2015 Water Quality Monitoring Report
Matteson Lake
Branch County, Michigan

Prepared for:
Twin Lakes of Matteson Association

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Executive Summary

In May to September 2015, the Matteson Lake Association Water Quality Committee conducted a series of measurements designed to monitor water quality within Matteson Lake and its primary drainage inlet and outlet in Branch County, Michigan. Water quality indicators measured for this study included nitrogen, phosphorus, suspended solids, *E. coli* bacteria, and chlorophyll-A. In addition, water temperature, dissolved oxygen, and pH profiles were measured near the center of the lake during June, July, and August. Variation in these parameters over the summer of 2015 is documented in this report.

Water samples were collected on nine separate occasions during 2015. Samples of water flowing into and out of the lake were collected at the M-86 bridge and Butz Road weir, respectively. Nutrient (total nitrogen and phosphorus), suspended solids, and chlorophyll-A samples were also taken from a central location near the deepest part of the lake. In-lake samples for fecal bacteria (*E. coli*) analysis were taken at five locations around the perimeter of the lake, as well as at the lake inlet and outlet.

Nitrogen and phosphorus concentrations at the inlet were 30 to 40% higher than nitrogen and phosphorous exiting the lake at its outlet. Lower nutrient concentrations in water flowing out of the lake suggest that: 1) nutrient loading from the watershed exceeds loading from lawns or septic fields on developed parcels along the lakeshore, and 2) some portion of the nutrients delivered from watershed are stored or consumed by plants and algae within the lake.

Total suspended solids measurements indicated that water within and flowing out of Matteson Lake has a higher concentration of suspended solids than water entering the lake through the inlet stream. This suggests that wave action from wind and motor boat activity on Matteson Lake contribute to the suspension of silts and clays that make the water turbid during summer months.

Over the past decade, trophic state index (TSI) conditions in Matteson Lake have fluctuated within eutrophic (nutrient-rich) levels without a clearly discernable trend. In 2015, TSI estimates confirmed that Matteson Lake remained eutrophic. The consistency of TSI estimates in June, July, and August of 2015 indicates that single measurements made in prior years likely provide a reasonable estimate of water quality conditions throughout each prior summer.

Recommendations for 2016 include continued lake and watershed water quality monitoring, formal surveying of abundance and diversity of aquatic plants within the lake, and expanded partnership with residents, local government officials, and federal conservation officers who share an interest in improving water quality in Matteson Lake and its surrounding watershed. Efforts to reduce watershed and lakefront nutrient loading (phosphorus, in particular) and to employ natural shoreline stabilization methods are strongly encouraged.

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1.0 Introduction and Background

1.1 Scope and Objectives

For more than a decade, the Twin Lakes of Matteson Association (aka Matteson Lake Association) has funded annual studies to monitor the quality of water in Matteson Lake and its surrounding watershed. Concerns include a lack of water clarity, presence of fecal bacteria, eutrophication resulting from excess nutrients, algal blooms, invasive weeds including Eurasian watermilfoil, and a lack of diversity among aquatic plants populating the lake. This report summarizes findings from monitoring conducted by members of the Matteson Lake Association Water Quality Committee from May to September 2015. It adds to a growing body of information documenting water quality trends and contributes to ongoing efforts to manage and improve the lake.

The primary objective of monitoring in 2015 was to establish a regular series of water quality measurements within the lake and at the primary inlet and outlet where surface water enters and exits the lake. The Water Quality Committee wanted to determine how parameters varied from month to month over the course of a summer season, when the lake experiences its highest levels of recreational activity. Water quality indicators for this study included nitrogen, phosphorus, suspended solids, *E. coli* bacteria, and chlorophyll A. In addition, temperature, dissolved oxygen, and pH profiles were measured near the center of the lake during June, July, and August.

1.2 Background

Matteson Lake covers approximately 256 acres in sections 22, 23, 26, and 27 of Matteson Township, Branch County, Michigan. The lake has an average depth of 20 feet (6 m) and a maximum depth of 39 feet (12 m). At its widest point, Matteson Lake is approximately ½ mile wide and stretches more than 1 mile in length. The long axis of the lake is oriented northeast-southwest and a shallow sill separates the main body of the lake to the northeast from a smaller 'Little Lake' to the southwest. Approximately 50 percent of the lake shoreline is developed with a combination of seasonal cottages and year round residences. The remainder is natural shoreline consisting of wetlands and forest. Matteson Lake supports a mixture of recreational activities including swimming, fishing, boating, and waterskiing.

Matteson Lake is fed primarily by water draining from a watershed spanning more than 12 square miles (approximately 8000 acres). It also receives water from natural springs discharging groundwater into the lake. Land use in the surrounding watershed is predominantly agricultural and major crops include corn and soybeans. Water exits from the southwest corner of the lake through an outflow channel and a weir along Butz Road. This weir can be adjusted to control seasonal lake levels on the order of one to two feet.

2.0 Methods

2.1 Water Sampling

Water samples were collected between the hours of 9am and 2pm on nine separate occasions during 2015 (**Table 1**). Weather conditions were dry during and for the 48 hours preceding all sampling events except June 1, 2015. Sampling on June 1 took place within 24 hours of a rainfall event exceeding ½ inches. Inlet and outlet samples were collected at the M-86 bridge and Butz Road weir, respectively. In-lake nutrient, suspended solid, and chlorophyll-A samples were taken from a central location near the deepest part of the lake. In-lake samples for fecal bacteria (*E. coli*) analysis were taken at five locations around the perimeter of the lake. A hand-held Garmin GPS unit was used to record the location of each of the sample sites in Universal Transverse Mercator (UTM) Zone 16 coordinates. Water temperature, pH, and dissolved oxygen concentrations were recorded at each sample site using a calibrated YSI ProDSS multi-parameter water quality meter.

Table 1. Matteson Lake Sampling Dates (indicated by √'s)

Date	Inlet and Outlet				Matteson Lake					Comments
	TN	TP	TSS	*E. coli*	TN	TP	TSS	Ch-A	*E. coli*	
May 21	√	√								
June 1	√	√	√	√						wet weather sampling
June 8	√	√	√	√	√	√	√	√	√	
June 23	√	√								
July 6	√	√	√	√	√	√	√	√	√	
July 22	√	√								
Aug 3	√	√	√	√	√	√	√	√	√	
Aug 18	√	√								
Sept 8	√	√								

TN = total nitrogen; **TP** = total phosphorus; **TSS** = total suspended solids; **Ch-A** = chlorophyll-A

Samples were properly labeled, preserved on ice, and hand delivered to the laboratory on the same day that they were collected. Total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and *Escherichia coli* (*E. Coli*) samples were analyzed by Kar Laboratories, Inc., in Kalamazoo, Michigan. Chlorophyll A (Ch-A) samples were analyzed at Wayne State University in Detroit, Michigan. Sample containers with appropriate preservatives for each analyte were provided by Kar Labs. Sample containers for Ch-A did not include preservative chemicals and were rinsed three times in lake water before collecting final samples. Water samples were filtered and Ch-A was extracted and measured using spectrophotometry following the methods of Biggs and Kilroy (2000).

2.2 Depth Profiling

At the central lake location, water temperature, pH, and dissolved oxygen were recorded at 1 meter (3 foot) depth increments using a calibrated YSI ProDSS multi-parameter water quality meter. In addition, a 1L Van Dorn water sampler was used to collect water samples for chemical analysis from shallow (1m), medium (5m) and deep (9m) depths.

3.0 Results

3.1 Depth Profiles

Temperature profiles measured as a function of water depth (**Figure 1**) indicate that Matteson Lake was stratified into a warmer upper layer (*epilimnion*) floating above a colder lower layer (*hypolimnion*) during the June, July, and August sampling events. The upper, warm layer was approximately 4 meters (13 feet) thick. A transition zone (*thermocline*) of steadily decreasing temperatures separates the two layers across a distance of approximately 2 meters (6 feet). The top of the lower, cold layer is well established by 6 meters (20 feet) below the water surface.

