MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

2017 National Lakes Assessment - CROOKED LAKE

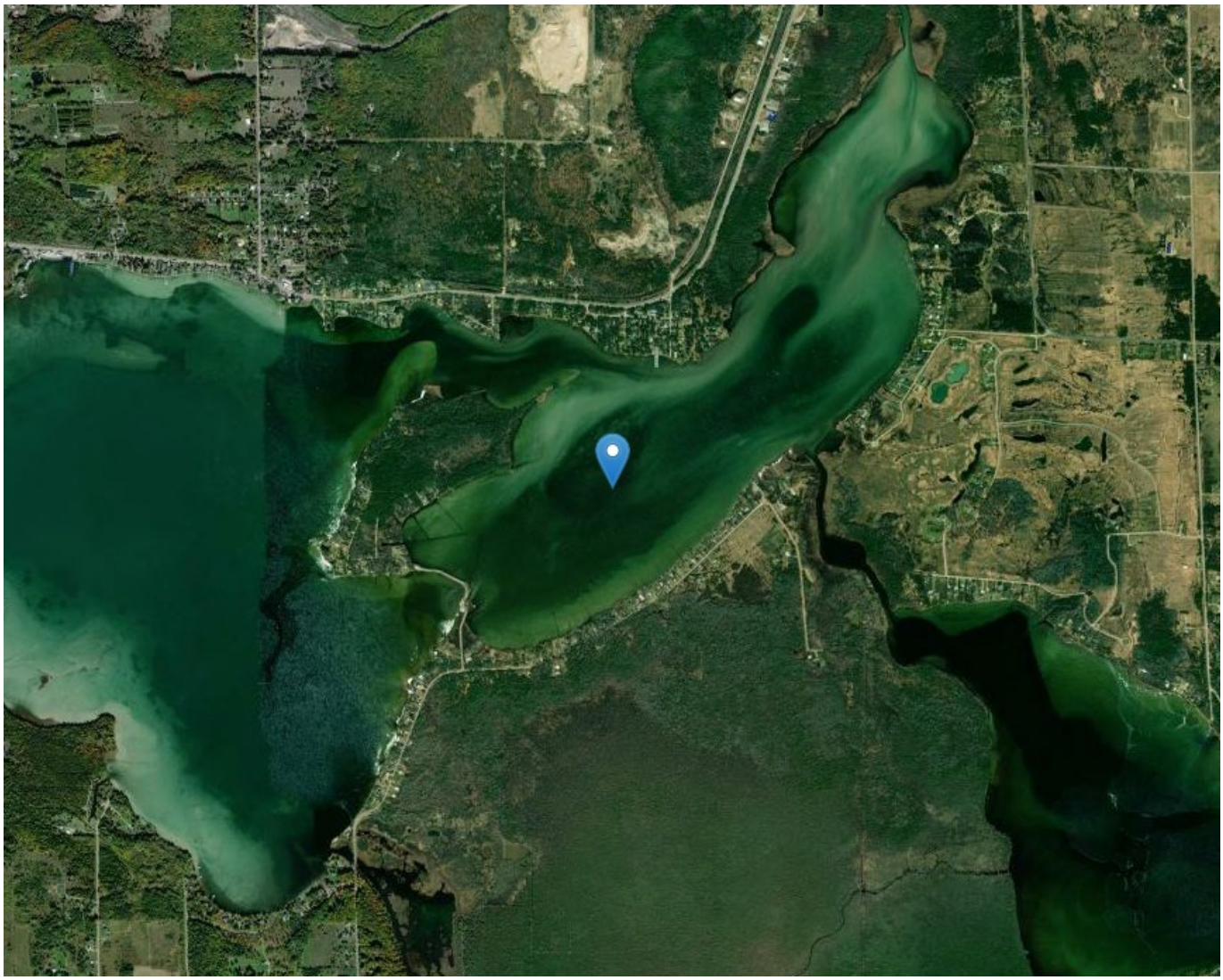
County: Emmet

Location: 45.41361, -84.80677

Ownership: Private

Depth (feet): 46.2

Area (acres): 2299



PROJECT BACKGROUND

In the summer of 2017, Michigan participated in the U.S. Environmental Protection Agency's (USEPA) nationwide survey of the condition of inland lakes to help measure the health of our waters, take actions to prevent pollution, and evaluate restoration activities. Crooked Lake was one of 50 Michigan inland lakes that were sampled as part of the National Lake Assessment (NLA). This fact sheet contains data collected from that study. Crooked Lake was sampled 1 time(s) in 2017 according to approved quality assurance procedures.

