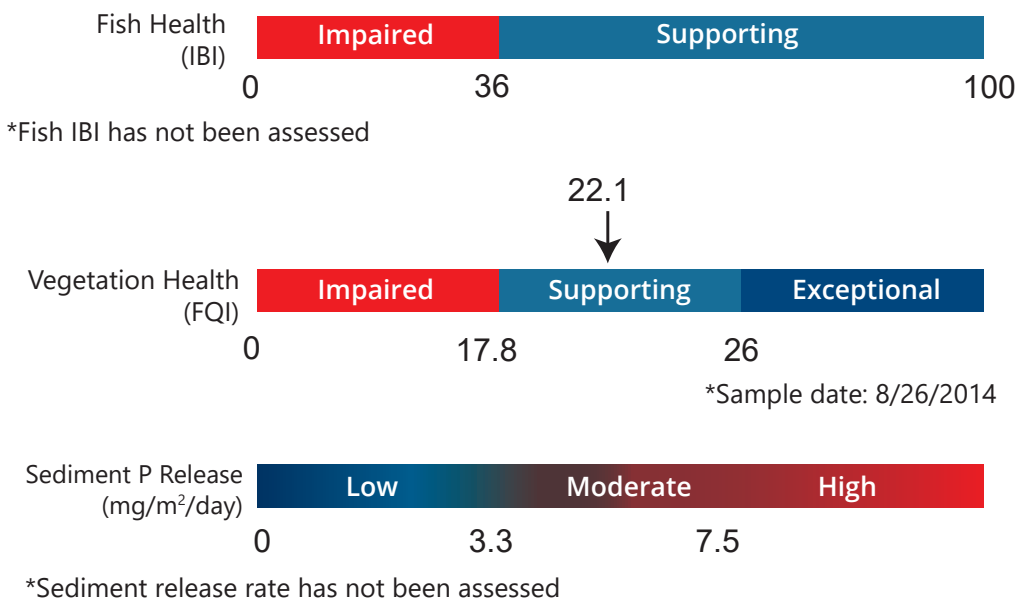
Status

Impaired, TMDL
Completed 2010



TO DO LIST

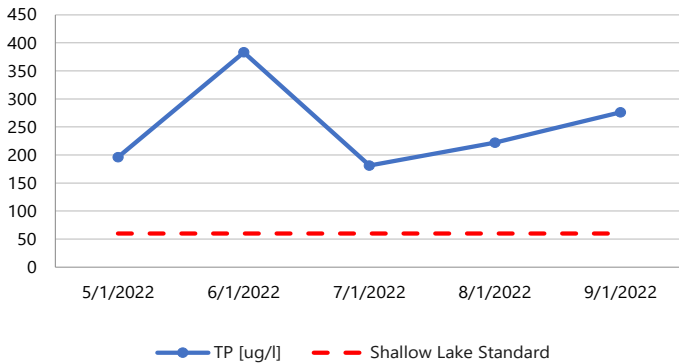
- ▲ Rough fish management
- ▲ AIS management
- ▲ Internal load management study
- ▲ Manage upstream load



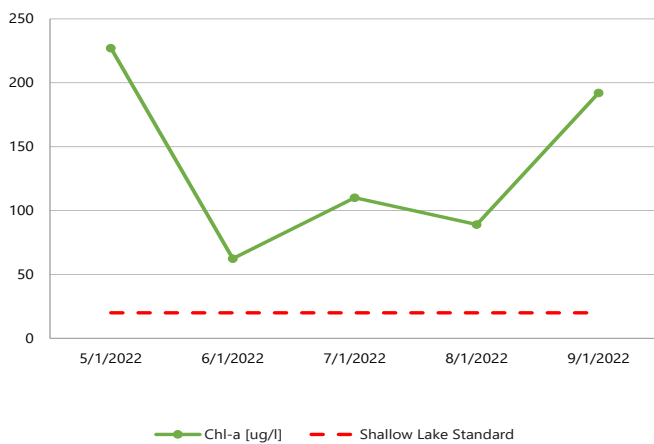
HENSHAW LAKE

2022 Water Quality

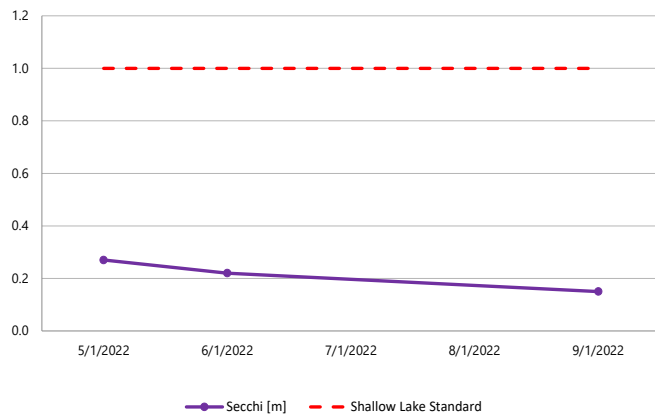
Henshaw - 2022 TP [ug/l]



Henshaw - 2022 Chl-a [ug/l]

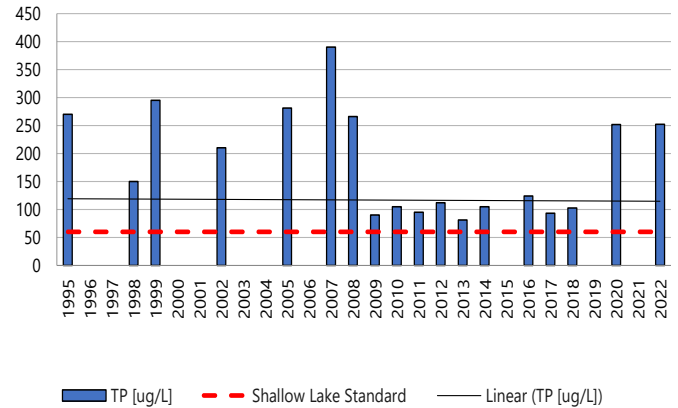


Henshaw - 2022 Secchi Depth [m]

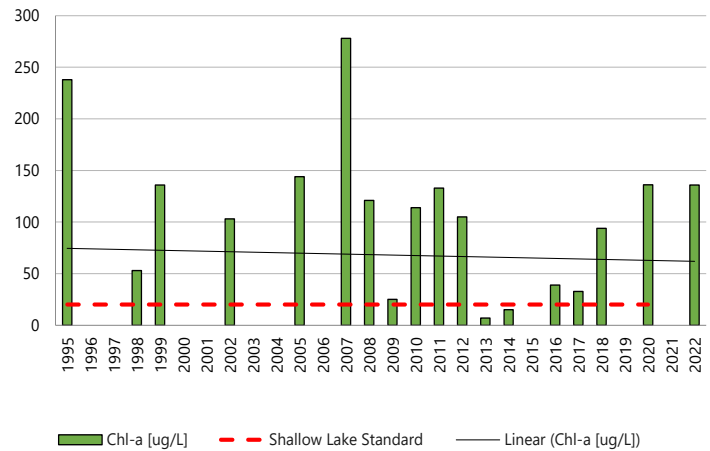


Historic Water Quality

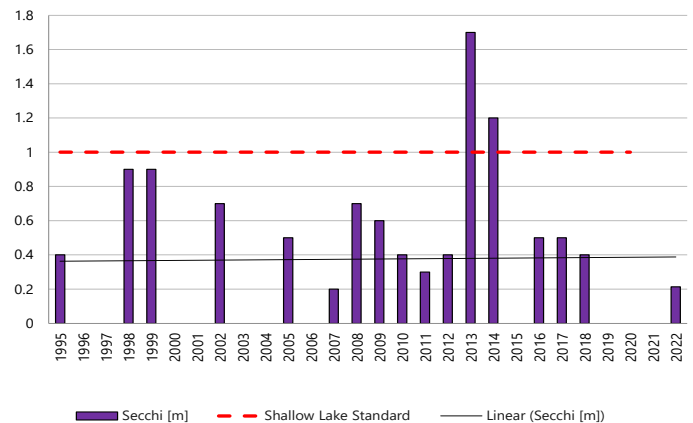
Henshaw - Historical TP [ug/l]



Henshaw - Historical Chl-a [ug/l]



Henshaw - Historical Secchi Depth [m]



LITTLE MUD LAKE

QUICK FACTS

Littoral Area: 25.1 acres

Residence Time: 1299 days

Surface Area: 37.4 acres

Subwatershed Area: 294 acres

Maximum Depth: 42 feet

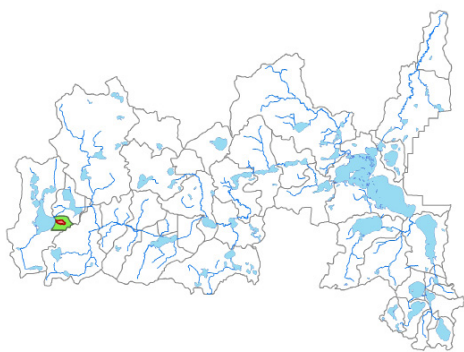
Upstream Waters: None

Common Fish No Recent Survey

Dominant Vegetation Coontail

Invasive Species Eurasian watermilfoil

Status Not Impaired

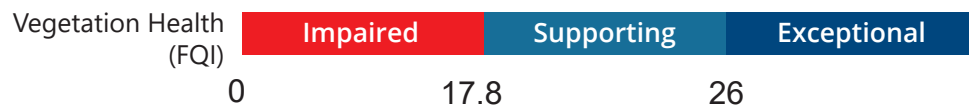


TO DO LIST

- ▲ Rough fish management
- ▲ AIS management
- ▲ Internal load management study
- ▲ Manage upstream load



*Fish IBI has not been assessed



*Vegetation FQI has not been assessed



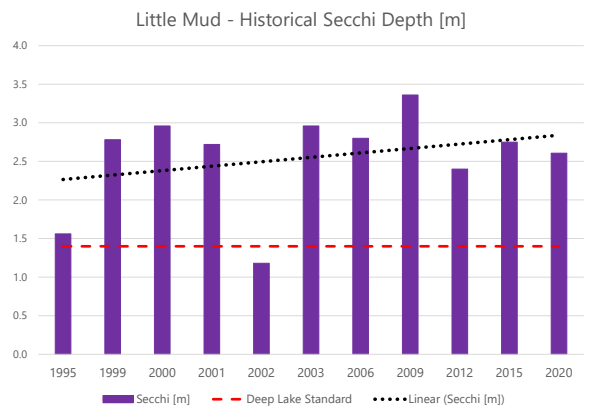
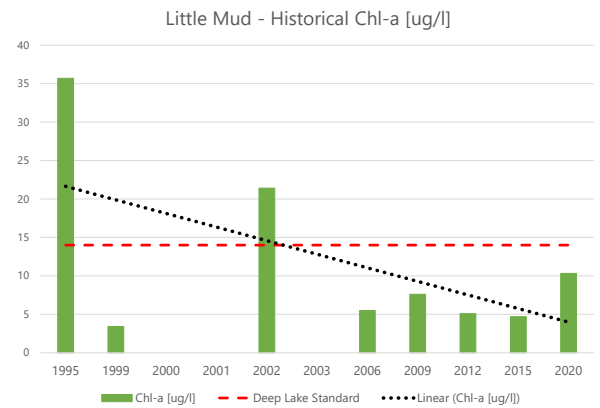
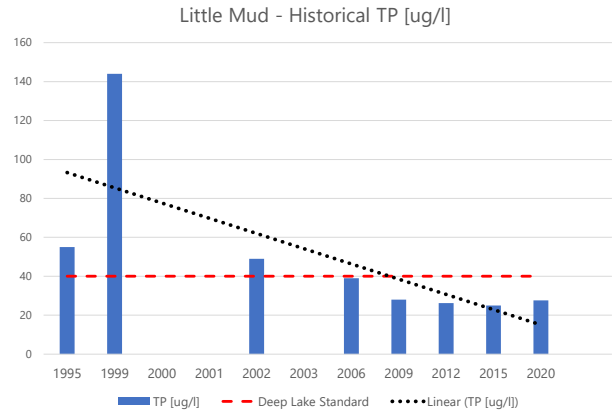
*Sediment release rate has not been assessed

LITTLE MUD LAKE

2022 Water Quality

Lake not sampled

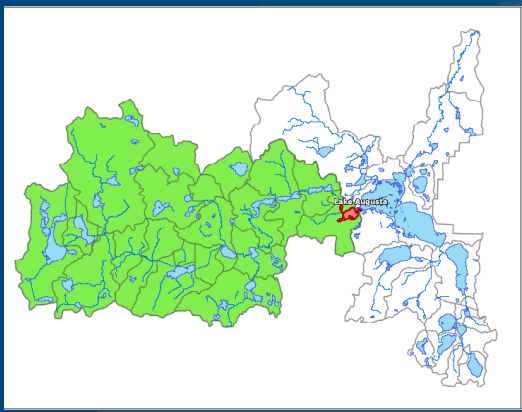
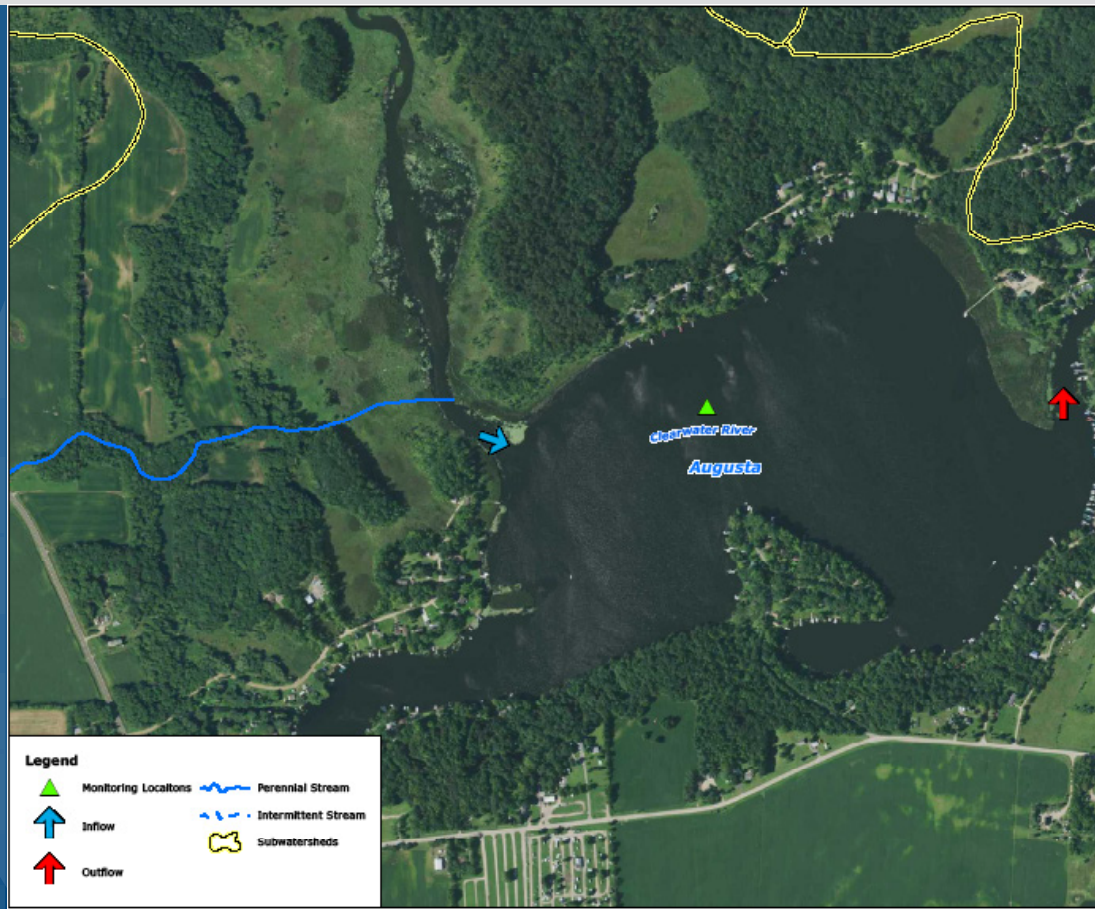
Historic Water Quality



LAKE AUGUSTA

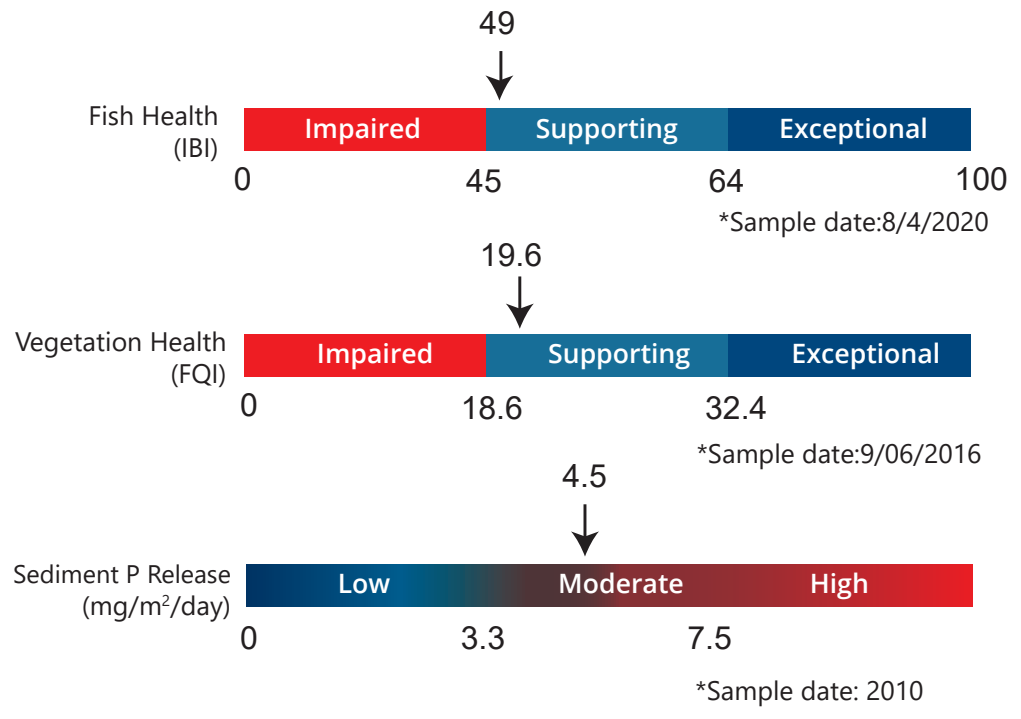
QUICK FACTS

- Littoral Area:** 65 acres
- Residence Time:** 55 days
- Surface Area:** 187 acres
- Subwatershed Area:** 62,936 acres
- Maximum Depth:** 82 feet
- Upstream Waters:** Caroline, Louisa, Marie
- Common Fish:** Bluegill, Northern Pike, Crappie, Yellow Bullhead, Common Carp
- Dominant Vegetation:** No species was dominant (>50% occurrence)
- Invasive Species:** Eurasian water milfoil, curly-leaf pondweed, zebra mussels
- Status:** Removed from Impaired Waters List in 2022; TMDL completed in 2010



