CASCADE CHARTER TOWNSHIP

YEAR 2023

THORNAPPLE RIVER SPECIAL ASSESSMENT DISTRICT

ANNUAL REPORT

2023

MEMBERS

THORNAPPLE RIVER SAD COMMITTEE MEMBERS

John Shipley, Trustee
Jeff Carpenter, Cascade Thornapple River Assoc. Rep
Thomas Keith
Scott Rissi
Leann Rowland
Chuck Whitley
Michael Wiegand

TOWNSHIP STAFF ASSISTING THE COMMITTEE

Jade Smith, Township Manager
Melanie Manion, Parks Director
Aric Thorne, Township Engineer
Jessica Stine, Management Office Administrative Assistant

SAFETY & NAVIGATIONAL MARKING PROJECT

The Thornapple River SAD Committee kicked off 2023 with the creation of an RFP to select a contractor to aid in developing and implementing a Safety & Navigational Marking Plan for the SAD section of the Thornapple River. Viking Marine Construction won the bid and took lead on obtaining permits to mark hazards on the river. Permitting was subcontracted to Peterson Vandenburg. Marking of objects/the channel will primarily be between the I-96/M-6 bridges and the CSX railroad bridge. This project is currently awaiting state approval from EGLE and will likely move forward in the next one to two years, depending on how long it takes for permit approval and availability of a contractor to place the navigational markers. The permit will be open for 5 years once approved. More markers were requested than will be placed as it will be easier for the committee to make modifications to the placement as necessary, without requiring additional permits. The committee intends to limit the number of markers so site lines to the water remain scenic.

In preparation for the permitting process, Viking Marine Construction surveyed river depths and provided the Township with both the raw data and professional mapping of the SAD potion of the river. While this information was obtained for permitting, the committee hopes to use it for other SAD related tasks in the future, such as updating the river map.

AQUATIC VEGETATION CONTROL & WATER TESTING

This year marked the second successful season of weed treatments and water quality testing of the river by PLM Lake & Land Management Corp. Water Quality results, including tests for E. coli, conductivity, total dissolved solids, pH, alkalinity, total phosphorus, nitrates, and chlorophyll are included in the appendix. The 2023 cutting and removal of weeds went much more smoothly than the 2022 mechanical harvest. In 2022 large quantities of weeds floated down stream. The committee recommended a change to PLM's mechanical harvesting process and that appears to have greatly reduced the amount of weeds floating downstream. While both the committee and Township received concerns related to this in 2022, neither received negative feedback from residents related to the mechanical harvesting of weeds in 2023.

Fewer acres of the river were weed treated in 2023 than in previous years, since fewer areas of invasive species were present; this suggests that the weed treatments are working. The committee hopes this trend continues, but are ready to act if new problems arise. In fall of 2023, there was an extensive algae bloom in Ada Township and, while Cascade Township has not experienced anything similar, the situation is being closely monitored.

SAD FUNDS

The SAD committee received an unexpected and welcome visit at its September meeting from Supervisor Lesperance and Treasurer Korstange. They explained the process in which funds are collected, processed, and set aside in a SAD. They also answered questions and assured the committee that they would have accurate financial information moving forward. The committee was confident in their financial outlook after the meeting

FLOATING DEBRIS RELOCATION

During the fall of 2023, Larry's Tree Service was contracted to use their barge to relocate several large floating trees and logs that the spring rains washed into the navigable waterway. These objects were successfully removed from the channel and securely laid at the edge of the river to provide bank stabilization in designated areas. Moving these objects has made for a much safer environment as these objects would frequently drift with the wind, many floating even with the water's surface, making them hard to spot in certain conditions.
In the first part of 2024, the committee intends to create a multi-year plan.

The committee appreciates the boards continued support of their efforts to improve and protect the quality of the Thornapple River.

