LAKE IVANHOE

2017 SAMPLING HIGHLIGHTS

Station – 2 Ivanhoe

Wakefield, NH

Extension

Station 2 (Figure 7) was used as a reference point to represent the overall Lake Ivanhoe water quality. Water quality data displayed in Tables 1 and 2 are surface water measurements.

Blue = Oligotrophic

Yellow = Mesotrophic

Red = Eutrophic

Gray = No Data

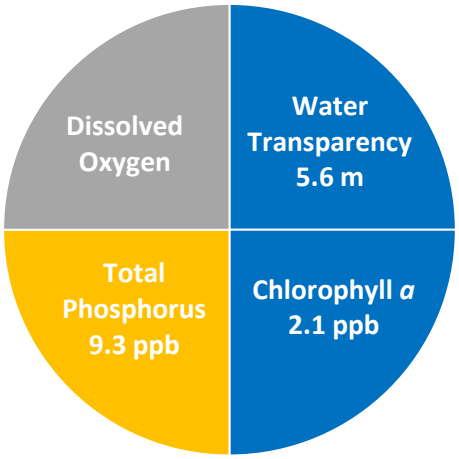


Figure 1. Lake Ivanhoe Water Quality (2017)

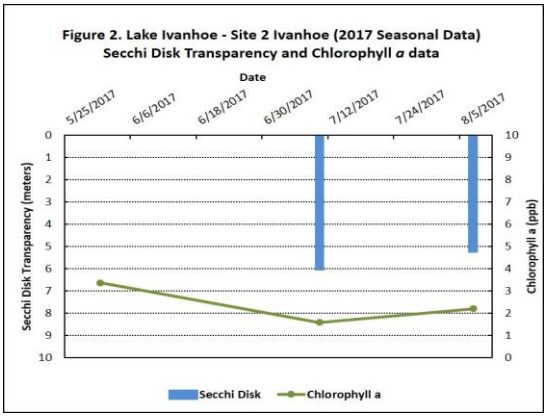
Table 1. 2017 Lake Ivanhoe Seasonal Averages and NH DES Aquatic Life Nutrient Criteria[1]

Parameter	Oligotrophic	Mesotrophic	Eutrophic	Lake Ivanhoe Average (range)	Lake Ivanhoe Classification
Water Clarity (meters)	4.0 – 7.0	2.5 - 4.0	< 2.5	**5.6** meters (5.2 - 6.0)	Oligotrophic
Chlorophyll *a* [1] (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	**2.1** ppb (1.4 – 3.4)	Oligotrophic
Total Phosphorus [1] (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	**9.3** ppb (7.6 – 11.7)	Mesotrophic
Dissolved Oxygen (mg/L)	5.0 – 7.0	2.0 – 5.0	<2.0	Not Assessed	Not Assessed

* Lake Ivanhoe did not develop a deep water layer that is the basis for the dissolved oxygen classification criteria.

Table 2. 2017 Lake Ivanhoe Seasonal Average Accessory Water Quality Measurements

Parameter	Assessment Criteria					Lake Ivanhoe Average (range)	Lake Ivanhoe Classification
Color (color units)	< 10 uncolored	10 – 20 slightly colored	20 – 40 lightly tea colored	40 – 80 tea colored	> 80 highly colored	**6.6** color units (range: 6.1 – 8.0)	Uncolored
Alkalinity (mg/L)	< 0.0 acidified	0.1 – 2.0 extremely vulnerable	2.1 – 10 moderately vulnerable	10.1 – 25.0 low vulnerability	> 25.0 not vulnerable	**3.3** mg/L (range: 3.2 – 3.7)	Moderately vulnerable
pH (std units)	< 5.5 suboptimal for successful growth and reproduction		6.5 – 9.0 optimal range for fish growth and reproduction			**7.0** standard units (range: 6.6 – 7.5)	Optimal range for fish growth and reproduction
Specific Conductivity (*u*S/cm)	< 50 *u*S/cm Characteristic of minimally impacted NH lakes		50-100 *u*S/cm Lakes with some human influence	> 100 *u*S/cm Characteristic of lakes experiencing human disturbances		**64.9** *u*S/cm (range: 61.1 – 67.3)	Lakes with some human influence



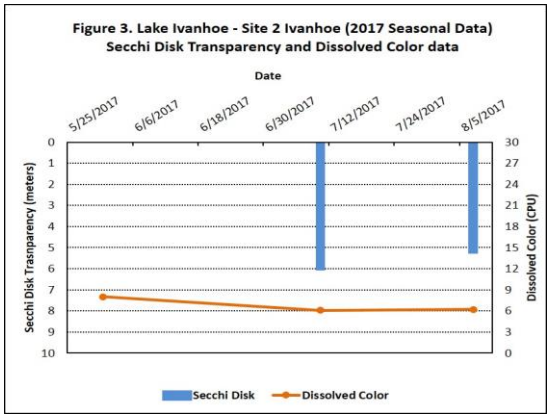


Figure 2 and 3. Seasonal Secchi disk transparency, chlorophyll *a* concentrations and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll *a* and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* and/or color concentrations. Note: both Secchi Disk measurements were visible on the lake bottom.