TO DO LIST

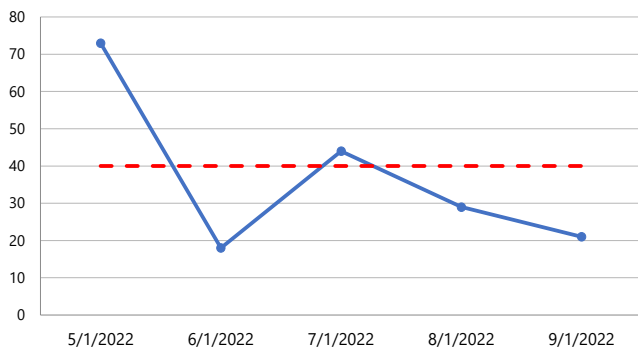
- ▲ Manage upstream loads
- ▲ AIS management



LAKE AUGUSTA

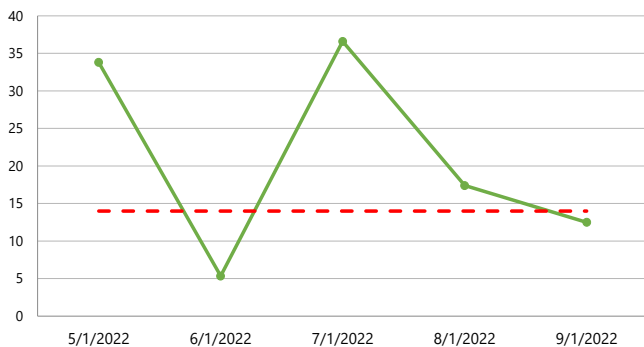
2022 Water Quality

Augusta - 2022 TP [ug/L]



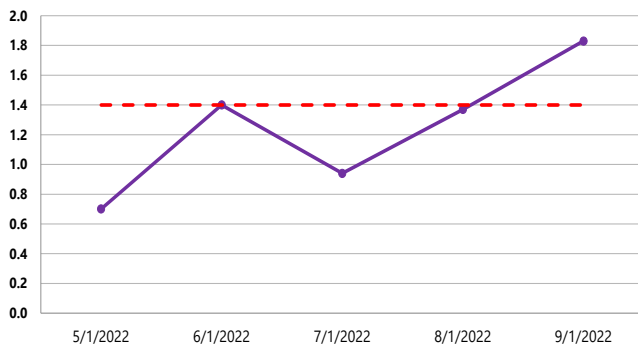
—●— Phosphorus as P [ug/l] - - - Deep Lake Standard

Augusta - 2022 Chl-a [ug/L]



—●— Chlorophyll a, corrected [ug/l] - - - Deep Lake Standard

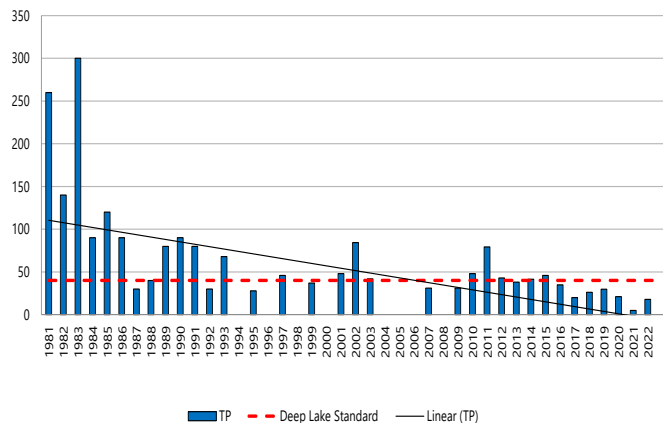
Augusta - 2022 Secchi Depth [m]



—●— Depth, Secchi Disk Depth (m) - - - Deep Lake Standard

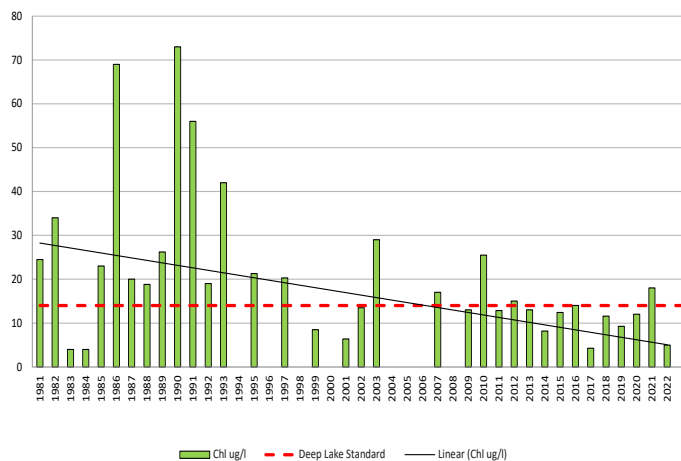
Historic Water Quality

Augusta - Historical TP [ug/L]



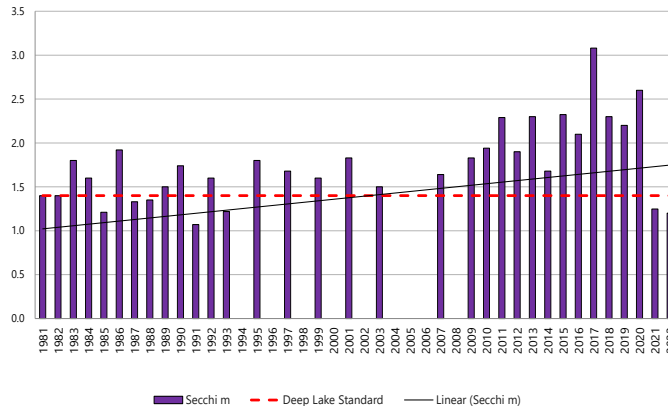
■ TP - - - Deep Lake Standard — Linear (TP)

Augusta - Historical Chl-a [ug/L]



■ Chl ug/l - - - Deep Lake Standard — Linear (Chl ug/l)

Augusta - Historical Secchi [m]



■ Secchi m - - - Deep Lake Standard — Linear (Secchi m)

LAKE BETSY

QUICK FACTS

Littoral Area: 90 acres

Residence Time: 33 days

Surface Area: 154 acres

Subwatershed Area: 43,789 acres

Maximum Depth: 29 feet

Upstream Waters: Clearwater River

Common Fish

Channel Catfish,
Northern Pike, Black
Crappie, Bluegill,
Common Carp

Dominant Vegetation

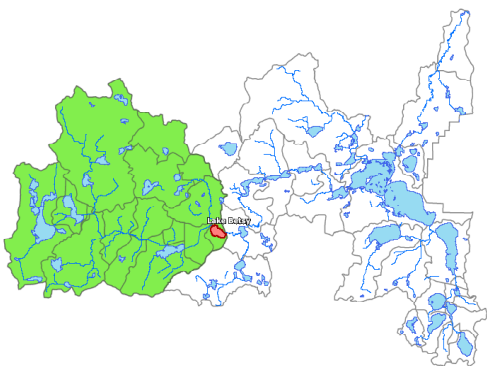
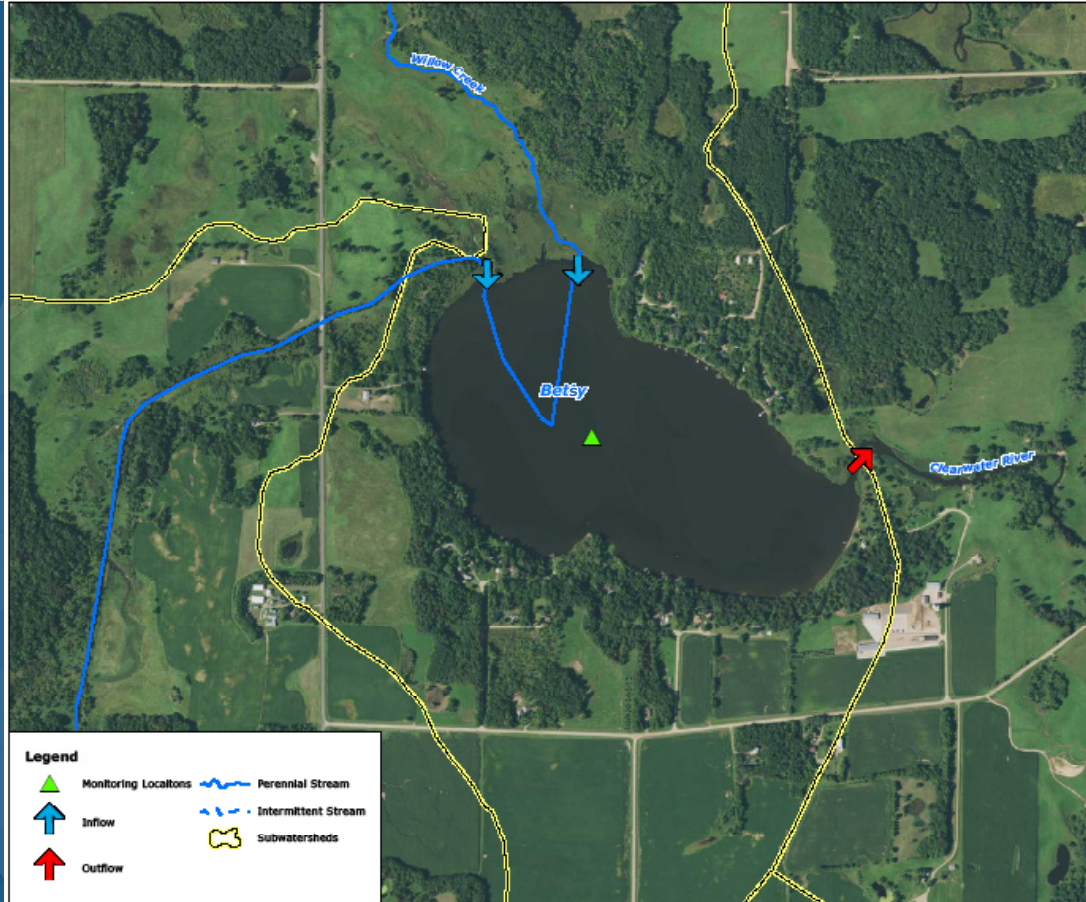
Coontail, Curly-
leaf pondweed

Invasive Species

Curly-leaf
pondweed

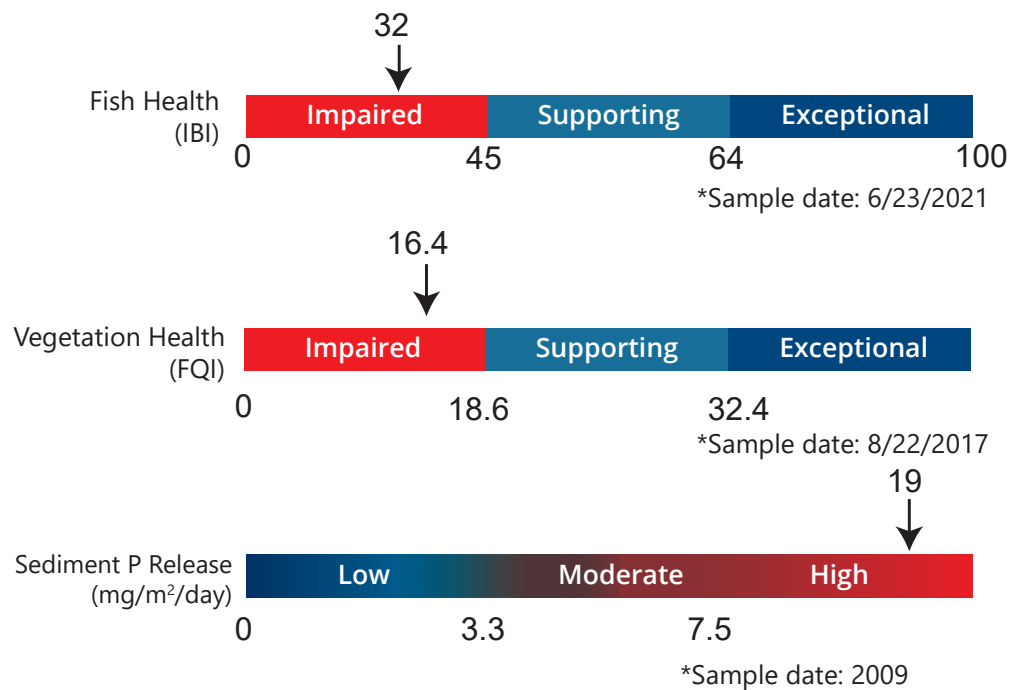
Status

Impaired, TMDL
completed in 2009



TO DO LIST

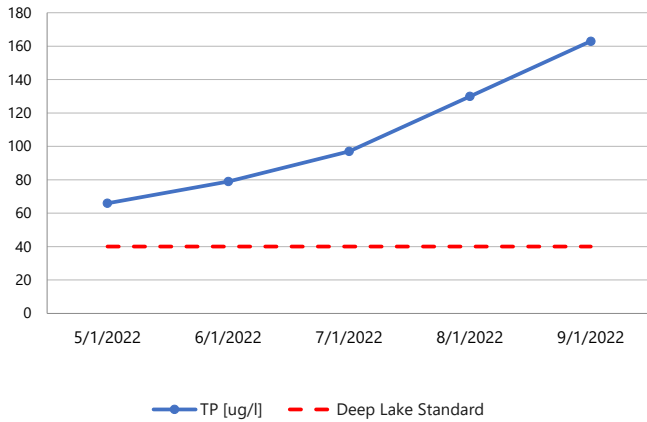
- ▲ Rough fish management
- ▲ Internal load reduction study and implementation
- ▲ Manage upstream loads
- ▲ AIS management



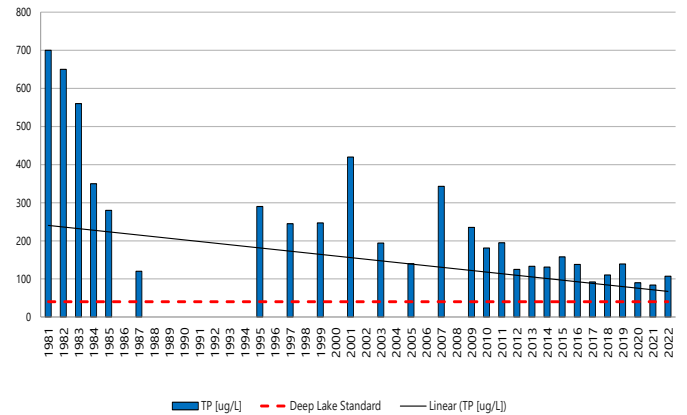
LAKE BETSY

2022 Water Quality

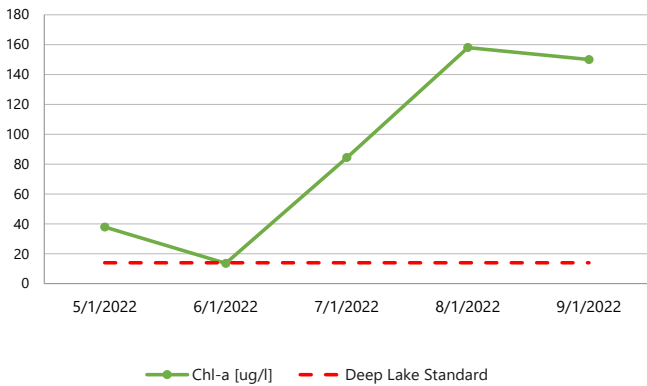
Betsy - 2022 TP [ug/l]



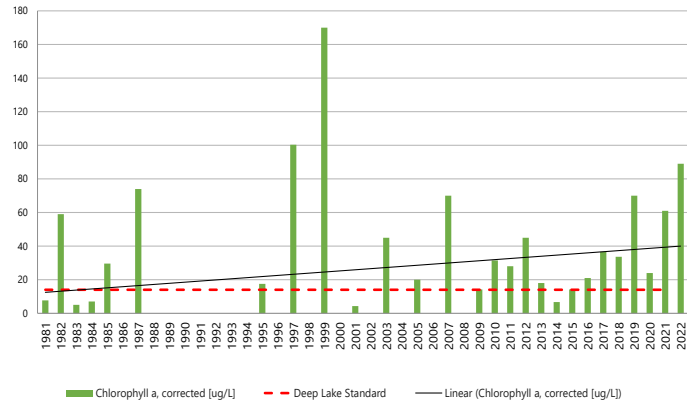
Betsy - Historical TP [ug/L]



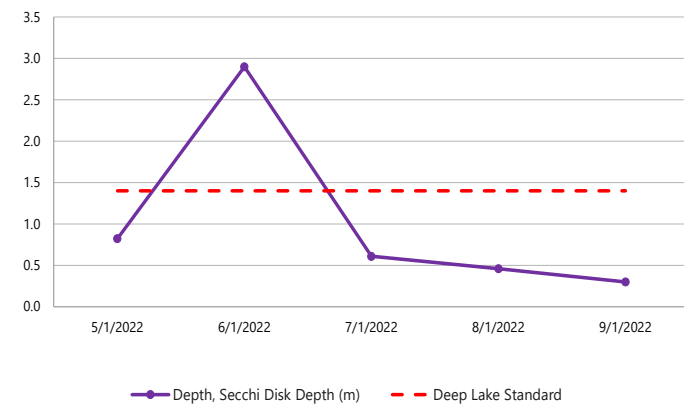
Betsy - 2022 Chl-a [ug/L]



