Report:
Water quality data from monthly sampling at Bass Lake

Photo credit: Bass Lake Property Owners Association

Prepared for:
Bass Lake Conservancy District
Knox, IN

Prepared by:
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Report Date: September 3, 2026

1. Summary

Aquatic Control completed data and sample collection at Bass Lake on August 20, 2026. Three open-water sites were sampled for water quality (see map and coordinates on page 2). At each of these three sites, a YSI ProDSS Multi-parameter water quality meter and ProDSS 4-port sensor cable were used to measure vertical profiles of pH, dissolved oxygen (DO), temperature, conductivity, phycocyanin, and chlorophyll-*a* at 1-meter intervals through the water column. Secchi depth was also measured at each sampling site. Water samples were collected at the surface and bottom of each site and overnight shipped to Aquatic Control's laboratory. Surface water samples were analyzed for total phosphorus, total nitrogen, total Kjeldahl nitrogen, and chlorophyll-*a* (via extraction and fluorescence). Bottom water samples were analyzed for total phosphorus and soluble reactive phosphorus. A sample was also collected from the groundwater pumphouse outflow for analysis of pH, DO, temperature, conductivity, phycocyanin, and chlorophyll-*a* using the multi-parameter sonde, while water samples were analyzed in the laboratory for total phosphorus, total nitrogen, total Kjeldahl nitrogen, and chlorophyll-*a* (via extraction and fluorescence). Five near-shoreline sites were also visited within the lake to collect water samples for analysis of algal identification and enumeration in the laboratory.

At the time of sampling August 20, 2026, Bass Lake was weakly stratified based on dissolved oxygen and temperature data. pH, conductivity, and dissolved oxygen were all within normal ranges for a freshwater lake in the summer. Algal pigments remain elevated, similar to the prior sampling event. Phosphorus concentrations decreased substantially relative to the prior sampling event. Nitrogen concentrations remained stable relative to the prior sampling events so far this summer. Secchi depths at all three sampling sites decreased slightly relative to measurements from July. Samples collected from shoreline sites for algae identification and enumeration showed much lower densities of cyanobacteria, likely due to the heavy rain events that took place around the time of this sampling event. Since growth of cyanobacteria was lower overall, toxin testing was not conducted.

2. Sampling Site Information

Sample Site Coordinates

Sample Site	Latitude	Longitude
Site 1- Water Quality	41.2136	-86.5942
Site 2- Water Quality	41.2251	-86.5836
Site 3- Water Quality	41.2357	-86.5765
Pumphouse Outflow	41.2298	-86.5759
Site 1- Algae ID&E	41.2120	-86.6113
Site 2- Algae ID&E	41.2242	-86.6015
Site 3- Algae ID&E	41.2216	-86.5791
Site 4- Algae ID&E	41.2312	-86.5867
Site 5- Algae ID&E	41.2409	-86.5742

3. Results

3.1 pH

pH is the measure of how acidic or basic water is, reported in standard units (S.U.). A pH of 7 is neutral, and a range of 6-9 is typical for freshwater. A pH range of 6.5-9 is required for health and protection of aquatic organisms (i.e., survival, growth, and reproduction).

Results:

pH levels measured in the open water sites at Bass Lake ranged from about 8.78 (highest value measured) at the water surface down to about 6.24 (lowest value measured at the bottom of the water column). pH in the pumphouse water was 7.38 (see Table 1 and Figure 1 for results). Therefore, pH levels in Bass Lake were on the higher end of normal range at the water surface, and the groundwater flowing into the lake was closer to neutral. Common factors that contribute to higher pH in lakes can include high photosynthetic activity by plants and algae (including algae blooms), and relatively higher alkalinity or carbonate geology in the lake or watershed. Higher pH levels are not inherently a problem or unusual but can be an indicator of eutrophication if levels are higher in the afternoon and lower in the early morning. Lower pH values at the lake bottom are often due to a combination of respiration by photosynthetic organisms and bacterial decomposition of organic matter.

3.2 Dissolved Oxygen

Dissolved oxygen (DO) is the amount of oxygen gas that is mixed into water and available for aquatic organisms to breathe. DO is considered an important metric for water quality since it is essential for survival of aquatic life. Changes in DO can occur for several reasons including changes in water temperature, wind action, and biomass of plants and algae in a lake. When plants and algae respire overnight, this process consumes oxygen. When these organisms are conducting photosynthesis during the daytime, this process produces oxygen. Thus, heavier growth of plants or algae will have a proportionally higher influence on DO swings each day. Warmer water can hold less oxygen, so summer months tend to see lower DO levels, while colder months will see higher DO levels. Bacterial decay of detritus and other organic matter in sediments consumes oxygen, so DO levels are often lowest at the bottom of the water column, especially when a lake stratifies. The most beneficial method for evaluating DO in lakes is to measure vertical profiles in the water column from surface to bottom, along with water temperature (as an explanatory parameter) to discern the amount of oxygen being consumed towards the bottom of the water column due to degradation of organic matter in sediments. By doing this, we can determine the amount of oxygen available to fish and the fraction of the water column that is habitable by fish during warmer summer months. DO of less than 2 mg/L is considered hypoxic (i.e., low or depleted oxygen), while DO between 3 and 5 mg/L can be stressful for sensitive organisms including larger fish, and DO greater than 5 mg/L is considered generally healthy. DO greater than 8 mg/L is considered optimum for aquatic organism health. However, super-saturated DO levels can be attributed to cyanobacteria blooms and are not necessarily representative of stable conditions.