LONG-TERM TRENDS

WATER CLARITY: The Lake Ivanhoe water clarity data, measured as Secchi Disk transparency, have oscillated among years while the long-term trend is stable (Figure 4). The long-term water clarity trend is based on the Secchi Disk transparency measurements that have been collected both with and without a view scope.

CHLOROPHYLL: The Lake Ivanhoe chlorophyll *a* concentrations, a measure of microscopic plant life within the lake, display a trend of increasing concentrations since 1981 (Figure 4).

TOTAL PHOSPHORUS: The Lake Ivanhoe total phosphorus concentrations, the nutrient most responsible for microscopic plant growth, have oscillated among years while the long-term trend is stable (Figure 5).

COLOR: Color is a result of naturally occurring "tea" color substances from the breakdown of soils and plant materials. Lake Ivanhoe color data have oscillated among years while the long-term trend is stable (Figure 5).

Figure 4. Ivanhoe - Site 2 Ivanhoe (1981-2017)
Long-term Secchi Disk and Chlorophyll *a* Data

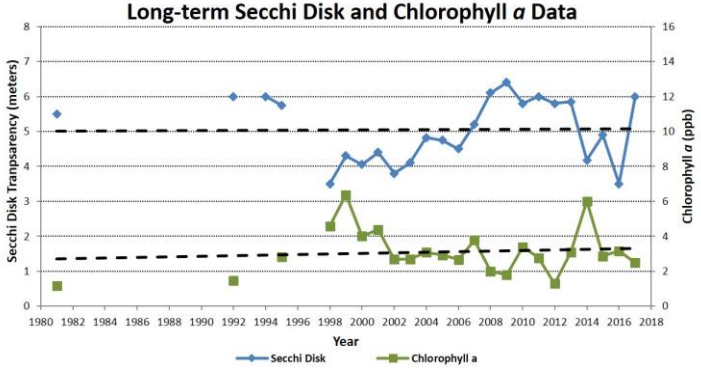


Figure 5. Ivanhoe - Site 2 Ivanhoe (1981-2017)
Long-term Total Phosphorus and Dissolved Color Data

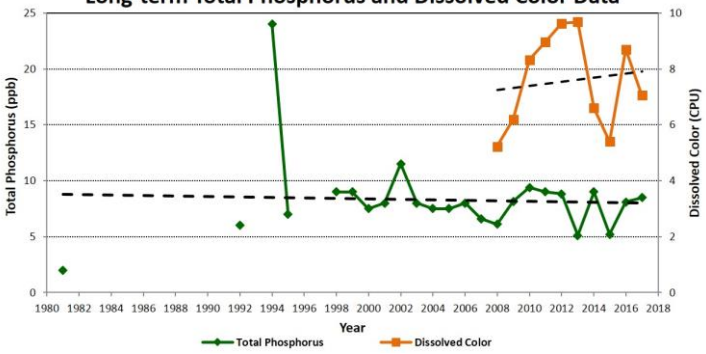


Table 3. Salmon Falls Headwaters Seasonal Average Water Quality Inter-comparison (2017)

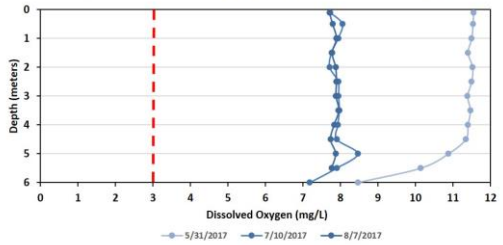
Lake	Average Secchi Disk Transparency (meters)	Average Chlorophyll *a* (ppb)	Average Total Phosphorus (ppb)	Average Dissolved Oxygen (ppm)
Great East Lake	11.0	0.7	4.4	8.4
Wilson Lake	6.3	2.6	6.4	0.5
Lovell Lake	6.7	2.6	8.1	3.3
Horn Pond	7.4	1.9	5.9	3.2
Lake Ivanhoe	5.6	2.1	9.3	------

- Water quality data are reported for a deep reference sampling location in each water body
- Dissolved oxygen measurements were collected in the summer (late July and August) in the bottom water layer (metalimnion or hypolimnion).
- ------ Indicates the site is too shallow to form a bottom water layer (metalimnion or hypolimnion) during the summer months.

Figures 4 and 5. Changes in the Lake Ivanhoe water clarity (Secchi Disk depth), chlorophyll *a* and total phosphorus concentrations measured between 1981 and 2017. **These data illustrate the relationship among plant growth, water color and water clarity. Total phosphorus data are also displayed and are oftentimes correlated with the amount of plant growth.** Trendlines are displayed when sufficient data are available.

Figure 6. Monthly Lake Ivanhoe dissolved oxygen profiles collected between May 31 and August 7, 2017. The vertical red line indicates the oxygen concentration commonly considered the threshold for successful growth and reproduction of warm water fish such as bass and perch.