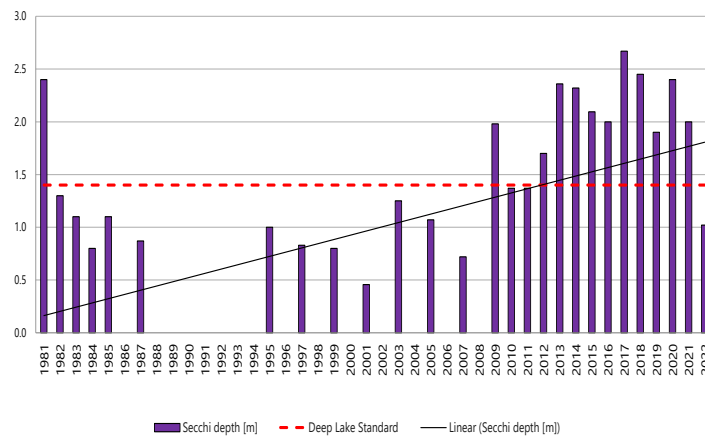
Betsy - Historical Chl-a [ug/L]



Betsy - 2022 Secchi Depth [m]



Betsy - Historical Secchi [m]



LAKE CAROLINE

QUICK FACTS

Littoral Area: 46 acres

Residence Time: 26 days

Surface Area: 135 acres

Subwatershed Area: 60,132 acres

Maximum Depth: 45 feet

Upstream Waters: Louisa, Marie

Common Fish

Black Crappie, Bluegill, Northern Pike, Largemouth Bass, Common Carp, Walleye, White Sucker

Dominant Vegetation

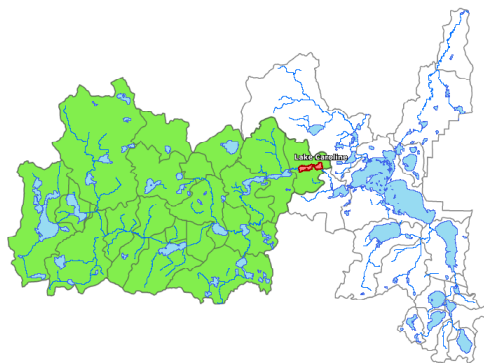
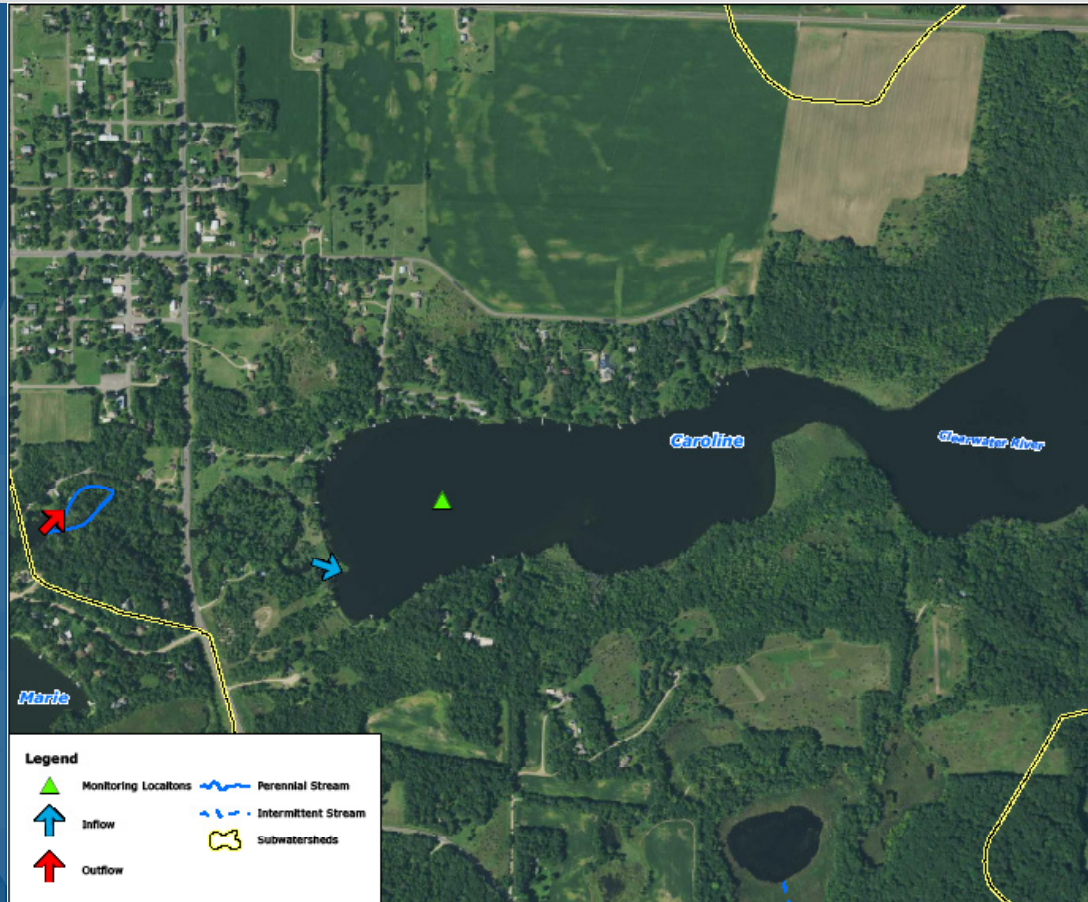
No Recent Survey

Invasive Species

Curly-leaf pondweed, Eurasian watermilfoil

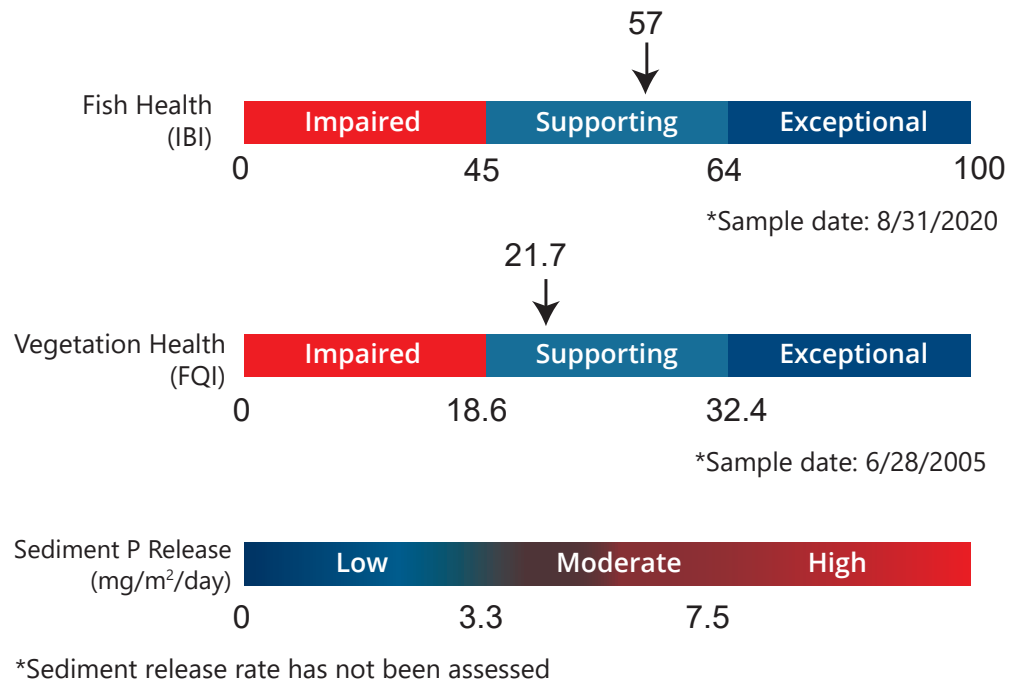
Status

Impaired, TMDL completed in 2010



TO DO LIST

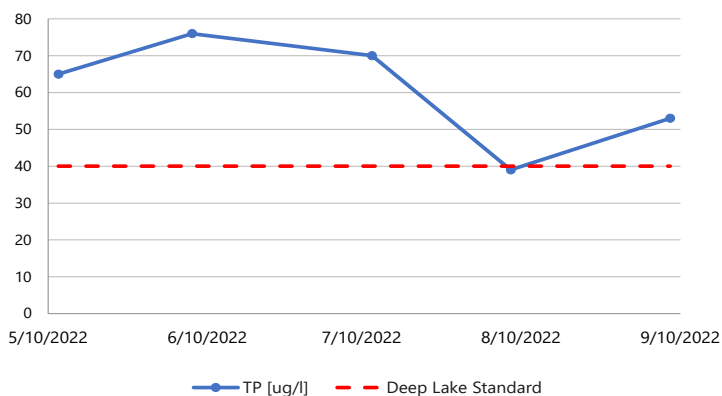
- ▲ Manage upstream loads
- ▲ AIS management
- ▲ Internal load management study



LAKE CAROLINE

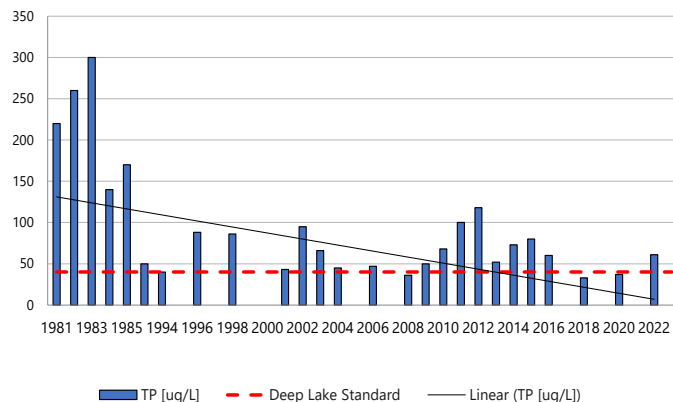
2022 Water Quality

Caroline - 2022 TP [ug/l]

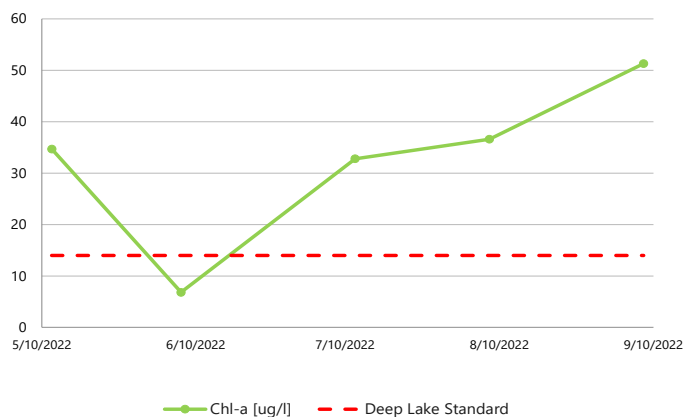


Historic Water Quality

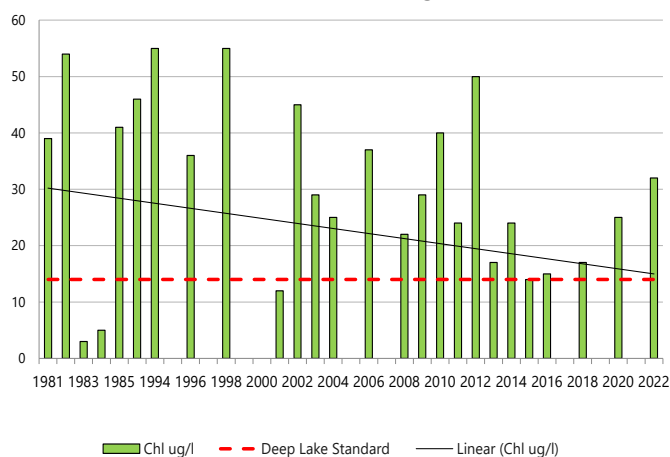
Caroline - Historical TP [ug/l]



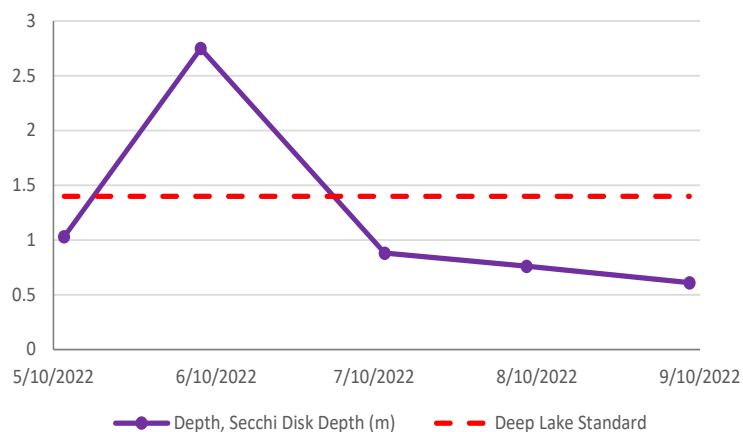
Caroline - 2022 Chl-a [ug/l]



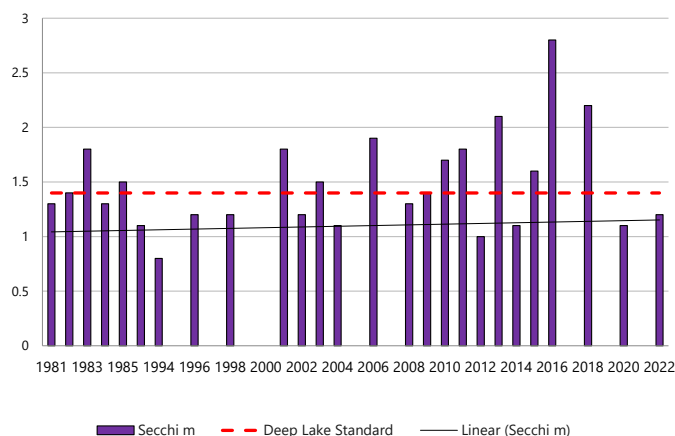
Caroline - Historical Chl-a [ug/l]



Caroline - 2022 Secchi Depth [m]



Caroline - Historical Secchi Depth [m]

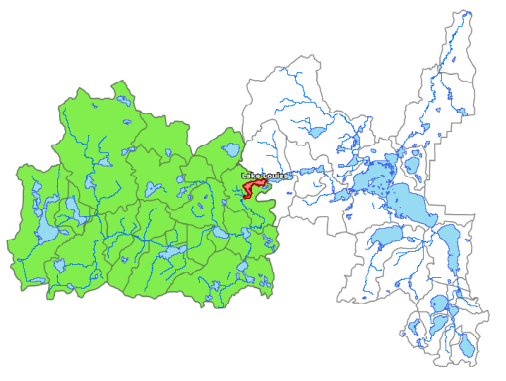
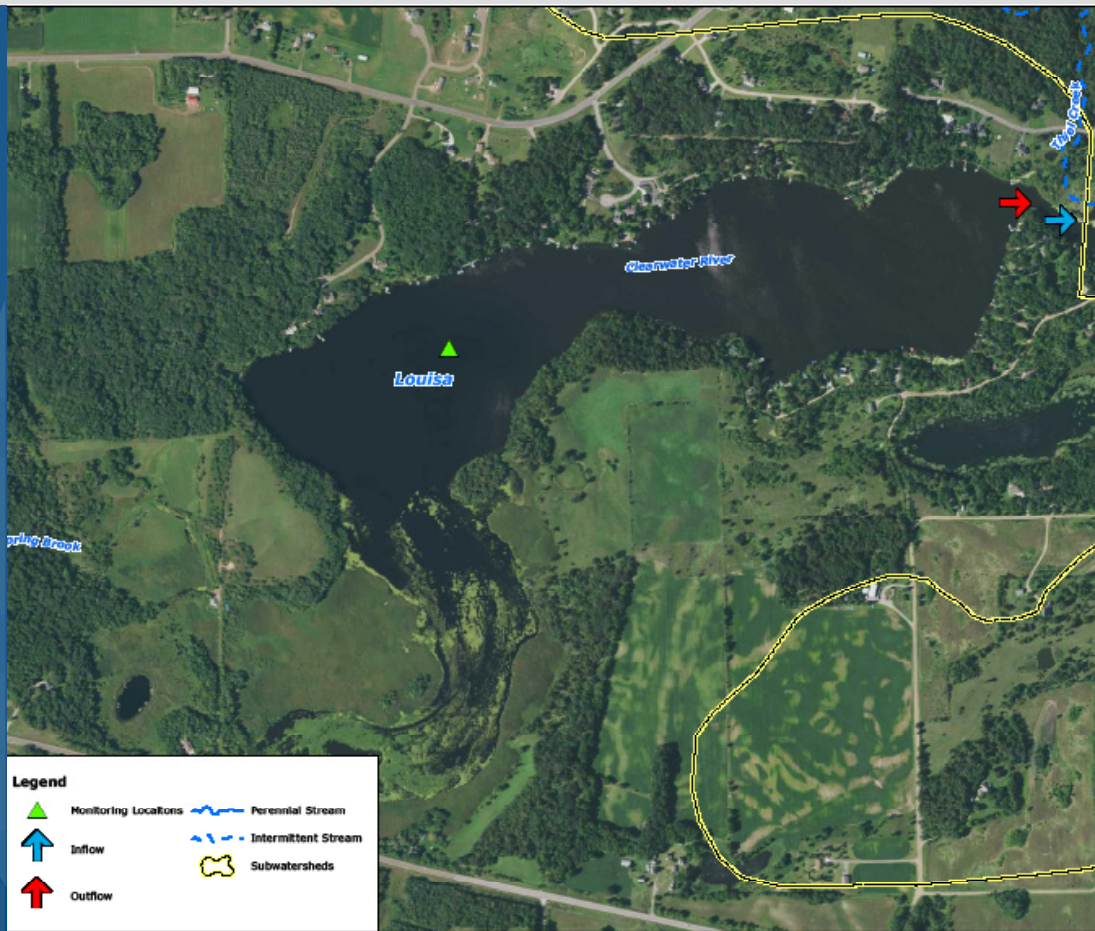


