Cranberry Pond

Cranberry Pond	Town of Greece	Monroe County

Lake Characteristics		
	Surface area (ac/ha)	237 / 96
	Max depth (ft/m)	10 / 3
	Mean depth (ft/m)	6 / 2
	Retention time (years)	1.8
	Lake Classification	B
	Dam Classification	

Watershed Characteristics		
	Watershed area (ac /ha)	887 / 359
	Watershed / Lake ratio	4
	Lake & wetlands %	52.6%
	Agricultural %	10.4%
	Forest, shrub, grasses %	15.9%
	Residential	21.1%
	Urban	0.0%

LCI Participation		
	Years	2016
	Samplers	David Kelley, David Newman, Bill Lints

Trophic state	HABs Susceptibility	Invasive Vulnerability	PWL Assessment
Eutrophic	Some reported blooms, Moderate susceptibility	Invasives present, High Vulnerability	Impaired

Water quality values for Cranberry Pond for the 2016 sampling season. "Seasonal change" shows current year variability. Light red color indicates eutrophic conditions in top table and bloom conditions in bottom table.

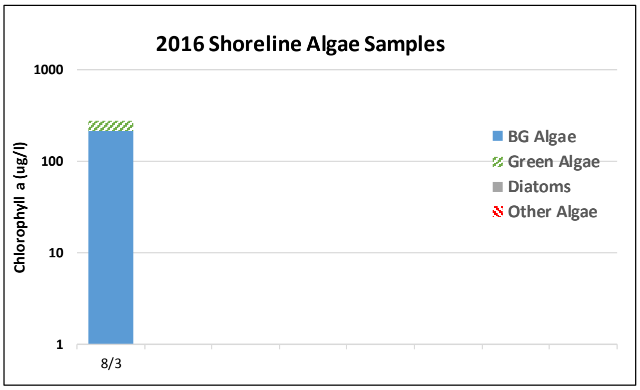
Open Water Indicators	2016 Sampling Results 6/9	7/6	8/3	9/7	Seasonal change	2016 Avg
Clarity (m)	0.6	0.6	0.5	0.4		0.5
TP (mg/l)	0.068	0.061	0.046	0.063		0.060
Soluble P (mg/l)	0.011	0.009	0.007	0.008		0.009
Deep TP (mg/l)						
Deep Soluble P (mg/l)						
TN (mg/l)	1.150	1.260	1.210	1.030		3.081
Surface N:P Ratio	17	21	26	16		52
Deep to Surface NH4 Ratio						
Chl.a (ug/l)	17.7	20.9	40.1	85.7		41.1
pH	8.2	8.4	8.5	9.1		8.5
Conductivity (umho/cm)	784	785	742	683		748
Total Organic Carbon (mg/l)						
True Color (ptu)	35	35	30	40		35
Calcium (mg/l)						
Deep Manganese (mg/l)						
Deep Iron (mg/l)						
Deep Arsenic (mg/l)						

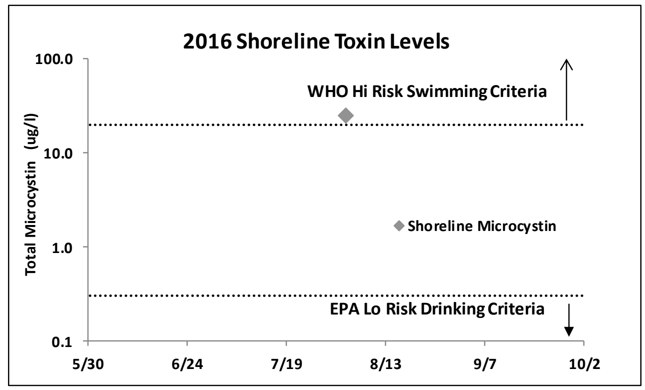
Shoreline bloom and HABs notifications

Date of first listing	Date of last listing	# weeks on the DEC notification list	# Weeks with updates
8/5/16	8/19/16	3	2

HAB Indicators	HAB criteria	8/3/16
BGA	25 - 30 ug/L	213.0
microcystin	20 ug/L	24.7
anatoxin - a		<DL

