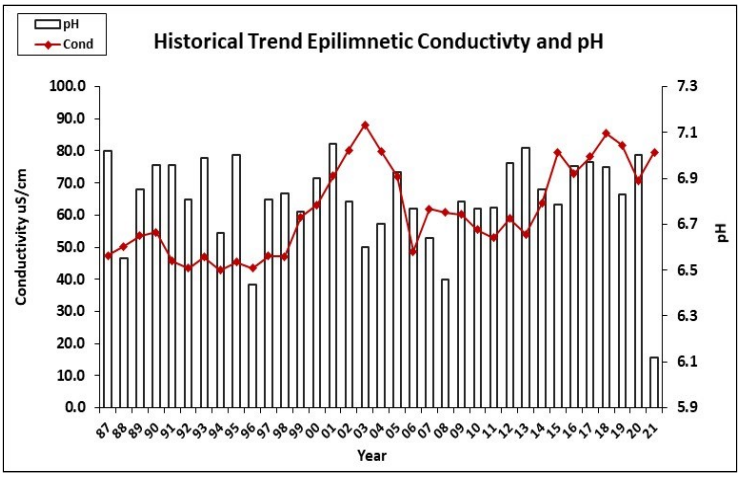
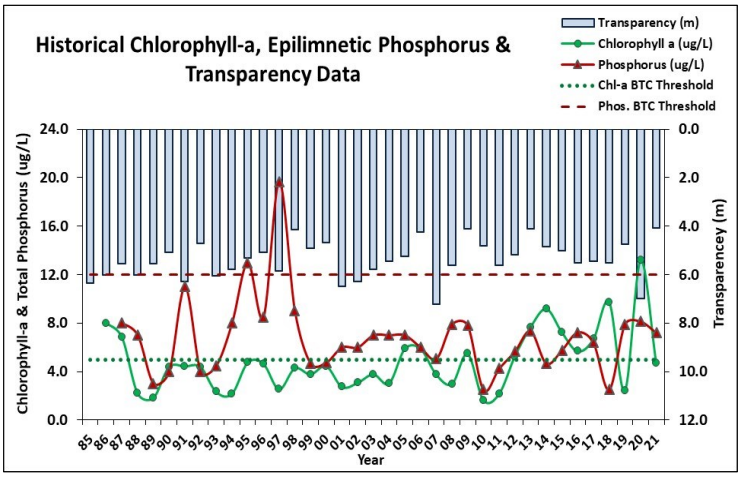
Volunteer Lake Assessment Program Individual Lake Reports
Winona Lake, New Hampton
2021 Data Summary

Recommended Actions: Great job sampling in 2021! Algal growth (chlorophyll-a) has significantly increased in the lake, particularly since 2012 when levels have generally remained above the threshold for mesotrophic lakes. Record rainfall amounts in July, 2021 may have helped to flush nutrients out of the system as no cyanobacteria blooms were reported. However, historical data suggest more frequent occurrence of summer algal/cyanobacteria blooms and potential increased dominance of cyanobacteria in the phytoplankton population. Phosphorus levels have significantly increased in the Hypolimnion suggesting a thick organic layer on the lake bottom that depletes dissolved oxygen resulting in release of phosphorus bound in lake sediments. This phosphorus is readily available for uptake by algae/cyanobacteria and highlights the importance of minimizing stormwater runoff, erosion, sedimentation and deposition of organic material to the lake. Encourage shoreline property owners to maintain a good vegetative buffer to help reduce stormwater runoff to the lake and shoreline erosion from wave action. NHDES' NH Homeowner's Guide to Stormwater Management and UNH Cooperative Extension's Landscaping at the Water's Edge are good resources. Lake conductivity levels have increased and likely being driven by road salt usage on local roadways. Encourage local winter maintenance companies to obtain Green SnowPro Certification to help address increasing conductivity/chloride levels Keep up the great work!

Historical Water Quality Trend Analysis

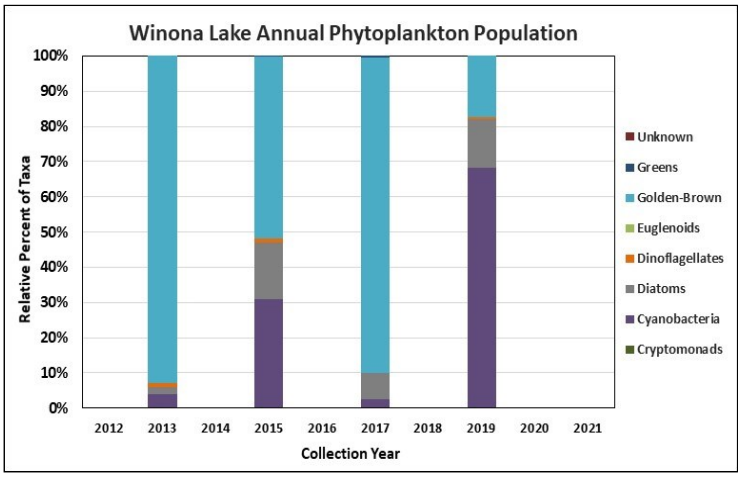
Parameter	Trend	Parameter	Trend
Conductivity	Worsening	**Chlorophyll-a**	Worsening
pH (epilimnion)	Stable	**Transparency**	Stable
		Phosphorus (epilimnion)	Stable