LAKE LOUISA

QUICK FACTS

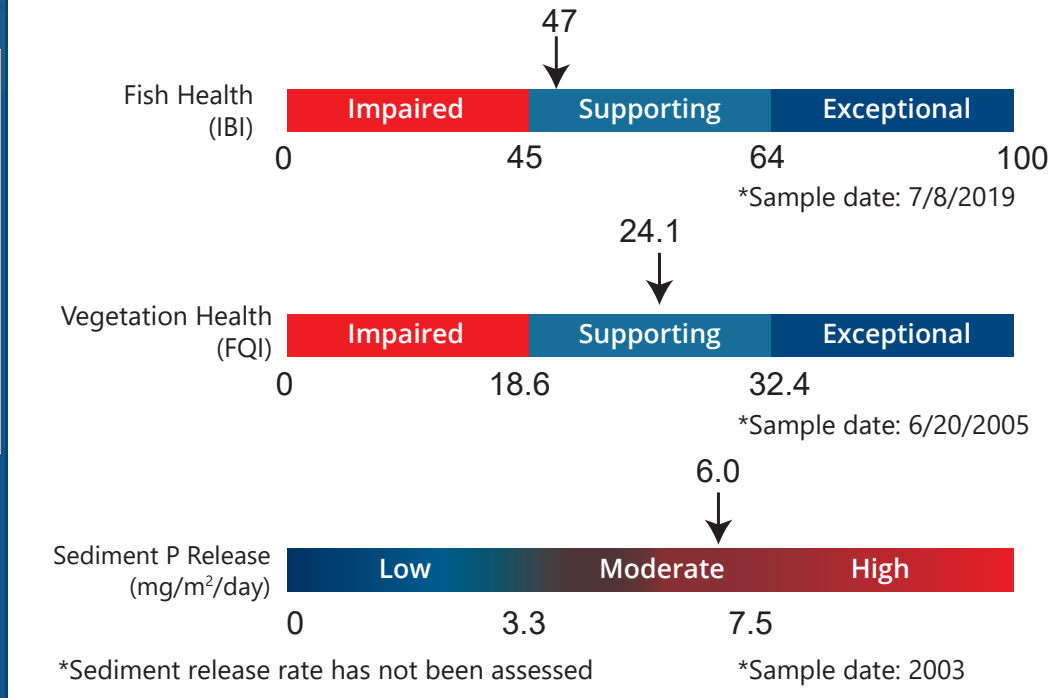
- Littoral Area:** 122 acres
- Residence Time:** 17 days
- Surface Area:** 189 acres
- Subwatershed Area:** 58,881 acres
- Maximum Depth:** 44 feet
- Upstream Waters:** Clearwater River, Lake Betsy

- Common Fish** → Bluegill, Northern Pike, Largemouth Bass, White Sucker
- Dominant Vegetation** → Coontail
- Invasive Species** → Curly-leaf pondweed
- Status** → Impaired, TMDL Completed 2009



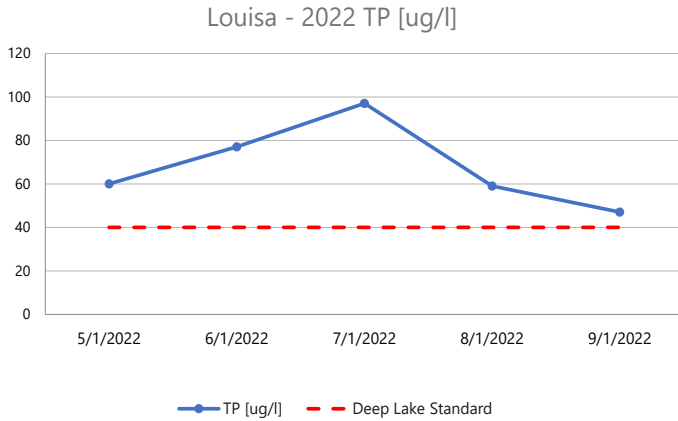
TO DO LIST

- ▲ Manage upstream loads
- ▲ AIS management
- ▲ Internal load management study



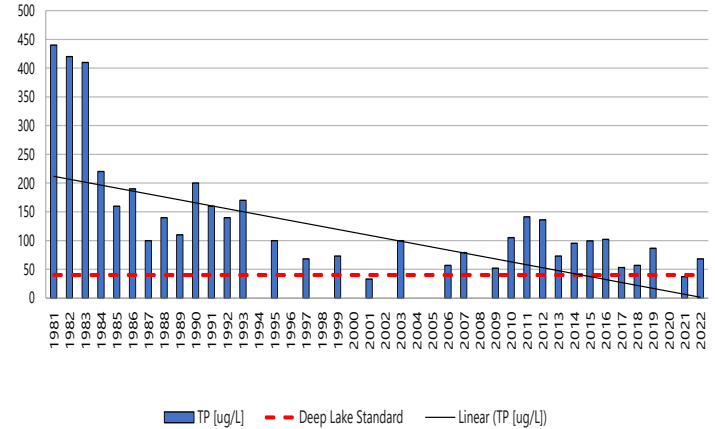
LAKE LOUISA

2022 Water Quality

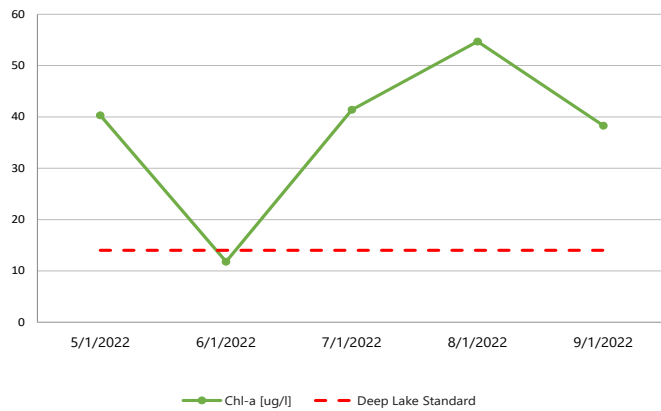


Historic Water Quality

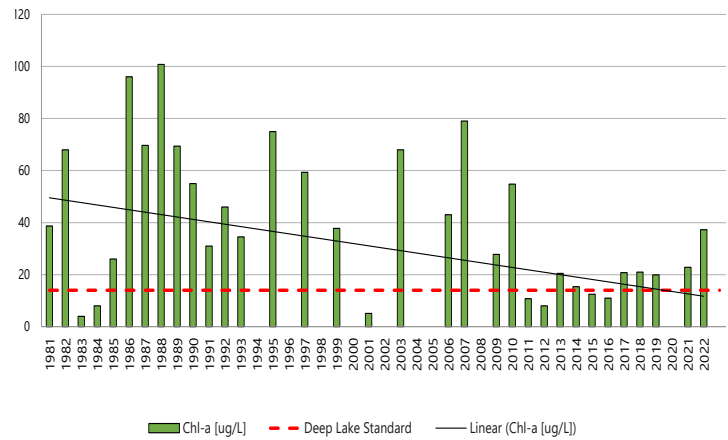
Louisa - Historical TP [ug/l]



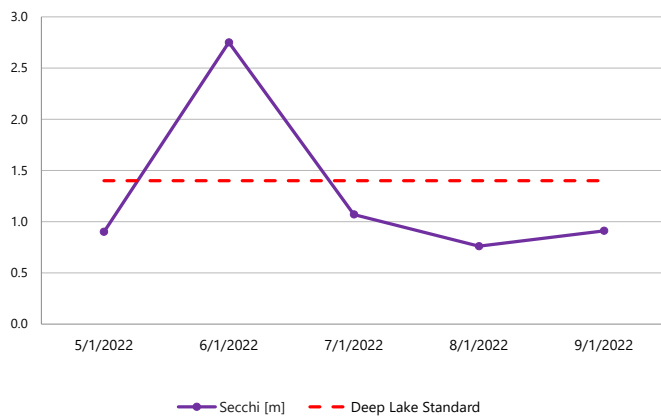
Louisa - 2022 Chl-a [ug/l]



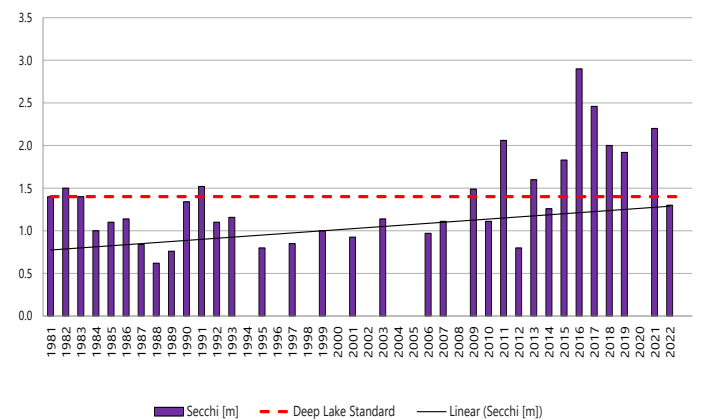
Louisa - Historical Chl-a [ug/l]



Louisa - 2022 Secchi Depth [m]



Louisa - Historical Secchi Depth [m]



LAKE MARIE

QUICK FACTS

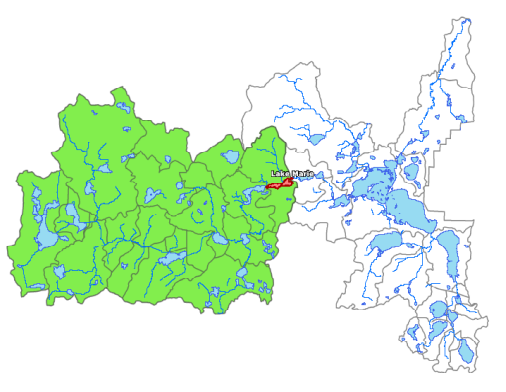
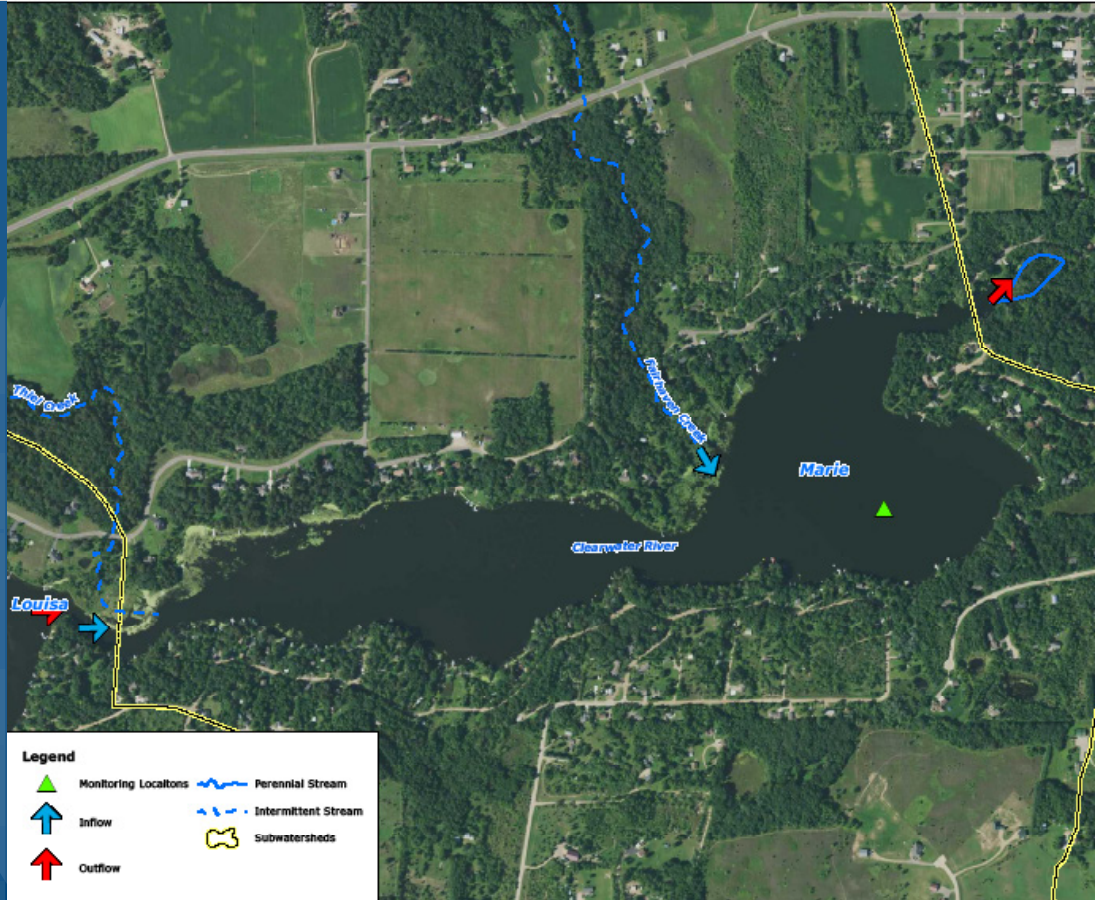
- Littoral Area:** 107 acres
- Residence Time:** 24 days
- Surface Area:** 146 acres
- Subwatershed Area:** 59,837 acres
- Maximum Depth:** 36 feet
- Upstream Waters:** Clearwater River, Louisa

Common Fish
Black Crappie, Bluegill, Northern Pike, White Sucker, Yellow Perch

Dominant Vegetation
Coontail, Canadian waterweed

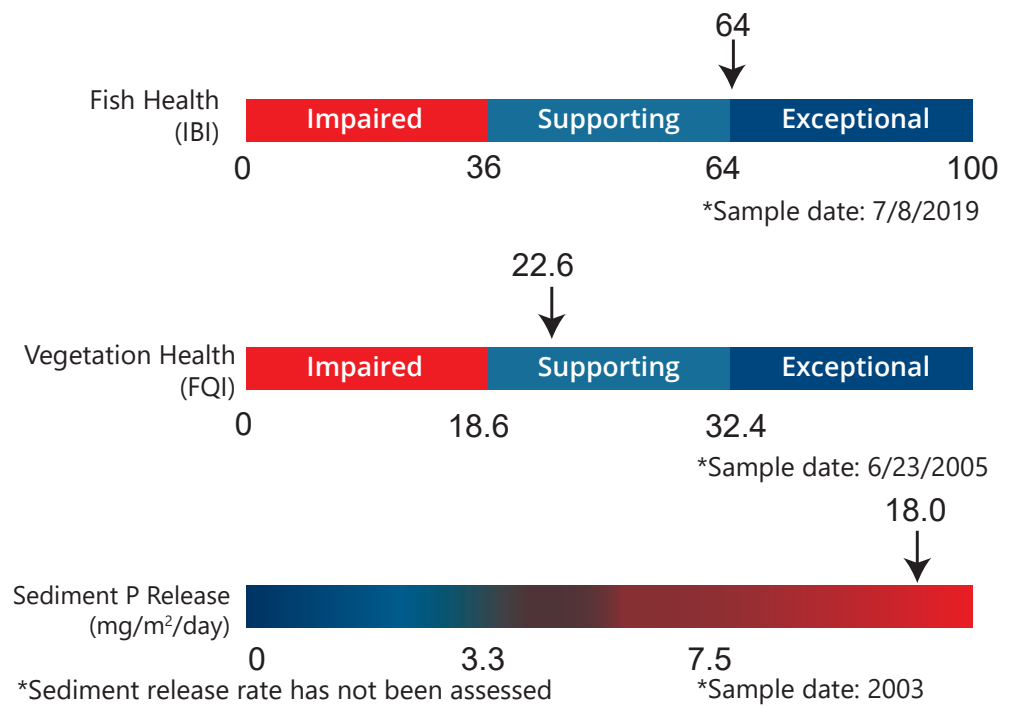
Invasive Species
Curly-leaf pondweed

Status
Impaired, TMDL Completed 2009



TO DO LIST

- ▲ Manage upstream loads
- ▲ AIS management
- ▲ Internal load management study

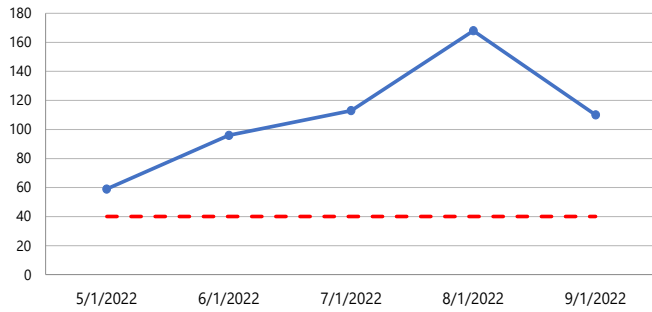


LAKE MARIE

2022 Water Quality

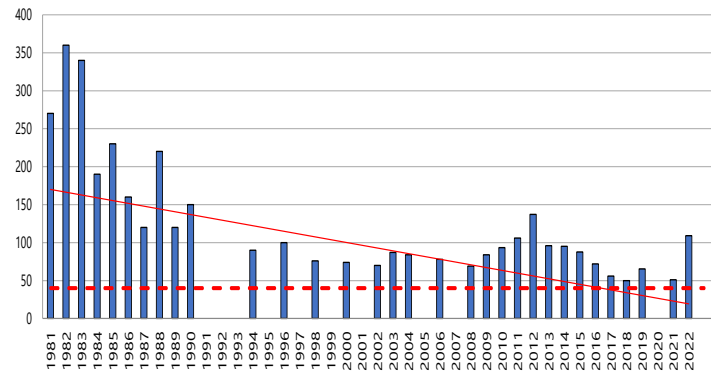
Historic Water Quality

Marie - 2022 TP [ug/l]



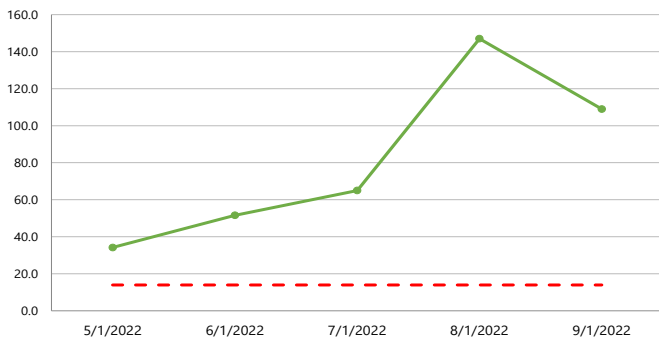
TP [ug/l] Deep Lake Standard

Marie - Historical TP [ug/l]