APPENDIX

Pages 7-8 *2023 Water Quality Report: Test Site #1*

Pages 9- 10 *2023 Water Quality Report: Test Site #2*

Page 11 *2023 Bacteria Sampling Report*

Pages 12-13 *2023 Overall Water Quality Measurements*

2023 WATER QUALITY REPORT: TEST SITE #1

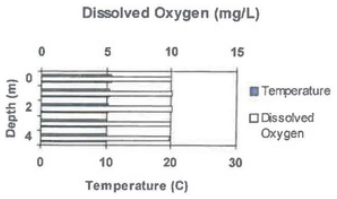
LAKE CHECK **Water Quality Monitoring Report**

2023093

Customer	Waterbody	Sample Information
Thornapple River Cascade	Thornapple River Cascade	Date: 4/20/2023
		Site: #1

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	10.7	10.0	90
1	10.4	10.0	90
2	10.2	10.0	89
3	10.1	10.0	89
4	10.0	9.9	88



Secchi Disk Depth	0.8	meters
Thermocline Depth		meters

Analytical Results

Parameter	Result	Units	Interpretation
Fecal Bacteria (E. coli		CFU/100 mL	N/A
Conductivity	331	uS/cm	Moderate concentration of dissolved salts
Total Dissolved Solids	297	mg/L	
pH	8.3	S.U.	Water is slightly alkaline
Alkalinity	234	mg CaCO3/L	Water is very hard
Total Phosphorus	7	ug/L	Slightly phosphorus enriched
Nitrates	1490	ug/L	Nitrogen enriched
Chlorophyll	N/A		

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	64	hypereutrophic
Based on Total Phosphorus	28	oligotrophic
Based on Chlorophyll	N/A	

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Sample is nitrogen enriched. Consider nutrient abatement measures.
- Repeat LakeCheck in Fall.

- WARNING, condition requires immediate attention.
- CAUTION, condition requires further evaluation.
- OK, condition within acceptable limits.
- NEUTRAL, condition neither good nor bad.

2023 WATER QUALITY REPORT: TEST SITE #1

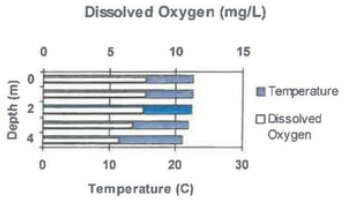
2023094

LAKE CHECK **Water Quality Monitoring Report**

Customer	Waterbody	Sample Information
Thornapple River Cascade	Thornapple River Cascade	Date: 9/5/2023
		Site: #1

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	22.6	7.7	90
1	22.6	7.7	90
2	22.4	7.5	87
3	21.9	6.8	77
4	21.0	5.7	64



Secchi Disk Depth	1.0	meters
Thermocline Depth		meters

Analytical Results

Parameter	Result	Units	Interpretation
Fecal Bacteria (E. coli		CFU/100 mL	N/A
Conductivity	528	uS/cm	Moderate concentration of dissolved salts
Total Dissolved Solids	344	mg/L	
pH	8.6	S.U.	Water is slightly alkaline
Alkalinity	251	mg CaCO3/L	Water is extrmely hard
Total Phosphorus	9	ug/L	Slightly phosphorus enriched
Nitrates	1520	ug/L	Nitrogen enriched
Chlorophyll	N/A		

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	60	eutrophic
Based on Total Phosphorus	31	meso-oligotrophic
Based on Chlorophyll	N/A	

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Sample is nitrogen enriched. Consider nutrient abatement measures.
- REPEAT LakeCheck NEXT YEAR!

- WARNING. condition requires immediate attention.
- CAUTION. condition requires further evaluation.
- OK. condition within acceptable limits.
- NEUTRAL. condition neither good nor bad.