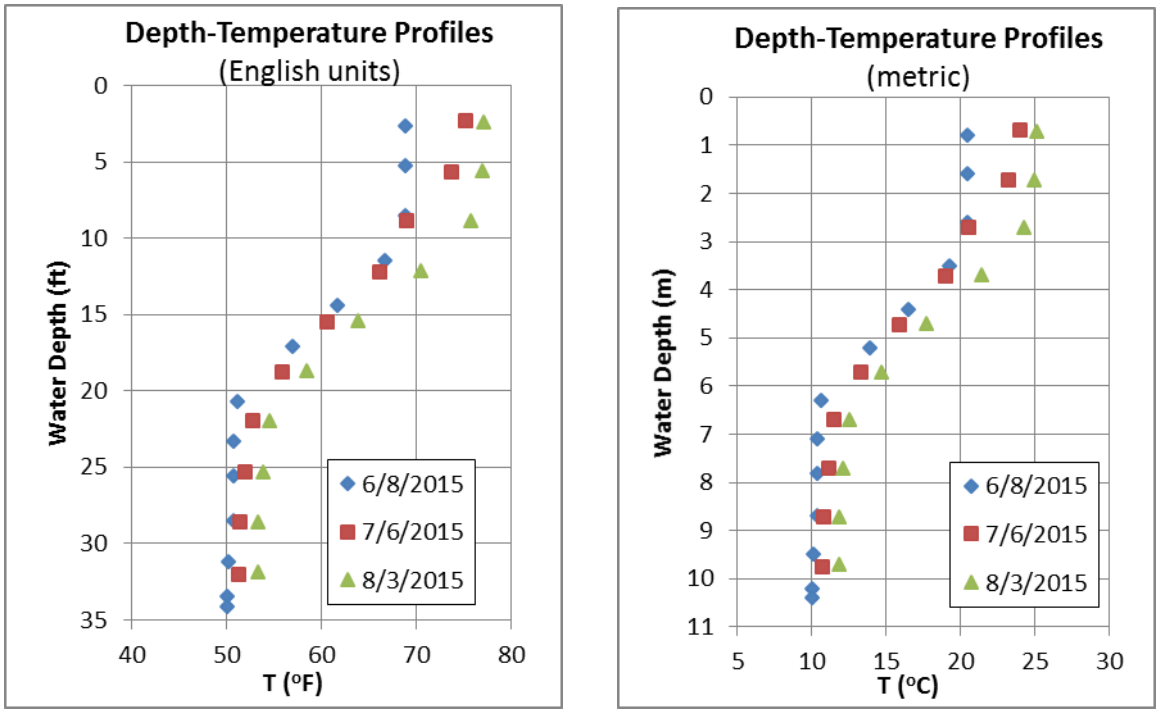
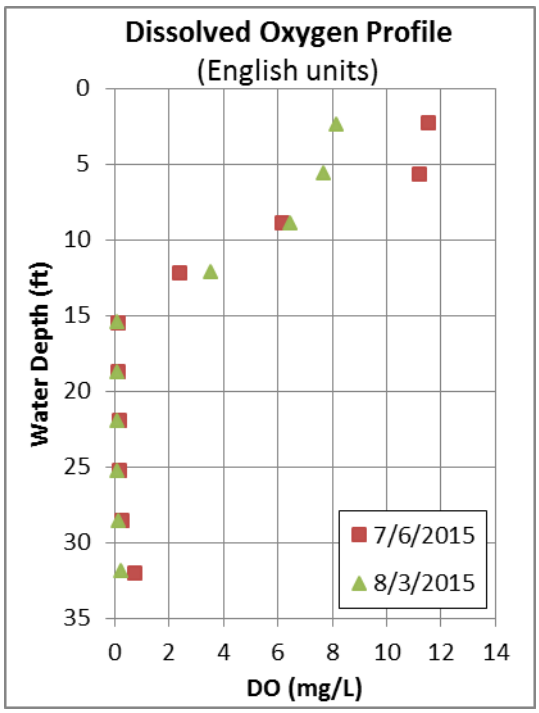


Figure 1. Water temperature as a function of water depth.

Similarly, dissolved oxygen (DO) profiles (**Figure 2**) measured during the July and August in-lake sampling events show a marked decrease between the shallow and deeper layers. Oxygen levels in the shallow layer are adequate to support fish. Oxygen content in the water drops off sharply between 2 and 4 meters (6 to 13 feet). Below 4 m (13 ft), oxygen in the water column is depleted below concentrations that are able to allow fish to breathe.

Stratification of water during summer months is common in inland lakes and the characteristics found in Matteson Lake during 2015 are similar to stratified water levels observed there in surveys by EnviroScience and Aquatic Enhancement in prior years.



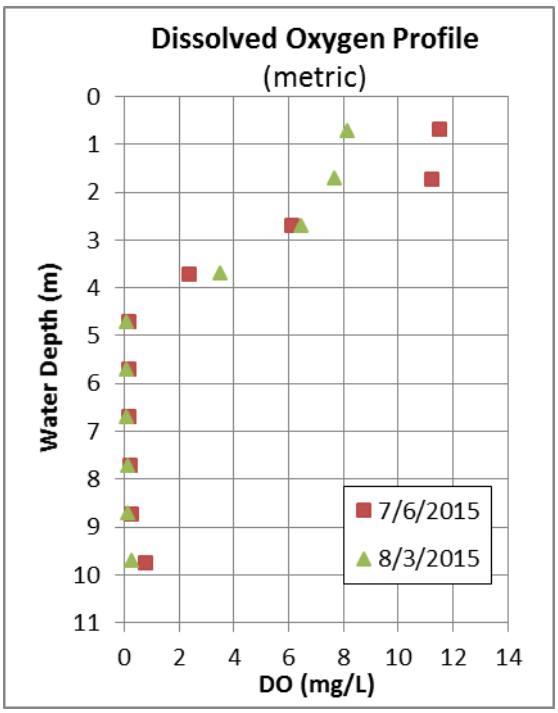


Figure 2. Dissolved Oxygen as a function of water depth.

3.2 Nutrient Concentrations

3.2.1 In-lake Nutrient Concentrations

In-lake concentrations of total nitrogen (TN) and phosphorus (TP) are presented in **Table 2**. TN concentrations are reported in units of mg/L (milligrams per liter) which are equivalent to ppm (parts per million). TP concentrations are significantly lower than nitrogen and are reported in units of µg/L (micrograms per liter), which are equivalent to ppb (parts per billion).

Table 2. In-Lake Nutrient Sampling Results

	UTM 16 Location Coordinates		Nitrogen (mg/L)			Phosphorus (ug/L)		
	Northing	Easting	Shallow	Medium	Deep	Shallow	Medium	Deep
Date	(m)	(m)	(1m)	(5m)	(9m)	(1m)	(5m)	(9m)
06/08/15	4643753	648711	1.4	2.1	2.1	30	60	50
07/06/15	4643723	648679	2.2	3.0	3.5	<20	30	50
08/03/15	4643697	648644	1.9	1.9	3.8	<20	20	30

The observed nitrogen and phosphorus concentrations were similar to values measured by EnviroScience and Aquatic Enhancement in prior years. TN values were approximately two orders of magnitude higher than TP values. Nitrogen values were higher in the hypolimnion (deeper layer) whereas phosphorous values were higher in the epilimnion (shallow layer) of the lake. TN:TP ratios ranged from 35:1 to 127:1 and averaged 80:1 across all dates and depths sampled. Ratios greater than 20:1 consistently indicate that phosphorus is the limiting nutrient for Matteson Lake (i.e., aquatic plants have more nitrogen than they need, but not enough phosphorus so that phosphorous controls growth.)

3.2.2 Inlet-Outlet Nutrient Concentrations

Concentrations of total nitrogen (TN) and phosphorus (TP) measured at the inlet (M-86 bridge) and outlet (Butz Road weir) are presented in **Table 3**.

Consistent with in-lake measurements (**Table 2**), nitrogen values measured at the inlet and outlet are approximately two orders of magnitude greater than phosphorus concentrations measured in the same locations. TN and TP concentrations at the outlet are similar to the shallow lake concentrations measured on June 8, July 6, and August 3 sampling events. This suggests that water within the epilimnion (shallow layer) does not mix with the hypolimnion (deeper layer) during the summer months when the lake is stratified.

The highest concentrations of nitrogen and phosphorous were observed at the inlet location during the wet weather sampling event on June 1, 2015. This result is consistent with higher concentrations observed by EnviroScience during wet weather sampling in watershed locations (including the M-86 bridge) in 2013 and 2014. Higher wet weather TN and TP concentrations in the inlet stream are an indication of nutrient loading from runoff within the Matteson Lake watershed.

Table 3. Inlet-Outlet Nutrient Sampling Results

	Nitrogen (mg/L)		Phosphorus (ug/L)	
Date	Inlet	Outlet	Inlet	Outlet
05/21/15	1.3	1.4	30	30
06/01/15*	9.9	1.2	70	30
06/08/15	2.0	0.8	40	30
06/23/15	3.7	2.1	60	30
07/06/15	2.6	2.4	40	20
07/22/15	4.2	2.6	50	30
08/03/15	1.1	1.8	60	<20
08/18/15	2.2	1.9	40	<20
09/08/15	1.7	1.4	30	<20

* Wet weather sampling event

Over the course of the summer but excluding the wet weather sampling event, average TN measurements at the inlet and outlet were 2.4 and 1.8 mg/L (ppm), respectively. Excluding the wet weather event, average TP measurements at the inlet and outlet were 44 and 28 µg/L (ppb), respectively.

Time series measurements are charted for total nitrogen in **Figure 3** and total phosphorus in **Figure 4**. Both figures indicate that nutrient levels are higher in water flowing into the lake compared to water flowing out of the lake. For nitrogen, there are two exceptions to this observation. These may result from small differences within measurement error (May 21) or from a lag in time between pulses of higher nitrogen loading initiated by wet weather events entering the lake at its inlet and exiting the lake outlet (Aug 3). In other words,

the process of mixing and transport of nutrients as they travel from one end of the lake to the other takes time. There are no exceptions for phosphorus, which is the limiting nutrient for Matteson Lake.

Lower nutrient concentrations in water exiting the lake suggest that: 1) nutrient loading from the watershed exceeds loading from lawns or septic fields on developed parcels along the lakeshore, and 2) nutrients added from watershed loading are stored or consumed by plants and algae within the lake.

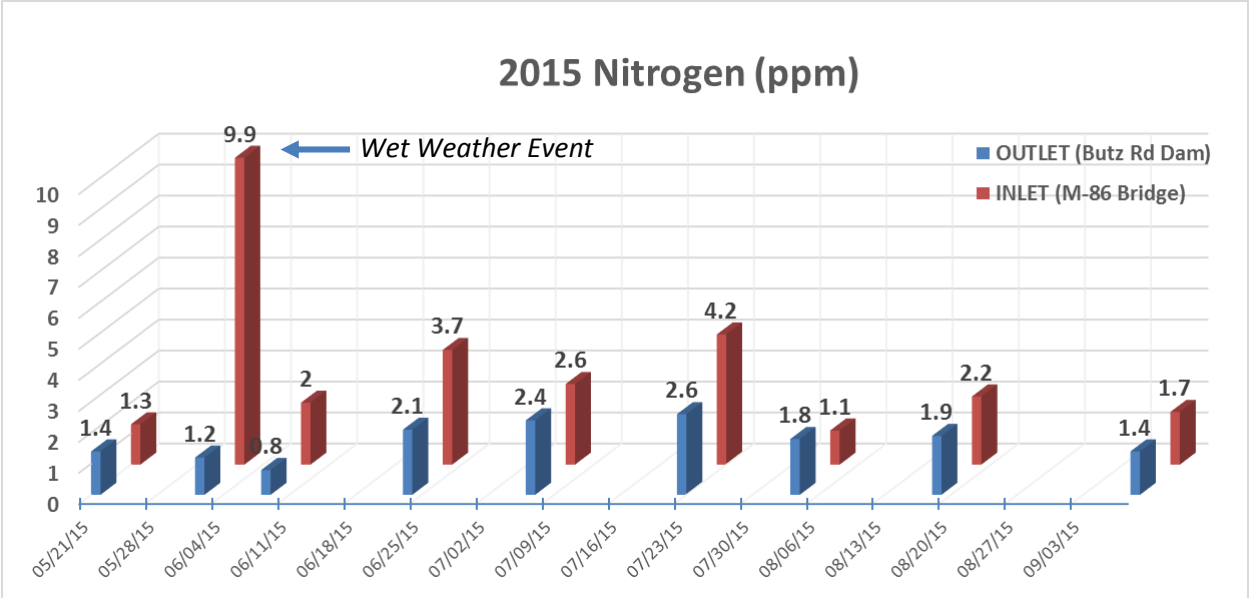


Figure 3. Total nitrogen time series measurements at the Matteson Lake inlet and outlet in 2015.

