2017 Lake Winnisquam Water Quality Report
Belknap County, New Hampshire

Lake Winnisquam is located in the towns of Laconia, Sanbornton, Meredith, Tilton, and Belmont in Belknap County, New Hampshire, and the watershed encompasses all of Lake Winnepesaukee. This lake is classified as Oligotrophic with the exotic species Variable milfoil in specific locations. NH DES consistently collects water samples for evaluation at Three Island, Mohawk Island, and Pot Island. The UNH Lay Lakes Monitoring Program collects water samples for evaluation from 10 Waldron Bay and 30 Bartlett Bay .

Watershed Area	291,649 acres
Shore Length	45,400 meters
Max. Depth	53 meters
Mean Depth	15.2 meters
Volume	262, 306, 500 m^3
Elevation	482 feet

Lake Winnisquam- Average Water Quality Data 2017

	ANC (mg/L)	Apparent Color (PCU)	Chlor-a (ug/L)	Chloride (mg/L)	Conductivity (uS/cm)	Total Phosphorus (ug/L)	Transparency (m)	Turbidity (NTUs)	pH
Mohawk Island	9.13	20	1.58	21	102.6	5	6.21	0.65	7.19
Pot Island	8.70	10	2.01	19	99.8	3	7.33	0.39	7.30
Three Island	8.93	20	1.81	21	100.5	6	7.33	0.73	7.19
Waldron Bay		20	2.06	20	104.0	9	6.69	1.05	6.86
Bartlett Bay		10	1.84	23	103.4	7	7.06	0.48	6.87

Whole Lake Results: The table below shows the combined average result of all three deep spots; Mohawk Island, Three Island, and Pot Island. These results are referred to on the following two pages and represent whole lake water quality.

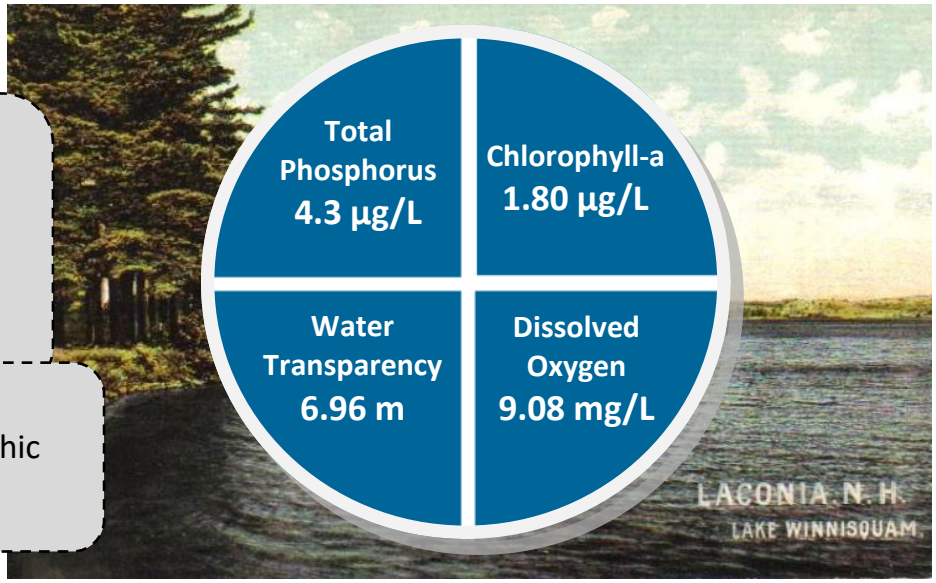
ANC (mg/L)	Apparent Color (PCU)	Chlor-a (ug/L)	Chloride (mg/L)	Conductivity (uS/cm)	Total Phosphorus (ug/L)	Transparency (m)	Turbidity (NTUs)	pH
8.92	**20**	**1.80**	**20**	**101**	**4**	**6.96**	**0.59**	**7.23**