Results:

At the time of sample and data collection, DO levels ranged from 9.26 mg/L (highest value measured) at the surface to 0.97 mg/L (lowest value measured) at the bottom (Table 3 and Figure 3). These measurements were collected between 2:15 PM at Site 1 through about 3:30 PM at Site 3. Dissolved oxygen levels resumed a similar stratification pattern to that of measurements taken in June. Temperature profiles ranged from about 27.2 degrees Celsius at the surface, down to 23.8 degrees Celsius at the bottom of the water column, indicating slight thermal stratification at these open water sites at the time sampled (Table 2 and Figure 2). DO in the groundwater outflow was 3.33 mg/L at 13.7 degrees Celsius. Thus, the groundwater is more oxygen-depleted when it enters the lake, but it does not appear to be negatively influencing lake-wide DO since it is a relatively small volume being added daily compared to the volume of the lake. Overall, these data indicate that at the time of collection, DO levels were generally good and supportive for aquatic organisms in most or all of the water column, with some slight oxygen depletion occurring at the bottom.

3.3 Conductivity

Conductivity is a measure of water's ability to pass an electrical charge. This is directly related to the concentration of dissolved ions in the water (e.g., calcium, magnesium, sodium, potassium, sulfate, and chloride). Conductivity is measured in µS/cm. In freshwater bodies, a conductivity less than 100 µS/cm is considered low, between 100 and 1,000 µS/cm is considered normal for freshwaters, and greater than 1,000 µS/cm may not be tolerable for fish and aquatic invertebrates.

Results:

Conductivity ranged from about 251.2 µS/cm at the water surface, up to 777.7 µS/cm at the bottom of the water column (Table 4 and Figure 4). Conductivity in the groundwater outflow was 460.6 µS/cm. All measurements were within normal range for freshwater. The higher conductivity levels measured at the lake bottom are typical due to respiration, bacterial decomposition, and release of ions from sediments due to anoxia at the sediment-water interface.

3.4 Phycocyanin

Phycocyanin is a blue-colored pigment produced in cyanobacteria for photosynthesis. This pigment is mostly unique to cyanobacteria, so it can often be used as a screening-level measurement for detection of these organisms in water. While chlorophyll-*a* (pigment discussed below) is a more standardized metric for algal productivity in water, phycocyanin measurements are useful to discern the relative proportion of cyanobacteria within an algal assemblage. These data can be used to prompt further investigation with manual water sampling, algal identification and enumeration, and toxin testing where appropriate.

<u>Results:</u>

Phycocyanin fluorescence values ranged from about 0.42 RFUs at the water surface up to about 28.3 RFUs at the bottom of the water column among the three open water sites (Table 5 and Figure 5). Higher levels in bottom waters at all 3 open water sites suggest algal growth may be occurring near the sediment layer. Phycocyanin was at 0 RFU in the groundwater outflow, indicating no pigment in that water. Overall, levels of phycocyanin in the open water have remained relatively stable over the summer.

3.5 Chlorophyll-a

Chlorophyll-*a* is a pigment produced by plants and algae that is used to conduct photosynthesis. Measurements in water provide an estimate of the amount of planktonic (i.e., free-floating) algae and cyanobacteria present and can serve as a metric of productivity in water at that point in time. Chlorophyll-*a* measurements are used as a core metric in determining trophic state of lakes, along with nutrient levels. For example, oligotrophic (low productivity systems) lakes generally have chlorophyll-*a* levels of less than 3 µg/L, while hypereutrophic systems may routinely experience chlorophyll-*a* levels of greater than 40 µg/L. It is important to note that these designations should not be derived from one-time measurements, but rather trends over time. For example, a lake may experience a temporary algal bloom and experience high chlorophyll-*a* levels but does not technically fall under the definition of a hypereutrophic lake. Thus, it is important to use this measurement as a line of evidence in tandem with other water quality parameters.

<u>Results:</u>

Concentrations of chlorophyll-a measured with the in-situ sonde ranged from 0.62 RFUs at the surface to 19.5 RFUs at the bottom of the water column. Actual concentrations of chlorophyll-*a* (when extracted and analyzed in the lab) ranged from 36.9 to 58.9 (Table 7).

3.6 Total Phosphorus

Phosphorus is an essential nutrient often correlating with algae growth. Total phosphorus (TP) is the measure of all phosphorus in a sample, reported in µg/L, and includes phosphorus that is readily available for algae and plant growth, as well as phosphorus that has potential to become available. The total phosphorus concentration in an aquatic system is often correlated with the trophic state of water. For example, < 12 µg/L is considered oligotrophic and is often characterized by clear water with little plant or algae growth; 12-24 µg/L is considered mesotrophic and is characterized by moderately clear water with some algae; 25-96 µg/L is considered eutrophic and is characterized by productive waters with algae and plants; > 96 µg/L is considered hypereutrophic (highly productive) and is characterized by frequent algal blooms.

