LAKE IVANHOE

2022 SAMPLING HIGHLIGHTS

Station Deep

Wakefield, NH

NH | Extension

Water quality data displayed in Tables 1 and 2 are surface water measurements with the exception of the dissolved oxygen data that are collected near the lake bottom. Summary statistics are provided for bi-weekly samples collected between June 27 and September 12, 2022.

Blue = Oligotrophic

Yellow = Mesotrophic

Red = Eutrophic

Gray = No Data

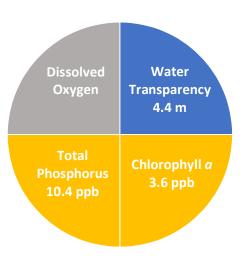| Dissolved Oxygen | Water Transparency 4.4 m |
| Total Phosphorus 10.4 ppb | Chlorophyll *a* 3.6 ppb |

Figure 1. Lake Ivanhoe Water Quality (2022)

Table 1. 2022 Lake Ivanhoe Seasonal Averages and NH DES Aquatic Life Nutrient Criteria[1]

Parameter	Oligotrophic "Excellent"	Mesotrophic "Fair"	Eutrophic "Poor"	Lake Ivanhoe Average (range)	Lake Ivanhoe Classification
Water Clarity (meters)	4.0 – 7.0	2.5 - 4.0	< 2.5	**4.4** meters (3.3 – 5.8)	**Oligotrophic**
Chlorophyll *a* [1] (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	**3.6** ppb (1.9 – 5.2)	**Mesotrophic**
Total Phosphorus [1] (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	**10.4** ppb (9.1 – 11.9)	**Mesotrophic**
Dissolved Oxygen (ppm)	5.0 – 7.0	2.0 – 5.0	<2.0	Not Assessed	Not Assessed

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

Table 2. 2022 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: 4.7 – 7.4)	**Uncolored**
Alkalinity (ppm)	< 0.0 acidified	0.1 – 2.0 extremely vulnerable	2.1 – 10 moderately vulnerable	10.1 – 25.0 low vulnerability	> 25.0 not vulnerable	**3.5** ppm (range: 3.1 – 3.8)	**Moderately vulnerable**
pH (std units)	< 5.5 suboptimal for successful growth and reproduction		6.5 – 9.0 optimal range for fish growth and reproduction			**6.4** standard units (range: 6.2 – 6.5)	**Sufficient range for fish growth and reproduction**
Specific Conductivity (uS/cm)	< 50 uS/cm Characteristic of minimally impacted NH lakes		50-100 uS/cm Lakes with some human influence	> 100 uS/cm Characteristic of lakes experiencing human disturbances		**74.5** uS/cm (range: 73.3 – 75.8)	**Characteristic of lakes with some human influence**

Strategies to stabilize and improve water quality

Implement Best Management Practices (BMPs) within the Lake Ivanhoe watershed to minimize the adverse impacts of polluted runoff and erosion into Lake Ivanhoe. Refer to "Landscaping at the Water's Edge: An Ecological Approach", "New Hampshire Homeowner's Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home", and the Acton Wakefield Watershed Alliance webpages for more information on how to reduce nutrient loading caused by overland run-off. NH Lakes also provides a series of resources aimed at educating residents and protecting our lakes and ponds.

- https://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/homeowner-guide-stormwater.pdf
- https://awwatersheds.org/
- https://nhlakes.org/lakesmart-resource-library/

Figure 2. Ivanhoe Lake (2022 Seasonal Data)
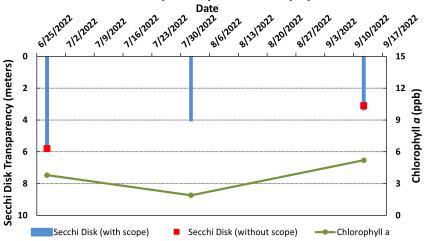**Secchi Disk Transparency and Chlorophyll *a* Data**