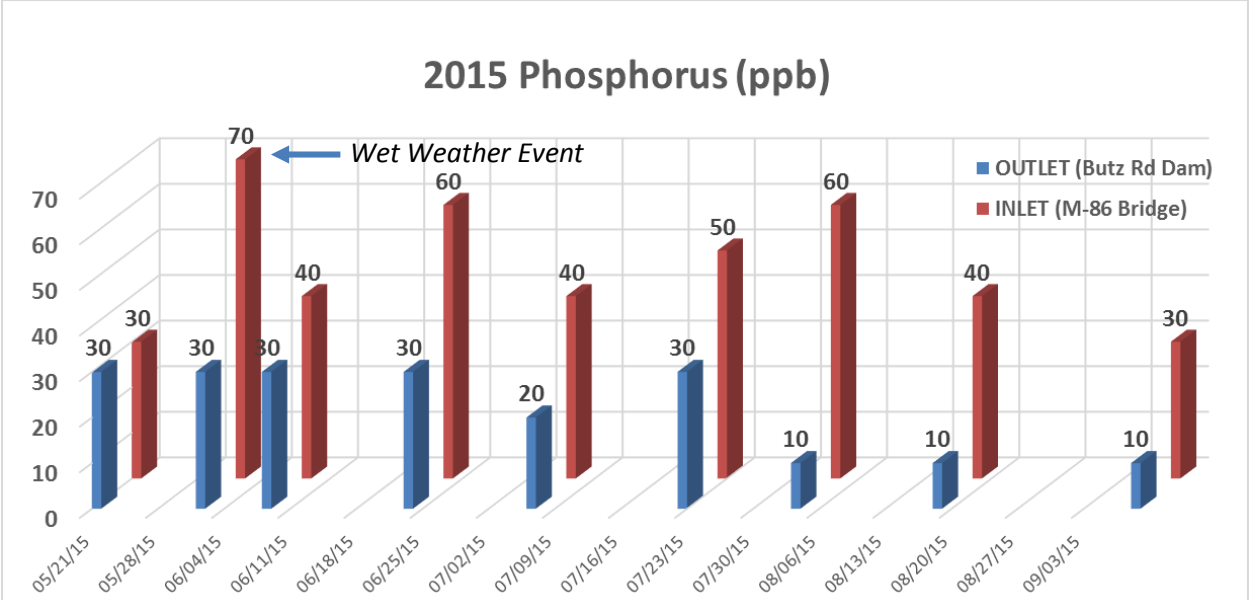


Figure 4. Total phosphorus time series measurements at the Matteson Lake inlet and outlet in 2015

3.3 Chlorophyll-A

Chlorophyll is the green pigment in plants that allows them to capture energy from sunlight during photosynthesis. Chlorophyll-A is a measure of the green pigment in living (i.e., active) algae and phytoplankton in the water column. Thus, it is a measure of the relative productivity of microscopic photosynthetic plants within the lake. In addition to variability in response to nutrient concentrations, algal abundance (and therefore chlorophyll-A concentrations) can vary in response to changes in sunlight, temperature, and wind.

In-lake chlorophyll-A measurements for water samples taken from the surface of Matteson Lake are given in **Table 4**.

Table 4. Matteson Lake chlorophyll-A

	06/08/15	07/06/15	08/03/15	**Average**
Chl-A (ppb)	32.8	27.2	46.2	**35.4**

These values fall within the range (2.9 to 58 ppb) observed in prior measurements during summers from 2005-2014.

3.4 Trophic Status

Eutrophication is the process by which a lake becomes enriched in nutrients from natural and manmade sources. Although nutrients are generally desirable to support plant and fish life within a lake, an overabundance of nutrients can lead to high growth rates of algae and other aquatic plants that steal oxygen from the water column after they die and decay. In addition to low dissolved oxygen levels, undesirable effects of eutrophication include water discoloration and the potential for harmful (toxic) algal blooms.

The trophic state of a lake depends on the total mass of living material (biomass) contained within the water column of the lake. Carlson's trophic state index (TSI) is a widely used measure of this relationship (Carlson, 1977). Clear lakes with relatively little aquatic vegetation have TSI values less than 40 and are classified as *oligotrophic*. *Mesotrophic* lakes with an intermediate level of productivity have TSI values between 40 and 50. *Eutrophic* lakes with high nutrient levels and high biologic productivity have TSI values between 50 and 70. Lakes with TSI values exceeding 70, classified as *hypereutrophic*, are characterized by poor water clarity and frequent nuisance algal blooms.

Three alternative methods are used to estimate the trophic state of a lake. The first measures water clarity by raising and lowering a black and white colored Secchi disk into the water column and recording the depth at which it becomes visible or disappears from view. Clearer water is associated with greater visibility depths and thus a lower trophic state index. The Secchi disk TSI value is calculated using the following equation:

$$TSI_{(SD)} = 60 - 14.4 \times \ln(\text{Secchi disk depth in feet})$$

The second TSI estimation method relies on the concentration of chlorophyll-A, associated with active green (photosynthetic) algae. It is calculated using the following equation:

$$TSI_{(CHL)} = 9.8 \times \ln(\text{chlorophyll-A concentration in ppb}) + 30.6$$

The third method uses the concentration of phosphorus (a limiting nutrient) in the water column and is calculated as follows:

$$TSI_{(TP)} = 14.4 \times \ln(\text{total phosphorus concentration in ppb}) + 4.15$$

TSI estimates for Matteson Lake are presented in **Table 5**. Average TSI values calculated using each of the three estimation methods for each of the three in-lake sampling events indicate that Matteson Lake remained within the eutrophic state throughout the summer of 2015. No significant variations in the TSI values were observed over the course of the summer months (early June through early August) in 2015.

Table 5. 2015 Matteson Lake Trophic State Index (TSI) Values

	06/08/15	07/06/15	08/03/15
$TSI_{(SD)}$	48.1	50.6	48.3
$TSI_{(CHL)}$	64.8	63.0	68.2
$TSI_{(TP)}$	53.2	47.3	47.3
Average	**55**	**54**	**55**

Historical TSI values for Matteson Lake are presented in **Table 6** and plotted in **Figure 5**. The 2015 average TSI value of 55 is equivalent to the value measured in June 2014 and similar to values measured in August of 2012 (under drought conditions) and June of 2013. TSI values for the last 4 years are lower than peak values observed in 2010 and 2011, yet eutrophic conditions have persisted during summer months over the past 9 years.

Taken together, these observations suggest that: 1) TSI estimates based on measurements taken during different months during different summers can be compared on a year-to-year basis, and 2) TSI conditions in Matteson Lake have fluctuated within eutrophic levels without a clearly discernable trend during the past decade.

Table 6. Historical TSI Data

Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Sample Date	n/a	1-Sep	19-Sep	31-Aug	31-Jul	23-Jul	21-Jul	23-Jul	8-Aug	6-Jun	22-Jul	Jun-Aug
Trophic State Index (TSI)	**44**	**48**	**45**	**57**	**54**	**54**	**62**	**60**	**53**	**50**	**55**	**55**
Secchi Disk Clarity (ft)	2.5	4.6	3.6	3.3	3.6	2.2	1.7	3.3	3.0	2.5	2.2	2.2
Chlorophyll-A (ppb)	10	21	2.9	17	14	16	58	<10	12.8	40	19	35
Phosphorus (ppb)	7	<7	9	26.4	20	10	20	112	14	9	38.2	23

2004-2010 data from Aquatic Enhancement & Survey, Inc.
2011-2014 data from EnviroScience, Inc.

