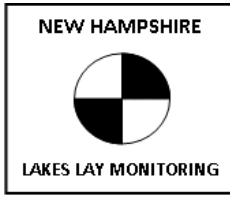


# NORTH RIVER LAKE

## 2013 SAMPLING HIGHLIGHTS

BARRINGTON, NORTHWOOD &  
NOTTINGHAM, NH



North River Lake volunteers collected water quality data between May 8 and September 19, 2013. A more in depth water quality survey of the North River Lake deep sampling station was conducted by the Center for Freshwater Biology on August 27, 2013.

**Light Blue** = Outstanding  
= Ultraoligotrophic

**Blue** = Excellent =  
Oligotrophic

**Yellow** = Fair =  
Mesotrophic

**Red** = Poor = Eutrophic

**Light Gray** = No Data

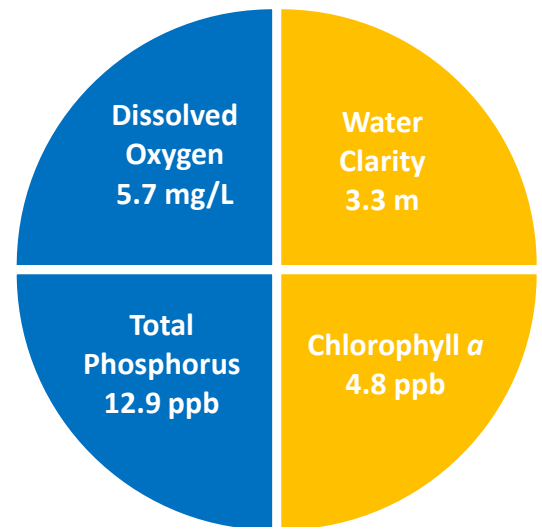


Figure 1. Average Water Quality Conditions

### 2013 RESULT HIGHLIGHTS

**WATER CLARITY:** Water clarity, measured as Secchi disk depth, averaged 3.3 meters (m) in North River Lake. The 2013 water clarity measurements indicate a decrease in water clarity relative to the 2012 levels.

**CHLOROPHYLL:** Chlorophyll *a*, a measure of microscopic plant life within the lake, averaged 4.8 parts per billion (ppb) in North River Lake. The 2013 chlorophyll *a* measurements indicate an increase in microscopic plant life relative to the 2012 levels.

**TOTAL PHOSPHORUS:** Phosphorus is the nutrient most responsible for microscopic plant growth. Total phosphorus concentrations collected in North River Lake averaged 12.9 parts per billion (ppb). The 2013 North River Lake total phosphorus measurements generally exceeded 10 parts per billion (ppb) that is considered sufficient to support green water events that are referred to as algal blooms.

**DISSOLVED OXYGEN:** Dissolved oxygen is important to the health of the North River Lake fishery. The North River Lake dissolved oxygen concentrations collected in the bottom waters ranged from 3.9 to 7.0 milligrams per liter (mg/L) on August 27, 2013. The North River Lake dissolved oxygen concentrations remained above 3.0 milligrams per liter (mg/L) throughout the water column. An oxygen concentration of 3.0 mg/l is considered the threshold for the successful growth and reproduction of warm water fish species such as bass and perch.

**COLOR:** Color is a result of naturally occurring “tea” color substances from the breakdown of soils and plant materials. The North River Lake color averaged 28.6 color units (CPU). Wet years tend to increase wetland drainage and the associated dissolved colored substances that enter the lake. This increase in the “tea” color reduces light penetration, and is oftentimes associated with reduced water clarity.

**ALKALINITY/pH:** Alkalinity measures the lake’s resistance against acid rain. The average North River Lake alkalinity measured 7.7 milligrams per liter (mg/L). The 2013 alkalinity indicates North River Lake is moderately vulnerability to acid rain. The North River Lake **pH**, a measure of lake acidity, ranged from 7.0 to 7.1 units in the surface waters, and remained within the acceptable range for most aquatic organisms.