Legend: Secchi Disk (with scope) ■ Secchi Disk (without scope) ● Chlorophyll a

Figure 3. Ivanhoe Lake (2022 Seasonal Data)
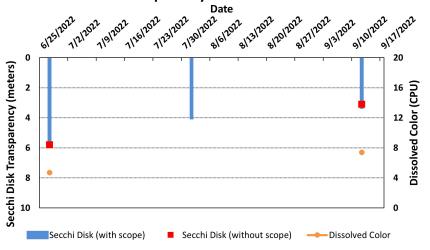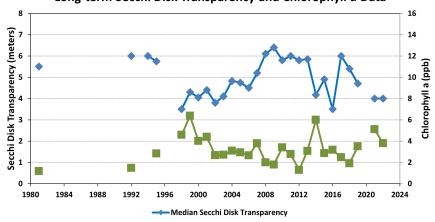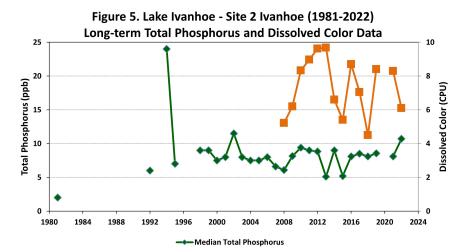**Secchi Disk Transparency and Dissolved Color Data**

Legend: Secchi Disk (with scope) ■ Secchi Disk (without scope) ● Dissolved Color

Figure 4. Lake Ivanhoe - Site 2 Ivanhoe (1981-2022)
Long-term Secchi Disk Transparency and Chlorophyll *a* Data

Legend: Median Secchi Disk Transparency

Figure 5. Lake Ivanhoe - Site 2 Ivanhoe (1981-2022)
Long-term Total Phosphorus and Dissolved Color Data

Legend: Median Total Phosphorus

Figures 2 and 3. Seasonal comparison of Lake Ivanhoe water transparency (Secchi Disk depth), chlorophyll *a* and dissolved color for 2022. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* and/or color concentrations.

Figures 4 and 5. Annual median Lake Ivanhoe water transparency, chlorophyll *a*, dissolved color and total phosphorus concentrations measured between 1981 and 2022, through the New Hampshire Lakes Lay Monitoring Program and the New Hampshire Department of Environmental Services. The long-term data provide insight into the water quality fluctuations, among years, that have been documented in Lake Ivanhoe.

Figure 6. Lake Ivanhoe - Site 2 Ivanhoe
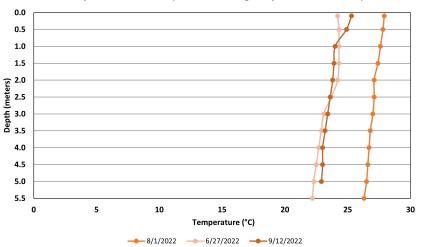## Temperature Profiles (June 27 through September 12, 2022)

Figure 7. Lake Ivanhoe - Site 2 Ivanhoe
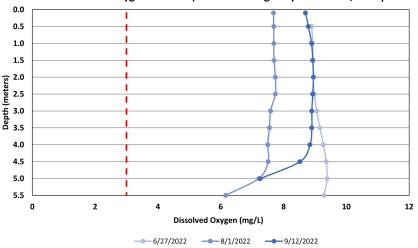## Dissolved Oxygen Profiles (June 27 through September 12, 2022)

Figure 8. Lake Ivanhoe - Site 2 Ivanhoe
Conductivity Profiles (June 27 through September 12, 2022)
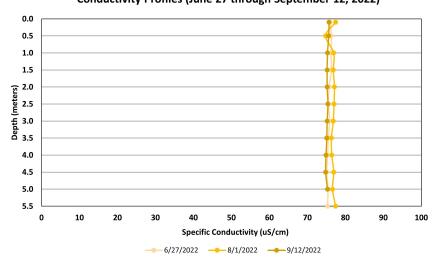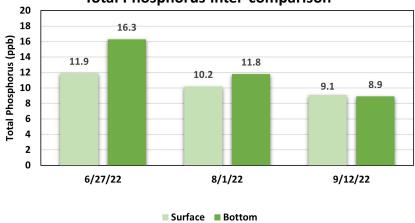

Figure 9. Lake Ivanhoe - Site 2 Ivanhoe
Total Phosphorus inter-comparison

Figures 6, 7 and 8. Temperature, dissolved oxygen and specific conductivity profiles displaying the water quality differences in 0.5-meter increments. Notice the decreasing dissolved oxygen concentrations, near the lake bottom, through the season. The dashed vertical red line in Figure 7 displays the dissolved oxygen threshold for the successful growth and reproduction of warm-water fish such as bass and perch.

