October 2026

LLOYD'S BAYOU

WATER QUALITY SUMMARY

PREPARED FOR:
LLOYD'S BAYOU LAKE IMPROVEMENT BOARD
OTTAWA COUNTY, MI

PROGRESSIVE COMPANIES

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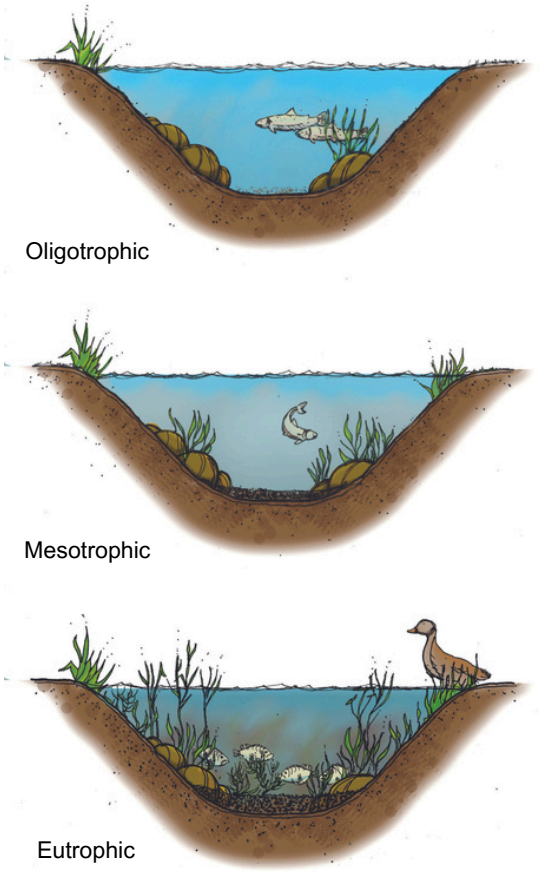
LAKE WATER QUALITY

Lake water quality is determined by a unique combination of processes that occur both within and outside of the lake. In order to make sound management decisions, it is necessary to have an understanding of the current physical, chemical, and biological condition of the lake, and the potential impact of drainage from the surrounding watershed.

Lakes are commonly classified as oligotrophic, mesotrophic, or 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. By contrast, eutrophic lakes are generally shallow, turbid, 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 warmwater fish such as bass and pike. Lakes that fall between these two extremes are called mesotrophic lakes.

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 aging process in lakes is called "eutrophication" and may take anywhere from a few hundred to several thousand years, generally depending on the size of the lake and its watershed. 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." The problem of cultural eutrophication can be managed by identifying sources of sediment and nutrient loading (i.e., inputs) to the lake and developing strategies to halt or slow the inputs. Key parameters used to evaluate a lake's productivity or trophic state include total phosphorus, chlorophyll-*a*, and Secchi transparency.



Lake classification.

PHOSPHORUS

Phosphorus is the nutrient that most often controls aquatic plant growth and the rate at which a lake ages and becomes more eutrophic. In the presence of oxygen, lake sediments act as a phosphorus trap, making it unavailable for aquatic plant and algae growth. If bottom-water oxygen is depleted, phosphorus will be released from the sediments and may be available to promote aquatic plant and algae growth. In some lakes, the internal release of phosphorus from the bottom sediments is the primary source of phosphorus loading.

By reducing the amount of phosphorus in a lake, it may be possible to limit the amount of aquatic plant and algae growth. In general, lakes with a phosphorus concentration greater than 20 µg/L (micrograms per liter, or parts per billion) are able to support abundant growth and are classified as nutrient-enriched or eutrophic.

CHLOROPHYLL-*a*

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 µg/L is considered characteristic of a eutrophic condition.

SECCHI TRANSPARENCY

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line. The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Generally, it has been found that aquatic plants can grow at a depth of approximately twice the Secchi transparency measurement. In eutrophic lakes, water clarity is often reduced by algae growth in the water column, and Secchi disk readings of 7.5 feet or less are common.

