Miner Lake
2022 Water Quality Report

A publication of the Miner Lake Improvement Board

Miner Lake Improvement Board
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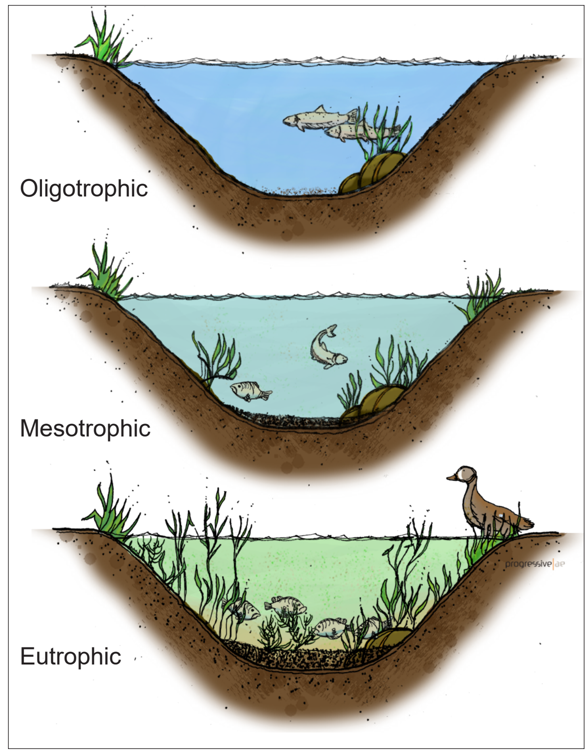
Water quality monitoring on Miner Lake has been ongoing periodically since 1996. This report provides background information on lake water quality and a discussion of sampling results from 2022.

Lakes can be classified into three broad categories based on their productivity or ability to support plant and animal life. The three basic lake classifications are oligotrophic, mesotrophic, and eutrophic.

Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold water fish such as trout and whitefish.

Eutrophic lakes have poor clarity, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike.

Lakes that fall between the two extremes of oligotrophic and eutrophic are called *mesotrophic* lakes.



Lake trophic states.

Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as *cultural eutrophication*.

Environmental Consultant
Progressive AE

For more information, visit:
www.michiganlakeinfo.com/trophic-state

Trophic State Indicators

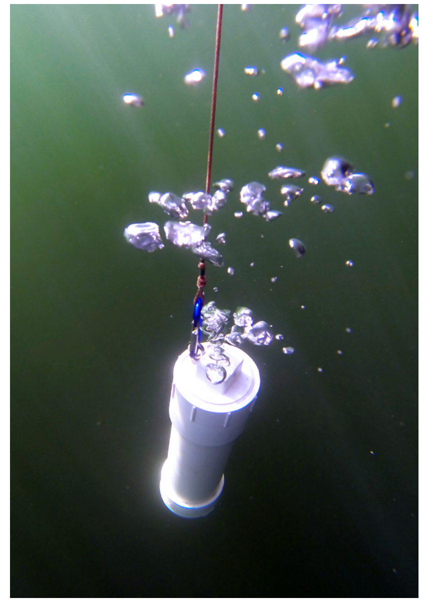
Key parameters used to evaluate a lake's productivity or trophic state include total phosphorus, chlorophyll-*a*, and Secchi transparency.

Phosphorus is the nutrient that most often stimulates excessive growth of aquatic plants and causes premature lake aging. By measuring phosphorus levels, it is possible to gauge the overall health of a lake.

Chlorophyll-a is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in the water column can be made by measuring the amount of chlorophyll-*a* in the water column.

A *Secchi disk* is a round, black and white, 8-inch disk that is used to estimate water clarity. Generally, it has been found that plants can grow to a depth of about twice the Secchi disk transparency.