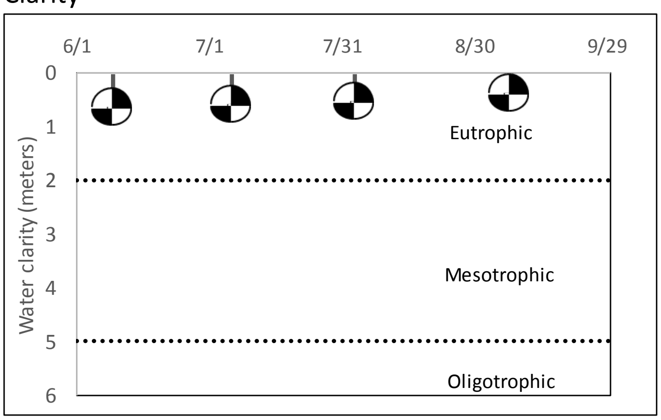
HABs Status Shoreline Algae Shoreline Toxins



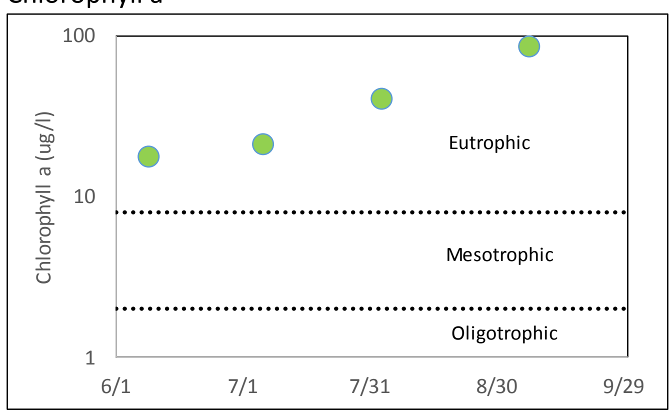


Seasonal Changes- Cranberry Pond 2016

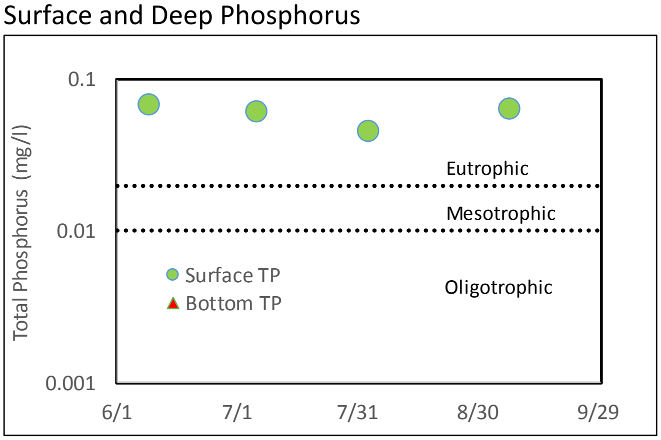
Clarity



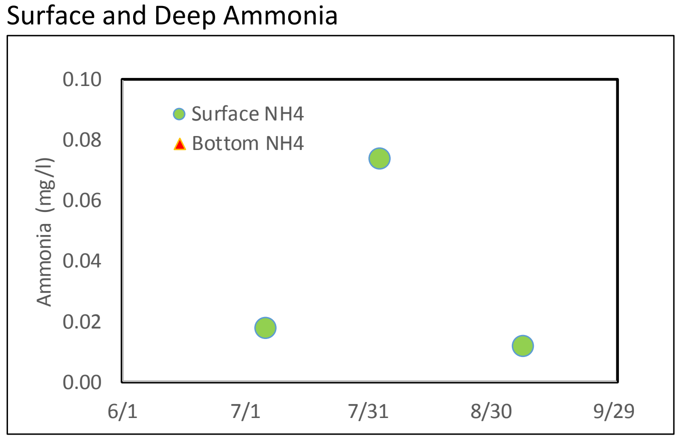
Chlorophyll a



Surface and Deep Phosphorus

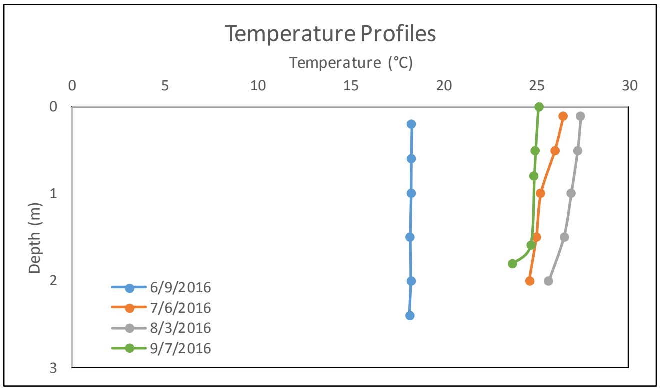


Surface and Deep Ammonia

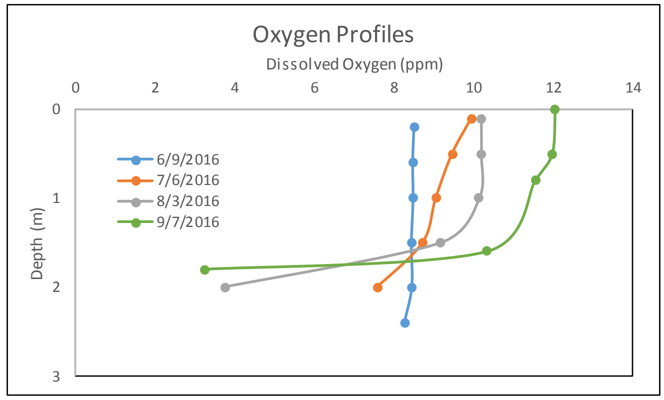


Depth Profiles- Cranberry Pond 2016

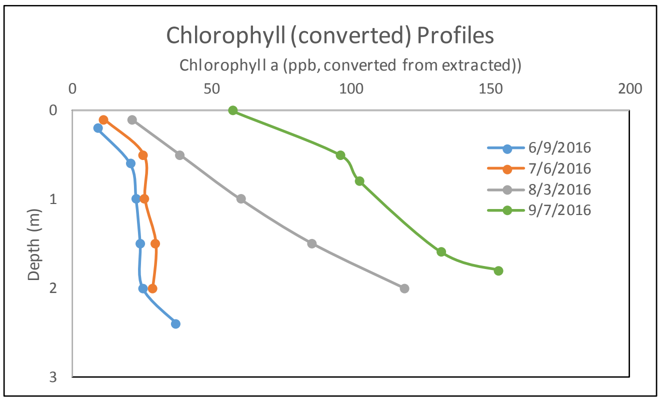
Temperature



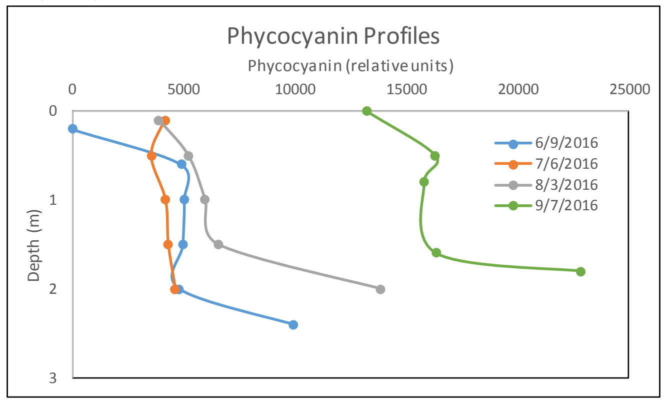
Dissolved Oxygen



Chlorophyll (corrected)



Phycocyanin



Scorecard

Lake Use

	PWL	2016	Primary issue
Potable Water	Not Known	Not Known	No impacts
Swimming	Impaired	Impaired	Algae levels
Recreation	Impaired	Impaired	Algae levels
Aquatic Life	Not Known	Threatened / Fair	Surface Oxygen
Aesthetics	Not Known	Stressed / Poor	Poor perception
Habitat	Not Known	Threatened / Fair	Invasive plants
Fish Consumption	Stressed / Poor	Not Known	Not applicable

- Supported / Good
- Threatened / Fair
- Stressed / Poor
- Impaired
- Not Known

LCI sampling summary- Cranberry Pond 2016

What is the condition of the lake?: NYSDEC conducted routine (monthly) sampling of Cranberry Pond as part of the DEC Lake Classification and Inventory (LCI) survey of the Lake Ontario drainage basin. Cranberry Pond can be characterized as a *eutrophic* lake, based on high nutrient (phosphorus) and algae (chlorophyll *a*) levels, and low water clarity (Secchi disk transparency), although the latter is influenced by the shallow depth of the lake. The lake has alkaline water with very hard water, elevated nitrogen (mostly organic) levels, and high water color (brownness).

Do conditions change over the summer?: Lake productivity increases significantly during the summer- water clarity decreases slightly as algae levels increase significantly, despite seasonally stable nutrient (phosphorus and nitrogen) levels. However, pH and conductivity vary unpredictably over the course of the sampling season.