Figure 6. Lake Ivanhoe - Site 2 Ivanhoe
Dissolved Oxygen Profiles (May 31 through August 7, 2017)



Recommendations

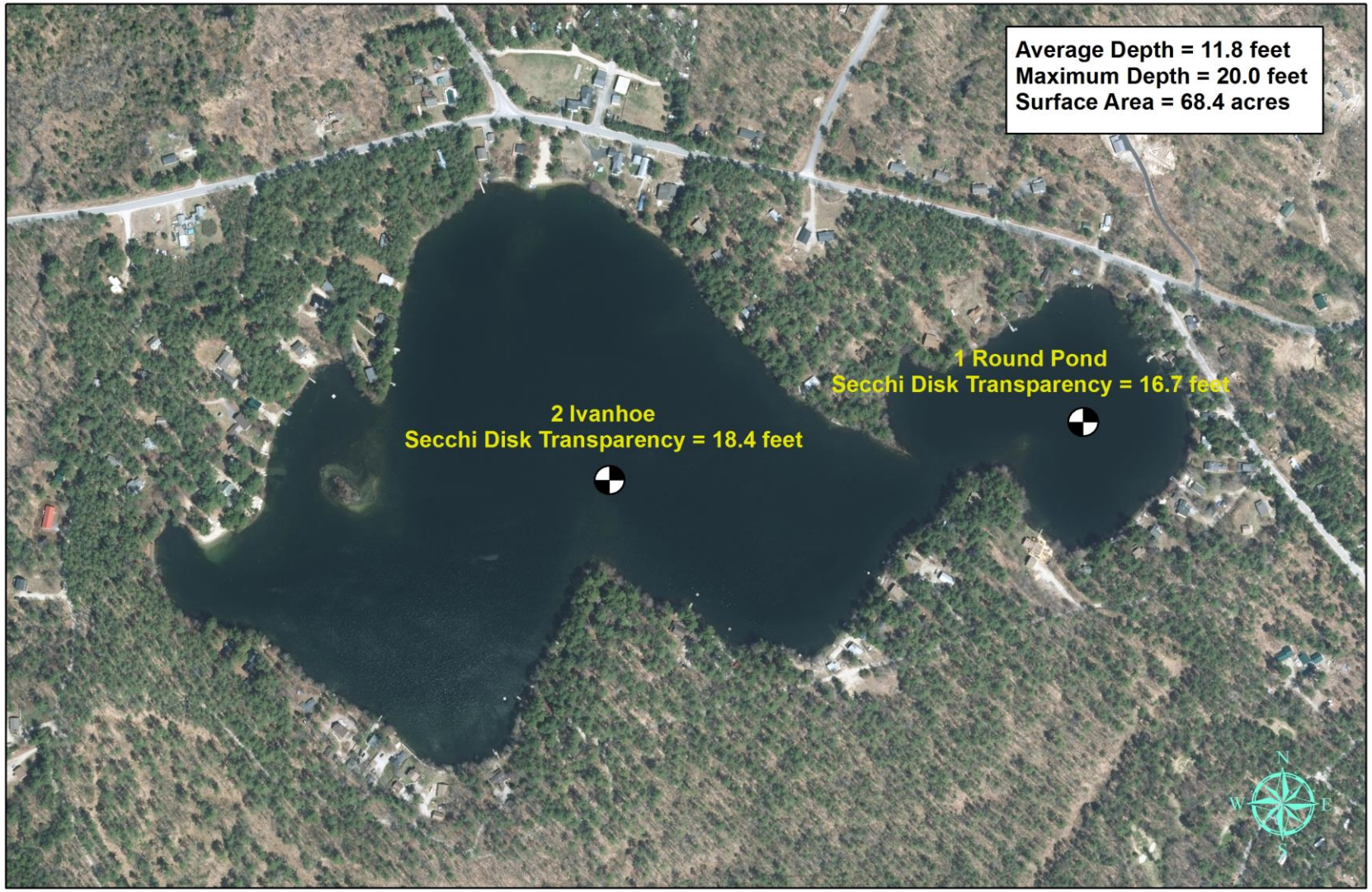
Implement Best Management Practices within the Lake Ivanhoe watershed to minimize the adverse impacts of polluted runoff and erosion on the lake. Refer to "Landscaping at the Water's Edge: An Ecological Approach" and "New Hampshire Homeowner's Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home" for more information on how to reduce nutrient loading caused by overland run-off. The Acton Wakefield Watershed Alliance also offers technical assistance to help design and implement erosion control project that protect water quality.

- http://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- http://soaknh.org/wp-content/uploads/2016/04/NH-Homeowner-Guide-2016.pdf
- http://awwatersheds.org/healthy-lakes/conservation-practices-for-homeowners/

Figure 7. Lake Ivanhoe

Wakefield, NH

2017 deep water sampling sites and seasonal average water clarity values



Aerial Orthophoto Source: NH GRANIT
GPS Site locations collected by the UNH Center for Freshwater Biology

Extension

NEW HAMPSHIRE LAKES LAY MONITORING