LAKE IVANHOE

2019 SAMPLING HIGHLIGHTS

Station – 2 Ivanhoe

Wakefield, NH

NH | Extension

Blue = Oligotrophic

Yellow = Mesotrophic

Red = Eutrophic

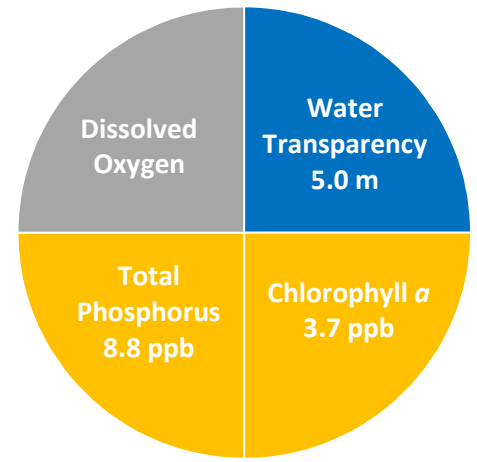**Gray** = No Data

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, 2 and 3 are surface water measurements with the exception of the dissolved oxygen data that were collected near the lake bottom.

Figure 1. Lake Ivanhoe Water Quality (2019)

Pie chart sections: Dissolved Oxygen; Water Transparency 5.0 m; Total Phosphorus 8.8 ppb; Chlorophyll *a* 3.7 ppb

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Table 1. 2019 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	**5.0** meters (4.2 – 6.0)	**Oligotrophic**
Chlorophyll *a* [1] (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	**3.7** ppb (2.5 – 5.4)	**Mesotrophic**
Total Phosphorus [1] (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	**8.8** ppb (7.7 – 10.3)	**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. 2019 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	**6.1** color units (range: 3.7 – 9.4)	**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	**3.6** mg/L (range: 3.4 – 3.9)	**Moderately vulnerable**
pH (std units)	< 5.5 suboptimal for successful growth and reproduction	6.5 – 9.0 optimal range for fish growth and reproduction				**6.9** standard units (range: 6.8 – 7.0)	**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			**78.8** *u*S/cm (range: 76.5 – 81.5)	**Lakes with some human influence**
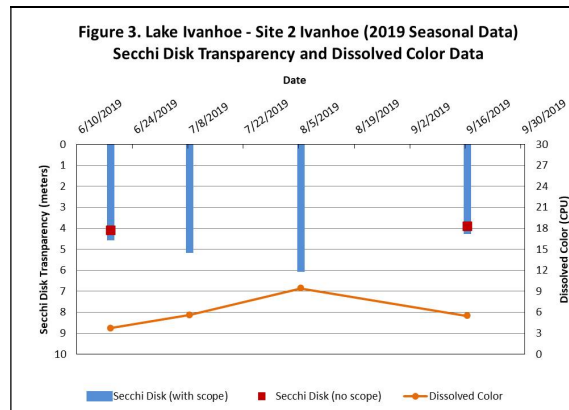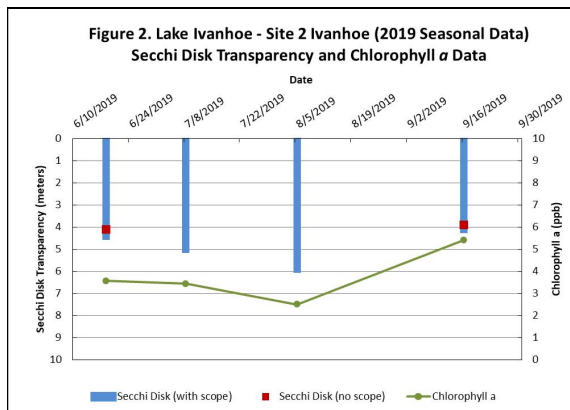
Figure 2 and 3. Seasonal Secchi disk transparency, chlorophyll *a* concentrations and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll *a* and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* concentrations. Note: The June 18 and August 5 Secchi Disk measurements were visible on the lake bottom when collected with the view scope. Secchi Disk transparency data are reported for measurements collected both with and without a view scope.