Again, these ranges are generalized, and site-specific data should be interpreted in context with other water quality data and lake assessments of productivity. It is helpful to measure phosphorus in both the surface water and bottom of the water column to discern if there is evidence of phosphorus loading into the water column from sediments. Evidence of this would include significantly higher phosphorus concentrations at the bottom of the water column, especially when a lake is stratified.

Results:

Total phosphorus concentrations were below the detection limit for the tests performed in both surface and bottom water samples, but estimated concentrations ranged from 17 to 25 µg/L in the surface water (Table 7) among Sites 1-3. In the bottom water, estimated concentrations (estimated since levels were below detection limits) of total phosphorus ranged from 6-12 µg/L (Table 8). The pumphouse water had a total phosphorus concentration of less than 50 µg/L, with an estimate of 21 µg/L (Table 7). Total phosphorus levels have decreased substantially since sampling in July.

3.7 Soluble Reactive Phosphorus

Soluble reactive phosphorus (SRP) is the form of phosphorus in water that is dissolved in water and immediately available for uptake by plants and algae to use for growth. Most of SRP consists of orthophosphate, which is an inorganic form of phosphorus and is the simplest, most biologically available. Since SRP is readily usable, measurement of this parameter can help inform whether there is potential risk for rapid growth of cyanobacteria and algae, as well as reduced water clarity. While there are no universally adopted ranges of SRP that are considered normal/healthy since this form fluctuates often, it is helpful when interpreted in context with total phosphorus concentrations and other water quality parameters. Measurement of SRP is most beneficial in bottom water samples as another line of evidence to discern if lake sediments are a major source of phosphorus release, transformation, and recycling. Surface water dynamics can mask SRP since there is a higher chance for algae in the water to immediately take up the phosphorus, thus this measurement is not as useful in surface water.

Results:

SRP concentrations in bottom waters were less than 10 µg/L at all sites sampled within the lake. The pumphouse water had a concentration of 25 µg/L (Table 8). These concentrations have decreased back to low levels since the prior sampling event in July.

3.8 Total Nitrogen

Nitrogen is an essential nutrient that can enhance growth of algae and plants, measured as total nitrogen (TN) in mg/L. Total nitrogen is the combined amount of all forms of inorganic nitrogen (ammonia, nitrite, nitrate) and organic nitrogen (forms found in animal and plant matter). Nitrogen is usually not a limiting nutrient in aquatic systems but is often compared to total phosphorus levels which can inform whether a lake is more nitrogen-limited or phosphorus-limited. In general, nitrogen levels less than 0.3 mg/L are consistent with nutrient-poor waters, levels between 0.3 and 1 mg/L are considered moderate, levels between 1-2 mg/L are considered a potential eutrophication risk (when interpreted along with phosphorus), and levels greater than 2 mg/L often correlate with highly nutrient enriched systems.

Results:

Total nitrogen concentrations in surface water samples ranged from 1.57 to 2.01 mg/L among the open water sites, while the groundwater had a concentration of 1.58 mg/L (Table 7). When interpreted alongside total phosphorus data, these nitrogen levels are slightly elevated, but common for lakes in the Midwest. Also importantly, these concentrations have remained stable over a few months. Therefore, nitrogen loading has not appeared to increase in the lake so far over the summer.

3.9 Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) is a measurement of the sum of organic-N and ammonia-N in water. TKN represents much of the nitrogen tied up in organic matter, which can include nitrogen in algae, plants, and organic debris, as well as in the ammonia form. High TKN levels may provide evidence of runoff containing manure or fertilizers, wastewater influence, decaying organic matter, or dense algae/aquatic vegetation. Organic-N and ammonia-N can both be transformed by bacteria over time into other forms of nitrogen, providing insight into the nitrogen cycle in the lake sampled.

Results:

TKN concentrations ranged from 1.39 to 1.83 mg/L (Table 7) in surface water among the open water sites. The TKN in the groundwater was 1.45 mg/L (Table 7). TKN was the most abundant form of nitrogen in the samples, indicating that there was very little nitrate and nitrite in the water and most of the nitrogen was either in organic form or as ammonia. This means that the nitrogen pool in the lake is currently dominated by algal biomass, dissolved organic nitrogen, particulate organic matter, and reduced nitrogen forms which is common for biologically active lakes.

3.10 Secchi Depth

Secchi depth is a simple measurement for water clarity in a lake. It is determined by using a piece of equipment called a Secchi disc which is a circular disc painted in alternating black and white quadrants, attached to a rope that is lowered down into the water. Secchi depth is defined as the depth of water at which the disc disappears from view as it is lowered. Therefore, a lower Secchi depth indicates highly turbid or algae-dense water, while a higher Secchi depth indicates clearer water. In general, Secchi depths of less than 1 meter (3.3 feet) indicate eutrophic or hypereutrophic conditions, while depths of greater than 6 meters (19.7 feet) would be indicative of clear water and low productivity systems. However, these ranges vary by region.

<u>Results:</u>

Secchi depth was approximately 2 feet among the three open water sites on the day of sampling (Table 9). These Secchi depths measured on August 20, 2026 were slightly less than those measured in July in the same areas, noting a decrease in water clarity.

