September

2025

SPRING LAKE

WATER QUALITY SUMMARY

PREPARED FOR:
SPRING LAKE-LAKE BOARD
OTTAWA AND MUSKEGON COUNTIES, MI

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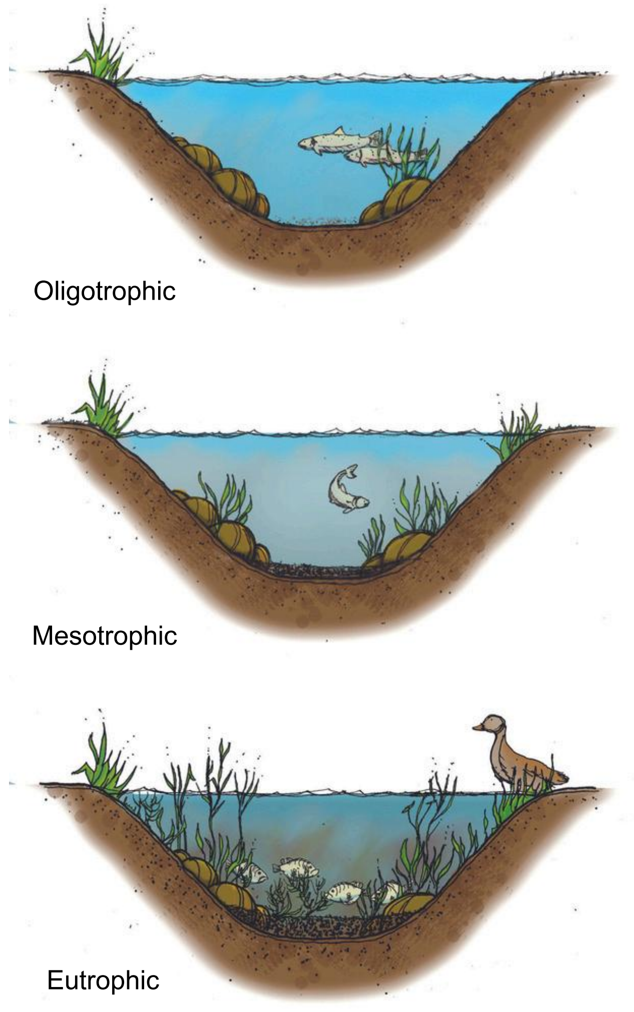
INTRODUCTION

Annual sampling to evaluate baseline water quality in Spring Lake has been ongoing since 1999. This report contains background information about lake water quality and a summary of 2025 sampling results. Historical sampling results for Spring Lake can be found on the Spring Lake – Lake Board website (www.springlakeboard.org).

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.

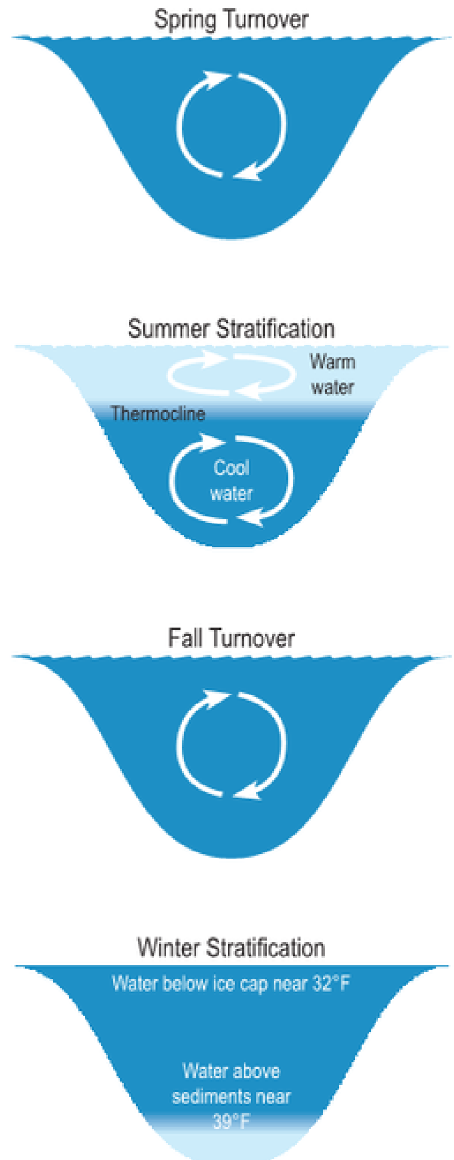
Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly 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. There are many ways to measure lake water quality, but there are a few important physical, chemical, and biological parameters that indicate the overall condition of a lake. These measurements include temperature, dissolved oxygen, total phosphorus, chlorophyll-*a*, and Secchi transparency.