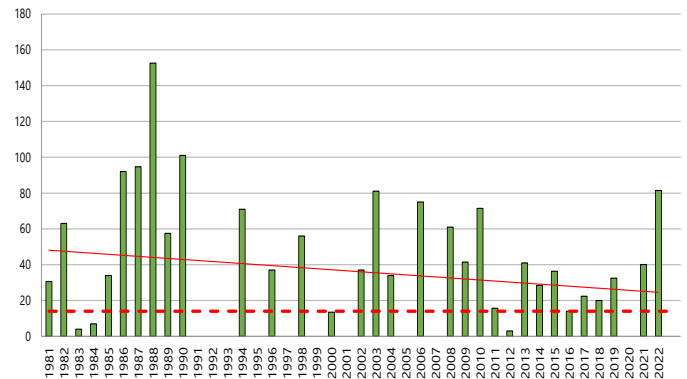
TP [ug/l] Deep Lake Standard Linear (TP [ug/l])

Marie - 2022 Chl-a [ug/l]



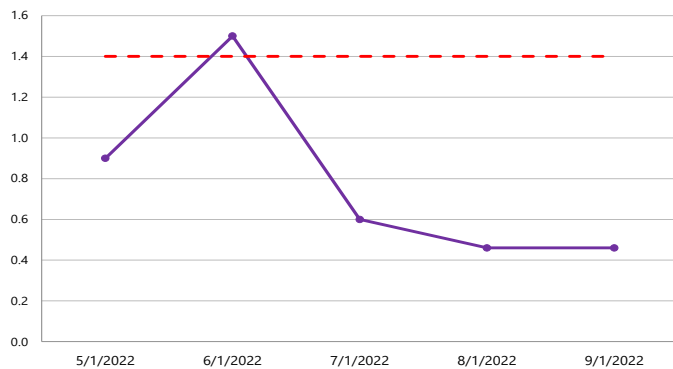
Chl-a [ug/l] Deep Lake Standard

Marie - Historical Chl-a [ug/l]

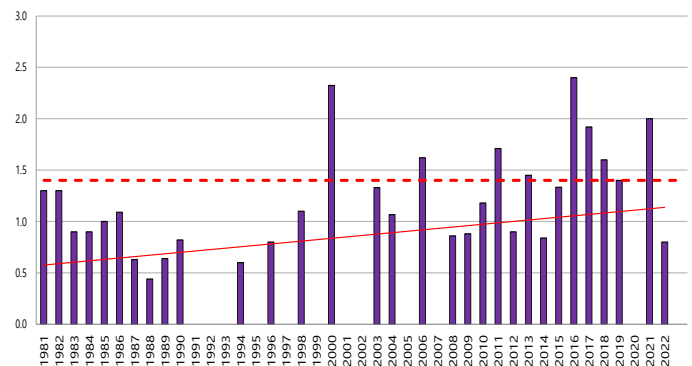


Chl-a [ug/l] Deep Lake Standard Linear (Chl-a [ug/l])

Marie - 2022 Secchi Depth [m]



Marie - Historical Secchi Depth [m]



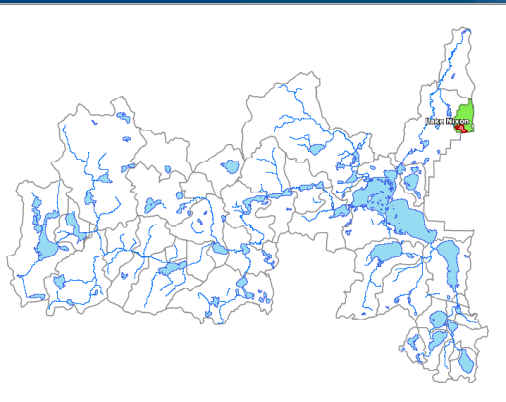
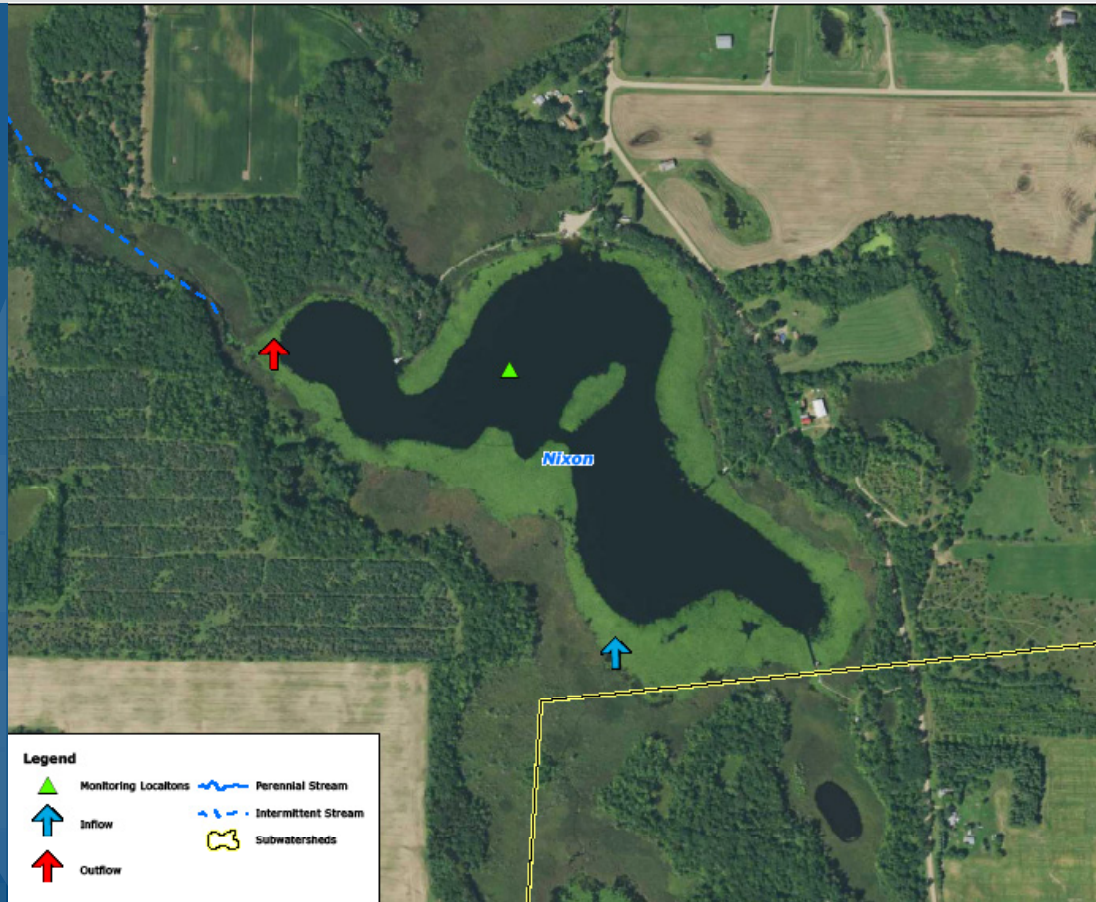
Secchi [m] Deep Lake Standard Linear (Secchi [m])

NIXON LAKE

QUICK FACTS

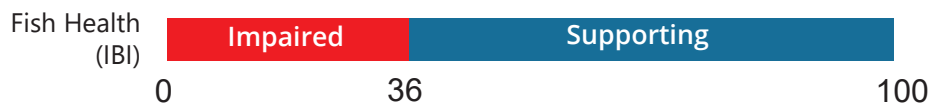
- Littoral Area:** 33 acres
- Surface Area:** 60 acres
- Subwatershed Area:** 690 acres
- Maximum Depth:** 67 feet
- Upstream Waters:** None

- Common Fish** → Bluegill, Northern Pike, Yellow Bull-head, Largemouth Bass
- Dominant Vegetation** → Currently obtaining vegetation info from DNR
- Invasive Species** → Currently obtaining vegetation info from DNR
- Status** → Not impaired

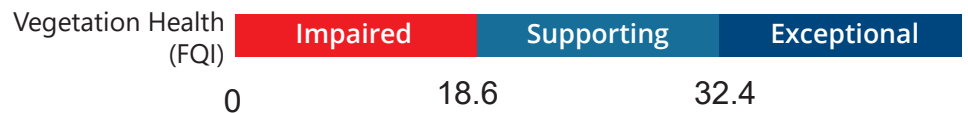


TO DO LIST

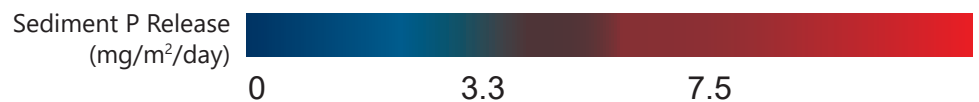
- ▲ Protect water quality
- ▲ Manage upstream loads
- ▲ AIS management and prevention



*Fish IBI has not been assessed



*Vegetation FQI has not been assessed



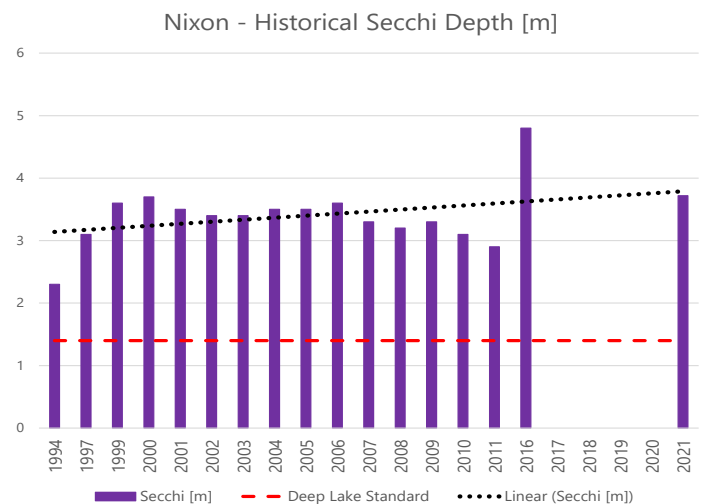
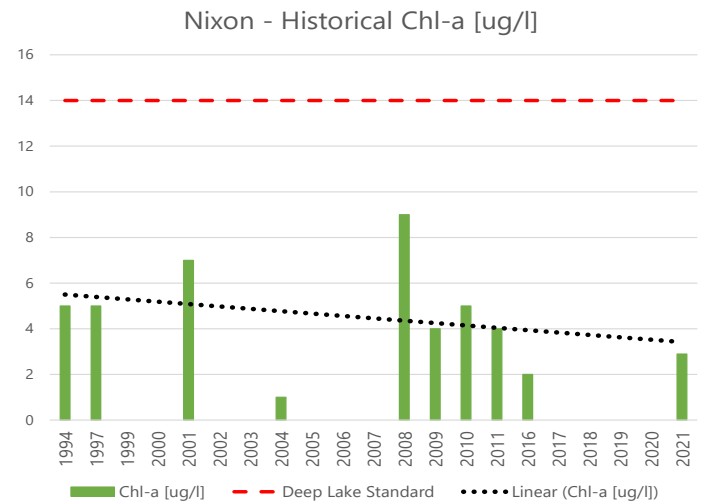
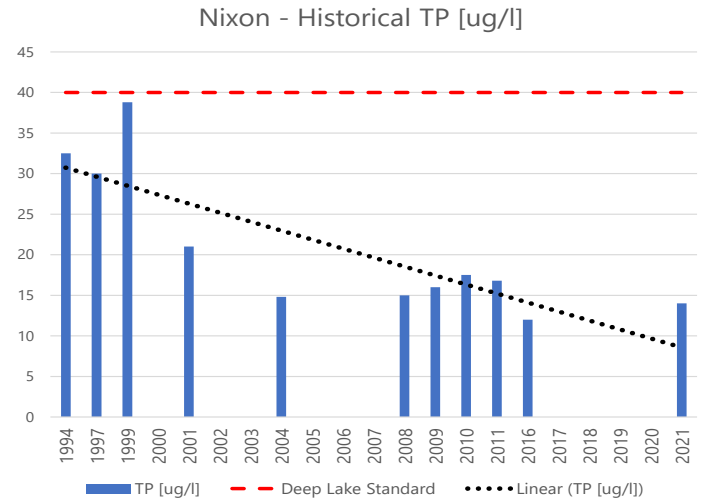
*Sediment release rate has not been assessed

NIXON LAKE

2022 Water Quality

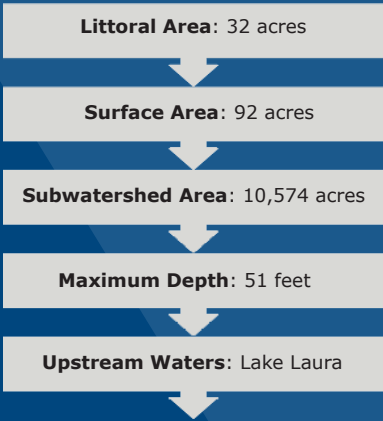
Lake not sampled

Historic Water Quality

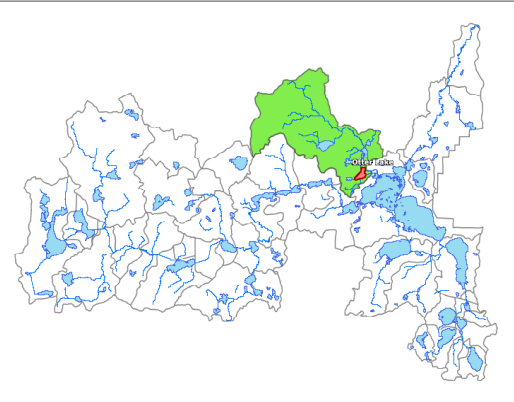
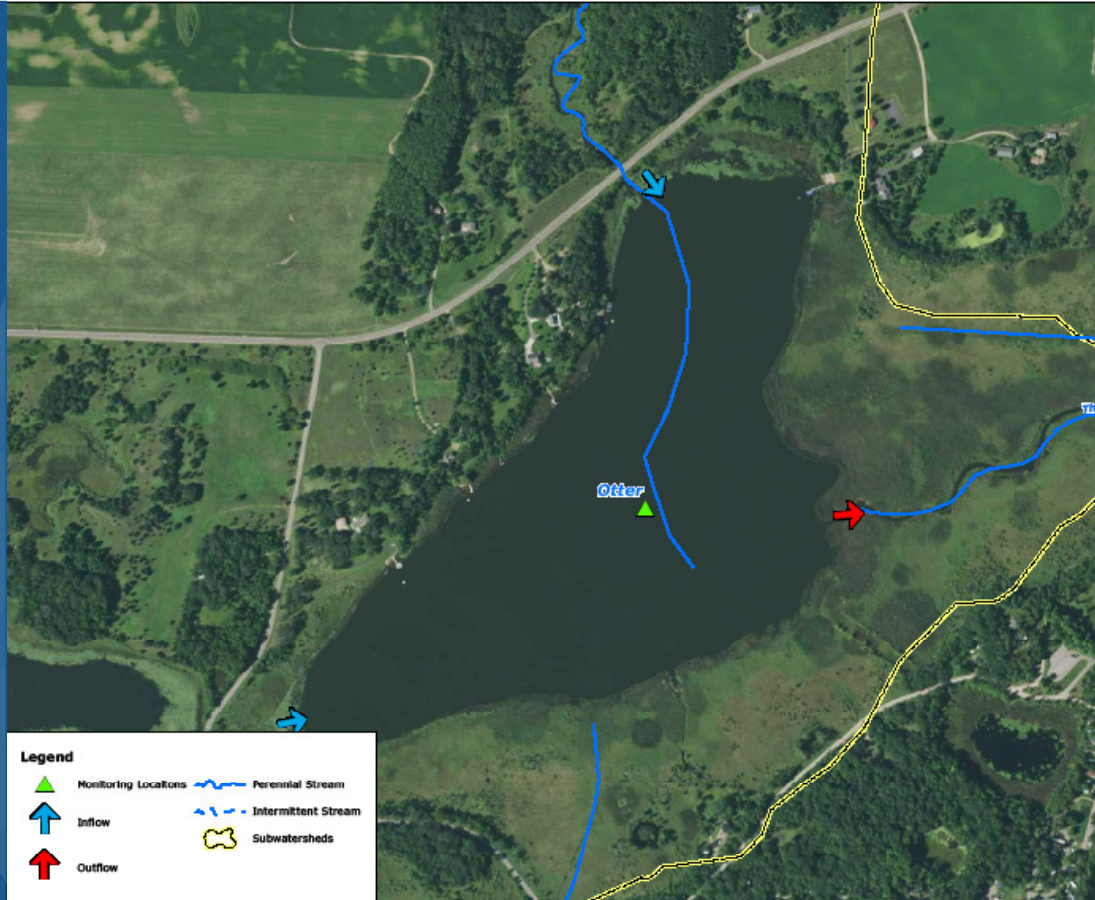