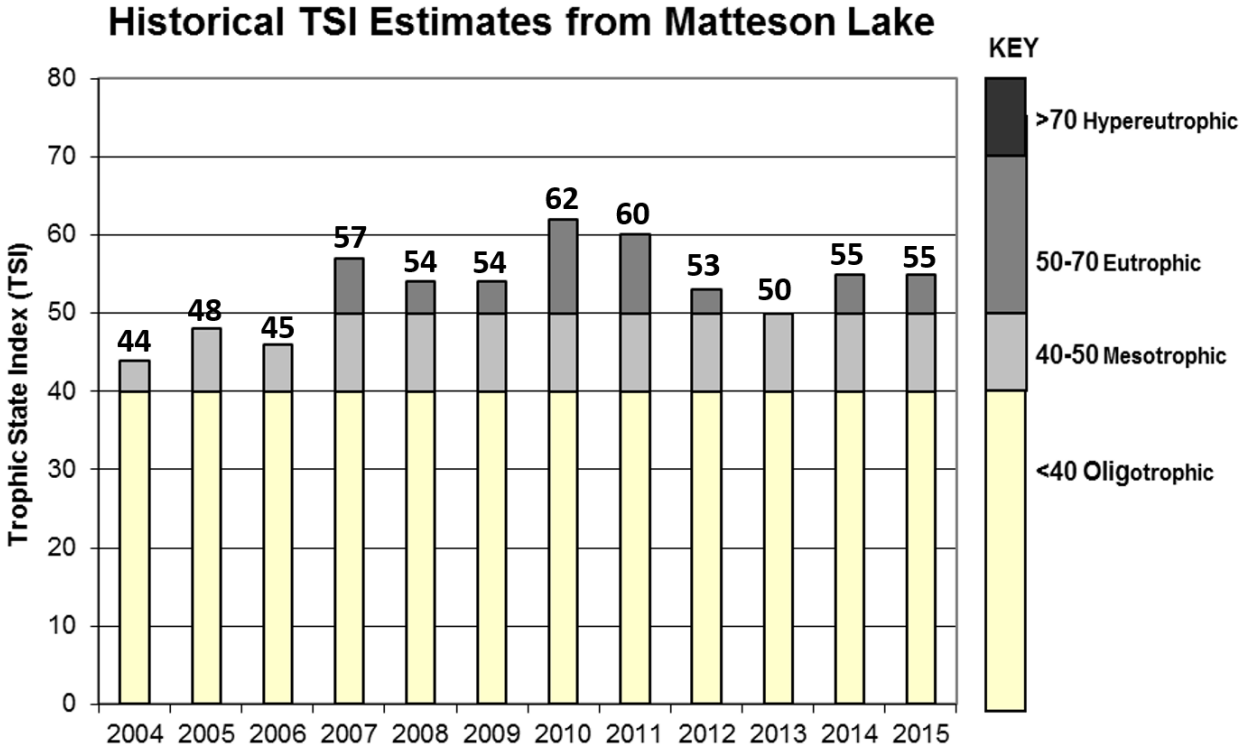


Figure 5. Historical TSI Estimates for Matteson Lake

3.5 Suspended Solids

Suspended solids are materials in the water column that will not settle out but can be removed using a filter. They include small sediment particles (silt and clay) as well as algae and plankton. Suspended solids result from erosion and transport of soil from the upstream watershed, bank erosion from waves along the lake shore, activities of bottom feeders (such as carp), and algae growth.

Suspended solids can reduce water quality by decreasing water clarity, absorbing sunlight to make water warmer, and reducing the amount of sunlight available for photosynthetic aquatic plants. In combination, these effects decrease the amount of dissolved oxygen in the lake water available for fish to breathe. In addition, suspended particles can affect fish by interfering with their gill functions, reducing growth rates and disease resistance, preventing egg development, and damaging microhabitats for aquatic insects that fish use for food (North Dakota Dept. of Health, 2015).

Concentrations of suspended solids are reported in units of milligrams per liter (mg/L) of water filtered. Results for 2015 sampling are reported in **Table 7**.

Table 7. 2015 Matteson Lake Total Suspended Solids

Total Suspended Solids, TSS (mg/L)				
Date	Inlet	Lake	Outlet	
6/1/2015	10	-	11	(wet weather)
6/8/2015	5	11	12	
7/6/2015	7	10	12	
8/3/2015	7	8	10	

TSS measurements indicate that water within and flowing out of Matteson Lake has a higher concentration of suspended solids than water entering the lake through the inlet stream. This may be attributable to high amounts of recreational motor boat activity on Matteson Lake during summer months. In addition, the effects of wave action may be magnified by the presence of hardened shorelines (i.e. artificial seawalls) that reflect wave energy and contribute to churning and scour along the lake bottom (Michigan Natural Shoreline Partnership, 2015).

3.6 Fecal Bacteria

Fecal coliform bacteria are microscopic organisms that live within the digestive tracks of humans and other warm-blooded animals. As a water quality indicator, their presence in large numbers can indicate contamination by pathogens or other disease producing bacteria or viruses which can also exist in fecal material. In Michigan, bathing beaches are closed whenever daily *E. coli* counts exceed 300 colonies per 100 milliliters (300 col/ml) based on Michigan Public Health Code standards (P.A. 368 of 1978) for full body contact.

The Matteson Lake fecal bacteria sampling plan is intended to provide a snapshot of *E. coli* bacteria concentrations at several locations along the perimeter of the lake, but is not designed to follow Michigan standards for beach monitoring. Those standards require a minimum of three samples taken at least five times each month. The daily geometric mean concentrations of those samples must be below 300 *E. coli* colonies per 100 ml. The monthly (30-day) geometric mean must be below 130 colonies per 100 ml for the water to be considered safe for swimming (MDEQ, 2015).

Results for 2015 *E. coli* sampling are presented in **Table 8** and **Figure 6**. All in-lake samples fell below 130 col/100 ml. Higher concentrations, exceeding 300 col/100 ml, were observed at the inlet sampling point along the M86 bridge. The highest concentrations were observed there during wet weather sampling on June 1 (1400 col/100 ml) and under dry conditions on August 3 (3900 col/100 ml).

These results are consistent with observations made in prior sampling years. Over the past decade, *E. coli* values exceeding 300 col/100ml have not been observed within Matteson Lake proper. Since 2005, concentrations exceeding 300 col/100ml have been observed on at least five occasions at the M86 bridge.

Table 8. Summer 2015 Fecal Coliform Bacteria

Station	Date	Sample Location Coordinates Northing (m)	Easting (m)	E. coli Bacteria (col/100mL)
Inlet	6/1/2015*			1400
Outlet	6/1/2015*			70
FC1	06/08/15	4644453	649509	120
FC2	06/08/15	4644033	648884	15
FC3	06/08/15	4643389	648589	8
FC4	06/08/15	4643146	648292	9
FC5	06/08/15	4643493	647893	4
Inlet	06/08/15			250
Outlet	06/08/15			36
FC1	7/6/2015	4644460	649491	9
FC2	7/6/2015	4644070	648862	3
FC3	7/6/2015	4643334	648628	2
FC4	7/6/2015	4643150	648296	18
FC5	7/6/2015	4643480	647907	4
Inlet	7/6/2015			520
Outlet	7/6/2015			38
FC1	8/3/2015	4644474	649486	82
FC2	8/3/2015	4644057	648872	42
FC3	8/3/2015	4643345	648657	20
FC4	8/3/2015	4643154	648302	29
FC5	8/3/2015	4643470	647886	25
Inlet	8/3/2015			3900
Outlet	8/3/2015			92

* wet weather sampling event

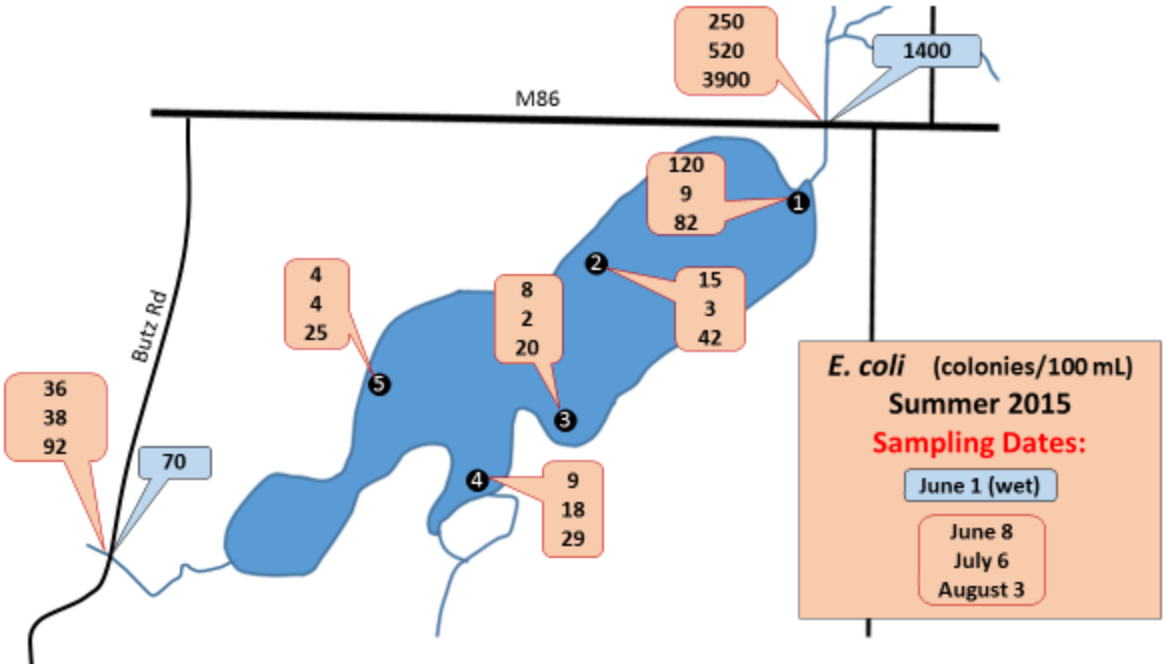


Figure 6. 2015 Matteson Lake *E. coli* Measurements

4.0 Conclusions and Recommendations

Results from the 2015 water quality sampling program were largely consistent with prior years. As expected, Matteson Lake was stratified throughout the summer months, with warmer water temperatures and higher dissolved oxygen concentrations found in the shallowest 4-6 m (13-20 ft) of the water column.

Nitrogen and phosphorus concentrations in the inlet stream were consistently greater than levels recorded in the lake. However, the reverse was found for total suspended solid concentrations, which were greater in the lake than the inlet stream.

Relatively low *E. coli* bacteria levels, similar to observations made in prior summers, were observed at all in-lake sampling sites. Significantly higher *E. coli* concentrations were observed at the inlet sampling location, however. Higher inlet concentrations during wet weather suggests runoff from the watershed flushes bacteria and nutrients sourced from the watershed into Matteson Lake.