Generally, as phosphorus inputs (both internal and external) to a lake increase, the amount of algae the lake can support will also increase. Thus, the lake will exhibit increased chlorophyll-*a* levels and decreased transparency. A summary of lake classification criteria is shown in Table 1.

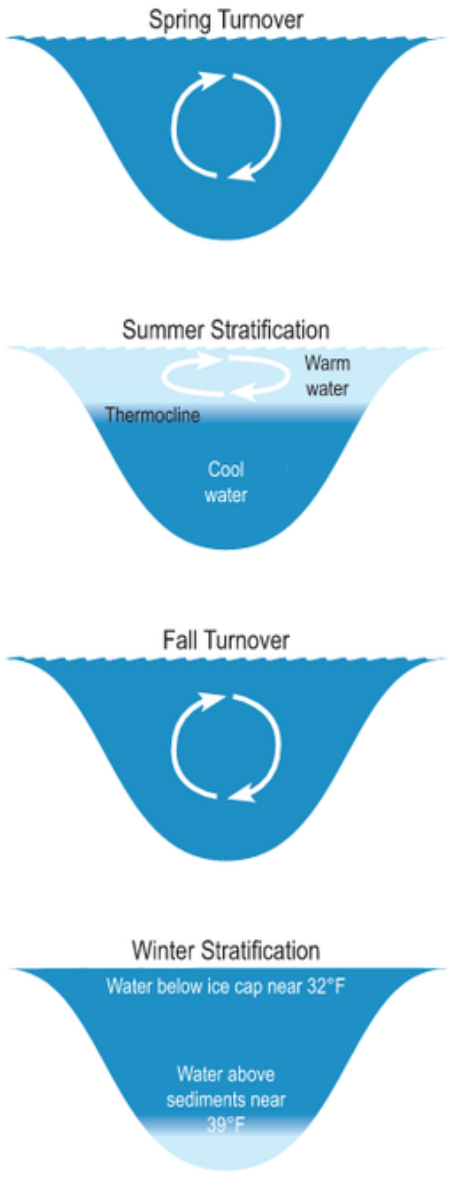
TABLE 1 - LAKE CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)*	Chlorophyll-*a* (µg/L)*	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

* µg/L = micrograms per liter = parts per billion

TEMPERATURE

Temperature is important in determining the type of organisms which 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 strata of water. This process is called thermal 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.



Seasonal thermal stratification cycles.

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 warmwater 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 the oxygen has been consumed, in large part, 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 coldwater fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.

SAMPLING METHODS

Water quality sampling was conducted in the spring and summer of 2026 at the deep basin within Lloyd's Bayou. Temperature and dissolved oxygen were measured using a YSI Prosolo ODO/T probe. Samples were collected at the surface, mid-depth, and just above the lake bottom with a Van Dorn bottle to be analyzed for total phosphorus. Samples were placed on ice and transported to Summit Laboratory* for analysis using Standard Methods procedures 4500-PE. In addition to the depth-interval samples at the deep basin, Secchi transparency was measured and composite chlorophyll-*a* samples were collected from the surface to a depth equal to twice the Secchi transparency. Chlorophyll-*a* samples were analyzed by Prein and Newhof Laboratories* using Standard Methods procedure 10200 H.

SAMPLING RESULTS AND DISCUSSION

Sampling results are provided in Tables 2 and 3.

In April of 2026, water temperatures were cool and dissolved oxygen concentrations were high throughout the water column. Clarity in the spring was poor, however, chlorophyll-*a* concentrations were below detectable limits. Reduced clarity was likely not a result of algal production and more likely a result of other factors such as suspended sediments or microorganisms such as diatoms.