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, have oscillated among years while the long-term trend is stable (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 (1981-2019) Long-term Secchi Disk and Chlorophyll *a* Data
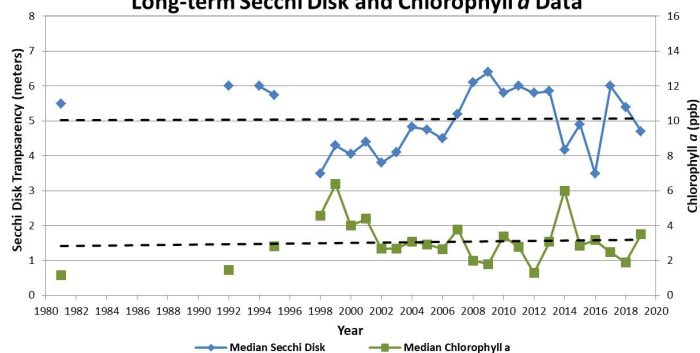
Table 3. Salmon Falls Headwaters Seasonal Average Water Quality Inter-comparison (2019)

Lake	Average Secchi Disk Transparency (meters)	Average Chlorophyll *a* (ppb)	Average Total Phosphorus (ppb)	Average Dissolved Oxygen (ppm)
Great East Lake	10.4	1.3	4.2	6.6
Wilson Lake	Not Sampled in 2019			
Lovell Lake	6.6	2.7	6.9	0.5
Horn Pond	Not Sampled in 2019			
Lake Ivanhoe	5.0	3.7	8.8	------

- 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.


Figure 5. Ivanhoe - Site 2 Ivanhoe (1981-2019) Long-term Total Phosphorus and Dissolved Color Data
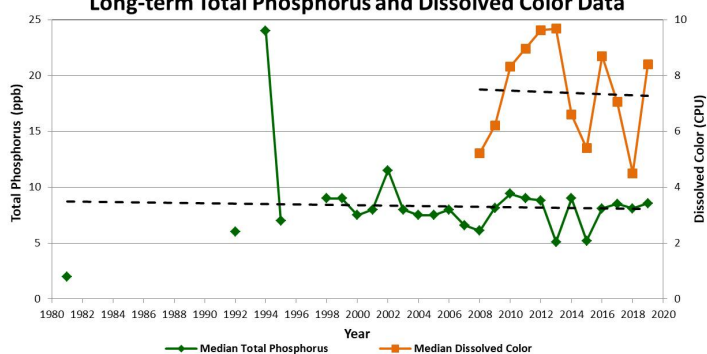
Figures 4 and 5. Changes in the Lake Ivanhoe water clarity (Secchi Disk depth), chlorophyll *a* and total phosphorus concentrations measured between 1981 and 2019. **These data illustrate the relationship among plant growth, water color and water clarity. Total phosphorus data are also displayed and are oftentimes correlated with the amount of plant growth.** Long-term trends are based on the analysis of annual median values.