LAND USE

The water quality of a lake is impacted by processes that occur both within the lake and the surrounding watershed. A *watershed* is all of the land and water area that drains to the lake. Land use in the watershed can greatly impact the water quality of a lake, especially if the land use activity changes the landscape drastically from its natural state. Land use in the watershed surrounding Crooked Lake consists of 8 percent agriculture, 6 percent developed, 58 percent forest, 11 percent other, 5 percent water, and 11 percent wetland (Figure 1).

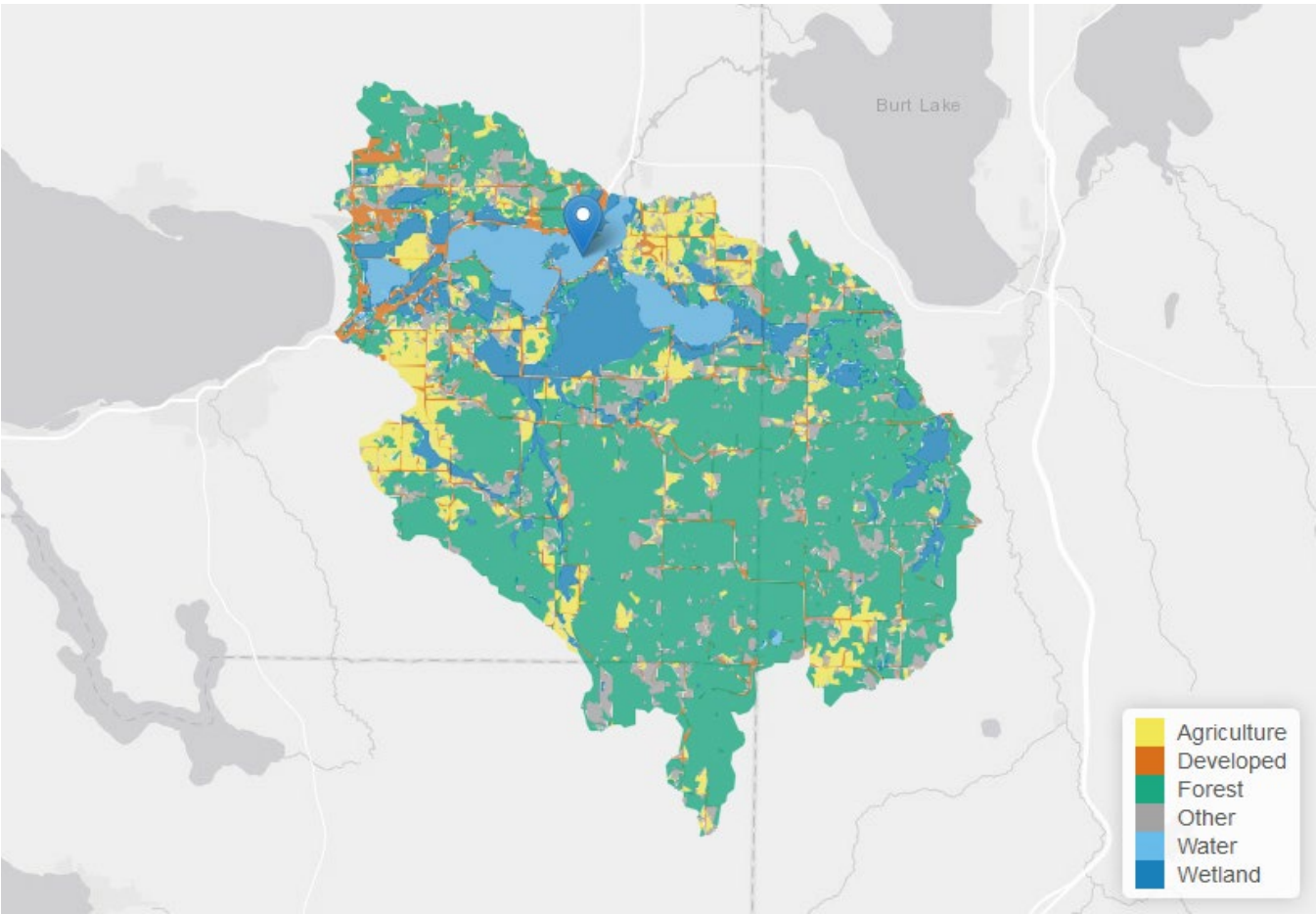


Figure 1. Land use map of Crooked Lake.