During the August sampling period, Lloyd's Bayou was thermally mixed; having warm-water temperature from surface to just above the lake bottom. The lake was well-oxygenated at the surface and oxygen-depleted near the bottom. Total phosphorus concentrations were low to moderate in the spring and elevated in the summer. Nutrient loading within Lloyd's Bayou comes from both internal and external factors. The elevated bottom-water phosphorus is likely due to internal release of phosphorus from the lake sediments during periods of anoxic (oxygen-depleted) conditions. Elevated surface-water phosphorus is likely due to external loading from the greater watershed and residential shoreline areas. Clarity in the summer was poor and chlorophyll-*a* was high, indicating algae was likely the primary source of reduced clarity.

Lloyd's Bayou can be classified as eutrophic, having elevated phosphorus and chlorophyll-*a* concentrations and low clarity. It's highly productive state generates abundant aquatic plant and algae growth, which has been increasingly difficult to manage over the past several years. Management strategies to improve water quality and provide improved recreational capacity on the lake include the use of mechanical harvesting, which removes excess plant biomass from the lake. Currently, a permit application is in review to conduct harvesting efforts on Lloyd's Bayou. It is also recommended that residents implement best management practices such as natural shorelines, buffer strips, and reducing fertilizer use to help slow external nutrient loading into Lloyd's Bayou. Water quality monitoring efforts should continue to help compare yearly trends and determine if any alternative management strategies are needed.

* Summit Laboratory, 900 Godfrey Ave SW, Grand Rapids, MI 49503
* Prein and Newhof Laboratories, 3260 Evergreen Dr NE, Grand Rapids, MI 49525