**SPECIFIC CONDUCTIVITY:** Specific conductivity is a general indicator of pollution. The North River Lake specific conductivity measured between 111.0 and 117.0 micro-Siemans ( $\mu S$ ). The North River Lake specific conductivity indicates high concentrations of dissolved substances such as nutrients (e.g. phosphates and nitrates) and other dissolved salts (e.g. sodium and chloride).

**CYANOBACTERIA:** Cyanobacteria are the measure of potentially harmful plant-like bacteria. North River Lake did not participate in the 2013 cyanobacteria-monitoring. Please refer to the recommendation section for further information.

**Note:** Site 1 Turtle Rock (see map) was used to as the reference point to give an overall representation of the North River Lake water quality discussed above. For a more detailed discussion of water quality measurements, please refer to the 2013 North River Lake Annual Report.

Table 1. 2013 North River Lake Seasonal Average Water Quality Readings and Trophic Level Classification Criteria used by the New Hampshire Lakes Lay Monitoring Program

Parameter	Ultraoligotrophic “Outstanding”	Oligo “Excellent”	Meso “Fair”	Eutrophic “Poor”	North River Lake Average (range)	North River Lake Classification
Water Clarity (meters)	> 7.0	4.0 – 7.0	2.5 - 4.0	< 2.5	3.3 meters (range: 2.4 – 4.6)	Mesotrophic
Chlorophyll <i>a</i> (ppb)	< 2.0	2.0 - 3.0	3.0 - 7.0	> 7.0	4.8 ppb (range: 1.9 – 9.3 )	Mesotrophic
Total Phosphorus (ppb)	< 7.0	15.0 – 7.0	15.0 - 25.0	> 25.0	12.9 ppb (range: 9.4 – 14.7)	Oligotrophic
Dissolved Oxygen (mg/L)	> 7.0	5.0 – 7.0	2.0 – 5.0	<2.0	5.7 mg/L (range: 3.9 – 7.0)	Oligotrophic
Cyanobacteria (cell counts, microcystin concentration & Water safety)	The Massachusetts Department of Public Health considers dangerous microcystin (MC) levels to be 14 micrograms per liter (ug/l) lake water, and/or 70,000 cyanobacteria cells per milliliter lake water.			The New Hampshire Department of Environmental services posts warnings at State beaches when cyanobacteria cell numbers exceed 70,000 cells per milliliter lake water.		

## LONG TERM TRENDS (NORTH RIVER LAKE)

**WATER CLARITY:** The water clarity has increased significantly over the past seventeen years of water quality sampling. The annual water clarity increased approximately 1.0 meter (m) between 1997 and 2013.

**CHLOROPHYLL:** The chlorophyll *a* concentration has decreased significantly over the past seventeen years of water quality sampling. The annual chlorophyll *a* concentration decreased approximately 2.0 parts per billion (ppb) between 1997 and 2013.

**COLOR:** The color concentrations documented over the past seventeen years do not indicate a long-term trend.

**TOTAL PHOSPHORUS:** Total phosphorus concentrations have decreased over the past seventeen years of sampling. The annual total phosphorus concentrations decreased approximately 3.0 parts per billion (ppb) between 1997 and 2013 although the decrease is not statistically significant.

In summary, there are indications that the North River Lake water quality has improved. Long-term water quality data display a statistically significant trend of increasing Secchi disk transparency, while the chlorophyll *a* and total phosphorous concentrations display a corresponding trend of decreasing levels. The inter-relationship between rainfall and water quality measurements will be discussed in next year's report and should provide additional insight into the annual water quality variability.