REPORT CARD

NHDES Criteria for Oligotrophic Classification

Phosphorus (µg/L)	<8
Chlorophyll-a (µg/L)	<3.3
Secchi Disk (m)	>4
DO (mg/L)	>5

Blue= Oligotrophic
Orange= Mesotrophic
Green= Eutrophic

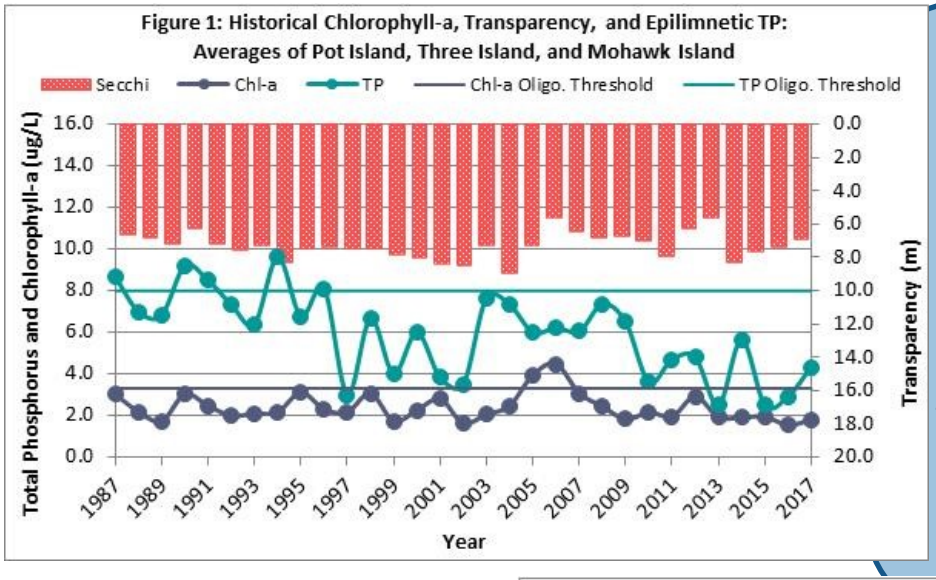


Status

Good	Fair	Poor

	Target Water Quality Conditions	2017 Average Result	Current Status
AQUATIC LIFE	pH 6.5 - 8.0	7.23	The pH value is within the desirable range 6.5 to 8.0 units, and represents ideal conditions for aquatic life.
	Total Phosphorus 1-8 ug/L	4	The phosphorus value is less than the oligotrophic threshold and represents ideal lake water quality and aquatic life conditions. The phosphorus levels have significantly decreased in the lake since monitoring began.
	Chlorophyll-a 0-3.3 ug/L	1.80	The chlorophyll value is less than the oligotrophic threshold and represents ideal conditions for lake water quality and aquatic life conditions.
	Dissolved Oxygen >5 mg/L	9.08	There is no 2017 dissolved oxygen data. Data collected in 2016 indicates high levels of dissolved oxygen throughout the water column.
Acid Neutralizing Capacity (ANC) >25 mg/L		8.92	The ANC value indicates waters with a less than ideal buffering capacity making it moderately vulnerable to pH changes from acid rain and other pollution.
Turbidity <0.1 - 10 NTUs		0.59	The turbidity value represents good lake conditions with minimal suspended sediments in the water body.
Chloride <230 mg/L		20.5	The chloride level is much less than the NH state chronic chloride standard of 230 mg/L, but slightly higher than the NH state median of 4 mg/L).
Conductivity <100 uMhos/cm		101.0	The conductivity value is slightly higher than 100.0 uS/cm that typically indicates human activity/disturbance. The conductivity has significantly increased in the lake since monitoring began.
Apparent color 0-40 PCU		20	The apparent color value is representative of a clear lake with minimal dissolved organic matter.
Water Transparency >2-4.5 meters		6.96	Water clarity (transparency) is higher (better) than the NH reference for ideal water quality conditions and is considered exceptional.

See page 5 for a detailed explanation of water quality parameters.