LAKE CONDITION INDICATORS

Lake ecosystems are dynamic, and indicators selected to characterize them should represent their varied aspects. For the 2017 NLA, a suite of chemical, physical and biological indicators were chosen to assess biological integrity, trophic state, recreational suitability, and key stressors affecting the biological quality of Crooked Lake (Table 1). Although there are many more indicators and stressors that affect lakes, NLA analysts believe these to be among the most representative at a national scale. Visit the USEPA's National Aquatic Resource Surveys What is the National Lakes Assessment? Web page to learn more about these indicators.

Table 1. Condition values for indicators measured for Crooked Lake during the 2017 National Lakes Assessment.

BIOLOGICAL

Indicator	Condition
Chlorophyll a	Good
Benthic Macroinvertebrates	Good
Zooplankton	Fair

CHEMICAL

Indicator	Condition
Acidification	Good
Atrazine Detection	Not Detected
Atrazine Risk	At or Below Benchmark
Oxygen (Dissolved)	Good
Nitrogen (Total)	Good
Phosphorus (Total)	Good

PHYSICAL

Indicator	Condition
Lake Drawdown Exposure	Not Assessed
Lake Habitat Complexity	Poor
Lakeshore Disturbance	Fair
Riparian Vegetation Cover	Poor
Shallow Water Habitat Condition	Poor

RECREATIONAL/HUMAN HEALTH

Indicator	Condition
Microcystins Detection	**Detected**
Microcystins Risk	**At or Below Benchmark**
E.coli Detection	**Not Detected**
E.coli Risk	**At or Below Benchmark**

TROPHIC STATUS

In addition to the various chemical, physical, and biological indicators assessed during NLA, lakes were also classified by their trophic status. The trophic status of a lake provides a relative indication of the amount of nutrients and plant growth in a waterbody, and for NLA, is evaluated using chlorophyll a concentration.

Lakes can be placed into one of four trophic state categories:

- *Oligotrophic* - low nutrient concentrations and low plant growth
- *Mesotrophic* - moderate nutrient concentrations and moderate plant growth
- *Eutrophic* - high nutrient concentrations and high plant growth
- *Hypereutrophic* – extreme algae and plant growth, usually due to human activity

Crooked Lake was classified as: **Mesotrophic**

WATER CHEMISTRY DATA

Following is a summary of water chemistry data collected during the 2017 National Lakes Assessment for Crooked Lake (Table 2, Figure 2). Field and laboratory manuals detailing how water samples were collected and analyzed can be found on the USEPA's National Aquatic Resources Surveys Manuals Used in the National Aquatic Resource Surveys Web page. If you wish to have access to all of the raw data collected as part of NLA, along with any other data collected through EPA's National Aquatic Resource Surveys, they are available for download on the USEPA's National Aquatic Resource Surveys Data from the National Aquatic Resource Surveys Web page.

Table 2. Water quality parameters collected during the 2017 National Lakes Assessment of Crooked Lake.

Parameter	Result	Average Michigan 2017 NLA Result
Acid Neutralizing Capacity (UEQ/L)	2,565.18	1,700.48
Ammonia (mg N/L)	0.01	0.02
Calcium (mg/L)	39.74	24.67
Chloride (mg/L)	8.34	15.62
Chlorophyll a (µg/L)	5.29	11.88
Color (APHA PT-CO)	10.00	37.22
Conductivity (µS/cm at 25 °C)	320.00	232.72
Dissolved Organic Carbon (mg/L)	3.77	8.28
Magnesium (mg/L)	13.15	8.66
Nitrate (mg N/L)	0.00	0.11
Nitrite (mg N/L)	0.00	0.00
pH (STU)	8.50	7.80
Potassium (mg/L)	0.75	1.00
Secchi Depth (ft)	6.90	8.64
Silica (mg/L)	5.85	2.40
Sodium (mg/L)	6.08	9.87
Sulfate (mg/L)	6.24	6.20
Total Nitrogen (mg/L)	0.48	0.77
Total Phosphorus (µg/L)	12.14	26.64
Turbidity (NTU)	5.17	2.32