Do conditions change from surface to bottom?: Cranberry Pond is shallow (less than seven feet deep), so "deep" samples were not collected. Based on the depth profile, which shows similar temperatures from surface to bottom, but decreasing oxygen levels, it is likely that most of the water quality indicators would vary little, or unpredictably, throughout the water column.

How do these conditions compare to nearby lakes?: Cranberry Pond has much higher productivity- higher nutrient and algae levels, and lower water clarity- than many other lakes in the Lake Ontario region.

Have these conditions changed over time? Cranberry Pond was sampled by the NYSDEC in 2000. Phosphorus and nitrogen concentrations were substantially higher in 2000, resulting in much higher algae levels, although water clarity was much higher in 2000. pH and conductivity were much higher in 2016; the rise in conductivity is consistent with long-term patterns seen in many NYS lakes. There is insufficient data to evaluate water quality trends, although by some measures, lake conditions were more favorable in 2016.

Were any algal blooms or HABS observed or reported?: Water quality conditions indicated a high susceptibility to blooms, and a cyanobacteria (blue green algae) bloom was observed along the shoreline in 2016. Toxin levels in this bloom were highly elevated, although any shoreline harmful algal bloom (HAB) represents an exposure risk and should be avoided.

Are there any aquatic invasive species on the lake?: Eurasian watermilfoil, European frog bit and curly leafed pondweed have been found in the lake, but it is not known if these invasive plants have affected lake use. Calcium levels are high enough to support zebra mussels, but these invasive mussels have not been reported in the lake.

Were there any other observations?: Native plants observed during the sampling included yellow water lilies, but native plant growth may have been limited by high water turbidity.

Are any designated uses likely impacted by these conditions?: Cranberry Pond is heavily used for boating and fishing. Algae levels are consistently high enough to impair the use of the lake for recreation due to water clarity that is too low to support safe swimming. The lake was cited on the federal 303d list for excessive nutrients in 2002 (https://www.dec.ny.gov/docs/water_pdf/303dListfinal2016.pdf). This excessive algae growth and ow water clarity may also affect aesthetics. Aquatic life may be threatened by low oxygen levels near the lake surface and habitat may be affected by invasive plants. Fish consumption is stressed due to the proximity to Lake Ontario and associated fish consumption advisories.

What actions, if any, are appropriate for consideration?: A TMDL was developed in 2010 to identify and address nutrient loads to the lake (https://www.dec.ny.gov/docs/water_pdf/tmdlgenepds10.pdf). It is not known how any of the actions proposed in the TMDL can be implemented in the lake. A buffer of native plants next to the lakeshore may help reduce nutrient and sediment loading to the lake. In the rest of the watershed outside the control of the municipality, stewardship activities such as pumping septic systems, reducing fertilization, shoreline erosion and channelized stormwater runoff, and other best management practices can also help to maintain or improve water quality. More information about in-lake algae control measures and watershed nutrient control measures to improve lake condition can be found in Diet for a Small Lake (https://www.dec.ny.gov/chemical/82123.html).

How to Read the Report

In order to make this lake report as easy to digest as possible for the typical reader, only the most critical information collected in the LCI is presented. We hope that presenting the data in a more succinct manner will draw in more readers and hold their attention. Unfortunately, this new format leaves little room for definitions of terms, so we are including this section primarily as a glossary of terms for which the typical reader may not know the definition.

The report begins with the lake name, town, and county. The next section contains some physical characteristics of the lake. The surface area is the two dimensional area of the lakes surface and is given in units of acres and hectares. The max depth is the water depth measured at the deepest part of the lake and is given in units of feet and meters. The mean depth is either known from a rigorous study of the bathymetry of the lake or is calculated as 0.46 times the maximum depth and is given in units of feet and meters. The retention time is the time it takes for a drop of water to pass through a lake, given in units of years. The lake classification is a letter defining the “best uses” for this particular lake, based on the legal classification assigned by New York state. Class AA, AAspec and A lakes may be used as sources of potable water. Class B lakes are suitable for contact recreational activities, like swimming. Class C lakes are suitable for non-contact recreational activities, including fishing, although they may still support swimming. The addition of a T or TS to any of these classes indicates the ability of a lake to support trout populations and/or trout spawning. The dam classification is a letter defining the hazard class of a dam if one exists. Class A, B, C, and D dams are defined as low, intermediate, high, or negligible/no hazard dams in that order. A “0” or blank indicates that no class has been assigned to a particular dam, or that no dam exists.