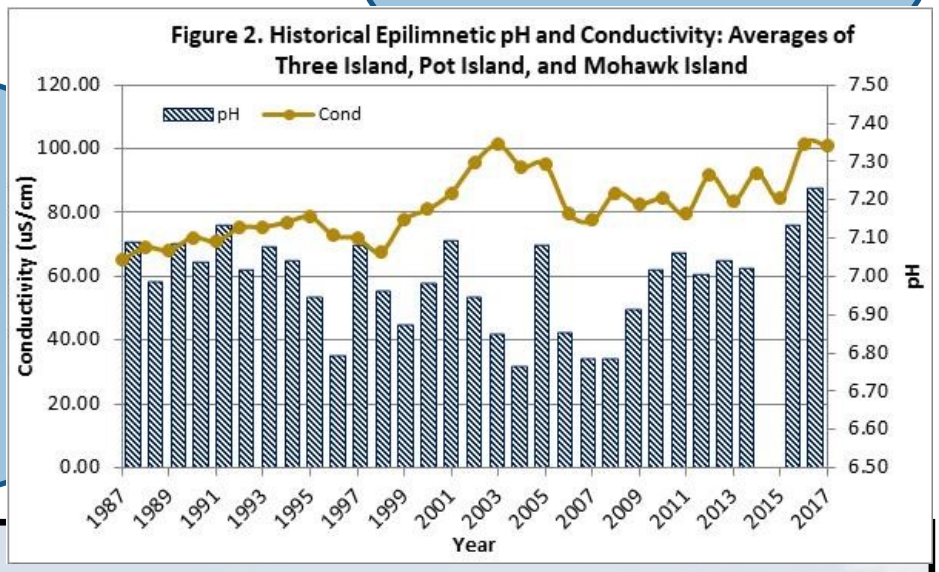


WATER QUALITY TRENDS (Figure 1)

WATER TRANSPARENCY: Historical data analysis indicates a relatively stable trend in water transparency since monitoring began.

CHLOROPHYLL-A: Historical data analysis indicates a relatively stable trend in chlorophyll-a levels since monitoring began.

TOTAL PHOSPHORUS: Historical data analysis indicates a significantly decreasing (improving) trend in epilimnetic total phosphorus levels since monitoring began.



WATER QUALITY TRENDS (Figure 2)

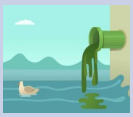
pH: Historical data analysis indicates a relatively stable trend in epilimnetic pH levels since monitoring began.

CONDUCTIVITY: Historical data analysis indicates a significantly increasing (worsening) trend in epilimnetic conductivity levels since monitoring began.

CONCLUSIONS

The 2017 water quality data from Mohawk Island, Pot Island, and Three Island indicate that the lake represents ideal water quality conditions in comparison with NH state water quality standards and thresholds. Lake Winnisquam supports an oligotrophic lake classification as phosphorus and chlorophyll-a levels are consistently below the oligotrophic thresholds, and water clarity and dissolved oxygen levels are high. The decreasing (improving) phosphorus trend suggests that nutrient loading into the lake (from fertilizers, pesticides, agricultural runoff, septic failure, etc.) has been decreasing throughout the watershed over time. Apparent color measured in the epilimnion indicates that the overall lake color is clear with little dissolved organic matter that imparts a tea color to the water. Turbidity is consistently low (good) suggesting minimal suspended solids and particulate matter. This is further supported by the high water clarity (transparency). Conductivity levels are slightly elevated and higher than the state median of 40.0 uS/cm and have significantly increased (worsened) over time. Chloride levels are between 10 and 20 mg/L, which is above the NH state median of 4 mg/L, but well below the NH state chronic chloride standard of 230 mg/L. The increasing conductivity levels are most likely a result of road salt usage on impervious surfaces that enters the lake through stormwater runoff and groundwater discharge. Lake pH levels are generally within an ideal range for aquatic life. The ANC level indicates that the lake is moderately vulnerable to changes in pH from acid rain and other pollutants. Best management practices for road salting, development, and stormwater should be implemented throughout the watershed as increased frequency and intensity of precipitation events will continue to impact water quality. Refer to “Ready, Set, Action” on the next page for collaborative watershed management considerations that can be executed to effectively protect lake water quality health.

Ready, Set, ACTION!