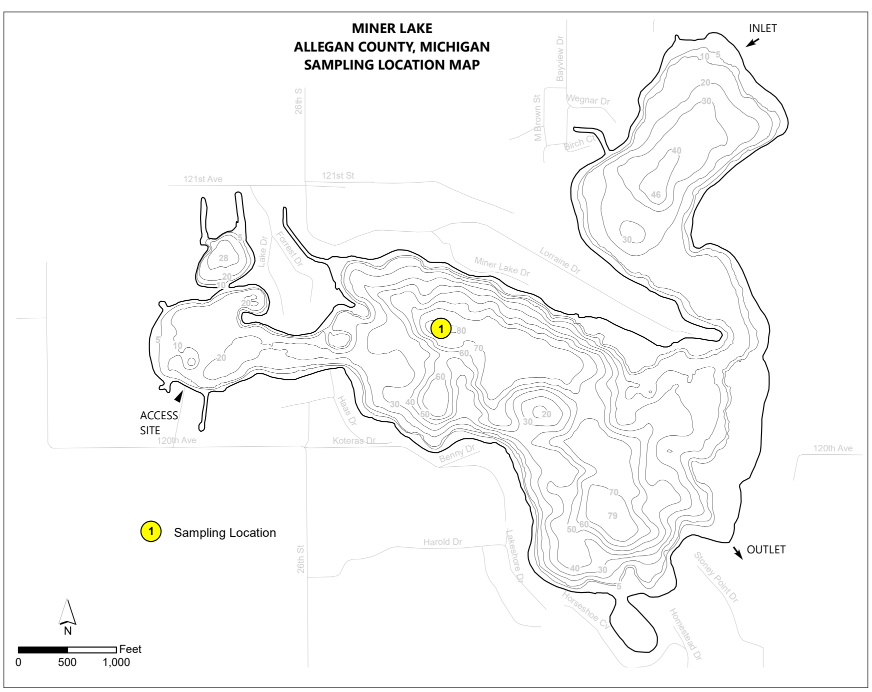
Generally, as phosphorus inputs to a lake increase, algae growth and chlorophyll-*a* increase and Secchi transparency decreases.



A composite sampler is used to collect chlorphyll-*a* samples.

TROPHIC CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)[1]	Chlorophyll-*a* (µg/L)[1]	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5



In 2022, samples were collected during spring and summer at 10-foot intervals over the deepest basin in Miner Lake.

1 µg/L = micrograms per liter = parts per billion.

Temperature and Dissolved Oxygen

Temperature and dissolved oxygen strongly influence lake water quality and are very important to a lake's fishery.

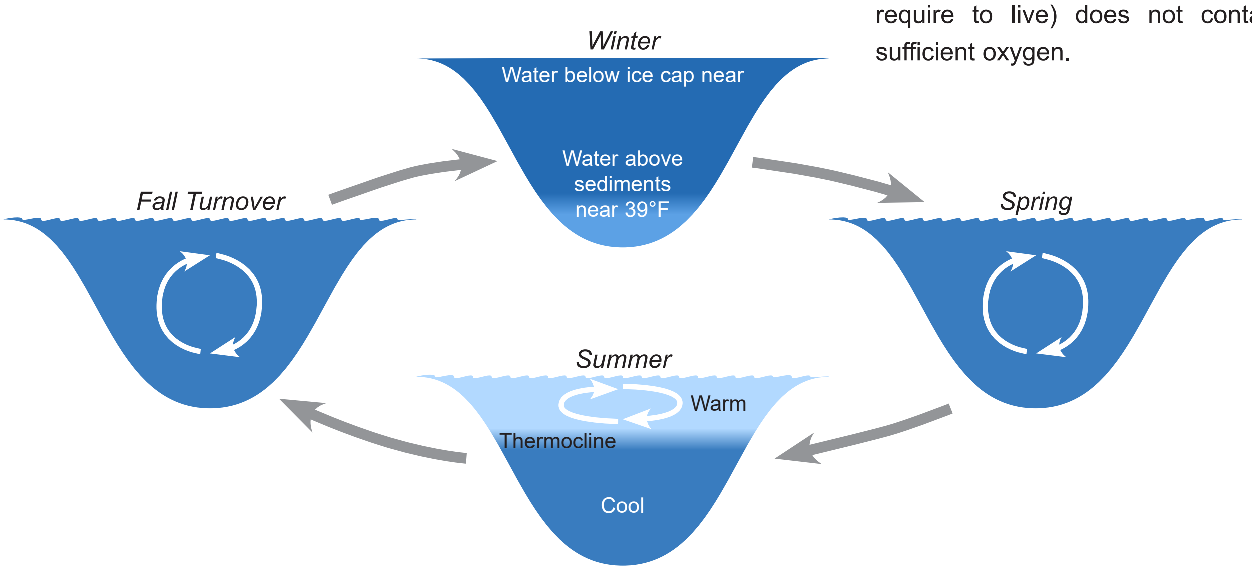
For more information, visit:
michiganlakeinfo.com/turnover-and-stratification