Water flowing out of the lake at the Butz Road weir was sampled for the first time in 2015. These samples documented nitrogen and phosphorus concentrations that were lower than those measured at the inlet stream. Outlet nutrient concentrations were also equal to or lower than the corresponding in-lake values, suggesting that nutrient loading from the watershed exceeds loading from developed parcels along the lakeshore and that some portion of the nutrients delivered from the watershed are stored or used by plants and algae within the lake.

In contrast, total suspended solid values at the outlet were slightly higher than in-lake samples suggesting that wave action, motor boat activity, and hardened shorelines contribute to sediment suspension in the lake. *E. coli* bacteria levels were also generally higher at the outlet than in the lake for reasons that are not yet fully understood.

Based on its estimated trophic state index (TSI), Matteson Lake remained eutrophic in 2015, as it has been for the past nine years. Prior to 2007, however, TSI values measured at Matteson Lake were indicative of mesotrophic conditions. Consequently, water quality in Matteson Lake can be improved by reducing the input of nutrients (particularly phosphorus), both from the stream draining the surrounding watershed as well as from developed lakeshore properties. Water quality can also be improved through the implementation of natural shoreline stabilization methods that contribute to wave energy dissipation (Michigan Sea Grant, 2011).

Recommendations for 2016 include continued lake and watershed water quality monitoring, formal surveying of abundance and diversity of aquatic plants within the lake, and expanded partnership with residents, local government officials, and federal conservation officers who share an interest in improving water quality in Matteson Lake and its surrounding watershed.

5.0 Acknowledgements

Lake and watershed sampling on multiples occasions requires a great deal of planning and effort, and a team effort was required to complete the sampling program for 2015. Sincere appreciation is extended to all members of the Matteson Lake Water Quality Committee, and especially to Bill Sweers, Mike Miner, John Wiler, and Randy Rider who helped to collect samples and transport them to the lab throughout the course of the summer. Thanks also to Donna Kashian and Anna Boegehold for assistance with chlorophyll-A measurements made at Wayne State University. Logistical sampling support from Carolyn Hochstadt, Megan Keller, and Wendy Lemke are also gratefully acknowledged. Without the support of all these participants, as well as funding from the Matteson Lake Association, this study would not have been possible.

6.0 References

Biggs, B.J. and Kilroy, C., 2000. Stream periphyton monitoring manual. Niwa.

Carlson, R.E., 1977, A trophic state index for lakes, *Limnology and Oceanography*, 22(2):361-369.

MDEQ, 2015, About Beach Monitoring in Michigan, Michigan Department of Environmental Quality, http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3730-11005--,00.html, accessed on December 18, 2015.

Michigan Natural Shoreline Partnership, 2015, Understanding erosion at the shoreline, http://www.mishorelinepartnership.org/understanding-shorelines.html, accessed on December 18, 2015.

Michigan Sea Grant, 2011, Natural shorelines for inland lakes: A simple solution for lakefront property owners; Michigan Sea Grant and the Michigan Department of Environmental Quality, publication MICHU-11-501, http://www.michigan.gov/documents/deq/wrd-natural-shorelines-inland-lakes_366530_7.pdf.

North Dakota Dept. of Public Health, 2015, Total Suspended Solids, https://www.ndhealth.gov/WQ/SW/Z6_WQ_Standards/WQ_TSS.htm, accessed on December 18, 2015.

APPENDIX A.

CHAIN OF CUSTODY AND WATER QUALITY ANALYSIS REPORTS

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality

KAR Project No. : ***504384***
Date Reported : ***06/05/15***
Date Activated : ***05/21/15***
Date Due : ***06/05/15***
Date Validated : ***06/05/15***

Attn : ***Mr. Larry Lemke***

Project Description : ***Analysis of two samples from Matteson Lake.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 504384. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: ***Matteson Lake Water Quality***

KAR Project No. : ***504384***

Date Reported : ***06/05/15***

Attest: David R. Alkema, Lab Manager

Project Description: ***Analysis of two samples from Matteson Lake.***

Sample ID : ***"Matt WS-1"***

Sampled By :

Sample Date : ***05/21/15***

Sample Time : ***1308***

Date Received : ***05/21/15***

Sample Type : ***aqueous***

KAR Sample No. : ***504384-01***

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	*1.3*	*mg/L*	*EPA 351.2,353.2*	*05/28/15*	*ALK*	
Phosphorus, total (as P)	*0.03*	*mg/L*	*SM 4500-P B5,E*	*06/03/15*	*EIF*	

Sample ID : ***"Matt DAM"***

Sampled By :

Sample Date : ***05/21/15***

Sample Time : ***1323***

Date Received : ***05/21/15***

Sample Type : ***aqueous***

KAR Sample No. : ***504384-02***

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	*1.4*	*mg/L*	*EPA 351.2,353.2*	*05/28/15*	*ALK*	
Phosphorus, total (as P)	*0.03*	*mg/L*	*SM 4500-P B5,E*	*06/03/15*	*EIF*	

4425 MANCHESTER RD KAZ MI 49001 269 381-9266

KAR *Laboratories, Inc.* **Chain-of-Custody** www.karlabs.com

Client: MATTESON LAKE WATER QUALITY

Attn: LARRY LEMKE

Phone: 1-313-205-4254 Fax:

Cell : Email:

Project Name: MATTESON LAKE

Project # 2015

P.O. #

Sampled by: Initials
☐ KAR ☒ Client ___

Turnaround Time:
☐ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types:
DW-Drinking Water Solid
AQ-Aqueous (Liquid)
Sludge/Biosolid Air

KAR use only
Proj#: 50434
Login: JR
Date: 5/21/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	Requested Analyses: TOTAL PHOSPHORUS	TOTAL NITROGEN	Remarks
1	MATT WS-1	5.21.15	13:08	SW	P	250mL	1	X	X	*PRESERVE ON ICE
2	MATT-DAM	5.21.15	13:23	SW	↓	↓	1	X	X	"

Relinquished By: William Swem MATTESON LAKE
Received by: [signature]
Date/Time: 5/21/15 1425
Notes:

Relinquished By:
Received by:
Date/Time:

MATRIX SW SURFACE WATER

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality

KAR Project No. : ***504695***
Date Reported : ***06/15/15***
Date Activated : ***06/01/15***
Date Due : ***06/15/15***
Date Validated : ***06/15/15***

Attn : ***Mr. Larry Lemke***

Project Description : ***Analysis of two samples from Matteson Lake 2015.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 504695. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *504695*

Date Reported : *06/15/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of two samples from Matteson Lake 2015.*

Sample ID : *"Matt WS-1-WET"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *06/01/15*
Sample Time : *1038*

Date Received : *06/01/15*
Sample Type : *aqueous*
KAR Sample No. : *504695-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	1400	colonies/100mL	SM 9213 D.3	06/01/15	EIF	
Nitrogen, total	9.9	mg/L	EPA 351.2,353.2	06/03/15	ALK	
Phosphorus, total (as P)	0.07	mg/L	SM 4500-P B5,E	06/10/15	EIF	
Suspended solids, total	10	mg/L	SM 2540 D	06/04/15	EIF	

Sample ID : *"Matt DAM-WET"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *06/01/15*
Sample Time : *1053*

Date Received : *06/01/15*
Sample Type : *aqueous*
KAR Sample No. : *504695-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	70	colonies/100mL	SM 9213 D.3	06/01/15	EIF	
Nitrogen, total	1.2	mg/L	EPA 351.2,353.2	06/03/15	ALK	
Phosphorus, total (as P)	0.03	mg/L	SM 4500-P B5,E	06/10/15	EIF	
Suspended solids, total	11	mg/L	SM 2540 D	06/04/15	EIF	

269-381-9666

KAR Laboratories, Inc. **Chain-of-Custody** www.karlabs.com

Client: MATTESON LAKE WATER QUALITY

Attn: LARRY LEMKE

Phone: 1-313-205 4254 Fax: 1-313-577-0517

Cell : Email:

Project Name: MATTESON LAKE

Project # 2015

P.O. #

Sampled by: ☐ KAR ☒ Client Initials WJS

Turnaround Time:
☐ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types:
DW-Drinking Water Solid
AQ-Aqueous (Liquid)
Sludge/Biosolid Air

Requested Analyses

KAR use only
Proj#: 504695
Login: AB
Date: 6/1/2015
FRB Y (N)
On-Ice Y (N)

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	TOTAL PHOSPHORUS	TOTAL NITROGEN	TOTAL SUSPENDED SOLIDS	E-COLI	Remarks
	MATT WS-1-WET	6-1-	10:38	SW				X	X	X	X	PRESERVATIVE ON ICE
	MATT - DAM-WET	6-1-	10:53	SW				X	X	X	X	"

Relinquished By: William Sween MATTESON LAKE
Received by:
Date/Time: 6/1/15 12:10 pm
Notes:

Relinquished By:
Received by:
Date/Time:

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality

KAR Project No. : ***505014***
Date Reported : ***06/19/15***
Date Activated : ***06/08/15***
Date Due : ***06/22/15***
Date Validated : ***06/19/15***

Attn : ***Mr. Larry Lemke***

Project Description : ***Analysis of 11 samples from Matteson Lake 2015.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 505014. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *505014*

Date Reported : *06/19/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake 2015.*

Sample ID : *"MATT-TP-TN-S"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0757*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	1.4	mg/L	EPA 351.2,353.2	06/09/15	ALK	
Phosphorus, total (as P)	0.03	mg/L	SM 4500-P B5,E	06/16/15	EIF	

Sample ID : *"MATT-TP-TN-M"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0805*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	2.1	mg/L	EPA 351.2,353.2	06/09/15	ALK	
Phosphorus, total (as P)	0.06	mg/L	SM 4500-P B5,E	06/16/15	EIF	

Sample ID : *"MATT-TP-TN-B"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0813*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-03*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	2.1	mg/L	EPA 351.2,353.2	06/09/15	ALK	
Phosphorus, total (as P)	0.05	mg/L	SM 4500-P B5,E	06/16/15	EIF	