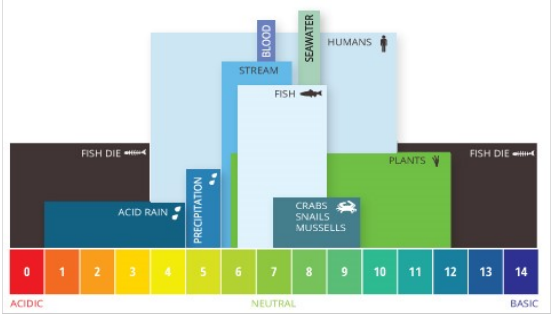
TOPIC	CONSIDERATIONS	WHAT CAN YOU DO	RESOURCES
Stormwater Management 	Stormwater runoff is any precipitation that is not soaked into the ground after a storm event that runs over surfaces directly into our waterways. Runoff carries pollutants into waters and erodes unstable sediments. It is a common occurrence in any developed area (residential, commercial, industrial, etc.) where impervious surfaces (roads, driveways, rooftops, sidewalks, etc…) are present. ◊ Identify areas prone to stormwater runoff and erosion and prioritize remediation activities. ◊ Implement Green Infrastructure and Low Impact Development (LID). ◊ Encourage watershed residents and local governments to actively engage in stormwater management through education and outreach.	There are several actions that you can take as an individual around your home and yard, within your town, and with your friends and family to protect lake water quality: ◊ Properly maintain your septic system by ensuring that it is functioning properly and being pumped regularly . ◊ Use environmentally friendly household cleaning products that do not contain harmful chemicals. ◊ Pick up after your pets so that E. coli bacteria does not run-off into nearby waters. ◊ Avoid bathing yourself or pets directly in a lake. ◊ Avoid washing cars/boats on impervious surfaces (pavement) and do so on the grass instead. ◊ Maintain a natural vegetative buffer of trees, shrubs and ground cover along the shoreline. ◊ Reduce nutrient pollution by avoiding use of pesticides and fertilizers on lawns/gardens. ◊ Reduce salt use and/or implement BMPs. Better calibration techniques for road salting equipment, pre-wetting chemicals to accelerate the brine-making process, and anti-icing before a storm event. ◊ Practice low impact development and stormwater management at your home and encourage local businesses, neighbors, and friends to do so as well. Utilize rain barrels, rain gardens, pervious pavement and patios.	New Hampshire Homeowner's Guide to Stormwater Management NH Stormwater Management Manual: Volumes 1-3 Soak Up The Rain NH UNH Stormwater Center
Road Salt 	The use of road salt in New England, while necessary during the harsh winters, can degrade water quality as Sodium and Chloride ions readily runoff into lakes, rivers and streams, and infiltrate soils and groundwater. As extreme weather events may be more prevalent in New England, more winter precipitation falling as rain and sleet can be expected which means more ice, and the need for more salt. It is necessary for members of the community to be aware of these changing conditions and recognize how it will affect water quality. ◊ Implement best management practices for salt reduction. There are numerous steps that private business owners and contractors can take to ensure better and safer application of road salt. ◊ Obtain a NH Voluntary Salt Applicator License through UNH Technology Transfer Center's Green SnowPro Certification Program. ◊ Reduce the amount of impervious surface in watersheds and utilize low impact development techniques.		NH DES Road Salt Reduction UNH Technology Transfer Center NH DES Innovative Land Use Planning Techniques Handbook
Nutrient Pollution 	Excess nutrients, such as nitrogen and phosphorus, can have adverse affects on lake water quality, aquatic life, and human health. Too much of these nutrients, particularly phosphorus, can cause algae blooms to form that deplete oxygen levels and may result in fish die-offs. Sources of phosphorus can include septic systems, waterfowl, non-phosphate free fertilizers, agricultural fertilizers and manure, sediments, leaf litter, and pet waste. ◊ Stormwater runoff is a main factor in transporting nutrients to surface waters. Implementing stormwater management best practices in residential and commercial areas is critical to reducing nutrient pollution. ◊ Cyanobacteria are a photosynthetic bacteria that utilize excess nutrients to form blooms. These blooms can potentially produce harmful toxins called cyanotoxins that may be hazardous to humans, pets and wildlife. Cyanobacteria is blue-green in color and thrives in warm, stagnant, nutrient rich waters.		New Hampshire Homeowner's Guide to Stormwater Management WD-BB-9 Lake Protection Tips WD-BB-11 Septic Systems and Water Quality WD-BB-20 Phosphorus in Lakes NH DES Beach Inspection Program
Shoreland Protection 	It is important to retain a combination of native shoreland plants, trees, and ground cover to protect a body of water from storwmater runoff and shoreline erosion. ◊ Maintain at least a 50 foot waterfront buffer of natural ground cover and low shrubs. ◊ Re-plant native vegetation along bare shorelines. ◊ Reduce lawn areas and let grass grow longer along the shoreline.		NH DES Shoreland Water Quality Protection Act NH DES Shoreland Program UNH Cooperative Extension: Landscaping at the Water's Edge
Watershed Planning 	Activities that occur in your watershed can have direct affects on lake water quality. ◊ DISTRICT/ORIDANCE -Develop a Watershed District/Ordinance in the town(s) that the lake's watershed lies within. -Watershed ordinances specify activities that can/cannot occur within the watershed boundary. ◊ LAND CONSERVATION -Prioritize land conservation to protect critical wildlife habitat such as wetlands and forests that serve as important filters for pollution. -Consider land acquisition and/or conservation easements as ways to regulate activities on land. ◊ BEST MANAGEMENT PRACTICES -Implement best management practices (BMPs) and LID to mitigate stormwater runoff and pollution of surface waters.		NH DES Watershed Management Bureau NH DES Innovative Land Use Planning Techniques Handbook NH Stormwater Management Manual: Volumes 1-3 NH Fish and Game Wildlife Action Plan