2023 WATER QUALITY REPORT: TEST SITE #2

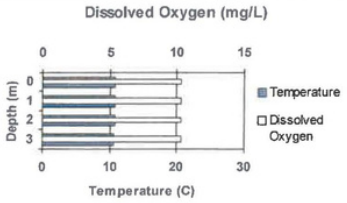
2023095

LAKE CHECK **Water Quality Monitoring Report**

Customer	Waterbody	Sample Information
Thornapple River Cascade	Thornapple River Cascade	Date: 4/20/2023
		Site: #2

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	10.7	10.3	93
1	10.7	10.3	93
2	10.7	10.3	93
3	10.5	10.3	93



Secchi Disk Depth	0.8	meters
Thermocline Depth		meters

Analytical Results

Parameter	Result	Units	Interpretation
Fecal Bacteria (E. coli		CFU/100 mL	N/A
Conductivity	535	uS/cm	Moderate concentration of dissolved salts
Total Dissolved Solids	300	mg/L	
pH	8.4	S.U.	Water is slightly alkaline
Alkalinity	241	mg CaCO3/L	Water is very hard
Total Phosphorus	7	ug/L	Slightly phosphorus enriched
Nitrates	1500	ug/L	Nitrogen enriched
Chlorophyll	N/A		

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	64	hypereutrophic
Based on Total Phosphorus	28	oligotrophic
Based on Chlorophyll	N/A	

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Sample is nitrogen enriched. Consider nutrient abatement measures.
- Repeat LakeCheck in Fall.

- WARNING. condition requires immediate attention.
- CAUTION. condition requires further evaluation.
- OK. condition within acceptable limits.
- NEUTRAL. condition neither good nor bad.

2023 WATER QUALITY REPORT: TEST SITE #2

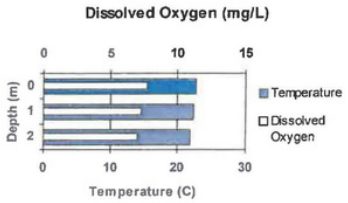
2023096

LAKE CHECK **Water Quality Monitoring Report**

Customer	Waterbody	Sample Information
Thornapple River Cascade	Thornapple River Cascade	Date: 9/5/2023 Site: #2

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	22.7	7.8	90
1	22.4	7.3	84
2	21.9	7.0	80



Secchi Disk Depth	1.0	meters
Thermocline Depth		meters

Analytical Results

Parameter	Result	Units	Interpretation
Fecal Bacteria (E. coli		CFU/100 mL	N/A
Conductivity	535	uS/cm	Moderate concentration of dissolved salts
Total Dissolved Solids	344	mg/L	
pH	8.5	S.U.	Water is slightly alkaline
Alkalinity	257	mg CaCO3/L	Water is extrmely hard
Total Phosphorus	13	ug/L	Moderately phosphorus enriched
Nitrates	1540	ug/L	Nitrogen enriched
Chlorophyll	N/A		

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	60	eutrophic
Based on Total Phosphorus	37	meso-oligotrophic
Based on Chlorophyll	N/A	

Conclusions

- Conditions are good for fish growth.
- Minimum dissolved oxygen is adequate for good fish production.
- pH is within acceptable limits.
- Sample is somewhat nutrient (N and P) enriched. Adopt appropriate lakeshore landscaping and lawn care practices.
- REPEAT LakeCheck NEXT YEAR!

- WARNING. condition requires immediate attention.
- CAUTION. condition requires further evaluation.
- OK. condition within acceptable limits.
- NEUTRAL. condition neither good nor bad.

2023 BACTERIA SAMPLING REPORT

BEACH CHECK **Bacteria Sampling Report**

Waterbody: Thornapple River Cascade

Thornapple River Cascade

Date Sampled:
7/19/2023

Location	*E. coli*	Total Coliforms	Interpretation
1	28		Water meets bacteriological standards for safe swimming.
2	88		Water meets bacteriological standards for safe swimming.
3	56		Water meets bacteriological standards for safe swimming.

Bacterial counts are expressed as the number of Colony Forming Units per 100 milliliters (CFU/100mL).