OTTER LAKE

QUICK FACTS

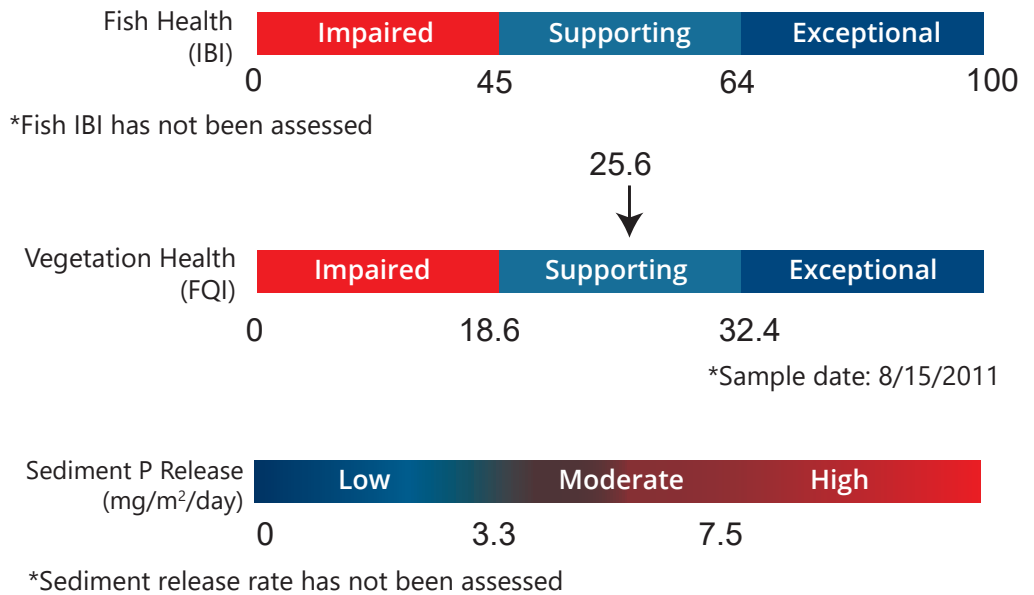


- Common Fish**: Black Crappie, Bluegill, Northern Pike, Largemouth Bass, Walleye
- Dominant Vegetation**: Diverse community
- Invasive Species**: Curly-leaf pondweed, Eurasian water milfoil
- Status**: Not impaired



TO DO LIST

- ▲ Protect water quality
- ▲ Manage upstream loads

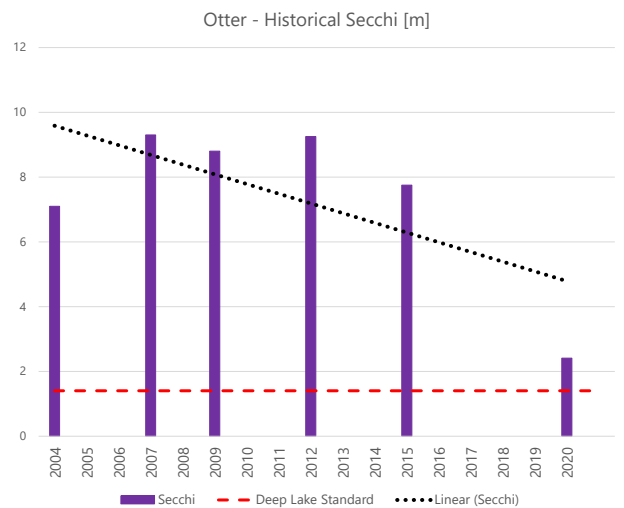
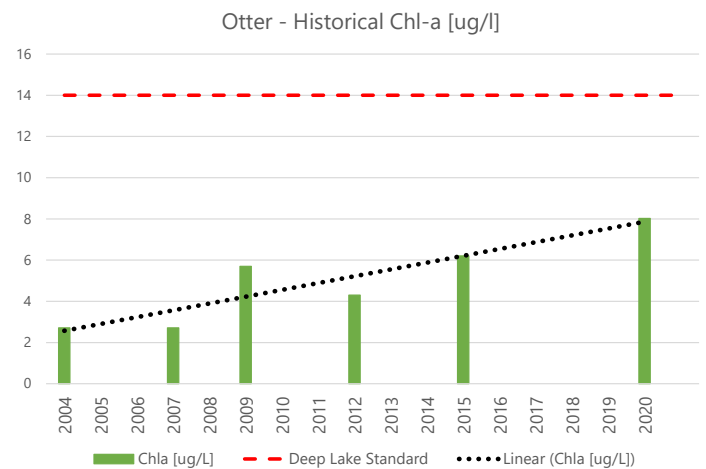
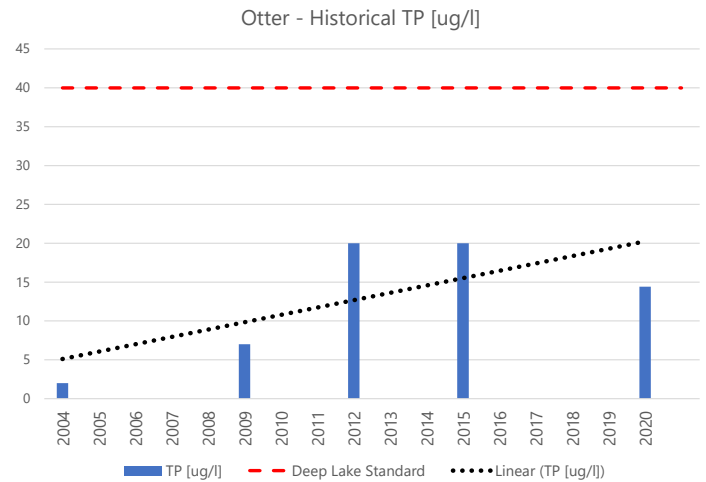


OTTER LAKE

2022 Water Quality

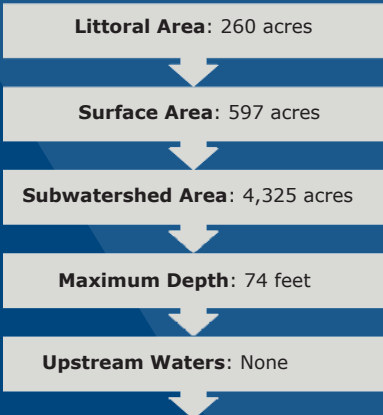
Lake not sampled

Historic Water Quality

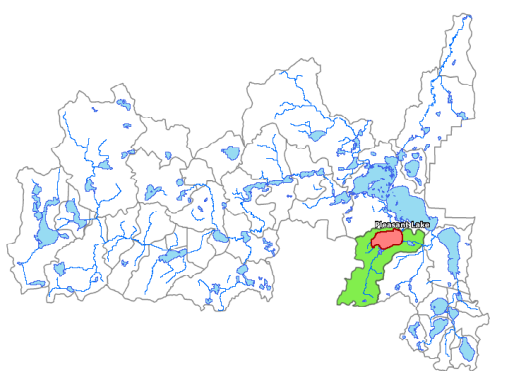
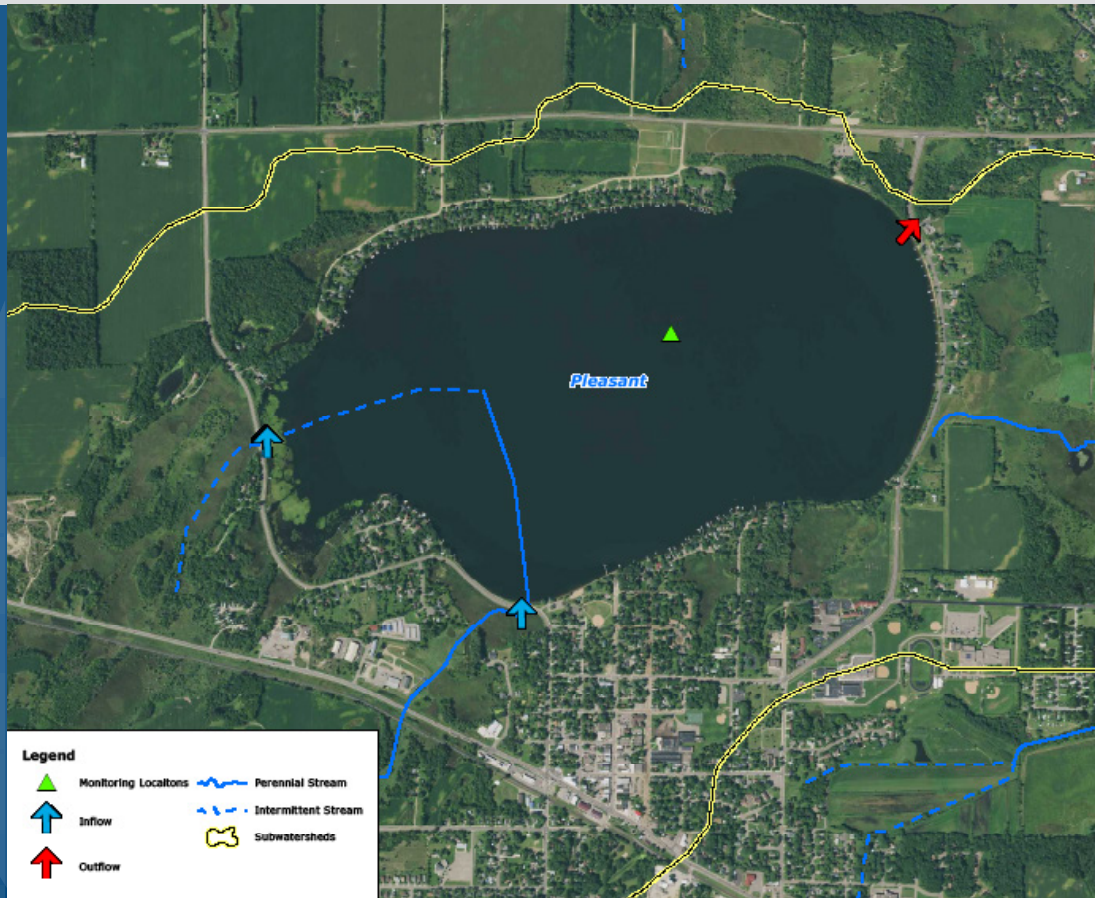


PLEASANT LAKE

QUICK FACTS

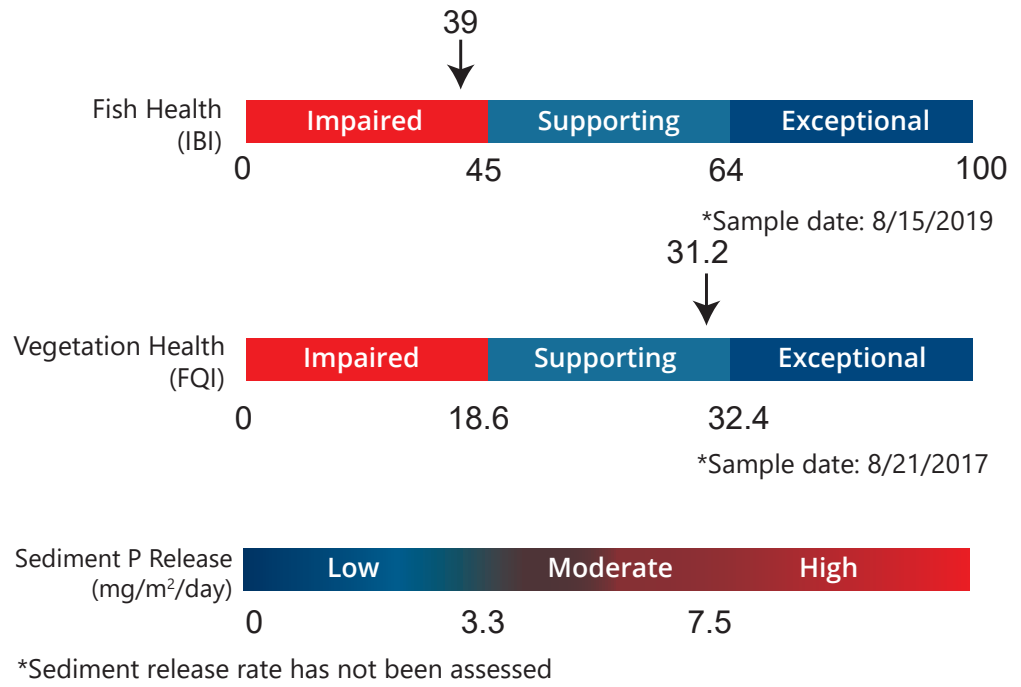


- Common Fish**: Bluegill, Yellow Bullhead, Northern Pike, Pumpkinseed, Sunfish
- Dominant Vegetation**: Curlyleaf, Coontail, chara species, Eurasian watermilfoil
- Invasive Species**: Currently obtaining vegetation info from DNR
- Status**: Not impaired



TO DO LIST

- ▲ Manage watershed loads
- ▲ Protect water quality
- ▲ Operate outlet to minimize flooding

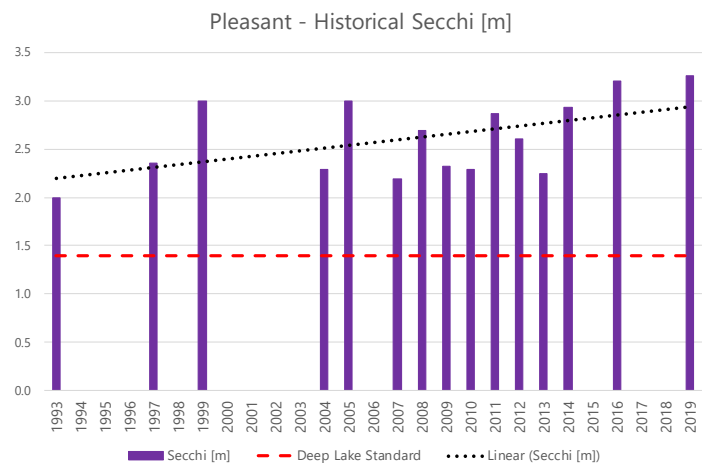
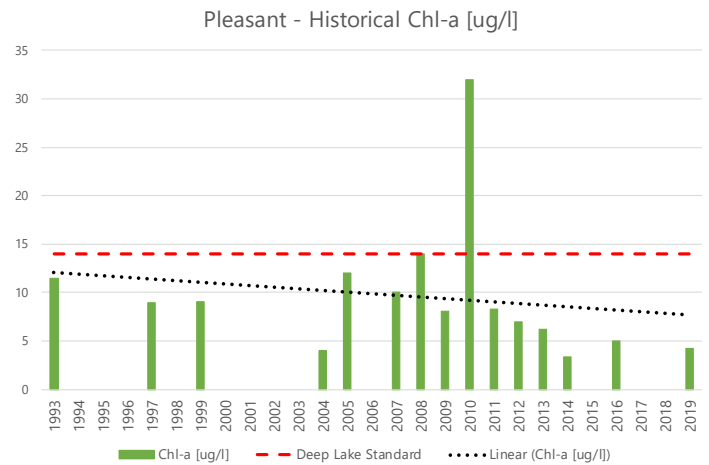
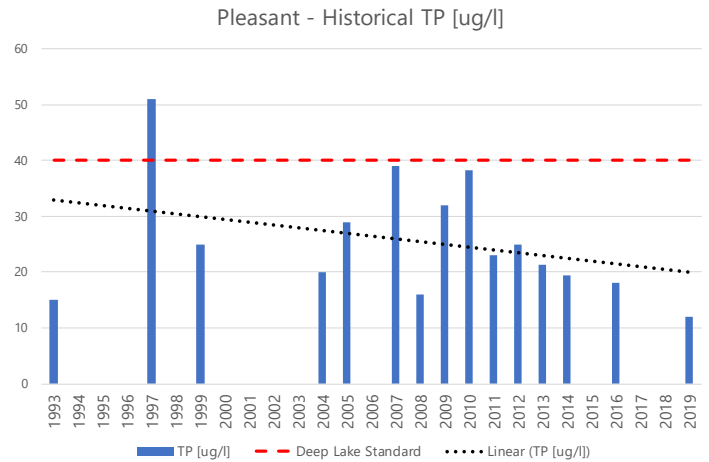


PLEASANT LAKE

2022 Water Quality

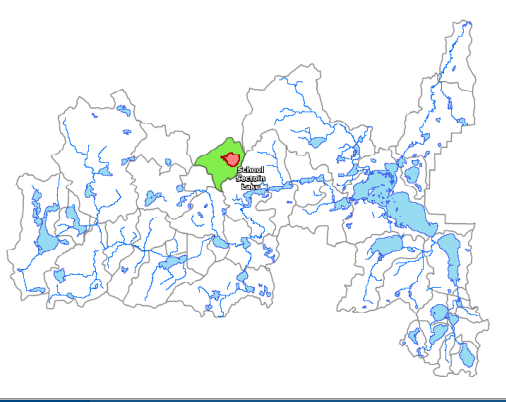
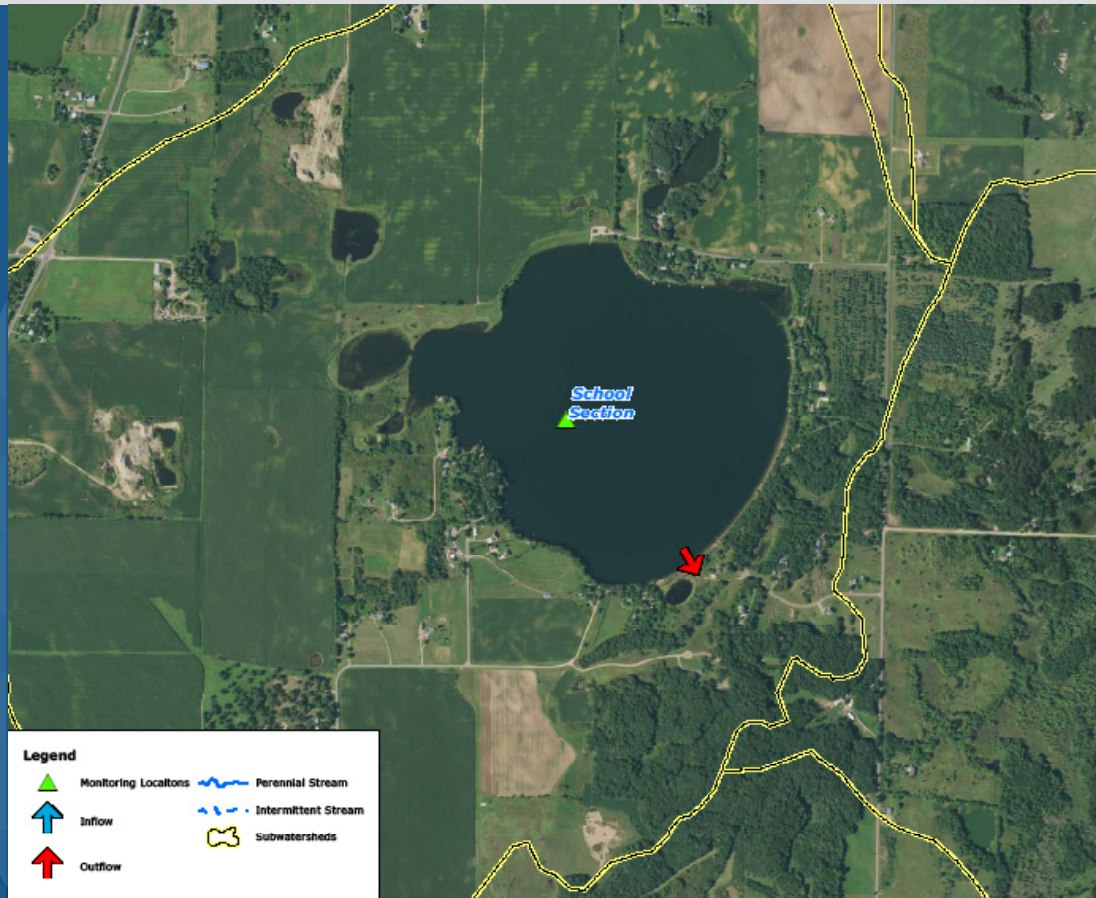
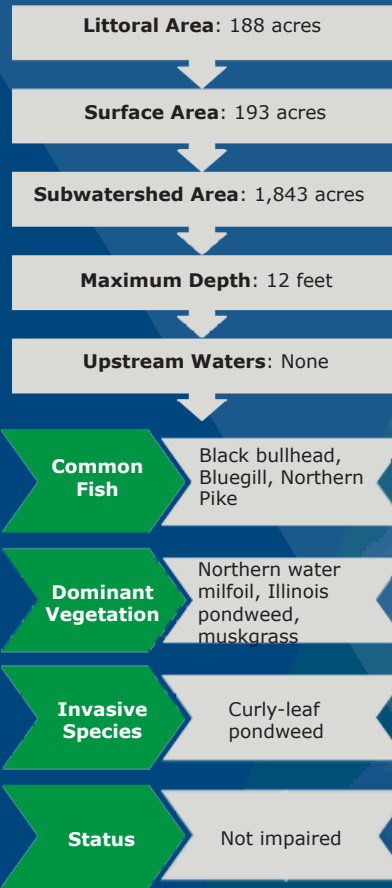
Lake not sampled