Water Quality Parameters and Explanations

PH
ACID NEUTRALIZING CAPACITY (ANC)

What Is It?

pH is the concentration of hydrogen ions (H+) in a solution. It is measured on a logarithmic scale from 0 (very acidic) to 14 (very basic) with 7 being neutral. Anything greater than 7 is considered basic, and anything below 7 is considered acidic. The ANC of a body of water is its ability to buffer or neutralize an acid, which is essentially how well the water can resist changes in pH.



Why Does It Matter?

Aquatic organisms require an optimum pH range of 6.5 to 8.0 units for growth and survival. There can be high mortality of organisms with even minor changes in pH. The pH of water is influenced naturally by the weathering of rocks and acid rain, or by humans from wastewater pollution.

TURBIDITY
APPARENT COLOR
WATER CLARITY

What Is It?

Turbidity is a measure of how much particulate matter is in the water and is influenced by suspended sediments (silt, sand, clay, etc.), inorganic materials, or decaying organic matter (algae) that causes light to be scattered. Turbid waters tend to be brown and murky in appearance with reduced water clarity. Water clarity is measure of how far down light can penetrate a body of water, and is directly related to turbidity. Apparent color is a visual measure of the color of water as a result of dissolved organic matter and decaying vegetation that increases turbidity and decreases clarity.

Why Does It Matter?

Factors that influence turbidity include sediments (silt, clay, sand) from erosion and runoff, algae and decaying plant material. High turbidity can negatively affect the feeding, reproduction and migration of aquatic life. High turbidity often correlates with tea or darker colored waters which are less clear and exhibit poor clarity.

CONDUCTIVITY
CHLORIDE

What Is It?

Conductivity is the ability of water to pass an electrical current, and it depends on the concentration of ions from inorganic materials, metals, and dissolved salts, such as chlorides. Many dissolved salts contribute to salinity of water, but specifically, chloride makes up a large part of the salinity concentration. Concentration of chloride ions can be directly related to and a strong contributor of conductivity in water.

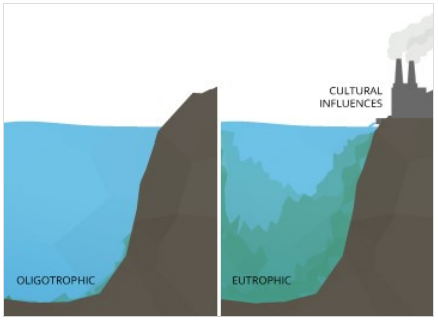
Why Does It Matter?