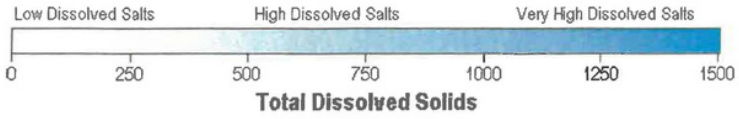
For full body contact recreation (including swimming) counts of E. coli should not exceed 130 (CFU/100mL)as a monthly geometric mean of at least five samples per the State of Michigan standard, or single samples should not exceed 298 (CFU/100mL) [235 CFU/100mL in a designated bathing beach area] per Federal (EPA) guidelines.

Current recreational water quality standards do not rely on Total Coliform counts.

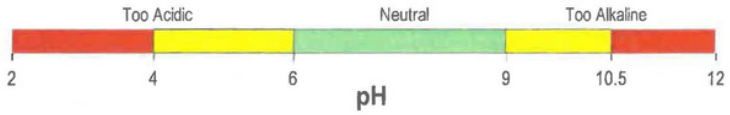
2023 OVERALL WATER QUALITY MEASUREMENTS

LAKE CHECK WATER QUALITY MEASUREMENTS

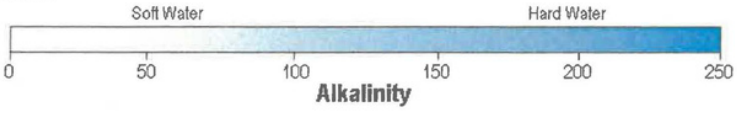
Conductivity and **Total Dissolved Solids (TDS)** measure the total amount of material dissolved in the water. Higher values indicate potentially richer, more productive water, whereas lower values indicate potentially cleaner, less productive water. Localized increases in conductivity and TDS may indicate inputs of groundwater or other nutrient-enriched water. [Note: Human activities that result in nutrient pollution (e.g., fertilizer runoff) can increase the productivity of algae and other organisms without raising conductivity/total dissolved solids very much. If nutrient pollution is occurring, the total phosphorus concentration is a much better indicator of potential productivity.]



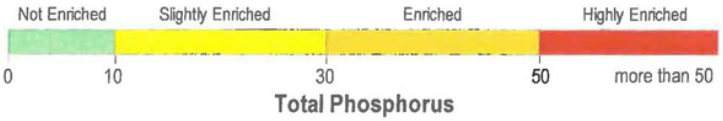
pH describes the balance between acids and bases in the water. Neutral values of pH (between 6 and 9) are desirable. Low pH values typically result either from the growth of bog vegetation (such as peat moss), acid precipitation ("acid rain"), or acid runoff (as in acid mine drainage). Excessive growth of certain plants and algae can raise pH values above 9.0 or 10.0.



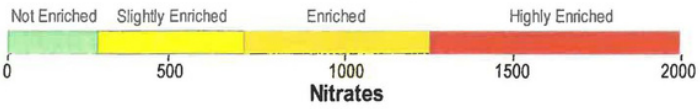
Alkalinity measures the concentration of carbonates and bicarbonates in the water. These compounds and other ions associated with them make water "hard". High alkalinity lakes are hardwater lakes, while low alkalinity lakes are softwater lakes. Different kinds of plants, algae, and other aquatic organisms live in hardwater than in softwater. Alkalinity also influences the effectiveness of some herbicides and algicides. Alkalinity is a basic characteristic of water, but is neither inherently good nor bad.



Total Phosphorus measures the total (organic and inorganic, dissolved and particulate) amount of phosphorus in the water. Phosphorus is usually the plant nutrient (i.e., fertilizer) that controls the amount of algal growth in lakes and ponds. Most Midwestern lakes have more phosphorus and more algae than is desirable, so lower values are generally better, though very unproductive water bodies typically support little fish production.