Lake classification.

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.



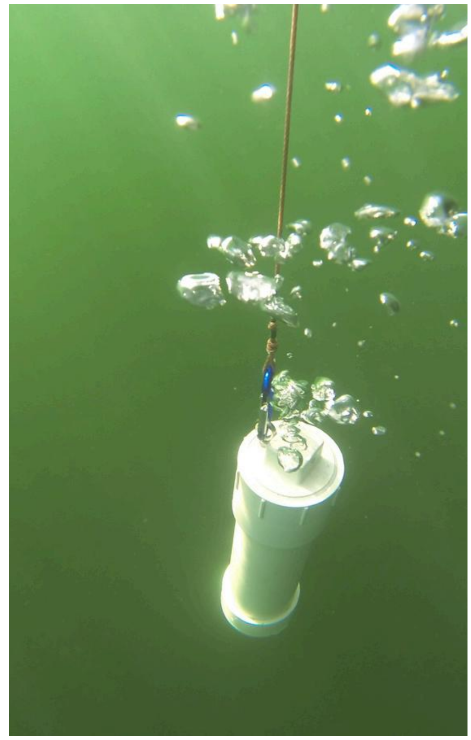
Seasonal thermal stratification cycles.

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.

PHOSPHORUS

The quantity of phosphorus present in the water column is especially important since 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, retaining phosphorus and, thus, making it unavailable for algae growth. However, if bottom-water oxygen is depleted, phosphorus will be released from the sediments and may be available to promote aquatic plant growth. In some lakes, the internal release of phosphorus from the bottom sediments is the primary source of phosphorus loading (or input). By reducing the amount of phosphorus in a lake, it may be possible to control the amount of aquatic plant 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 plant growth and are classified as nutrient-enriched or eutrophic.


Composite sampler.

CHLOROPHYLL

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

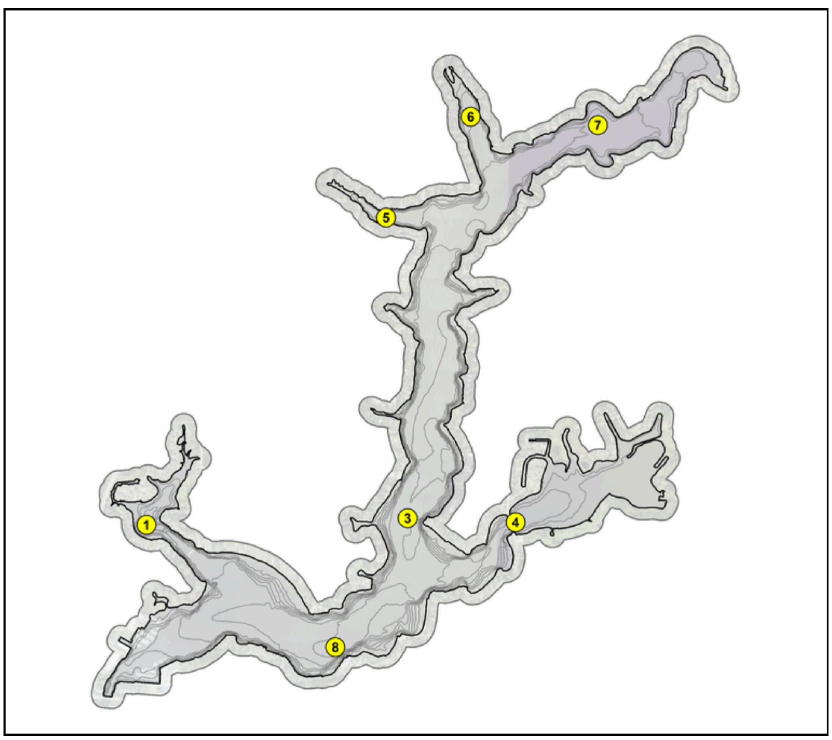
A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line. The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. 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.


Secchi disk.

SAMPLING RESULTS AND DISCUSSION

In 2025, samples were collected in the spring and summer at the surface, mid-depth and bottom from multiple locations in Spring Lake (map below). Sample results are presented in Tables 1 and 2. In April of 2025, sampling was conducted during spring turnover when water temperatures were cool and dissolved oxygen concentrations were high. During the August 2025 sampling period, Spring Lake exhibited thermal stratification, with the thermocline established at a depth of 19 feet. The surface of the lake was warm and well-oxygenated, while the deeper basin was cool and had low oxygen levels.