Conductivity is a parameter that can be used as an early indicator of water quality change because it remains fairly constant over time. Therefore, any changes occurring can be detected early to understand the impacts from the surrounding watershed. Conductivity and/or chloride levels are a good indication of how de-icing materials (road salt) used on impervious surfaces are impacting water quality. Aquatic organisms are sensitive to and have an optimum salinity range for which they can survive.

CHLOROPHYLL-A
TOTAL PHOSPHORUS

What Is It?

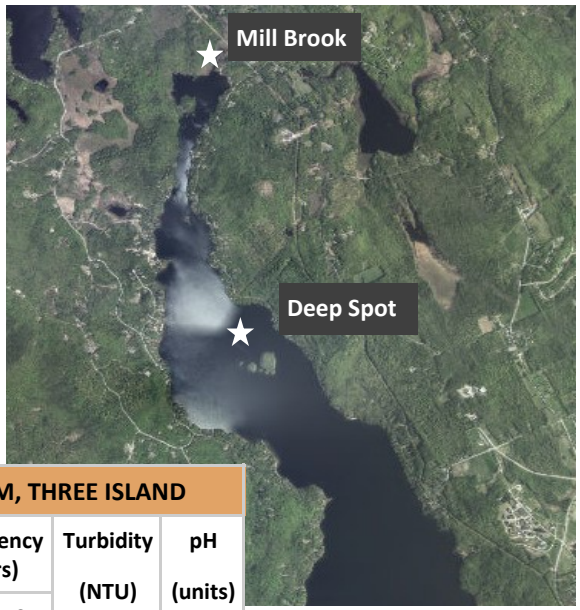
Chlorophyll-a is a pigment found in all photosynthetic organisms such as aquatic plants, algae, and phytoplankton, and is often used as a measure of algal growth in a body of water. Phosphorus is a limiting nutrient to aquatic plants, and high levels of phosphorus can result in excessive and potentially harmful algal growth.



Why Does It Matter?

An increase in chlorophyll-a and total phosphorus concentrations could be an indication of excessive nutrient loading in a lake from agricultural runoff (pesticides, fertilizers) or septic system failure. Algae blooms can form and be hazardous to aquatic organisms by depleting the oxygen supply. Cyanobacteria blooms can form and may be potentially toxic to aquatic organisms, wildlife, domestic animals and humans.