3.11 Algal Analysis

The purpose for algal analysis at Bass Lake was to discern the types and relative densities of planktonic cyanobacteria and/or algae. Surficial water samples were collected from five sites within the lake closer to the shoreline. Planktonic algae (especially cyanobacteria) are more likely to be found in shallow, stagnant, and wind-blown shoreline areas in lakes, especially in larger lakes. Therefore, it was important to analyze sites closer to shoreline for algal densities to ensure that if growth was present, it was detected. Sampling only in open water sites could result in false negatives. Samples were analyzed in the laboratory using a light microscope and standardized enumeration methods.

<u>Results:</u>

There were three dominant genera of cyanobacteria identified in the samples. These included 1) *Limnothrix*, a potential producer of the group of toxins microcystins; 2) *Raphidiopsis*, a potential producer of the group of toxins cylindrospermopsins, and 3) *Aphanocapsa*, a genus not correlated with toxin production. Even though these genera were detected in all samples, total cell densities (i.e., amount of growth) were relatively low, likely due to recent heavy rain events. Total cell densities of the planktonic algal assemblages ranged from 3,540 to 15,160 cells/mL. These are the lowest densities observed throughout the season. Toxin production becomes measurable at higher cell densities of cyanobacteria, and therefore toxin testing was not conducted on these samples.

Table 1. pH measurements (reported in standard units) collected with depth on August 20, 2026. Pumphouse outflow water was collected in a bucket for measurement with sonde.

Depth (m)	Site 1	Site 2	Site 3	Pumphouse
0	8.78	8.78	8.73	7.38
1	8.79	8.78	8.76	
2	8.82	8.80	8.79	
3	8.65	8.82	8.79	
4	8.46	8.77	8.54	
5	7.75	8.76	8.37	
6	6.97	8.72	6.28	
7		8.33		
8		6.24		

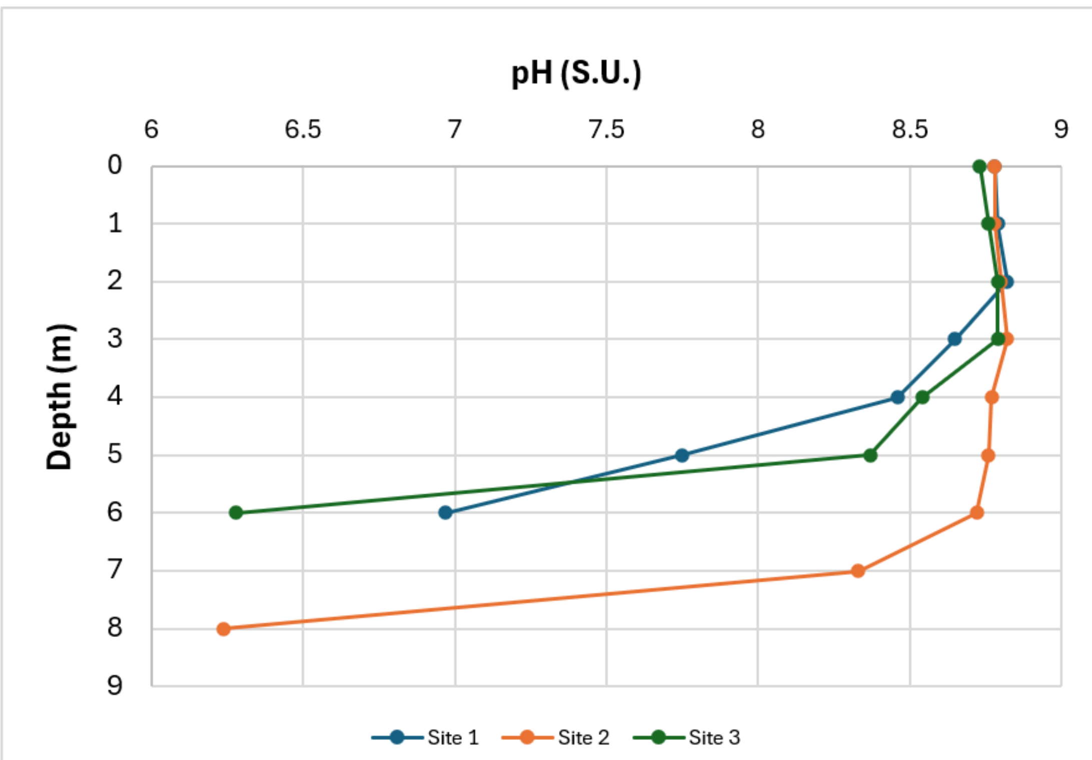

Figure 1. Graph of pH measurements (reported in standard units) collected with depth on August 20, 2026. Pumphouse measurement only reported in Table 1.

Table 2. Temperature measurements (reported in degrees Celsius) collected with depth on August 20, 2026. Pumphouse outflow water was collected in a bucket for measurement with sonde.