Sample ID : *"MATT-TSS"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0801*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-04*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Suspended solids, total	11	mg/L	SM 2540 D	06/11/15	EIF	

LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *505014*

Date Reported : *06/19/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake 2015.*

Sample ID : *"MATT-FC1"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0853*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-05*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	120	colonies/100mL	SM 9213 D.3	06/08/15	EIF	

Sample ID : *"MATT-FC2"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0824*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-06*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	15	colonies/100mL	SM 9213 D.3	06/08/15	EIF	

Sample ID : *"MATT-FC3"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0846*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-07*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	8	colonies/100mL	SM 9213 D.3	06/08/15	EIF	

Sample ID : *"MATT-FC4"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0839*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-08*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	9	colonies/100mL	SM 9213 D.3	06/08/15	EIF	

LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *505014*

Date Reported : *06/19/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake 2015.*

Sample ID : *"MATT-FC5"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0831*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-09*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	4	colonies/100mL	SM 9213 D.3	06/08/15	EIF	

Sample ID : *"MATT-WS-1"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0917*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-10*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	250	colonies/100mL	SM 9213 D.3	06/08/15	EIF	
Nitrogen, total	2.0	mg/L	EPA 351.2,353.2	06/09/15	ALK	
Phosphorus, total (as P)	0.04	mg/L	SM 4500-P B5,E	06/16/15	EIF	
Suspended solids, total	5	mg/L	SM 2540 D	06/11/15	EIF	

Sample ID : *"MATT-DAM"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *06/08/15*
Sample Time : *0936*
Date Received : *06/08/15*
Sample Type : *aqueous*
KAR Sample No. : *505014-11*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	36	colonies/100mL	SM 9213 D.3	06/08/15	EIF	
Nitrogen, total	0.8	mg/L	EPA 351.2,353.2	06/09/15	ALK	
Phosphorus, total (as P)	0.03	mg/L	SM 4500-P B5,E	06/16/15	EIF	
Suspended solids, total	12	mg/L	SM 2540 D	06/11/15	EIF	

③ **KAR** *Laboratories, Inc.* **Chain-of-Custody** www.karlabs.com

Client: Matteson Lake Water Quality

Attn: Larry Lemke

Phone: 313-577-6412 Fax: 313-577-0517

Cell: 313-205-4254 Email: LDLEMKE@WAYNE.EDU

Project Name: MATTESON LAKE

Project #: 2015

P.O. #

Sampled by: ☐ KAR ☒ Client Initials: L D L

Turnaround Time:
☐ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types:
DW-Drinking Water Solid
AQ-Aqueous Liquid
Sludge/Biosolid Air

KAR use only
Proj#: 15014
Login: LD
Date: 6/8/2015
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	TOTAL PHOSPHORUS	TOTAL NITROGEN	TOTAL SUSPENDED SOLIDS	E. COLI						Remarks
	MATT-TP-TN-S	06/08/15	7:57 am	SW		250cc	1	X	X								preserved on ice
	MATT-TP-TN-M	06/08/15	8:05 am	SW		250 cc	1	X	X								"
	MATT-TP-TN-B	06/08/15	8:13 am	SW		250 cc	1	X	X								"
	MATT-TSS	06/08/15	8:01 am	SW		1000 mL	1			X							"
	MATT-FC1	06/08/15	8:53 am	SW		120 mL	1				X						"
	MATT-FC2	06/08/15	8:24 am	SW		120 mL	1				X						"
	MATT-FC3	06/08/15	8:46 am	SW		120 mL	1				X						"
	MATT-FC4	06/08/15	8:39 am	SW		120 mL	1				X						"
	MATT-FC5	06/08/15	8:31 am	SW		120 mL	1				X						"
	MATT-WS-1	6/8/15	9:17 am	SW			2	X	X	X	X						"
	MATT-DAM	6/8/15	9:36 am	SW				X	X	X	X						"

Relinquished By: Lawrence D. Lemke

Received by:

Date/Time:

Relinquished By:

Received by:

Date/Time: 6/8/2015 1210

Notes: MATRIX SW = Surface Water

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality
P O Box 123
Bronson, MI 49028

Attn : ***Mr. Larry Lemke***

KAR Project No. : ***505640***
Date Reported : ***07/08/15***
Date Activated : ***06/23/15***
Date Due : ***07/08/15***
Date Validated : ***07/08/15***

Project Description : ***Analysis of two samples from Matteson Lake.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 505640. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *505640*

Date Reported : *07/08/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of two samples from Matteson Lake.*

Sample ID : *"Matt WS-1"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *06/23/15*
Sample Time : *1020*

Date Received : *06/23/15*
Sample Type : *aqueous*
KAR Sample No. : *505640-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	3.7	mg/L	EPA 351.2,353.2	06/25/15	ALK	
Phosphorus, total (as P)	0.06	mg/L	SM 4500-P B5,E	06/26/15	EIF	

Sample ID : *"Matt DAM"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *06/23/15*
Sample Time : *1036*

Date Received : *06/23/15*
Sample Type : *aqueous*
KAR Sample No. : *505640-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	2.1	mg/L	EPA 351.2,353.2	06/25/15	ALK	
Phosphorus, total (as P)	0.03	mg/L	SM 4500-P B5,E	06/26/15	EIF	

KAR *Laboratories, Inc.* **Chain-of-Custody** www.karlabs.com

Client: MATTESON LAICE WATER QUALITY

Attn: LARRY LEMKE

Phone: 1-313 205 4254 Fax:

Cell : Email:

Project Name: MATTESON LAKE

Project # 2015

P.O. #

Sampled by: Initials
☐ KAR ☒ Client WJS

Turnaround Time:
☐ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types:
DW-Drinking Water Solid
AQ-Aqueous (Liquid)
Sludge/Biosolid Air

Requested Analyses

KAR use only
Proj#: 505140
Login: AB
Date: 6/23/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	TOTAL PHOSPHORUS	TOTAL NITROGEN	Remarks
1	MATT WS-1	6/23/15	10:20	SW	P	250 cc	1	X	X	PRESERVATIVE & ON ICE
2	MATT - DAM	6/23/15	10:36	SW	↓	↓	1	X	X	"

Relinquished By: William J. Sweeney Matteson Lake

Received by:

Date/Time:

Notes:

Relinquished By:

Received by: Arden Cole

Date/Time: 1140 6/23/15

MATRIX - SW - SURFACE WATER

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality
P O Box 123
Bronson, MI 49028

Attn : ***Mr. Larry Lemke***

KAR Project No. :	***506134***
Date Reported :	***07/14/15***
Date Activated :	***07/06/15***
Date Due :	***07/20/15***
Date Validated :	***07/14/15***

Project Description : ***Analysis of 11 samples from Matteson Lake Water Quality.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 506134. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *506134*

Date Reported : *07/14/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake Water Quality.*

Sample ID : *"MATT-LAKE-TNTP-D"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *0935*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	3.5	mg/L	EPA 351.2,353.2	07/07/15	ALK	
Phosphorus, total (as P)	0.05	mg/L	SM 4500-P B5,E	07/10/15	EIF	

Sample ID : *"MATT-LAKE-TNTP-M"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *0941*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	3.0	mg/L	EPA 351.2,353.2	07/07/15	ALK	
Phosphorus, total (as P)	0.03	mg/L	SM 4500-P B5,E	07/10/15	EIF	

Sample ID : *"MATT-LAKE-TNTP-S"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *0945*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-03*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	2.2	mg/L	EPA 351.2,353.2	07/07/15	ALK	
Phosphorus, total (as P)	<0.02	mg/L	SM 4500-P B5,E	07/10/15	EIF	

Sample ID : *"MATT-LAKE-TSS"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *0947*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-04*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Suspended solids, total	10	mg/L	SM 2540 D	07/07/15	AJK	

LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *506134*

Date Reported : *07/14/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake Water Quality.*

Sample ID : *"MATT-FC5"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1009*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-05*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	4	colonies/100mL	SM 9213 D.3	07/06/15	ALK	

Sample ID : *"MATT-FC4"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1015*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-06*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	18	colonies/100mL	SM 9213 D.3	07/06/15	ALK	

Sample ID : *"MATT-FC3"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1023*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-07*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	2	colonies/100mL	SM 9213 D.3	07/06/15	ALK	

Sample ID : *"MATT-FC1"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1032*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-08*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	9	colonies/100mL	SM 9213 D.3	07/06/15	ALK	

LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *506134*

Date Reported : *07/14/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake Water Quality.*

Sample ID : *"MATT-FC2"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1042*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-09*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	3	colonies/100mL	SM 9213 D.3	07/06/15	ALK	

Sample ID : *"MATT-WS1"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1112*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-10*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	520	colonies/100mL	SM 9213 D.3	07/06/15	ALK	
Nitrogen, total	2.6	mg/L	EPA 351.2,353.2	07/07/15	ALK	
Phosphorus, total (as P)	0.04	mg/L	SM 4500-P B5,E	07/10/15	EIF	
Suspended solids, total	7	mg/L	SM 2540 D	07/07/15	AJK	

Sample ID : *"MATT-DAM"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *07/06/15*
Sample Time : *1129*
Date Received : *07/06/15*
Sample Type : *aqueous*
KAR Sample No. : *506134-11*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	38	colonies/100mL	SM 9213 D.3	07/06/15	ALK	
Nitrogen, total	2.4	mg/L	EPA 351.2,353.2	07/07/15	ALK	
Phosphorus, total (as P)	0.02	mg/L	SM 4500-P B5,E	07/10/15	EIF	
Suspended solids, total	12	mg/L	SM 2540 D	07/07/15	AJK	

KAR Laboratories, Inc. **Chain-of-Custody** www.karlabs.com

Client: Matteson Lake Association

Attn: Larry Lemke

Phone: 313-577-6412 Fax:

Cell: 313-205-4254 Email: LDLEMKE@WAYNE.EDU

Project Name: MATTESON LAKE WATER QUALITY

Project #

P.O. #

Sampled by: ☐ KAR ☒ Client Initials L D L

Turnaround Time:
☒ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types: Surface water
DW-Drinking Water Solid
AQ-Aqueous Liquid
Sludge/Biosolid Air

KAR use only
Proj# 500134
Login: AB
Date: 7/6/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	Total Nitrogen	Total Phosphorus	Total Suspended Solids	E. Coli						Remarks
	MATT-LAKE-TNTP-D	7/6/15	9:35am	AQ	HDPE	250cc		X	X								DEEP
	MATT-LAKE-TNTP-M	7/6/15	9:41am			"		X	X								MID-DEPTH
	MATT-LAKE-TNTP-S	7/6/15	9:45am			"		X	X								SHALLOW
	MATT-LAKE-TSS	7/6/15	9:47am			1.0L				X							
	MATT-FC 5	7/6/15	10:08am			4oz					X						
	MATT-FC 4	7/6/15	10:15am			"					X						
	MATT-FC 3	7/6/15	10:23am			"					X						
	MATT-FC 1	7/6/15	10:32am			"					X						
	MATT-FC 2	7/6/15	10:42am			"					X						
	MATT-WS1-TNTP	7/6/15	11:09am			250cc		X	X								
	MATT-WS1-TSS	7/6/15	11:11am			1.0L				X							
	MATT-WS1-FC	7/6/15	11:12am	↓	↓	4oz					X						

Relinquished By: Jamuna D. Clarke
Received by:
Date/Time:

Relinquished By:
Received by:
Date/Time: 1249 7/6/15

Notes: Page 1 of 2
Samples transported in cooler on ice

KAR Laboratories, Inc. **Chain-of-Custody** www.karlabs.com

Client: Matteson Lake Association

Attn: Larry Lemke

Phone: 313-577-6412 Fax: LDLEMKE@

Cell: 313-205-4254 Email: WAYNE.EDN

Project Name: Matteson Lake Water Quality

Project #

P.O. #

Sampled by: Initials ☐ KAR ☒ Client L D L

Turnaround Time:
☒ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types: Surface Water
DW-Drinking Water Solid
AQ-Aqueous Liquid
Sludge/Biosolid Air

Requested Analyses

KAR use only
Proj#: 606134
Login: AB
Date: 7/6/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	Total Nitrogen	Total Phosphoros	Total Suspended Solids	E. Coli							Remarks
	MATT-DAM-TNTP	7/6/15	11:27am	AQ	HDPE	250cc		X	X									
	MATT-DAM-TSS	7/6/15	11:28am			1.0L				X								
	MATT-DAM-FC	7/6/15	11:29am			4oz					X							

Relinquished By: Lawrence D. Lemke

Received by:

Date/Time:

Relinquished By:

Received by: 1249 7/6/15

Date/Time:

Notes: Page 2 of 2
Samples transported in cooler on ice

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality
P O Box 123
Bronson, MI 49028

Attn : ***Mr. Larry Lemke***

KAR Project No. :	***506863***
Date Reported :	***08/05/15***
Date Activated :	***07/22/15***
Date Due :	***08/05/15***
Date Validated :	***08/05/15***

Project Description : ***Analysis of two samples from Matteson Lake, 2015-6.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 506863. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *506863*

Date Reported : *08/05/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of two samples from Matteson Lake, 2015-6.*

Sample ID : *"Matt WS-1"*

Sampled By : *WJS of Matteson Lake Water Quality*

Sample Date : *07/22/15*

Sample Time : *0938*

Date Received : *07/22/15*

Sample Type : *aqueous*

KAR Sample No. : *506863-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	*4.2*	*mg/L*	*EPA 351.2,353.2*	*07/23/15*	*ALK*	
Phosphorus, total (as P)	*0.05*	*mg/L*	*SM 4500-P B5,E*	*07/28/15*	*EIF*	

Sample ID : *"Matt DAM"*

Sampled By : *WJS of Matteson Lake Water Quality*

Sample Date : *07/22/15*

Sample Time : *0923*

Date Received : *07/22/15*

Sample Type : *aqueous*

KAR Sample No. : *506863-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	*2.6*	*mg/L*	*EPA 351.2,353.2*	*07/23/15*	*ALK*	
Phosphorus, total (as P)	*0.03*	*mg/L*	*SM 4500-P B5,E*	*07/28/15*	*EIF*	

KAR Laboratories, Inc.

Chain-of-Custody

www.karlabs.com

Client: MATTESON LAKE WATER QUALITY

Attn: LARRY LEMKE

Phone: 313 577 6412
CELL 313 205 4254
Fax: 313-577-0517

E-mail: LDLEMKE@WAYNE.EDU

CC:

~~P.O.#:~~ PROJECT NAME — MATTESON LAKE

Project #/WSSN #: 2015-6

Project Description: SAMPLE TYPE AQ - AQUEOUS

Sampled by: ☐ KAR ☒ Client **Initials** WJS

Turnaround Time:
☐ 10 bus. days ☐ Emergency(quote)
☐ 5 bus. days (x 1.5)
☐ 3 bus. days (x 2)
☐ Monthly ☐ Bact.- Nitrate

REQUESTED ANALYSIS

KAR Use Only
Proj#: SDL8603
Login: AB
Date: 7/22/15
FRB Y (N)
On-Ice (Y) N
Paid: _____
Cash ☐
Check ☐
Card ☐

	Sample Identification	Sample Date	Sample Time	MATRIX Sample Type	Container Type	#	TOTAL PHOSPHORUS	TOTAL NITROGEN	PRESERVED & ON ICE
1	MATT-WS-1	7/22/15	9:38	SW	250 cc	1	X	X	11
2	MATT - DAM	7/22/15	9:23	SW	250 cc	1	X	X	

Relinquished by: William J. Sweers
Received by: Carol Klevit
Date/Time: 7/22/15 12:20pm
Notes: MATRIX SW SURFACE WATER

Relinquished by:
Received by:
Date/Time:

Form KC020.F1.02

June 9, 2015

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality
P O Box 123
Bronson, MI 49028

Attn : ***Mr. Larry Lemke***

KAR Project No. :	***507302***
Date Reported :	***08/17/15***
Date Activated :	***08/03/15***
Date Due :	***08/17/15***
Date Validated :	***08/14/15***

Project Description : ***Analysis of 11 samples from Matteson Lake Water Quality.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 507302. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *507302*

Date Reported : *08/17/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake Water Quality.*

Sample ID : *"MATT-LAKE-TNTP-D"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *0940*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	3.8	mg/L	EPA 351.2,353.2	08/04/15	ALK	
Phosphorus, total (as P)	0.03	mg/L	SM 4500-P B5,E	08/12/15	EIF	Matrix effect observed; result is approximate.

Sample ID : *"MATT-LAKE-TNTP-M"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *0945*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	1.9	mg/L	EPA 351.2,353.2	08/04/15	ALK	
Phosphorus, total (as P)	0.02	mg/L	SM 4500-P B5,E	08/12/15	EIF	

Sample ID : *"MATT-LAKE-TNTP-S"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *0948*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-03*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	1.9	mg/L	EPA 351.2,353.2	08/04/15	ALK	
Phosphorus, total (as P)	<0.02	mg/L	SM 4500-P B5,E	08/12/15	EIF	

Sample ID : *"MATT-LAKE-TSS"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *0950*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-04*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Suspended solids, total	8	mg/L	SM 2540 D	08/10/15	AJK	

LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *507302*

Date Reported : *08/17/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake Water Quality.*

Sample ID : *"MATT-FC5"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1010*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-05*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	25	colonies/100mL	SM 9213 D.3	08/03/15	EIF	

Sample ID : *"MATT-FC4"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1017*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-06*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	29	colonies/100mL	SM 9213 D.3	08/03/15	EIF	

Sample ID : *"MATT-FC3"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1025*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-07*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	20	colonies/100mL	SM 9213 D.3	08/03/15	EIF	

Sample ID : *"MATT-FC1"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1034*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-08*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	82	colonies/100mL	SM 9213 D.3	08/03/15	EIF	

LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *507302*

Date Reported : *08/17/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of 11 samples from Matteson Lake Water Quality.*

Sample ID : *"MATT-FC2"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1044*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-09*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	42	colonies/100mL	SM 9213 D.3	08/03/15	EIF	

Sample ID : *"MATT-WS1"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1128*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-10*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	3900	colonies/100mL	SM 9213 D.3	08/03/15	EIF	
Nitrogen, total	1.1	mg/L	EPA 351.2,353.2	08/04/15	ALK	
Phosphorus, total (as P)	0.06	mg/L	SM 4500-P B5,E	08/12/15	EIF	
Suspended solids, total	7	mg/L	SM 2540 D	08/10/15	AJK	

Sample ID : *"MATT-DAM"*
Sampled By : *LDL of Matteson Lake Water Quality*
Sample Date : *08/03/15*
Sample Time : *1146*
Date Received : *08/03/15*
Sample Type : *aqueous*
KAR Sample No. : *507302-11*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Bacteria, E. coli	92	colonies/100mL	SM 9213 D.3	08/03/15	EIF	
Nitrogen, total	1.8	mg/L	EPA 351.2,353.2	08/04/15	ALK	
Phosphorus, total (as P)	<0.02	mg/L	SM 4500-P B5,E	08/12/15	EIF	
Suspended solids, total	10	mg/L	SM 2540 D	08/10/15	AJK	

KAR Laboratories, Inc. **Chain-of-Custody** www.karlabs.com

Client: Matteson Lake Association

Attn: Larry Lemke

Phone: 313-577-6412 Fax:

Cell : 313-205-4254 Email: LDLemke@WAYNE.EDU

Project Name: Matteson Lake Water Quality

Project #

P.O. #

Sampled by: Initials ☐ KAR ☒ Client L D L

Turnaround Time:
☒ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types: Surface water
DW-Drinking Water Solid
AQ-Aqueous Liquid
Sludge/Biosolid Air