Lake Winnisquam Three Island 2017 Report

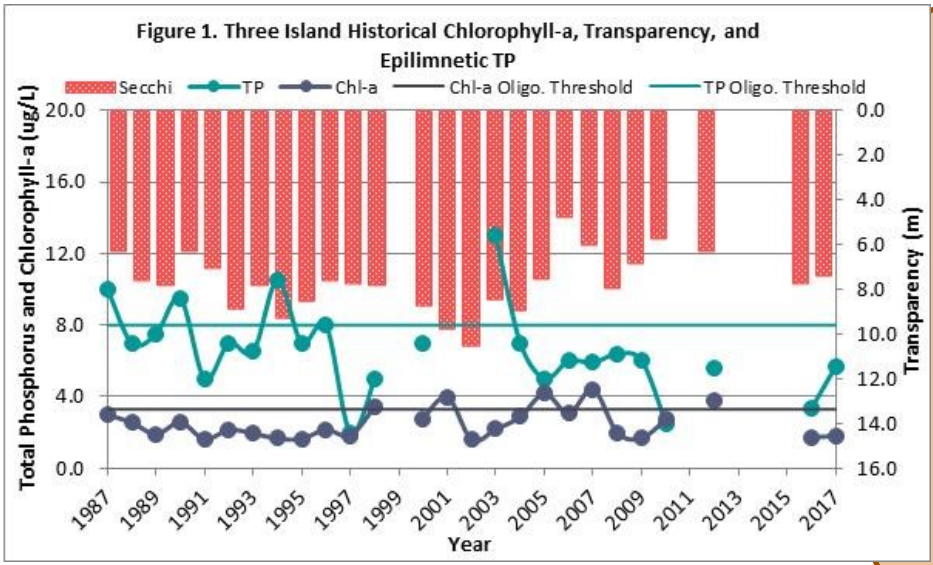


STATION	2017 AVERAGE WATER QUALITY DATA - LAKE WINNISQUAM, THREE ISLAND									
	ANC (mg/L)	Apparent Color (PCU)	Chl-a (ug/L)	Chloride (mg/L)	Cond. (uS/cm)	Total P (ug/L)	Transparency (meters)		Turbidity (NTU)	pH (units)
							NVS	VS		
Epilimnion	8.9	20	1.81	21	100.5	6	7.33	7.83	0.73	7.19
Metalimnion					104.3	8			0.61	6.76
Hypolimnion					108.9	7			0.77	6.59

Status

Good	Fair	Poor
●	●	●

Parameter	NH Water Quality Evaluations			Current Status
pH (units) ●	<5 Acidified	5.0-6.4 Critical/Endangered	6.5-8.0 Satisfactory	pH levels represent ideal water quality conditions for aquatic life.
ANC (mg/L) ●	<0 Acidified	0-25 Moderate to low vulnerability	>25 Not vulnerable	ANC levels represents less than ideal buffering capacity making the lake moderately vulnerable to acidic inputs from acid rain and other pollutants.
Turbidity (NTU) ●	<0.1 Minimum	1.0 Median	22.0 Maximum	Turbidity levels are less than the state median (1 NTU) and represent good water quality conditions.
Total Phosphorus (ug/L) ●	1-8 Oligotrophic GOOD	>8-12 Mesotrophic FAIR	>12-28 Eutrophic POOR	Phosphorus levels throughout the water column are considered low (good) and below the threshold for oligotrophic lakes.
Conductivity (uS/cm) ●	<100 Minimal human disturbance	>100 Moderate to high human disturbance		Conductivity levels indicate low to moderate human disturbance in the watershed and are higher than the state median of 40.0 uS/cm.
Chloride (mg/L) ●	>860 Acute	>230 Chronic		Chloride levels indicate minor human disturbance from salted roads and/or septic systems.
Chlorophyll-a (ug/L) ●	0-3.3 Oligotrophic GOOD	>3.3-5 Mesotrophic FAIR	>5-11 Eutrophic POOR	Chlorophyll-a levels indicate very low levels of algal growth and are below the threshold for oligotrophic lakes.
Transparency (m) ●	>4.5 Oligotrophic GOOD	>2-4.5 Mesotrophic FAIR	<2 Eutrophic POOR	Water transparency (clarity) is very good and considered exceptional for NH lakes.
Apparent Color (PCU) ●	0-25 Clear	25-80 Tea color	>80 Highly Tea Colored	Apparent color levels are representative of a clear lake with minimal dissolved organic matter.



WATER QUALITY TRENDS (Figure 1)

WATER TRANSPARENCY: Historical data analysis indicates a relatively stable water transparency trend with moderate variability since monitoring began.