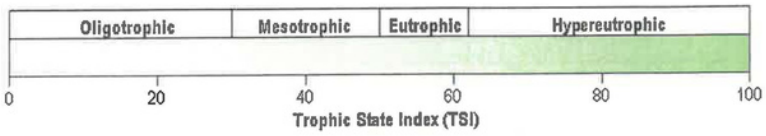


Nitrate measures the total inorganic amount of nitrogen in the water. Nitrogen is the plant nutrient (i.e., fertilizer) most likely to control the amount of rooted plant growth in lakes and ponds. Most Midwestern lakes have more nitrogen and more rooted plant growth than is desirable, so lower values are generally considered better

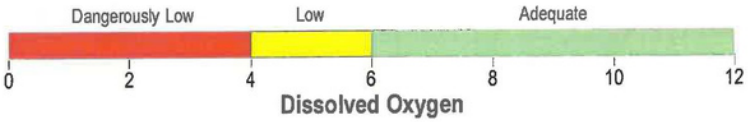


2023 OVERALL WATER QUALITY MEASUREMENTS

Trophic State Indices calculate the trophic status of the waterbody. Waterbodies are classified as oligotrophic, mesotrophic, eutrophic or hypereutrophic depending on the overall amount of plants, algae and other organisms the waterbody supports. Lakes of different trophic states vary in a number of chemical characteristics and support different types of organisms (see the enclosure "Lake Trophic States and Eutrophication"). Thus the trophic state of a waterbody provides a wealth of information concerning the types of organisms living in the waterbody, the processes likely to occur there and the kinds of problems to be expected. Trophic State Index values can be calculated from a number of variables. LakeScan calculates Carlson's Trophic State Index (TSI) from total phosphorus, Secchi disk depth and chlorophyll (separate TSI values are calculated for each of the variables that was measured as part of your LakeCheck package).

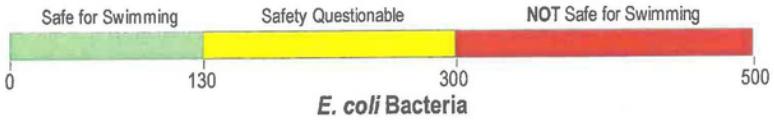


Dissolved Oxygen is a measure of the amount of oxygen dissolved in the water. Oxygen is needed by fish and other aquatic organisms to allow them to "breath" underwater. Plants and algae produce oxygen by photosynthesizing during the day and use oxygen for respiration at night.



Temperature provides information about the kinds of fish that can grow in a lake, information necessary for interpretation of other parameters, and information about the extent to which a lake is stratified into layers having water of different temperatures. If the lake is stratified, the **thermocline depth** tells how deep the surface layer of warm water is.

Fecal Indicator Bacteria (*E. coli*) measurements count the number of live fecal indicator bacteria in the sample. These bacteria are considered reliable indicators of fecal contamination—when they are found in a pond or lake, it is very likely that the water is being contaminated by animal feces. Contamination can potentially be derived from a number of sources, including failed septic systems, agricultural runoff, or waterfowl or wildlife droppings.



- *E. coli* counts of 300 (CFU/100 mL) and above in a single sample are considered to represent conditions that are **UNSAFE** for swimming and other body contact recreation.
- *E. coli* counts of 130 (CFU/100 mL) and above averaged (using a geometric mean) over measurements made during a 30-day period are considered to represent conditions that are UNSAFE for swimming and other body contact recreation. When values of 130 (CFU/100 mL) or higher but less than 300 are encountered, LakeCheck rates the safety of the water for swimming as questionable.
- *E. coli* counts below 130 are considered safe for swimming and other body-contact recreation

We recommend prompt retesting whenever Fecal Indicator Bacteria counts exceed 100 (CFU/100 mL) to determine whether contamination is an ongoing problem. If frequent contamination is detected, steps to identify and eliminate the source of contamination are highly recommended.