KAR use only
Proj#: 507302
Login:
Date: 8/3/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	Total Nitrogen	Total Phosphorus	Total Suspended Solids	E. Coli							Remarks
	MATT-LAKE-TNTP-D	8/3/15	9:40 AM	AQ	HDPE	250cc		X	X									Deep
	MATT-LAKE-TNTP-M	8/3/15	9:45AM			"		X	X									mid-depth
	MATT-LAKE-TNTP-S	8/3/15	9:48AM			"		X	X									shallow
	MATT-LAKE-TSS	8/3/15	9:50AM			1.0 L				X								
	MATT-EC 5	8/3/15	10:10 AM			4oz					X							
	MATT-EC 4	8/3/15	10:17 AM			"					X							
	MATT-EC 3	8/3/15	10:25AM			"					X							
	MATT-EC 1	8/3/15	10:34AM			"					X							
	MATT-EC 2	8/3/15	10:44AM			"					X							
	MATT-WS1-TNTP	8/3/15	11:21 AM			250cc		X	X									
	MATT-WS1-TSS	8/3/15	11:23 AM			1.0 L				X								
	MATT-WS1-EC	8/3/15	11:28AM	↓	↓	4oz					X							

Relinquished By: Tamara D. Thelen
Received by: Carol Klatt
Date/Time: 8/3/15 1810 pm

Relinquished By:
Received by:
Date/Time:

Notes: Page 1 of 2
Samples transported in cooler on ice

KAR Laboratories, Inc. **Chain-of-Custody** www.karlabs.com

Client: Matteson Lake Association

Attn: Larry Lemke

Phone: 313-577-6412 Fax:

Cell: 313-205-4254 Email: LOLemke@WAYNE.EDU

Project Name: Matteson Lake Water Quality

Project #

P.O. #

Sampled by: Initials ☐ KAR ☒ Client L D L

Turnaround Time:
☐ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types: Surface water
DW-Drinking Water Solid
(AQ-Aqueous) Liquid
Sludge/Biosolid Air

KAR use only
Proj#: 503302
Login:
Date: 8/3/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	Total Nitrogen	Total Phosphorus	Total Suspended Solids	E. Coli						Remarks
	MATT-DAM-TNTP	8/3/15	11:44AM	AQ	HDPE	250cc		X	X								
	MATT-DAM-TSS	8/3/15	11:45AM	↓	↓	1.0L				X							
	MATT-DAM-FC	8/3/15	11:46AM	↓	↓	4oz					X						

Relinquished By: Jamie D. Jones
Received by: Carol Hart
Date/Time: 8/3/15 9:10pm

Relinquished By:
Received by:
Date/Time:

Notes: Page 2 of 2
Samples transported in cooler on ice

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality
P O Box 123
Bronson, MI 49028

Attn : ***Mr. Larry Lemke***

KAR Project No. :	***508033***
Date Reported :	***09/01/15***
Date Activated :	***08/18/15***
Date Due :	***09/01/15***
Date Validated :	***09/01/15***

Project Description : ***Analysis of two samples from Matteson Lake, 2015-8.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 508033. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *508033*

Date Reported : *09/01/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of two samples from Matteson Lake, 2015-8.*

Sample ID : *"Matt WS-1"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *08/18/15*
Sample Time : *1021*
Date Received : *08/18/15*
Sample Type : *aqueous*
KAR Sample No. : *508033-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	2.2	mg/L	EPA 351.2,353.2	08/20/15	ALK	
Phosphorus, total (as P)	0.04	mg/L	SM 4500-P B5,E	08/25/15	EIF	

Sample ID : *"Matt DAM"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *08/18/15*
Sample Time : *1038*
Date Received : *08/18/15*
Sample Type : *aqueous*
KAR Sample No. : *508033-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	1.9	mg/L	EPA 351.2,353.2	08/20/15	ALK	
Phosphorus, total (as P)	<0.02	mg/L	SM 4500-P B5,E	08/25/15	EIF	

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Client: MATTESON LAKE WATER QUALITY

LARRY LEMKE
Attn:

Phone: 313 577-6412 Fax: 313 577 0517

Cell : 313 205 4254 Email: LDLEMKE@WAYNE.EDU

Project Name: MATTESON LAKE WATER QUALITY

Project # 2015-8

P.O. #

Sampled by: Initials
☐ KAR ☒ Client WJS

Turnaround Time:
☐ 10 business day ☐ Emergency(quotation)
☐ 5 business days (x 1.5) ☐ Monthly
☐ 3 business days (x 2) ☐ Bacteria - Nitrate

Sample Types:
DW-Drinking Water Solid
AQ-Aqueous Liquid
Sludge/Biosolid Air

Requested Analyses

KAR use only
Proj#: 508033
Login: AB
Date: 8/18/15
FRB Y (N)
On-Ice (Y) N

#	Sample Identification	Sample Info: Date	Time	Matrix	Sample Containers Type	Size	#	TOTAL PHOSPHORUS	TOTAL NITROGEN	Remarks
1	MATT WS-1	8-18-15	10:21	SW		250 cc	1	X	X	PRESERVED ON ICE
2	MATT-DAM-	8.18.15	10:38	SW		250 cc	1	X	X	PRESERVED ON ICE

Relinquished By: William J Sweers
Received by: Carrie Hunt
Date/Time: 8/18/15 11:45 AM

Relinquished By:
Received by:
Date/Time:

Notes: SAMPLES TRANSPORTED IN COOLER ON ICE

MATRIX - SW - SURFACE WATER

4425 Manchester Rd
Kalamazoo, MI 49001
Phone 269 381-9666
Fax 269 381-9698
www.karlabs.com

Matteson Lake Water Quality
P O Box 123
Bronson, MI 49028

Attn : ***Mr. Larry Lemke***

KAR Project No. :	***508939***
Date Reported :	***09/22/15***
Date Activated :	***09/08/15***
Date Due :	***09/22/15***
Date Validated :	***09/22/15***

Project Description : ***Analysis of two samples from Matteson Lake, 2015-9.***

Dear Client,

Your laboratory data is presented to you in this report. Unless otherwise stated under the "Comments" heading, all tests were performed within the maximum allowable holding times, have met or exceeded QC requirements and the result represents the sample as it was received. If a sample was identified as drinking water under the Safe Drinking Water Act, the "Comments" column may also contain federal drinking water information including MCL which is the Maximum Contaminant Level set by USEPA. Values enclosed in brackets ([]) are Secondary MCL's and are non-enforceable guidelines for aesthetic quality.

If you wish to contact us about this work please mention KAR Project No. 508939. To arrange additional sampling or testing please contact our Client Services Department. If you have any questions regarding quality assurance please contact us.

Thank you for the opportunity to serve you. Please do not hesitate to call if we can provide additional assistance.

Respectfully submitted,

David R. Alkema
Laboratory Manager

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LABORATORY DETAIL REPORT

Client: *Matteson Lake Water Quality*

KAR Project No. : *508939*

Date Reported : *09/22/15*

Attest: David R. Alkema, Lab Manager

Project Description: *Analysis of two samples from Matteson Lake, 2015-9.*

Sample ID : *"Matt WS-1"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *09/08/15*
Sample Time : *1151*
Date Received : *09/08/15*
Sample Type : *aqueous*
KAR Sample No. : *508939-01*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	*1.7*	*mg/L*	*EPA 351.2,353.2*	*09/14/15*	*ALK*	
Phosphorus, total (as P)	*0.03*	*mg/L*	*SM 4500-P B5,E*	*09/15/15*	*EIF*	

Sample ID : *"Matt DAM"*

Sampled By : *WJS of Matteson Lake Water Quality*
Sample Date : *09/08/15*
Sample Time : *1201*
Date Received : *09/08/15*
Sample Type : *aqueous*
KAR Sample No. : *508939-02*

Test	Result	Units of Measure	Method	Analyzed	Analyst	Comments
Nitrogen, total	*1.4*	*mg/L*	*EPA 351.2,353.2*	*09/14/15*	*ALK*	
Phosphorus, total (as P)	*<0.02*	*mg/L*	*SM 4500-P B5,E*	*09/15/15*	*EIF*	

KAR *Laboratories, Inc.* **Chain-of-Custody** www.karlabs.com

Client: MATTESON LAKE WQ
~~LARRY LEMKE~~

Attn: LARRY LEMKE

Phone: 313 - 577 - 6412

Fax: 313 - 577 - 0517

E-mail: LD LEMKE @ WAYNE EDU

CELL
cc: 313 - 205 - 4254

P.O.#:

Project #/WSSN #:

Project Description: 2015 - 9

Sampled by: **Initials**
☐ KAR ☒ Client W I S

Turnaround Time:
☐ 10 bus. days ☐ Emergency(quote)
☐ 5 bus. days (x 1.5)
☐ 3 bus. days (x 2)
☐ Monthly ☐ Bact.- Nitrate

KAR Use Only
Proj# 508939
Login: AB
Date: 9/8/15
FRB Y (N)
On-Ice (Y) N
Paid: ____
Cash ☐
Check ☐
Card ☐

#	Sample Identification	Sample Date	Sample Time	Sample Type	Container Type	#	REQUESTED ANALYSIS: TOTAL PHOSPHORUS	REQUESTED ANALYSIS: TOTAL NITROGEN	
1	MATT WS - 1	9-8-15	11:51	AQ	250 cc		X	X	PRESERVED ON ICE
2	MATT - DAM -	9-8-15	12:01	AQ	250 cc		X	X	PRESERVED ON ICE

Relinquished by: William J Sweers
Date/Time: 9/8/15 1310
Received by:

Relinquished by:
Date/Time:
Received by:

Notes: AQ - AQUEOUS MATRIX
SW - SURFACE WATER
SAMPLES TRANSPORTED IN COOLER WITH ICE