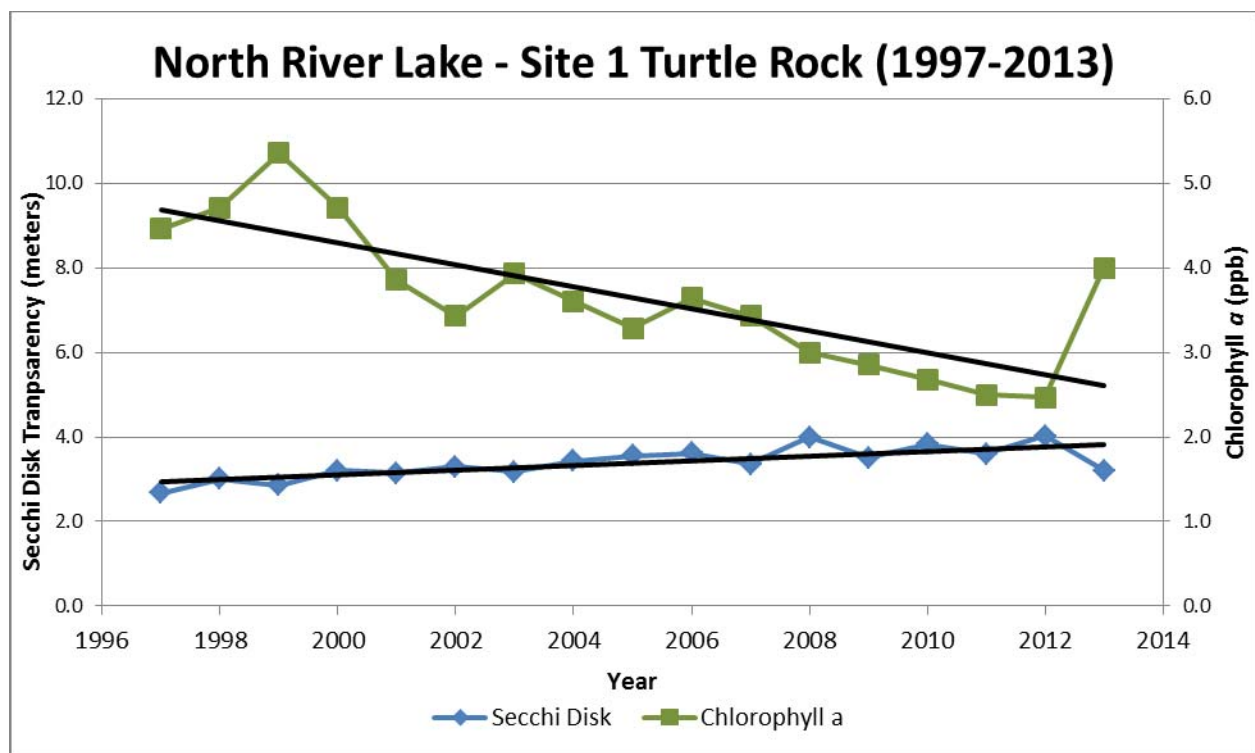


Figure 2. Changes in water clarity (Secchi disk depth) and chlorophyll *a* measured from 1997-2013 at Site 1 Turtle Rock. There has been an increasing water quality trend shown by deeper Secchi disk depth over time (solid line). Increasing water clarity is a positive trend for lakes if caused by a decrease in algae or polluted runoff. Algal growth (chlorophyll; solid line) has decreased over the past seventeen years of sampling. The solid trendlines indicate a statistically significant trend.

### Recommendations:

- Continue early season sampling (April/May) to document North River Lake's reaction to the period of spring thaw and periods of high streamflow.
- Consider adding a simple cyanobacteria monitoring routine that is based on the existing water quality monitoring methods. Cyanobacteria collections throughout the summer and fall months can give insight as to how these populations are distributed throughout the seasons, and when they are most likely to be at harmful levels. If you are interested in discussing additional water quality monitoring options that would meet your needs, please contact [Bob Craycraft @ 862-3696](mailto:Bob.Craycraft@862-3696) or [bob.craycraft@unh.edu](mailto:bob.craycraft@unh.edu).

# North River Lake

Barrington, Northwood and Nottingham, NH

2013 Deep water sampling site with average seasonal water clarity



UNIVERSITY  
of NEW HAMPSHIRE

Cooperative Extension

Aerial Orthophoto Source: NH GRANIT  
Site locations GPSed by the UNH Center of Freshwater Biology