Historic Water Quality



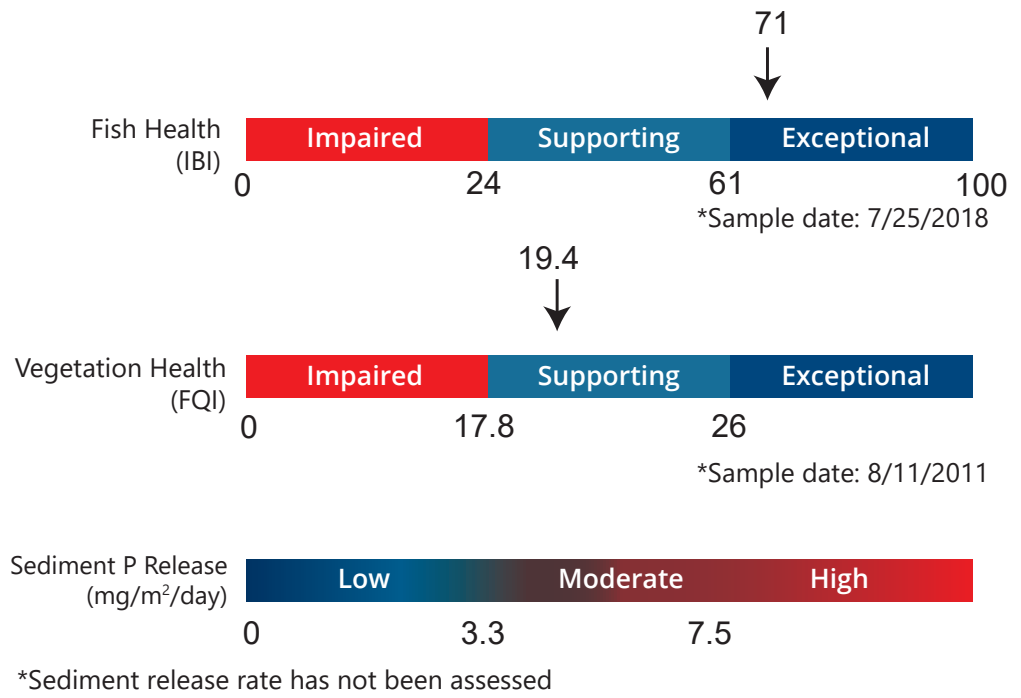
SCHOOL SECTION LAKE

QUICK FACTS



TO DO LIST

- ▲ Operate outlet to minimize flooding
- ▲ Protect water quality

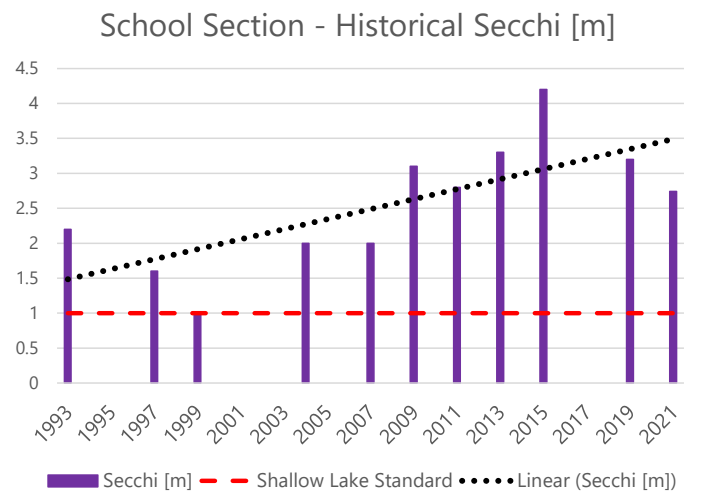
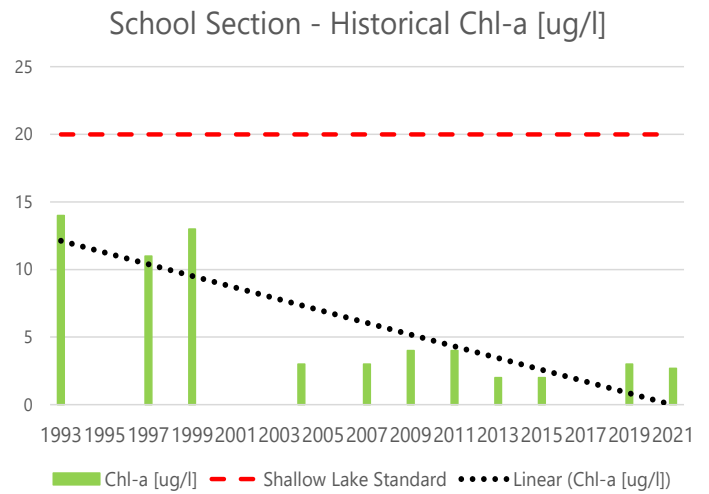
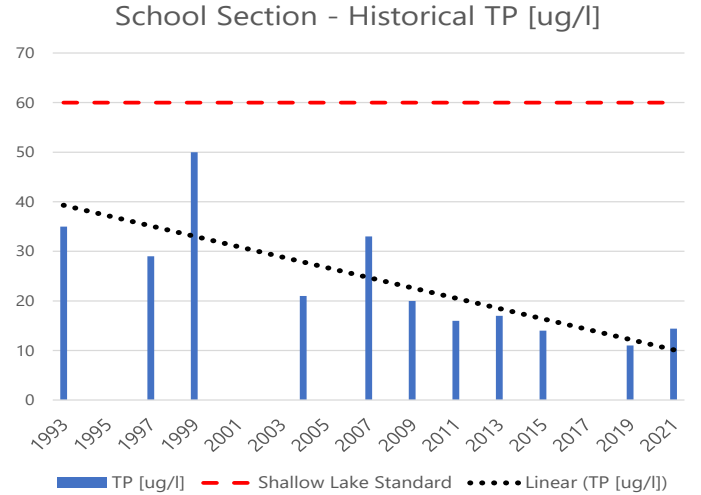


SCHOOL SECTION LAKE

2022 Water Quality

Lake not sampled

Historic Water Quality

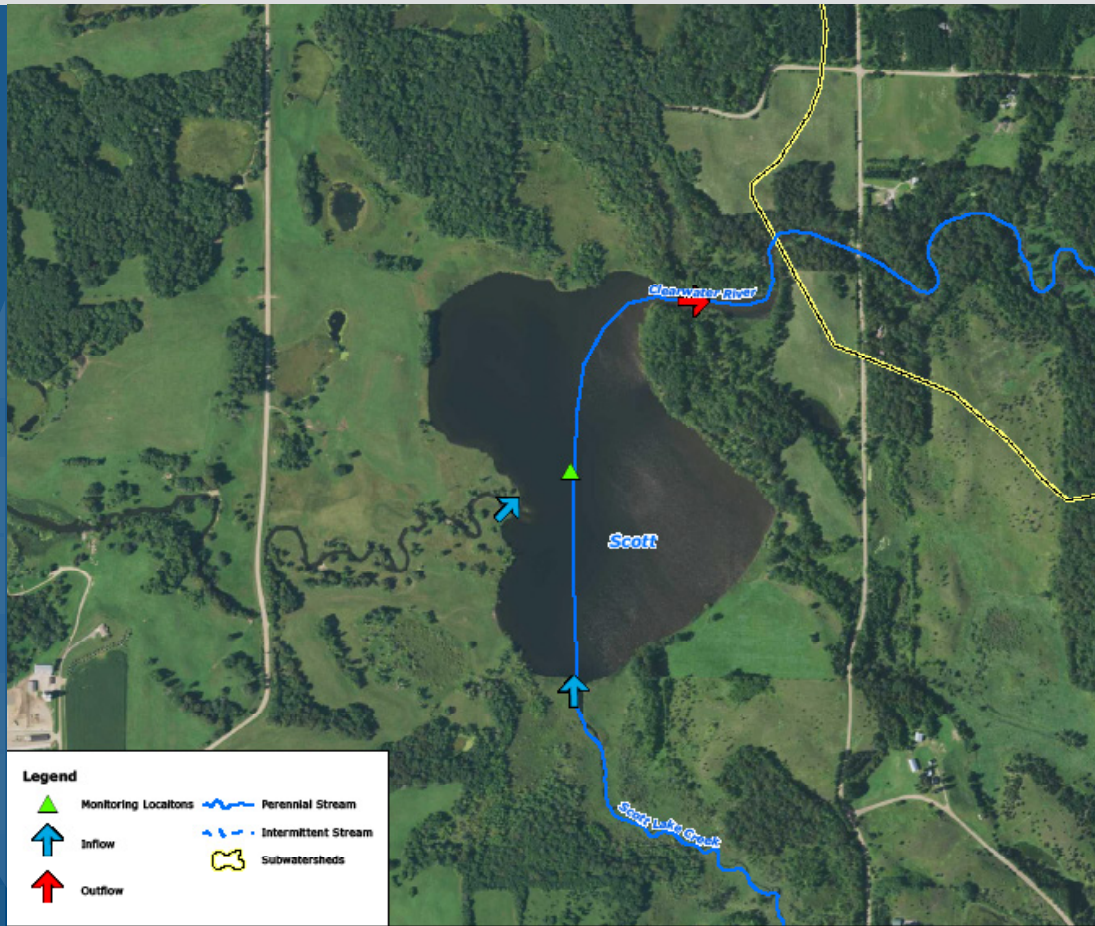


SCOTT LAKE

QUICK FACTS

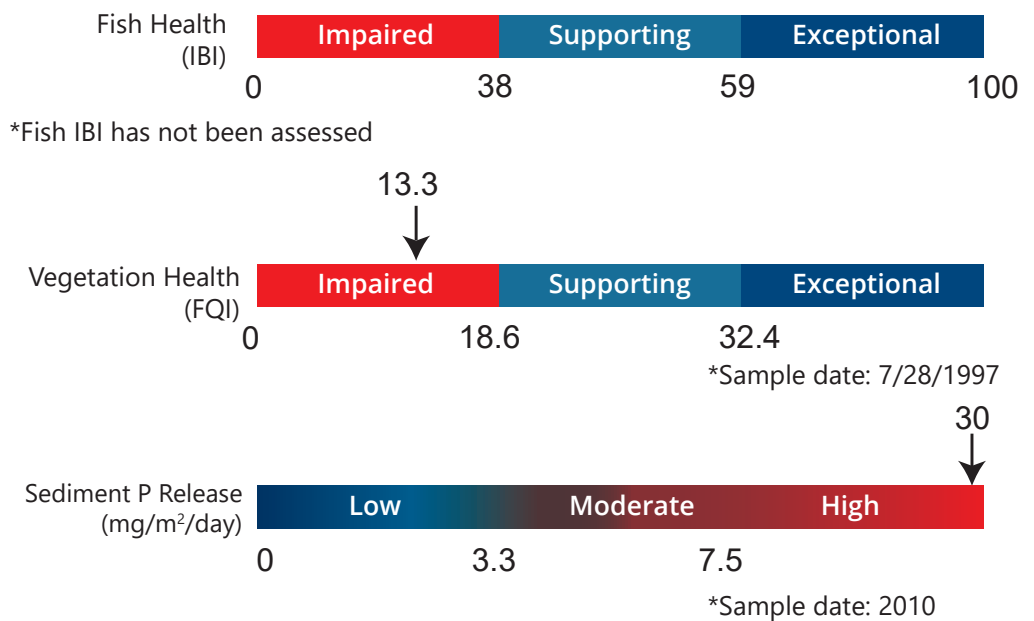
- Littoral Area:** 52 acres
- ↓
- Residence Time:** 12 days
- ↓
- Surface Area:** 80 acres
- ↓
- Subwatershed Area:** 51,000 acres
- ↓
- Maximum Depth:** 23 feet
- ↓
- Upstream Waters:** Clearwater River, Lake Betsy, Union Lake

- Common Fish** → Black Crappie, Bluegill, Channel Catfish, White Sucker
- Dominant Vegetation** → No Recent Survey
- Invasive Species** → Curly-leaf pondweed
- Status** → Impaired, TMDL Completed 2009



TO DO LIST

- ▲ Rough fish management
- ▲ Manage upstream loads
- ▲ Internal load management study

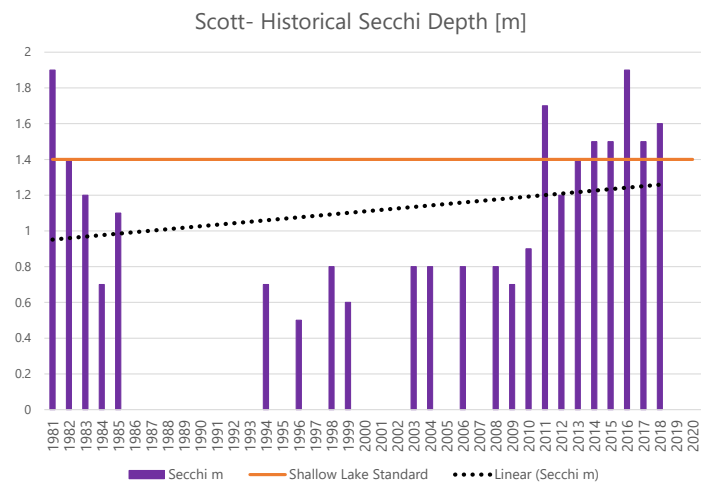
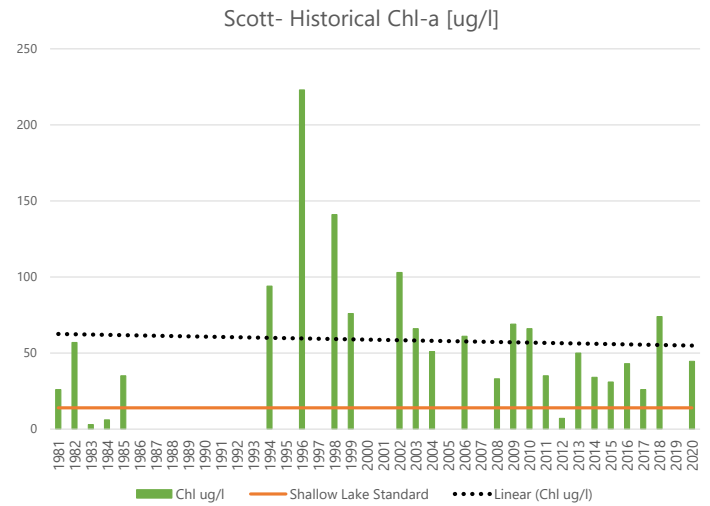
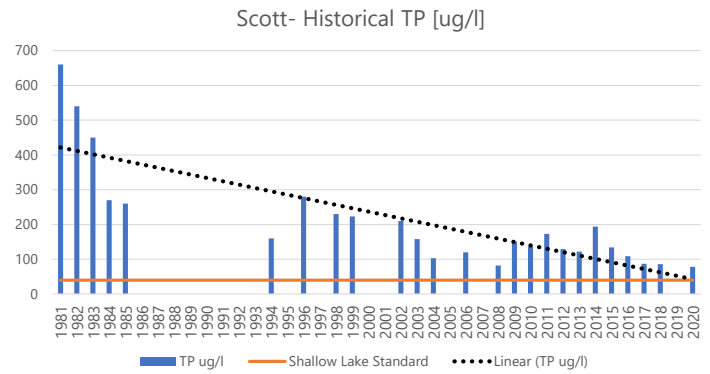