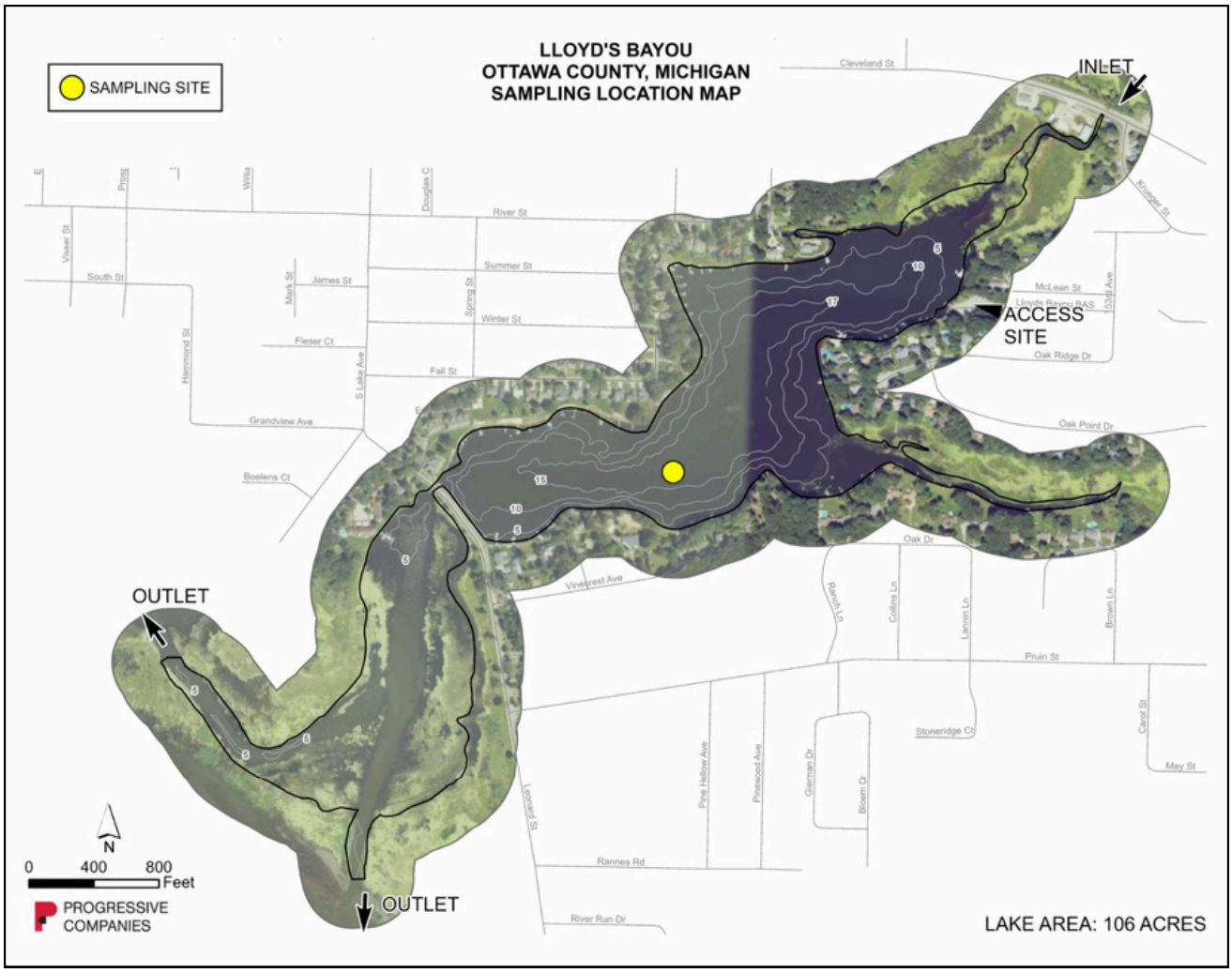

LLOYD'S BAYOU
OTTAWA COUNTY, MICHIGAN
SAMPLING LOCATION MAP
SAMPLING SITE
INLET
ACCESS SITE
OUTLET
OUTLET
LAKE AREA: 106 ACRES
0 400 800 Feet
N
PROGRESSIVE COMPANIES
Cleveland St
River St
Summer St
Winter St
Fall St
Grandview Ave
Boelens Ct
Vinecrest Ave
Oak Dr
Oak Point Dr
Oak Ridge Dr
McLean St
Pruin St
Stoneridge Ct
May St
Rannes Rd
River Run Dr
Leonard St
Pine Hollow Ave
Pinewood Ave
Gieman Dr
Bloem Dr
Ranch Ln
Collins Ln
Lannin Ln
Brown Ln
Carol St
Kruger St
Douglas C
Spring St
Mark St
James St
South St
Visser St
Hammond St
S Lake Ave
Fleser Ct
Willis
Prosp

TABLE 2 - LLOYD'S BAYOU 2026 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (F)	Dissolved Oxygen (mg/L)*	Total Phosphorus (µg/L)*
7-Apr-26	1	1	46	11.7	<10
7-Apr-26	1	8	46	11.7	14
7-Apr-26	1	16	45	11.7	13
18-Aug-26	1	1	79	8.3	18
18-Aug-26	1	8	78	6.0	30
18-Aug-26	1	16	76	0.5	65

TABLE 3 - LLOYD'S BAYOU 2026 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (µg/L)*
7-Apr-26	1	3.5	ND
18-Aug-26	1	4.0	7.5

* mg/L = milligrams per liter = parts per million
* µg/L = micrograms per liter = parts per billion
ND = none detected

LLOYD'S BAYOU TROPHIC STATE

Carlson's Trophic State Index (TSI) was developed from mathematical relationships that allowed phosphorus, chlorophyll-*a*, and Secchi transparency readings to be converted to a numerical scale from 0 to 100, with increasing numbers indicating more productive lakes. Table 4 shows how the TSI can be used to rate the trophic state of Michigan lakes.

TABLE 4 - TSI INDEX FOR MICHIGAN

Trophic State	TSI Value
Oligotrophic	Less than 38
Mesotrophic	38 to 48
Eutrophic	Greater than 48

Based on water quality data collected in 2026, Lloyd's Bayou has a TSI value of 55, giving the lake its eutrophic classification. Average phosphorus concentrations in Lloyd's Bayou are within the mesotrophic threshold while chlorophyll-*a* values and clarity are within the eutrophic range. The TSI data are consistent with historical observations on clarity and macrophyte growth within Lloyd's Bayou.