Phosphorus levels in Spring Lake in 2025 were dramatically reduced as a result of the alum treatment conducted on the lake immediately following the spring sampling in April. While the spring water quality sampling results (pre-alum treatment) were very similar to results observed in 2024, the August 2025 deep-water phosphorus concentrations were reduced by over 98% at Site 3 and over 92% at Site 8. Sites 3 and 8 are the deepest sampling locations in the lake and have historically exhibited the highest phosphorus concentrations in late summer. These high phosphorus concentrations in the late summer and early fall likely were a primary driver fueling late season algae blooms on Spring Lake over the past few years. The surface water quality during late summer of 2025 did show a 44% reduction in surface total phosphorus compared to 2024. Secchi transparency increased by 70% compared to 2024 and chlorophyll-*a* decreased by 48% compared to 2024 late season results. These results indicate that the spring alum treatment has moved Spring Lake's trophic status from eutrophic to meso-eutrophic. That is, Spring Lake exhibits some mesotrophic characteristics, moderate phosphorus and chlorophyll-*a* concentrations while exhibiting eutrophic Secchi transparency.



Spring Lake Sampling Location Map.


Alum application, May 2025.

TABLE 1 - SPRING LAKE 2025 DEEP BASIN WATER QUALITY DATA

Date	Station	Sample Depth (feet)	Temperature (F)	Dissolved Oxygen (mg/L)*	Total Phosphorus (ug/L)*
3-Apr-25	1	1	45	12.2	22
3-Apr-25	1	9	44	12.2	37
3-Apr-25	1	17	44	12.1	24
3-Apr-25	3	1	44	12.9	23
3-Apr-25	3	17	44	12.7	26
3-Apr-25	3	34	44	12.5	39
3-Apr-25	4	1	44	11.8	21
3-Apr-25	4	8	44	11.8	35
3-Apr-25	4	16	44	11.8	22
3-Apr-25	5	1	44	12.5	<10
3-Apr-25	5	8	44	12.5	11
3-Apr-25	5	16	44	12.2	19
3-Apr-25	6	1	44	12.2	10
3-Apr-25	6	7	44	12.2	21
3-Apr-25	6	14	44	12.1	12
3-Apr-25	7	1	44	11.7	19
3-Apr-25	7	8	44	11.7	13
3-Apr-25	7	17	44	11.6	33
3-Apr-25	8	1	44	12.4	59
3-Apr-25	8	19	44	12.5	26
3-Apr-25	8	39	44	12.4	18
18-Aug-25	1	1	80	9.8	27
18-Aug-25	1	9	80	9.8	<10
18-Aug-25	1	17	80	9.1	24
18-Aug-25	3	1	80	8.5	13
18-Aug-25	3	17	79	7.1	14
18-Aug-25	3	34	73	0.5	20
18-Aug-25	4	1	80	6.6	17
18-Aug-25	4	8	80	6.3	22
18-Aug-25	4	16	79	5.8	15
18-Aug-25	5	1	80	9.0	16
18-Aug-25	5	8	80	8.9	<10
18-Aug-25	5	16	80	8.9	14
18-Aug-25	6	1	80	9.3	21
18-Aug-25	6	7	80	9.2	<10
18-Aug-25	6	14	80	9.0	12
18-Aug-25	7	1	80	5.8	25
18-Aug-25	7	9	78	5.6	14
18-Aug-25	7	17	77	5.4	17
18-Aug-25	8	1	80	9.4	20
18-Aug-25	8	19	80	6.4	17
18-Aug-25	8	38	64	0.1	33

*mg/L = milligrams per liter = parts per million
*ug/L = micrograms per liter = parts per billion

TABLE 2 - SPRING LAKE 2025 SURFACE WATER QUALITY DATA

Date	Station	Secchi Transparency (feet)	Chlorophyll-*a* (ug/L)*
3-Apr-25	1	4.0	4
3-Apr-25	3	4.5	5
3-Apr-25	4	5.5	3
3-Apr-25	5	5.0	5
3-Apr-25	6	ND	3
3-Apr-25	7	3.5	3
3-Apr-25	8	4.0	6
18-Aug-25	1	4.0	5
18-Aug-25	3	5.5	6
18-Aug-25	4	4.5	8
18-Aug-25	5	4.5	4
18-Aug-25	6	4.5	4
18-Aug-25	7	5.0	4
18-Aug-25	8	4.5	6

*ug/L = micrograms per liter = parts per billion
*ND = no data collected