Depth (m)	Site 1	Site 2	Site 3	Pumphouse
0	27.2	27.0	27.0	13.7
1	27.2	26.8	26.9	
2	26.7	26.4	26.1	
3	25.2	26.0	25.5	
4	25.0	25.4	25.4	
5	24.9	25.4	25.2	
6	24.5	25.3	24.2	
7		25.1		
8		23.9		

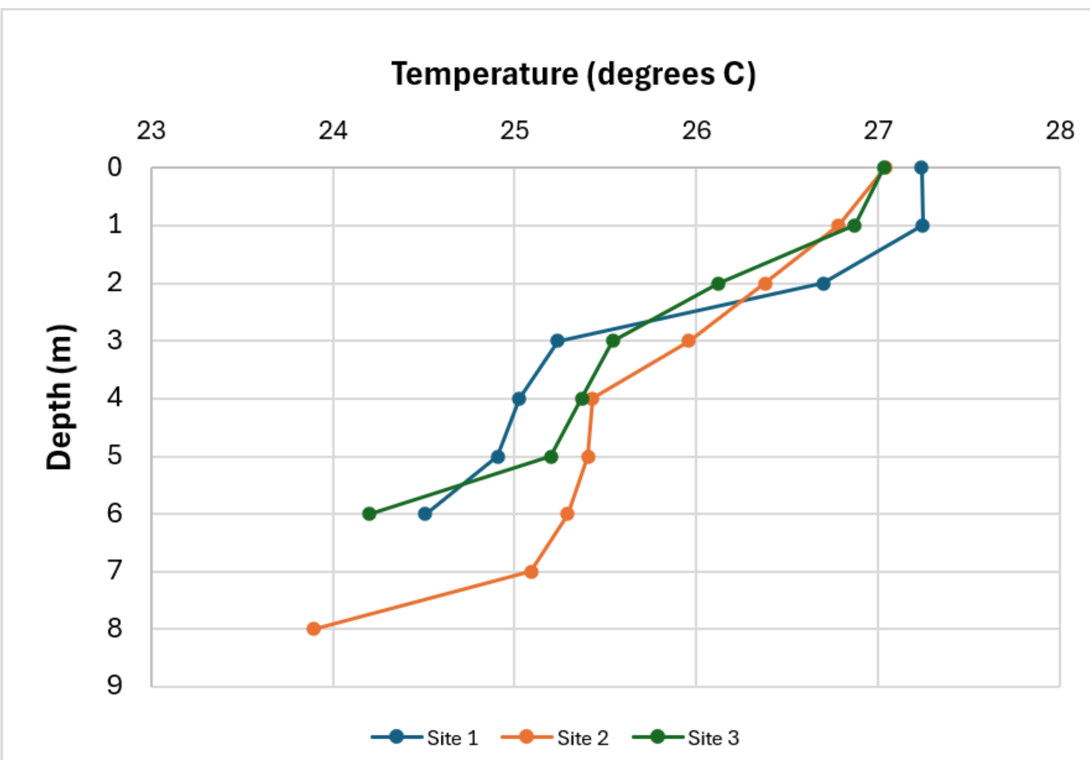

Figure 2. Graph of temperature measurements (reported in degrees Celsius) collected with depth on August 20, 2026. Pumphouse measurement reported in Table 2.

Table 3. Dissolved oxygen measurements (reported in mg/L) collected with depth on August 20, 2026. Pumphouse outflow water was collected in a bucket for measurement with sonde.

Depth (m)	Site 1	Site 2	Site 3	Pumphouse
0	9.04	9.26	8.92	3.33
1	9.23	9.45	9.21	
2	9.58	9.59	9.36	
3	8.45	9.68	9.39	
4	7.43	9.26	8.61	
5	3.36	9.21	7.60	
6	0.97	8.56	1.86	
7		7.23		
8		1.96		