Figure 9. Total phosphorus comparison between the surface (epilimnion) and bottom water (hypolimnion) zones. Notice the differences in the bottom water total phosphorus concentrations, relative to surface water concentrations.

Table 3. Salmon Falls River Watershed Lakes (Acton ME and Wakefield NH)
(2022 water quality data collected between May 31 and September 26)

Lake	Average (range) Secchi Disk Transparency (meters)	Average (range) Total Phosphorus (ppb)	Average (range) Chlorophyll-*a* (ppb)	Average (range) Dissolved Oxygen (ppm)
Great East Lake	9.8 meters (range: 8.6 – 10.9)	4.3 ppb (range: 3.3 – 6.0)	1.4 ppb (range: 1.2 – 1.7)	7.0 ppm (range: 5.3 – 9.0)
Horn Pond	7.7 meters (single point)	6.1 ppb (single point)	2.1 ppb (single point)	2.3 ppm (0.2 – 6.8)
Lake Ivanhoe/Round Pond	4.4 meters (range: 4.0 – 5.8)	10.4 ppb (range: 9.1 – 11.9)	3.6 ppb (range: 1.9 – 5.2)	------
Lovell Lake	7.0 meters (range: 5.1 – 8.9)	8.5 ppb (range: 6.4 – 16.0)	2.4 ppb (range: 1.7 – 3.1)	0.9 ppm (range: 0.0 – 4.9)
Wilson Lake	Not assessed	Not assessed	Not assessed	Not assessed

- Water quality data are reported for a deep reference sampling location in each water body
- Dissolved oxygen measurements were taken late season and from the middle or bottom water layer
- ------ indicates the site is too shallow to form a bottom water layer

Data Interpretation: Overview of factors to consider when reviewing the Lake Ivanhoe data

This highlight report provides a general overview of the current and historical conditions of Lake Ivanhoe. The report is intended to provide a simple assessment of the water quality trends. Should you have additional questions about interpreting your water quality results, we would be happy to discuss the data with you and/or any concerns you may have. In general, some factors that influence the current and long-term water quality results/trends for our New Hampshire lakes and ponds include:

- **Land-use Patterns** within the watershed (drainage basin) – Research indicates land use patterns have an impact on how much phosphorus (nutrient) is washing into our lakes. In general, more urbanized watersheds have a greater degree of phosphorus runoff than highly forested/vegetated drainage areas.
- **Weather Patterns** – Rainfall and temperature can influence water quality. Wet periods, and overland runoff, tend to be a time when elevated nutrients and other pollutants are transported into our lakes. Temperature can also influence water quality conditions since many aquatic plants and algae tend to respond to changing seasonal conditions. Unusually warm periods are sometimes tied to short-term algal and cyanobacteria blooms.
- **Best Management Practices (BMPs)** – The presence/absence of best management practices can have an interplay on water quality. BMPs are measures that are used to manage nutrients and other pollutants that could otherwise make their way into our lakes. Properties that employ BMPs, designed specifically to remove pollutants of concern (e.g. sediments and phosphorus), are less likely to contribute nutrients and other pollutants into our lakes.
- **Temperature (Thermal) Stratification** – Many lakes become thermally stratified during the summer months and may form three distinct thermal layers: upper water layer (epilimnion), middle lake layer (metalimnion) and bottom cold-water layer (hypolimnion). These thermal zones form a barrier to lake mixing, during the summer months, and can coincide with differences in dissolved oxygen and specific conductivity through the water column.
- **Internal Nutrient Loading** (nutrients that are introduced from the sediments along the lake bottom) – Some of our lakes experience significant internal nutrient loading. Such lakes generally tend to be well stratified and exhibit increasing deep water phosphorus concentrations, relative to surface levels.

Figure 10. Lake Ivanhoe
Wakefield, NH
2022 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 = 13.4 feet

2 Ivanhoe
Secchi Disk Transparency = 14.4 feet

Miles
0   0.1   0.2   0.3

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