Figure 6. Monthly Lake Ivanhoe dissolved oxygen profiles collected between June 18 and September 16, 2019. 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 - Station 1 Deep Dissolved Oxygen Profiles (June 18 through September 16, 2019)
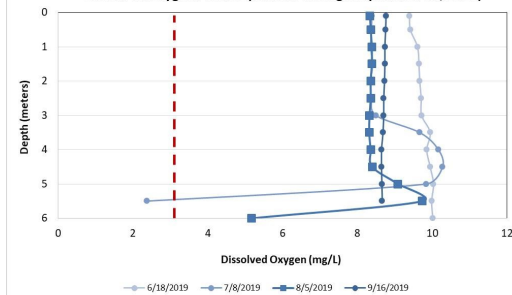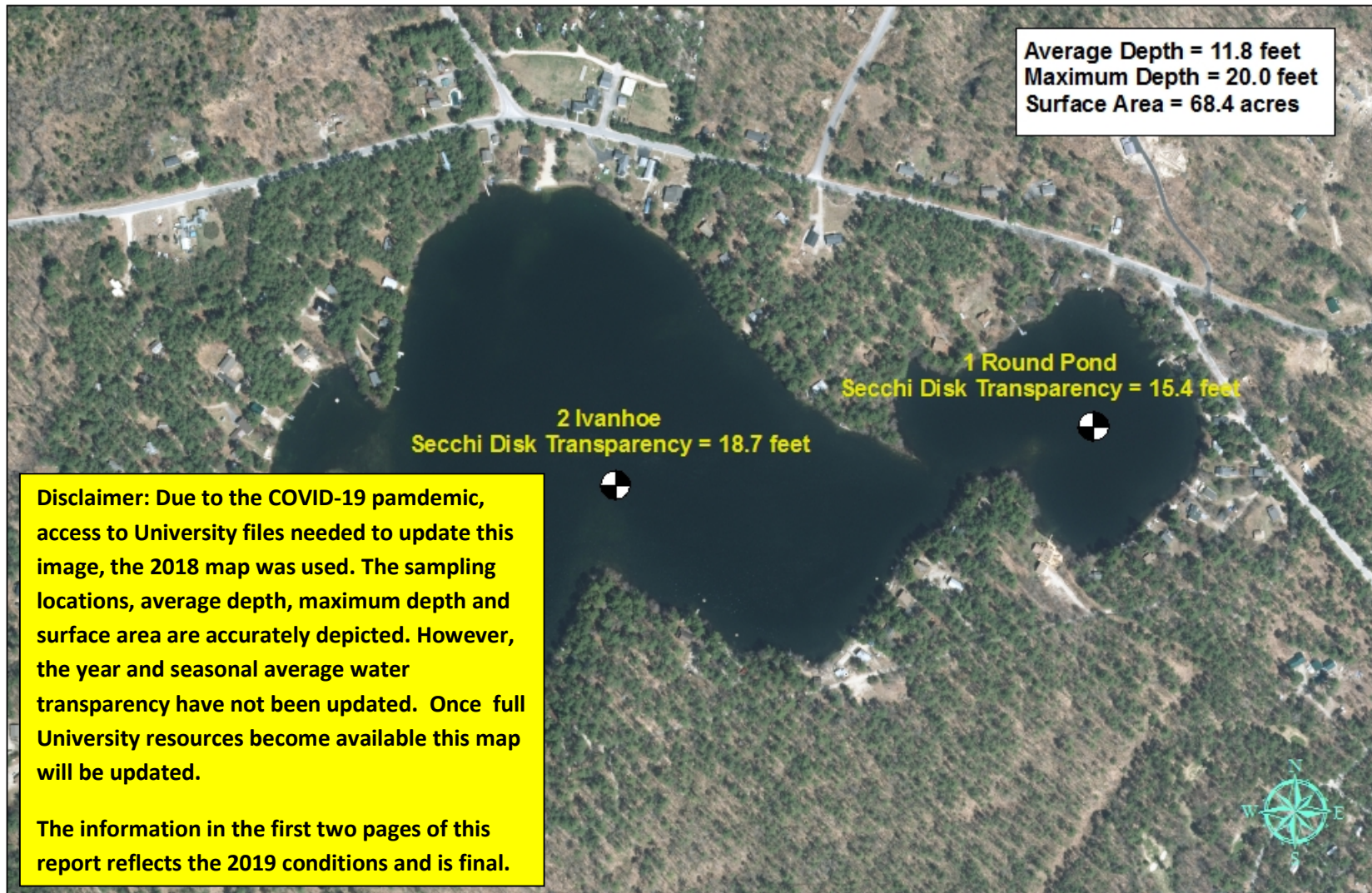
Recommendations

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 Watersheds Alliance also offers technical assistance to help design and implement erosion control project that protect water quality.

- https://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf
- https://awwatersheds.org/healthy-lakes/conservation-practices-for-homeowners/

Figure 7. Lake Ivanhoe
Wakefield, NH
2018 deep water sampling sites and seasonal average water clarity values

Average Depth = 11.8 feet
Maximum Depth = 20.0 feet
Surface Area = 68.4 acres

1 Round Pond
Secchi Disk Transparency = 15.4 feet

2 Ivanhoe
Secchi Disk Transparency = 18.7 feet

Disclaimer: Due to the COVID-19 pamdemic, access to University files needed to update this image, the 2018 map was used. The sampling locations, average depth, maximum depth and surface area are accurately depicted. However, the year and seasonal average water transparency have not been updated. Once full University resources become available this map will be updated.

The information in the first two pages of this report reflects the 2019 conditions and is final.

Miles
0   0.1   0.2   0.3

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

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