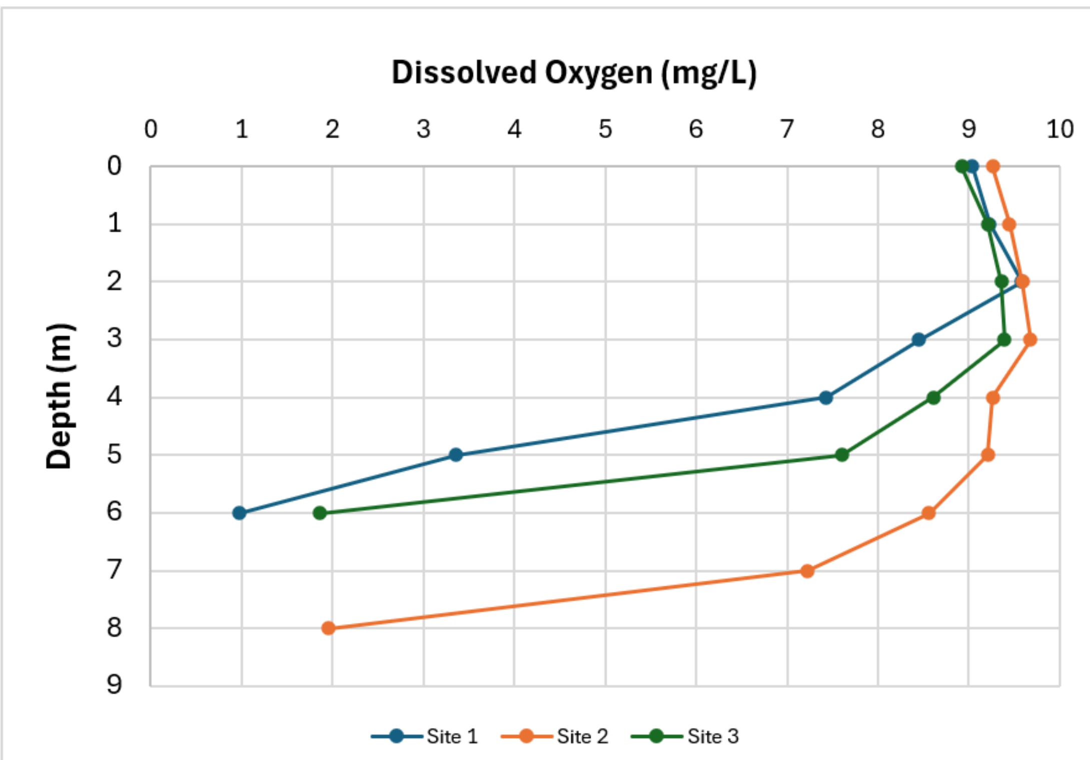

Figure 3. Graph of dissolved oxygen measurements (reported in mg/L) collected with depth on August 20, 2026. Pumphouse measurement reported in Table 3.

Table 4. Conductivity measurements (reported in µS/cm) collected with depth on August 20, 2026. Pumphouse outflow water was collected in a bucket for measurement with sonde.

Depth (m)	Site 1	Site 2	Site 3	Pumphouse
0	251.2	254.9	256.2	460.6
1	251.4	252.9	255.0	
2	247.8	250.1	250.5	
3	244.9	247.2	247.6	
4	245.5	245.2	248.6	
5	256.9	245.2	250.6	
6	449.6	245.5	777.7	
7		249.7		
8		506.8		

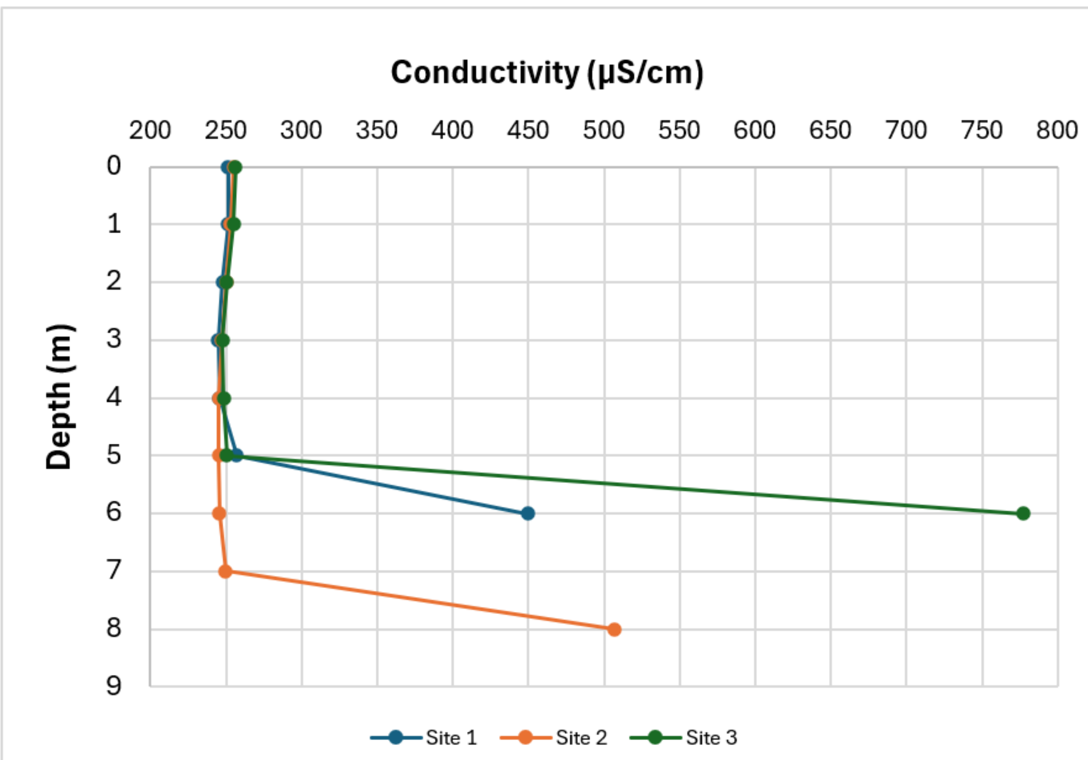

Figure 4. Graph of conductivity measurements (reported in µS/cm) collected with depth on August 20, 2026. Pumphouse measurement reported in Table 4.

Table 5. Phycocyanin measurements (reported in relative fluorescence units; RFUs) collected with depth on August 20, 2026. Pumphouse outflow water was collected in a bucket for measurement with sonde.