SCOTT LAKE

2022 Water Quality

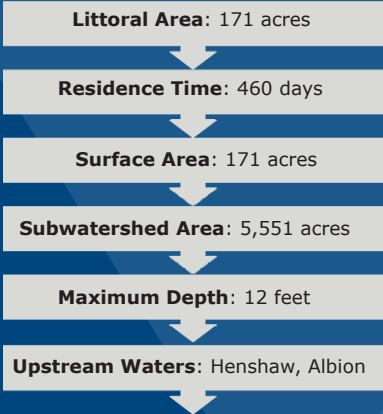
Lake not sampled

Historic Water Quality

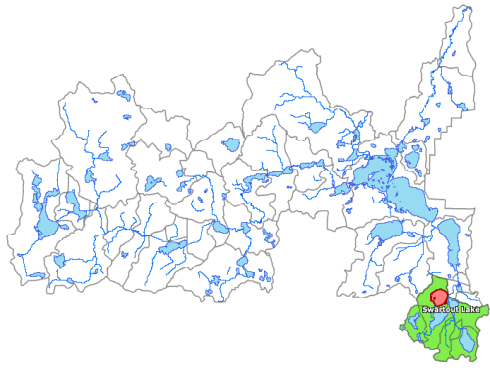
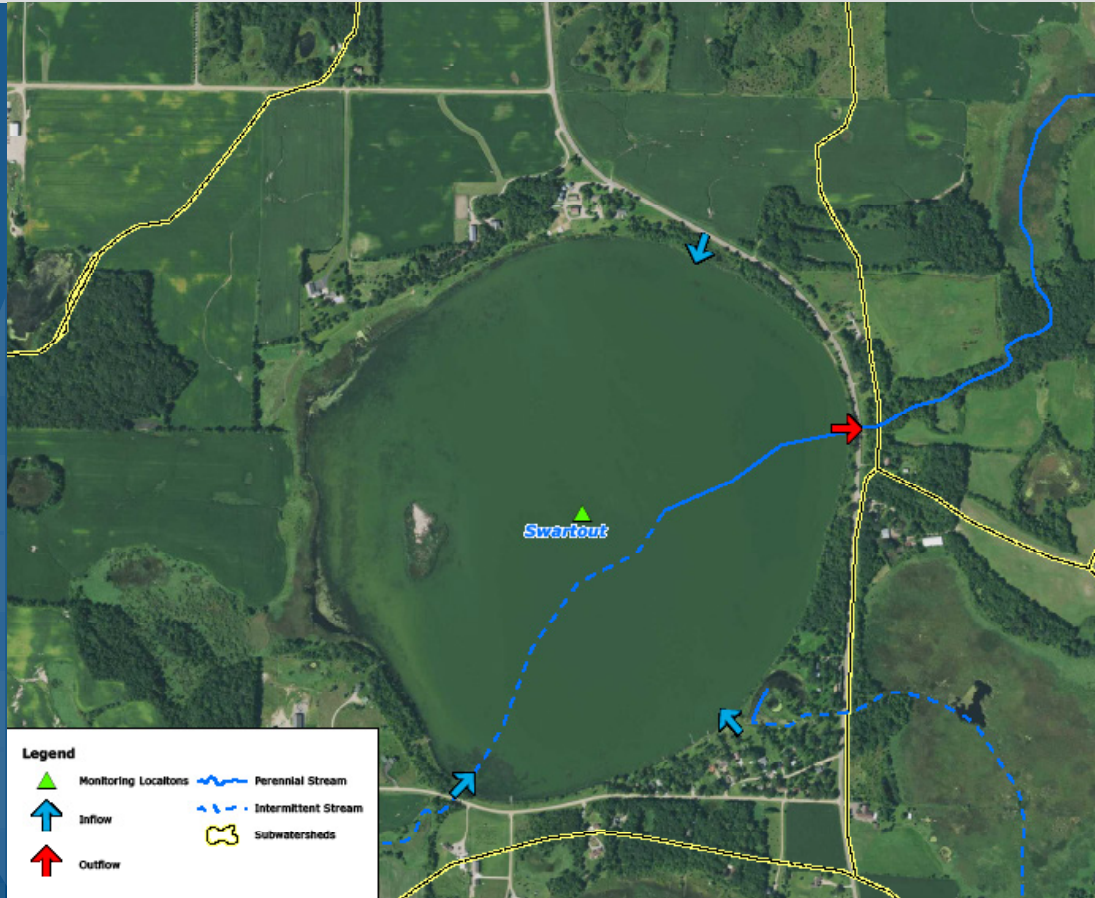


SWARTOUT LAKE

QUICK FACTS

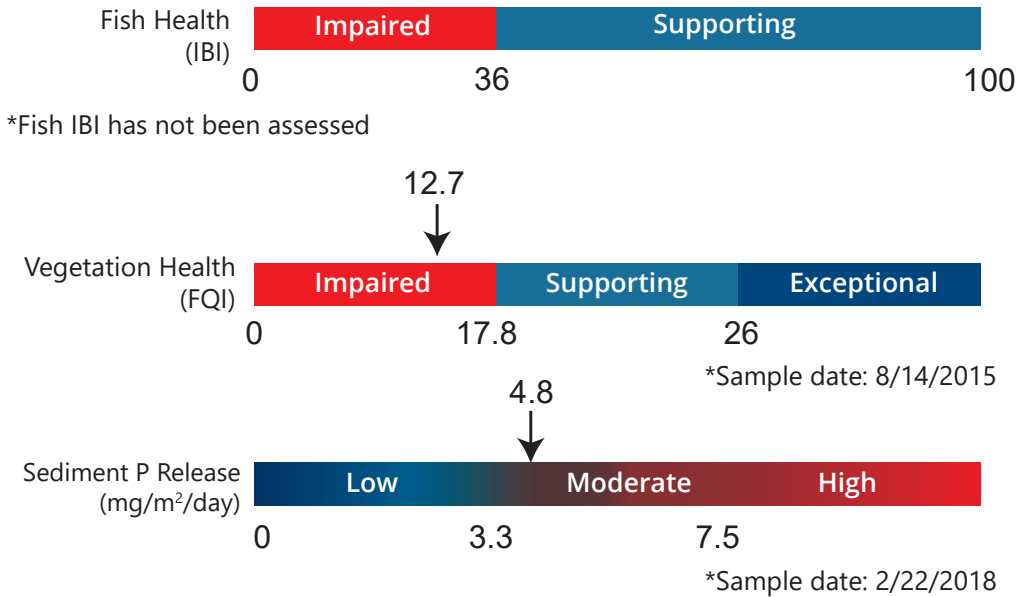


- Common Fish** → Black Bullhead, Black Crappie, Common Carp
- Dominant Vegetation** → Coontail, sago pondweed, bushy pondweed
- Invasive Species** → Curly-leaf pondweed
- Status** → Impaired, TMDL Completed 2010



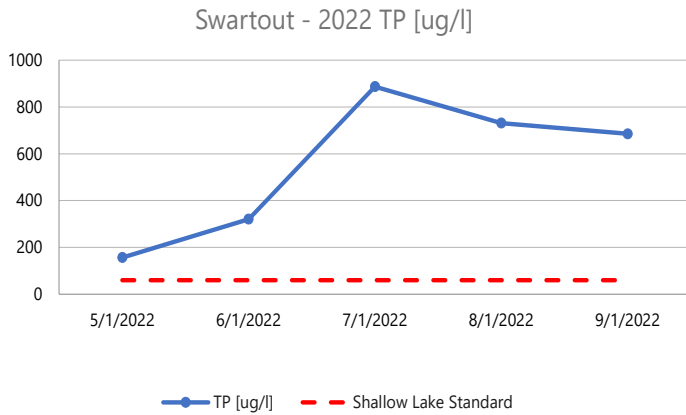
TO DO LIST

- ▲ AIS management
- ▲ Rough fish management
- ▲ Manage upstream loads

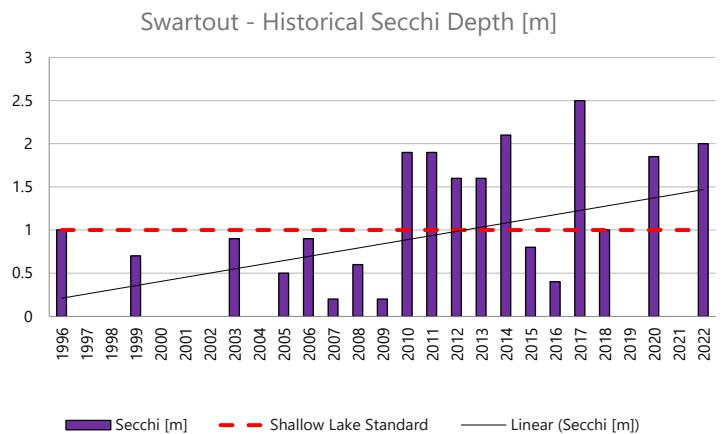
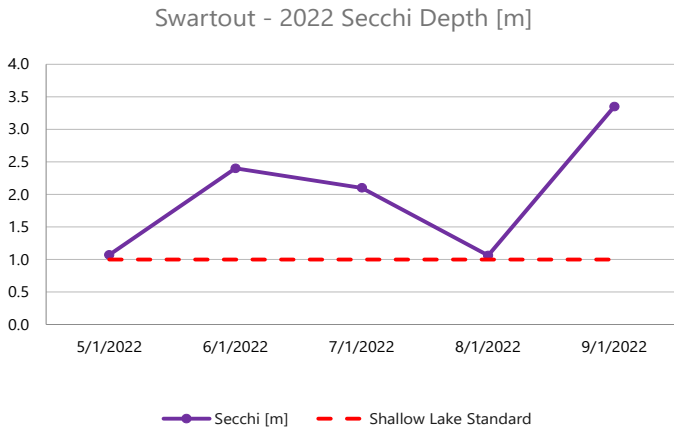
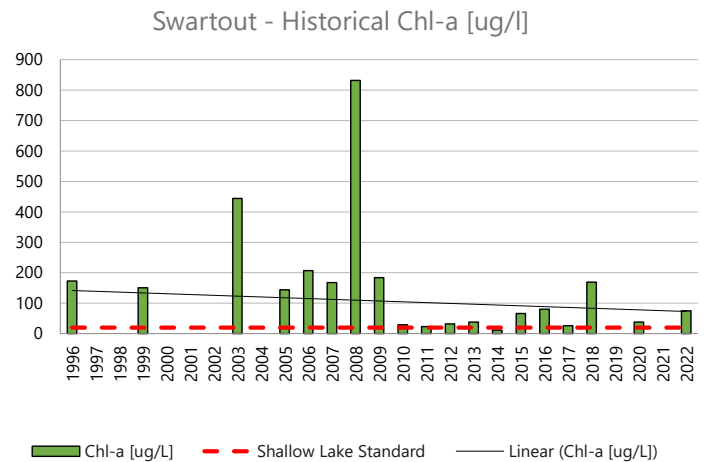
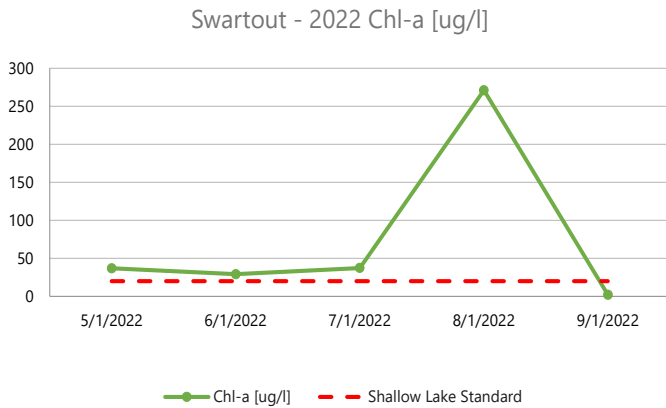
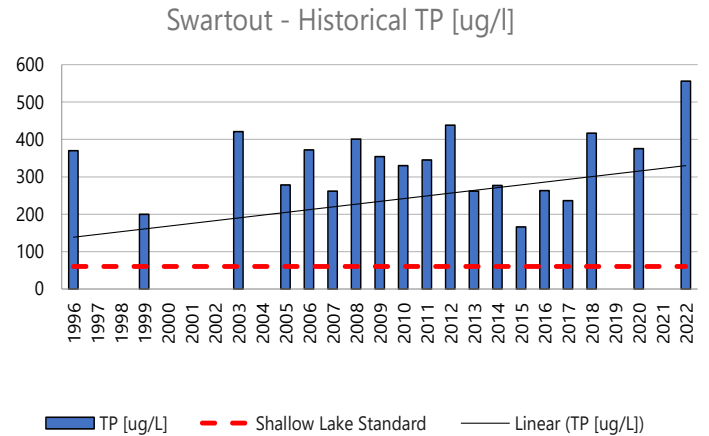


SWARTOUT LAKE

2022 Water Quality



Historic Water Quality



UNION LAKE

QUICK FACTS

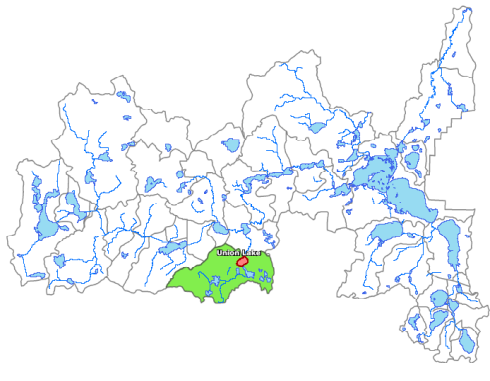
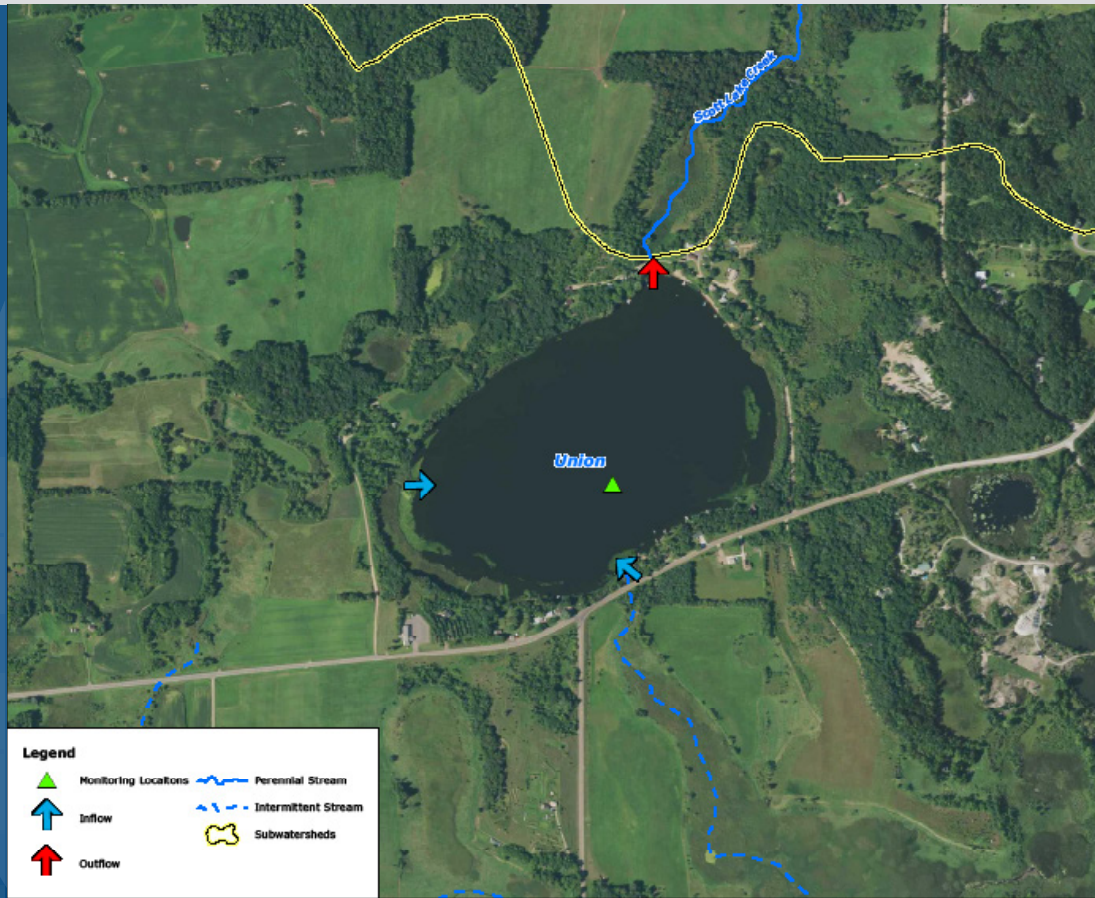
- Littoral Area: 27 acres
- Residence Time: 291 days
- Surface Area: 93 acres
- Subwatershed Area: 4,741 acres
- Maximum Depth: 35 feet
- Upstream Waters: None

Common Fish Black Crappie, Bluegill, Northern Pike, Largemouth Bass

Dominant Vegetation Coontail, curly-leaf pondweed, sago pondweed

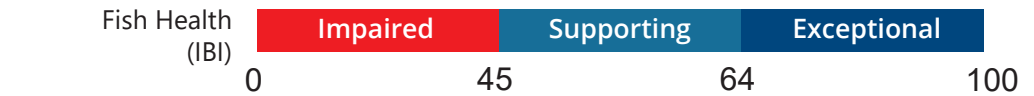
Invasive Species Curly-leaf pondweed

Status Removed from Impaired Waters List in 2022, TMDL Completed 2009

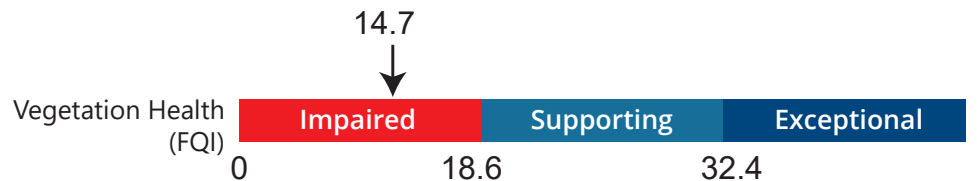


TO DO LIST

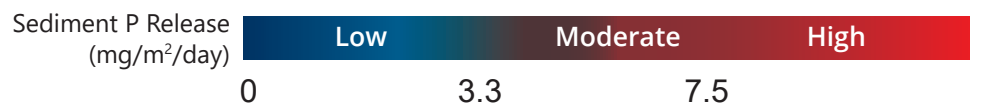
- ▲ Manage upstream loads



*Fish IBI has not been assessed



*Sample date: 6/17/2016



*Sediment release rate has not been assessed

2022 Water Quality

Lake not sampled

Historic Water Quality