Temperature

Temperature is important in determining the type of organisms that may live in a lake. For example, trout prefer temperatures below 68°F. Temperature also determines how water mixes in a lake. As the ice cover breaks up on a lake in the spring, the water temperature becomes uniform from the surface to the bottom. This period is referred to as *spring turnover* because water mixes throughout the entire water column. As the surface waters warm, they are underlain by a colder, more dense layer of water. This process is called thermal stratification. In deeper lakes during summer there are three distinct layers. This is referred to as *summer stratification*. Once thermal stratification occurs, there is little mixing of the warm surface waters with the cooler bottom waters. The transition layer that separates these layers is referred to as the *thermocline*. The thermocline is characterized as the zone where temperature drops rapidly with depth. As fall approaches, the warm surface waters begin to cool and become more dense. Eventually, the surface temperature drops to a point that allows the lake to undergo complete mixing. This period is referred to as *fall turnover*. As the season progresses and ice begins to form on the lake, the lake may stratify again. However, during *winter stratification*, the surface waters (at or near 32°F) are underlain by slightly warmer water (about 39°F). This is sometimes referred to as *inverse stratification* and occurs because water is most dense at a temperature of about 39°F. As the lake ice melts in the spring, these stratification cycles are repeated. These stratification cycles occur in deep lakes but not in shallow lakes or ponds. Lakes that are about 15 to 30 feet deep may stratify and destratify with storm events several times during the year. Miner Lake is deep enough to exhibit summer-long stratification. The thermocline in Miner Lake occurs around 20 feet of depth. Oxygen depletion starts to occur below the thermocline, however, at the time of sampling, oxygen was still present in the bottom waters.

Dissolved Oxygen

An important factor influencing lake water quality is the quantity of *dissolved oxygen* in the water column. The major inputs of dissolved oxygen to lakes are the atmosphere and photosynthetic activity by aquatic plants. An oxygen level of about 5 mg/L (milligrams per liter, or parts per million) is required to support warm-water fish. In lakes deep enough to exhibit thermal stratification, oxygen levels are often reduced or depleted below the thermocline once the lake has stratified. This is because deep water is cut off from plant photosynthesis and the atmosphere, and oxygen is consumed by bacteria that use oxygen as they decompose organic matter (plant and animal remains) at the bottom of the lake. Bottom-water oxygen depletion is a common occurrence in eutrophic and some mesotrophic lakes. Thus, eutrophic and most mesotrophic lakes cannot support cold-water fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.



Seasonal thermal stratification. Stratification cycles occur in deep lakes but not in shallow lakes or ponds.

Water quality data collected from Miner Lake in 2022 are summarized in the tables below.

Miner Lake is meso-eutrophic. That is, the lake exhibits phosphorus concentrations in the eutrophic range, but has moderate chlorophyll-*a* concentrations and moderate clarity.

MINER LAKE
2022 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (μg/L)[2]
28-Mar-22	1	1	40	10.8	55
28-Mar-22	1	10	40	10.9	57
28-Mar-22	1	20	40	11.4	21
28-Mar-22	1	30	40	11.4	27
28-Mar-22	1	40	40	11.3	20
28-Mar-22	1	50	40	11.0	19
28-Mar-22	1	60	40	11.1	20
28-Mar-22	1	70	41	11.7	17
28-Mar-22	1	80	41	11.4	18
26-Jul-22	1	1	81	8.9	35
26-Jul-22	1	10	79	8.9	36
26-Jul-22	1	20	62	7.6	26
26-Jul-22	1	30	50	5.7	27
26-Jul-22	1	40	47	4.6	29
26-Jul-22	1	50	46	4.7	32
26-Jul-22	1	60	46	3.0	31
26-Jul-22	1	70	46	2.3	45
26-Jul-22	1	82	46	2.0	54

MINER LAKE
2022 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (μg/L)[2]
28-Mar-22	1	7.5	1
26-Jul-22	1	4.0	2

1 mg/L = milligrams per liter = parts per million.

2 μg/L = micrograms per liter = parts per billion.