Depth (m)	Site 1	Site 2	Site 3	Pumphouse
0	0.52	0.42	0.87	0.00
1	0.63	0.62	1.01	
2	1.06	0.88	1.20	
3	2.02	1.00	1.49	
4	2.91	1.33	1.91	
5	7.65	1.41	2.43	
6	26.53	1.75	28.34	
7		3.97		
8		8.69		

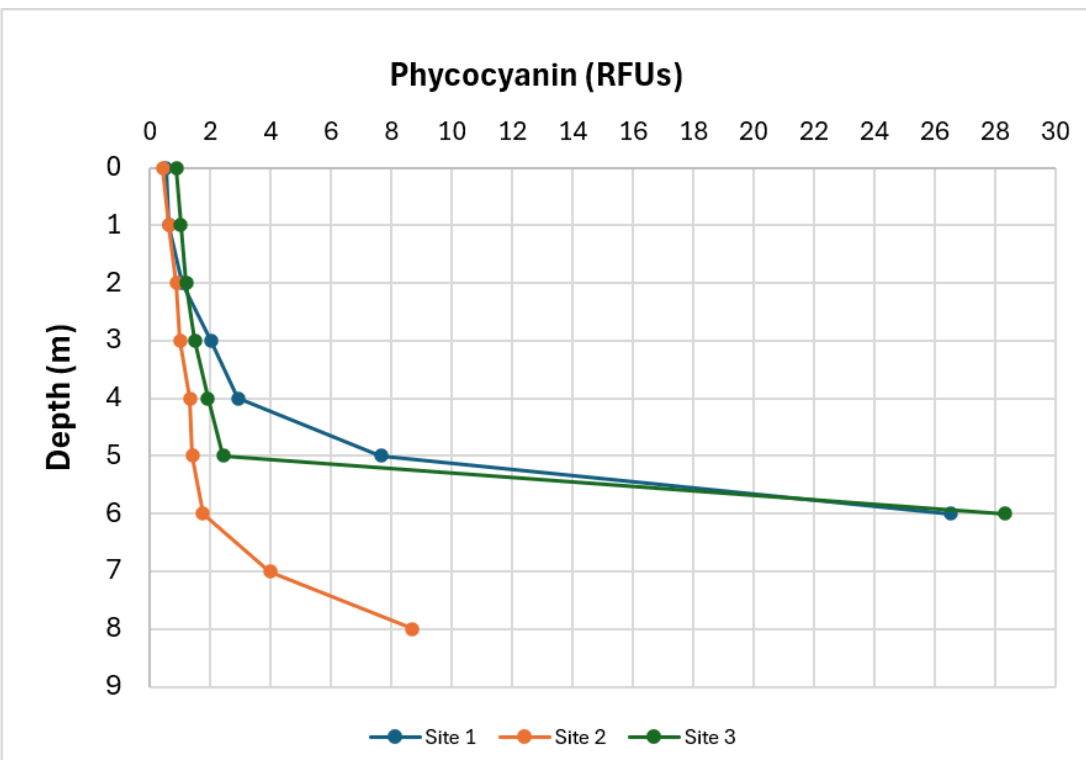

Figure 5. Graph of phycocyanin measurements (reported in relative fluorescence units; RFUs) collected with depth on August 20, 2026. Pumphouse measurement reported in Table 5.

Table 6. Chlorophyll-*a* measurements (reported in relative fluorescence units; RFUs) collected with depth on August 20, 2026. Pumphouse outflow water was collected in a bucket for measurement with sonde.

Depth (m)	Site 1	Site 2	Site 3	Pumphouse
0	0.62	0.62	0.77	0.07
1	0.91	1.09	1.13	
2	1.59	1.56	1.96	
3	3.12	1.89	2.52	
4	4.15	2.41	2.88	
5	8.37	2.52	3.20	
6	16.99	2.66	19.47	
7		5.06		
8		6.83		