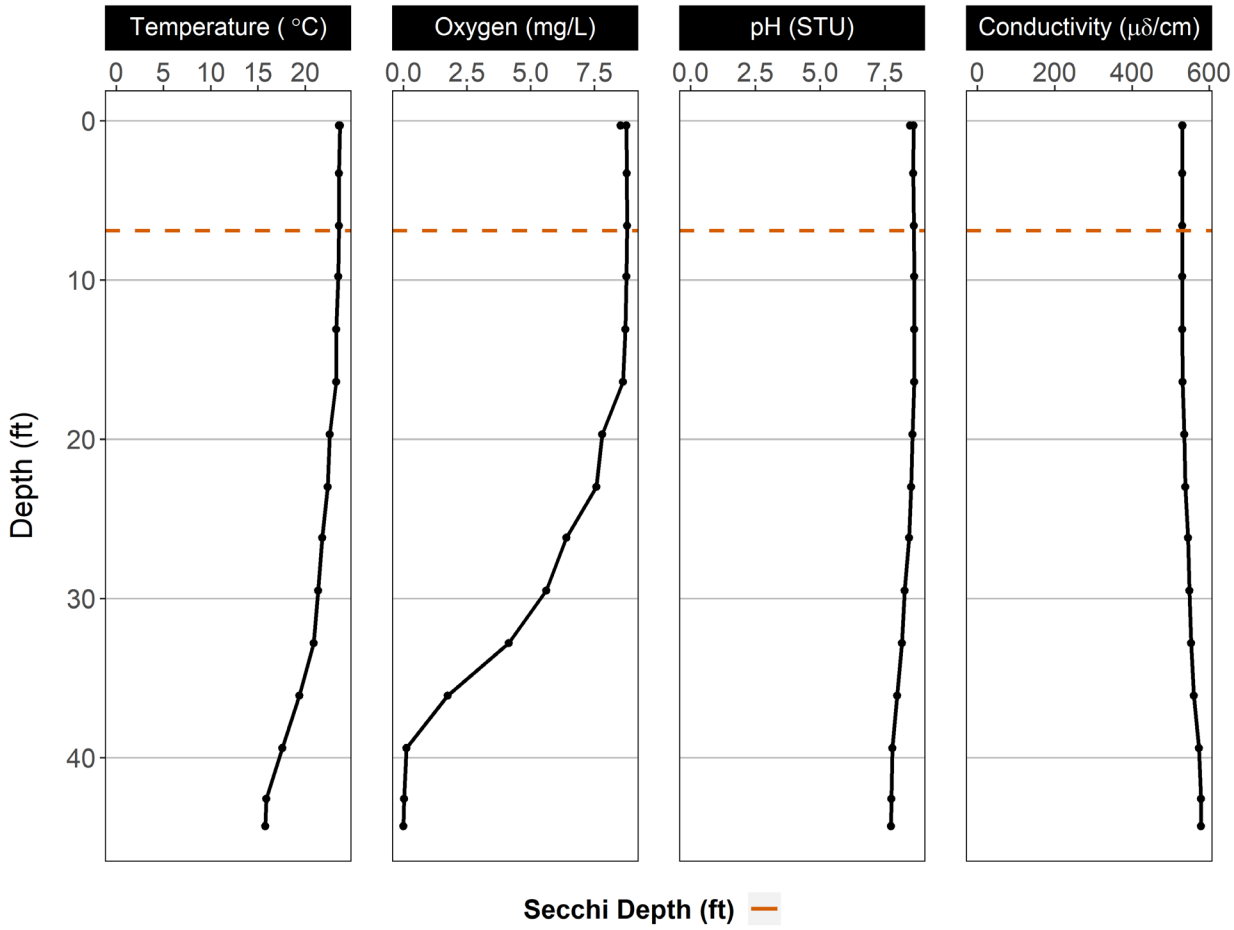


Figure 2. Vertical profile of temperature, dissolved oxygen, pH, and conductivity collected during the 2017 National Lakes Assessment of Crooked Lake.

SUPPLEMENTAL RESOURCES

- National Lakes Assessment: Learn more about USEPA's National Lakes Assessment program.
- EGLE Inland Lakes Monitoring: Learn more about the Michigan Department of Environment, Great Lakes, and Energy's Inland Lake Water Quality Monitoring Program.
- Eat Safe Fish Program: Determine if fish are safe to eat in your lake.
- Michigan BeachGuard System: View water quality data and beach closures.
- Michigan Harmful Algal Bloom Reports Mapper: Determine if a harmful algal bloom has been reported in your lake.
- MiCorps Cooperative Lakes Monitoring Program: Find volunteer monitoring data or start a volunteer monitoring program for your lake.

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