Dissolved Oxygen and Phytoplankton

(Note: Information may not be collected annually)



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Observations (*Refer to Table 1 and Historical Deep Spot Data Graphics)*

- **Chlorophyll-a:** Chlorophyll level was within a low range in June and remained stable in September. Average chlorophyll level decreased sharply from 2020, was slightly greater than the state median, and was slightly less than the threshold for mesotrophic lakes. Historical trend analysis indicates significantly increasing (worsening) chlorophyll levels since monitoring began.
- **Conductivity/Chloride:** Epilimnetic (upper water layer), Metalimnetic (middle water layer), Hypolimnetic (lower water layer), North Inlet, and Outlet conductivity and chloride levels were slightly greater than the state medians, yet not above a level of concern. However, historical trend analysis indicates significantly increasing (worsening) epilimnetic conductivity levels since monitoring began. Heights Brook Inlet conductivity and chloride levels were approximately equal to the state medians. Chutes Cove, Hawkins Pond Inlet and York Brook conductivity levels were elevated and much greater than the state medians. Hawkins Pond Inlet chloride levels were also greater than the state median, yet less than the state chronic chloride standard.
- **Color:** Epilimnetic color data indicate the water was lightly tea colored, or light brown, in June and September.
- **E. coli:** E. coli levels at all stations were less than the state standard of 406 cts/100mL for surface waters. E. coli levels were generally higher in June following significant storm event, but remained less than the state standard.
- **Total Phosphorus:** Epilimnetic phosphorus level was within a low range in June and decreased in September. Average epilimnetic phosphorus level decreased slightly from 2020 and was less than the state median and the threshold for mesotrophic lakes. Historical trend analysis indicates stable, yet variable, epilimnetic phosphorus levels since monitoring began. Metalimnetic phosphorus level was slightly elevated in June and decreased to a low level in September. Hypolimnetic phosphorus level was low in June and increased to an elevated level in September likely due to release of phosphorus from bottom sediments under anoxic (no dissolved oxygen) conditions. Chutes Cove and Hawkins Pond Inlet phosphorus levels were elevated in June following significant storm event. Heights Brook phosphorus level was also slightly elevated in June and lab data noted low levels of sediment/and or organics in all three stations. North Inlet, Outlet and York Brook phosphorus levels were within a low range.
- **Transparency:** Transparency measured without the viewscope (NVS) was below average (worse) in June following significant storm event and higher water levels, and then increased (improved) in September but remained slightly below average. Average NVS transparency decreased from 2020 but remained higher (better) than the state median. Historical trend analysis indicates relatively stable NVS transparency since monitoring began. Viewscope (VS) transparency was higher (better) than NVS transparency and a better measure of actual conditions.
- **Turbidity:** Epilimnetic, Heights Brook Inlet, North Inlet, Outlet, and York Brook turbidity levels were within a low range. Chutes Cove and Hawkins Pond Inlet turbidity levels were higher in June following significant storm event. Metalimnetic turbidity level was slightly higher in September potentially due to algal growth. Hypolimnetic turbidity level was elevated in September and lab data noted moderately colored water indicating formation and accumulation of organic compounds under anoxic conditions.
- **pH:** Epilimnetic, Metalimnetic, Hypolimnetic, Chutes Cove, Heights Brook Inlet, and York Brook pH levels were slightly acidic and less than desirable range 6.5-8.0 units. Historical trend analysis indicates stable epilimnetic pH levels since monitoring began. Outlet pH level was approximately equal to the low end of the desirable range. Hawkins Pond inlet and North Inlet pH levels were within the desirable range.

Station Name	Table 1. 2021 Average Water Quality Data for LAKE WINONA - NEW HAMPTON										
	Alk. (mg/L)	Chlor-a (ug/L)	Chloride (mg/L)	Color (pcu)	Cond. (us/cm)	E. coli (mpn/100mL)	Total P (ug/L)	Trans. (m)		Turb. (ntu)	pH
								NVS	VS		
Epilimnion	6.4	4.70	21	30	79.6		7	4.09	4.92	0.38	6.12
Metalimnion					80.0		11			0.94	6.13
Hypolimnion					90.4		24			3.76	6.10
Chutes Cove					164.5	113	34			1.20	6.27
Hawkins Pond Inlet			34		131.2	107	29			0.81	6.64
Heights Brook Inlet			9		56.9	14	12			0.68	6.10
North Inlet			24		78.5	56	10			0.75	6.71
Outlet			21		84.0	11	7			0.35	6.46
York Brook					243.0	5	2			0.08	6.28

NH Median Values

Median values generated from historic lake monitoring data.

Alkalinity: 4.5 mg/L **Chlorophyll-a:** 4.39 ug/L
Conductivity: 42.3 uS/cm **Chloride:** 5 mg/L
Total Phosphorus: 11 ug/L **Transparency:** 3.3 m
pH: 6.6

NH Water Quality Standards

Numeric criteria for specific parameters. Water quality violation if thresholds exceeded.

Chloride: > 230 mg/L (chronic) **Turbidity:** > 10 NTU above natural
E. coli: > 88 cts/100 mL (beach)
E. coli: > 406 cts/100 mL (surface waters)
pH: between 6.5-8.0 (unless naturally occurring)