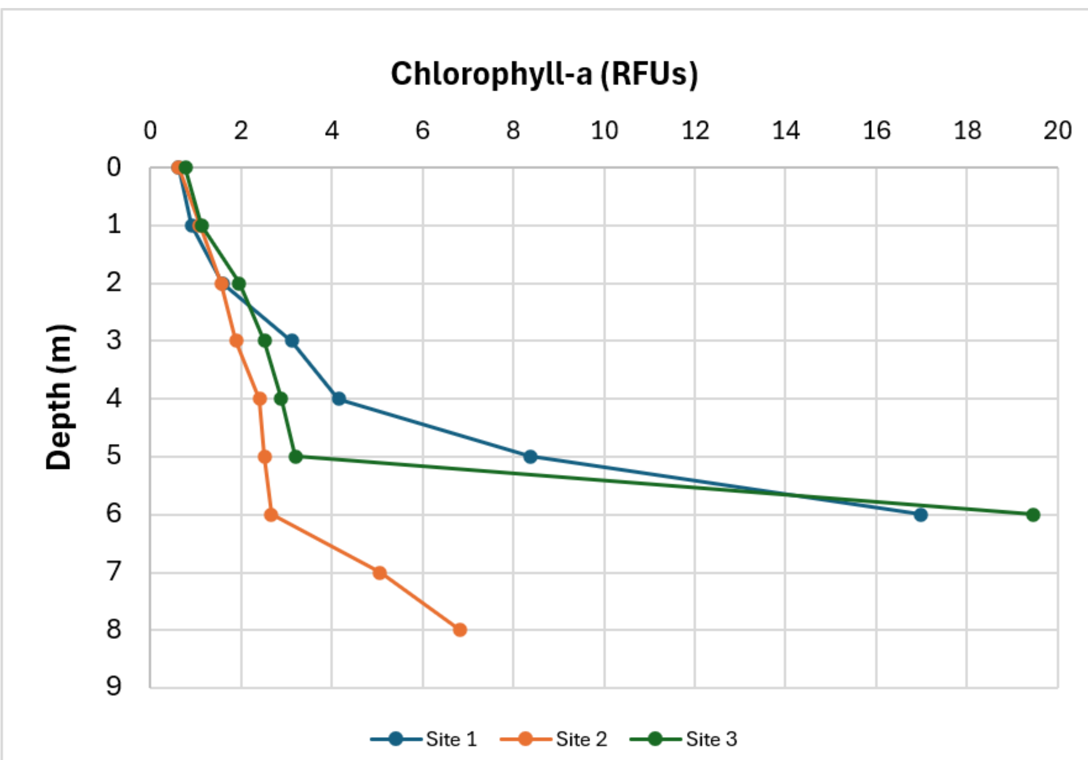

Figure 6. Graph of chlorophyll-a measurements (reported in relative fluorescence units; RFUs) collected with depth on August 20, 2026. Pumphouse measurement reported in Table 6.

Table 7. Nutrient and pigment data from surface samples collected at Bass Lake on August 20, 2026. Pumphouse sample not analyzed for chlorophyll-a since sonde detected near zero concentration in field sampling.

Sample ID	Total Phosphorus (µg/L)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Chlorophyll-a (µg/L)
Site 1	< 50 (17)*	1.57	1.39	54.5
Site 2	< 50 (25)*	2.01	1.81	36.9
Site 3	< 50 (23)*	1.99	1.83	58.9
Pumphouse	< 50 (21)*	1.58	1.45	n/a

*Concentration below detection limit. Estimated concentration in parentheses.

Table 8. Water quality data from bottom samples and pumphouse sample collected at Bass Lake on August 20, 2026

Sample ID	Total Phosphorus (µg/L)	Soluble Reactive Phosphorus (µg/L)
Site 1	< 50 (12)	< 10 (0)
Site 2	< 50 (6)	< 10 (0)
Site 3	< 50 (7)	< 10 (1)
Pumphouse	< 50 (21)	25

*Concentration below detection limit. Estimated concentration in parentheses.

Table 9. Secchi depth measurements collected at Bass Lake on August 20, 2026

Sample Site	Secchi Depth (feet)
Site 1	2’
Site 2	2’
Site 3	2’

Table 10. Algal identification and enumeration results

Site ID	Genus (Taxonomic Class)	Cell Density by Genus (cells/mL)	Total Cell Density (cells/mL)
Site 1	*Limnothrix sp*. (Cyanophyceae)	1,090	3,540
	Raphidiopsis sp. (Cyanophyceae)	2,370	
	Fragilaria sp. (Bacillariophyceae)	80	
Site 2	*Aphanocapsa sp.* (Cyanophyceae)	980	5,340
	Limnothrix sp. (Cyanophyceae)	2,950	
	Raphidiopsis sp. (Cyanophyceae)	1,270	
	Fragilaria sp. (Bacillariophyceae)	140	
Site 3	*Limnothrix sp*. (Cyanophyceae)	3,880	10,380
	Raphidiopsis sp. (Cyanophyceae)	6,370	
	Fragilaria sp. (Bacillariophyceae)	130	
Site 4	*Limnothrix sp*. (Cyanophyceae)	2,870	6,220
	Raphidiopsis sp. (Cyanophyceae)	3,350	
Site 5	*Limnothrix sp*. (Cyanophyceae)	6,420	15,160
	Raphidiopsis sp. (Cyanophyceae)	8,200	
	Fragilaria sp. (Bacillariophyceae)	210	
	Coelastrum sp. (Chlorophyceae)	330	

Note: Cyanophyceae is the taxonomic class that includes cyanobacteria (i.e., "blue-green algae"). Bacillariophyceae is the taxonomic class that includes diatoms (non-harmful algae). Chlorophyceae is the taxonomic class that includes green algae (non-harmful algae).

All data presented in this report met QA/QC criteria unless otherwise specified here.

Field Notes and Data Sheet
Bass Lake; Knox IN

Sample Date: 8/20/26
Analyst: Malena R + Laura S.
Notes on weather: Sunny, 79°F, SE 6 Wind Speed

Approximate time of sample/data collection:

Open Water Site 1: 2:11 pm CST

Open Water Site 2: 3:01 PM CST

Open Water Site 3: 3:33 pm CST

Pumphouse: 3:53 pm CST

Algae Site 1: 1:37 pm CST

Algae Site 2: 1:50 pm CST

Algae Site 3: 2:52 pm CST

Algae Site 4: 3:17 pm CST

Algae Site 5: 3:26 pm CST

Secchi Depth Measurements:

Site ID	Secchi Depth (ft)
Open Water Site 1	2 ft
Open Water Site 2	2ft.
Open Water Site 3	2ft.

Observations: Sunny day, wind is decent, water level of lake is up, lots of boaters & Jet ski'ers out