The next section contains some watershed characteristics including the watershed area in acres and hectares and the land use composition of the watershed. A watershed is the entire area that will drain to a particular lake and is constrained by the topology and hydrology of the land. The watershed area was calculated by the US Geological Survey “StreamStats” program. This area map was then used to calculate land uses from the most recent (2011) National Land Use Cover data on the NYSDEC ArcGIS mapping program. The map itself is shown on the left side of the front page. In general, blue colors show water, green and light brown show forested or shrub land, yellow and dark brown are agriculture, and pink to red is developed land. The program participation section lists the years the lake has been sampled through LCI over a two year period, and the names of the DEC samplers conducting the work.

The next section includes four boxes. The trophic state of a lake refers to its nutrient loading and productivity- in other words, how much algae is produced, and the cause (nutrients) and outcome (changes in clarity) of this algae growth. An oligotrophic lake has low nutrient and algae levels (low productivity) and high clarity while a eutrophic lake has high nutrient and algae levels (high productivity) and low clarity. Mesotrophic lakes fall somewhere in the middle. For most lakes, the nutrient of concern is phosphorus. A more productive lake will support more plant life, which may be good for warmwater fish, but may lower the quality of the lake if growth becomes excessive.

The harmful algal bloom susceptibility section contains a summary of the available historical HAB data. Although the factors that lead to the formation of HAB's is not yet well-understood, a history of HAB occurrences and high nutrient levels may indicate a susceptibility in the lake that could result in more HAB events in the future.

The invasive vulnerability section indicates if aquatic invasive species (AIS) are found in this lake or in nearby lakes. Invasive species are non-native and tend to rapidly colonize a waterbody once introduced, leaving little space for native species. Lakes with invasives or near other lakes with invasives are vulnerable to introductions of new AIS.

The next section is the priority waterbody list (PWL) assessment section. The PWL is a statewide inventory of the waters of New York State that DEC uses to track support (or impairment) of water uses, overall assessment water quality, causes and sources of water quality impact/impairment, and the status of restoration, protection and other water quality activities and efforts. A PWL assessment is broken into categories that include the following: potable water, swimming or public bathing, recreation, aquatic life, aesthetics, habitat, and fish consumption. All of the categories except aesthetics and habitat are accessed on a scale to determine if each of the listed uses are supported. The scale goes from best to worst in the following progression: fully supported, threatened, stressed, impaired, and precluded. Aesthetics and habitat are evaluated as good, fair, or poor. The cited PWL assessment reflects the "worst" assessment for the lake. The full PWL assessment for each lake can (or will eventually) be found on the DEC website by searching on "PWL" and the lake basin, at http://www.dec.ny.gov/chemical/36730.html#WIPWL.

The rest of the report contains a collection of tables and charts. A glossary of all the water quality and HABs indicators used in the plots and tables is included below. Of particular note are the seasonal change and average for the sampling season. There is also a seasonal change sparkline chart, which only shows the last year of summer trends. The average column summarizes the average of the last year of sampling results, with all samples weighted equally in the reported average. Data shown in these plots represent 0-2 meter depth integrated surface samples and grab samples collected one meter from the bottom in the deepest section of thermally stratified lakes.

The next table contains a summary of shoreline (and open water if appropriate) HABs data for the lake, along with the associated HAB notification information. If a HAB is suspected, a sample from the worst part of the bloom (usually along the shoreline) is collected and sent in for laboratory confirmation. A HAB notification is added to the HAB database where entries are updated on a weekly basis. Additional information- samples or visual reports- are used to update these listings. The HABs Status plots show the algal component (total algae and fractions associated with cyanobacteria (blue green algae), green algae, diatoms, and other algae, as measured by chlorophyll *a*, in any collected samples, and the associated levels of total microcystin. The shoreline toxin data graphs include the World Health Organization (WHO) high risk criteria to protect swimmers and the EPA low risk criteria to protect those using *treated* (not raw lake) drinking water.

The next section of the report shows seasonal changes in water clarity, (extracted) chlorophyll *a*, surface and deep phosphorus (if deep samples are collected) and surface and deep ammonia levels. Surface samples are indicated with round markers, while deep samples are shown as triangular markers. If multiple years of samples were collected, results from all samples are shown, with previous years data shown in red.

The depth profile section shows the water temperatures, dissolved oxygen, chlorophyll, and phycocyanin (a measure of blue green pigments) as measured on a profiling electronic meter. Chlorophyll measures are "corrected" to reflect the expected extracted chlorophyll measurement based on the relationship between the surface integrated chlorophyll (extracted) data and the profiler unextracted data. As such, these results should be considered estimated relative values, and should not be compared to water quality criteria developed from extracted measurements only. Phycocyanin data are reported in relative units, although they are characterized as cells per mL.

The next section of the report includes Lake Use Scorecard. The scorecard presents the results of the existing Priority Waterbody List assessment for this lake in a graphical form and compares it to information from the current year from LCI data and other lake information. The scorecard also includes a column that lists some primary issues that could impact specific use categories. Multiple issues could affect each designated use, but only the primary issue is listed.

The final section of the report is the Lake Summary. This includes a brief summary of the most recent LCI data for the lake, although there is some comparison to previously LCI data when available. It is essentially the same as the Q&A section of reports generated through the NY Citizens Statewide Lake Assessment Program (CSLAP), and with the Lake Use Scorecard, represents perhaps the most easily understood single page summary of the LCI data for the lake. This was intentionally created as the last page of the report to allow easy copying and distribution to interested parties.

Glossary of water quality and HAB indicators

Clarity: The depth to which a Secchi disk lowered into the water is visible, measured in meters. Water clarity is one of the trophic indicators for each lake.

TP: Total phosphorus, measured in milligrams per liter at the lake surface (1.5 meters below the surface). TP includes all dissolved and particulate forms of phosphorus. Total phosphorus is a second trophic indicator for each lake.

Soluble P: Dissolved phosphorus, measured in milligrams per liter at the lake surface, measured in water that passes through a 0.45 micron filter. It is an estimate of the amount of phosphorus available for biological uptake or growth, although available phosphorus is more accurately measured by soluble reactive P.

Deep TP: Total phosphorus measured in milligrams per liter at depth (1-2 meters above the lake bottom at the deepest part of the lake)

Deep Soluble P: Dissolved phosphorus measured at depth, measured in milligrams per liter

TN: Total nitrogen, measured in milligrams per liter at the lake surface. TN includes all forms of nitrogen, including **NOx** (nitrite and nitrate) and **NH_4** (ammonia).

Surface N:P Ratio: The ratio of total nitrogen to total phosphorus, unitless (mass ratio), in surface samples analyzed for TP and TN. This ratio helps determine if a lake is phosphorus or nitrogen limited.

Deep to Surface NH_4 Ratio: The ratio of ammonia measured in deep and surface samples; this is a surrogate for lake anoxia when these ratios are > 10

Chl.a (ug/l): Chlorophyll a, measured in micrograms per liter as chlorophyll extracted from surface water samples using reagents and a desktop fluorometer

pH: A range from 0 to 14, with 0 being the most acidic and 14 being the most basic or alkaline. A healthy lake generally ranges between 6 and 9.

Conductivity: Specific conductance is a measure of the conductivity of water, measured as micromhos per centimeter and corrected to 25 degrees centigrade. A higher value indicates the presence of more dissolved ions that help conduct electricity. Conductivity results may indicate hard or softwater conditions with high ion concentrations resulting in hardwater.

Total (or Dissolved) Organic Carbon: Organic carbon measures the carbon (total or dissolved) in living material within the water, measured in milligrams per liter.

True Color is a visual measure of the brownness of the water, based on water passing through a 0.45 micron filter and compared to a visual series of standards developed from a platinum-cobalt standard (and thus measured as platinum units)

Deep Manganese, Iron or Arsenic measure total manganese, iron or arsenic levels in milligrams per liter in samples collected near the lake bottom. Elevated levels indicate anoxic conditions.

BG Chl.a (ug/L): Chlorophyll a from blue-green algae, measured in micrograms per liter. Readings above 25 ug/L are indicative of bloom conditions.

HABs Reported?: Were any algal blooms reported within a week of the dates listed, and, if so, were they located along the shoreline, in open water, or both?

BGA: Blue-green algae, as measured with a desktop or field fluorometer and reported as micrograms per liter of unextracted chlorophyll a

Microcystin: The most common HAB liver toxin; total microcystin above 20 micrograms per liter indicates a “high toxin” bloom. However, ALL BGA blooms should be avoided, even if toxin levels are low.

Anatoxin-a: Another type of toxin that may be produced in a HAB and may be more dangerous as it targets the central nervous system. Neither EPA nor NYS has developed a risk threshold for anatoxin-a, although readings above 4 micrograms per liter are believed to represent an elevated risk.