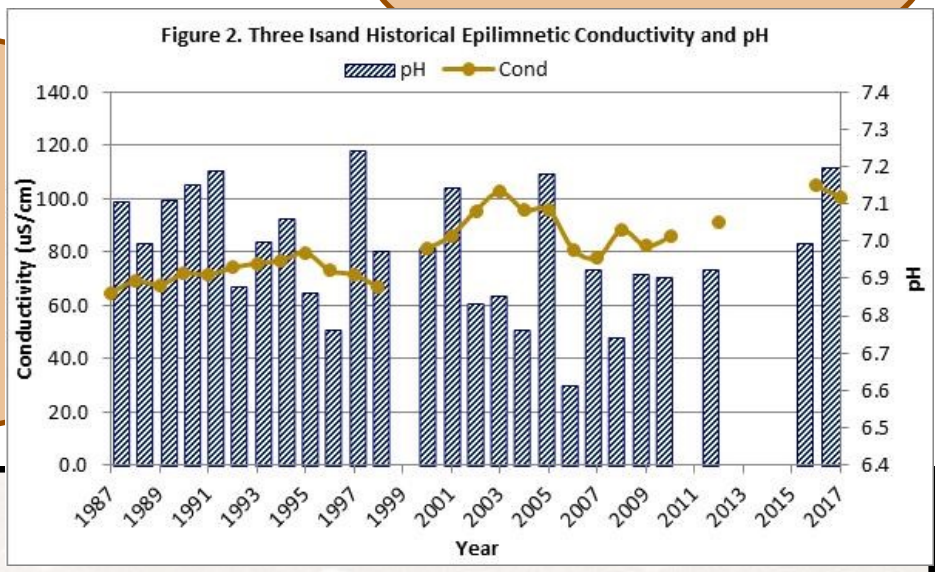
CHLOROPHYLL-A: Historical data analysis indicates a relatively stable trend in chlorophyll-a levels with moderate variability since monitoring began.

TOTAL PHOSPHORUS: Historical data analysis indicates a relatively stable trend in epilimnetic total phosphorus levels with high variability since monitoring began.

WATER QUALITY TRENDS (Figure 2)

PH: Historical data analysis indicates a significantly decreasing (worsening) trend in pH levels since monitoring began.

CONDUCTIVITY: Historical data analysis indicates a significantly increasing (worsening) trend in conductivity levels since monitoring began.



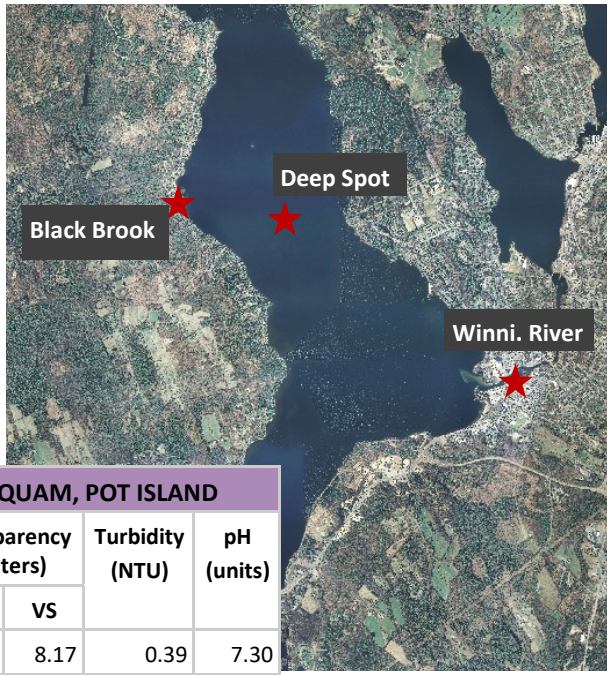
CONCLUSIONS

The increasing conductivity trend is an indication of human disturbances likely from the use of road salt on impervious surfaces that enters the lake through stormwater runoff and groundwater discharge. Chloride levels are well below the NH state chronic standard (230 mg/L), but they are above the state median of 4 mg/L indicating chloride may be contributing to conductivity levels in the lake. pH levels at all sampling locations in 2017 were within the desirable range of 6.5 to 8.0 units, however historical trend analysis indicates significantly decreasing (worsening) pH levels; however there are gaps in the data record may have influenced the trend analysis. Changes in pH can be influenced by weathering of bedrock, acid rain pollution, and/or wastewater pollution. The ANC level at Three Island indicates that the lake is moderately vulnerable to acidic inputs, and this is typical of NH surface waters. The turbidity results at each station were low, indicating minimal suspended sediments and particulate matter. Water clarity (transparency) was high (good) and apparent color values were low. These are representative of a clear lake with minimal dissolved organic matter and suspended sediments (silt, sand, clay, etc). The current and historical values of water transparency, chlorophyll-a, and total phosphorus are supportive of the oligotrophic lake classification, and are relatively stable with low variability since monitoring began.

Lake Winnesquam, N.H.

Lake Winnisquam Pot Island 2017 Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

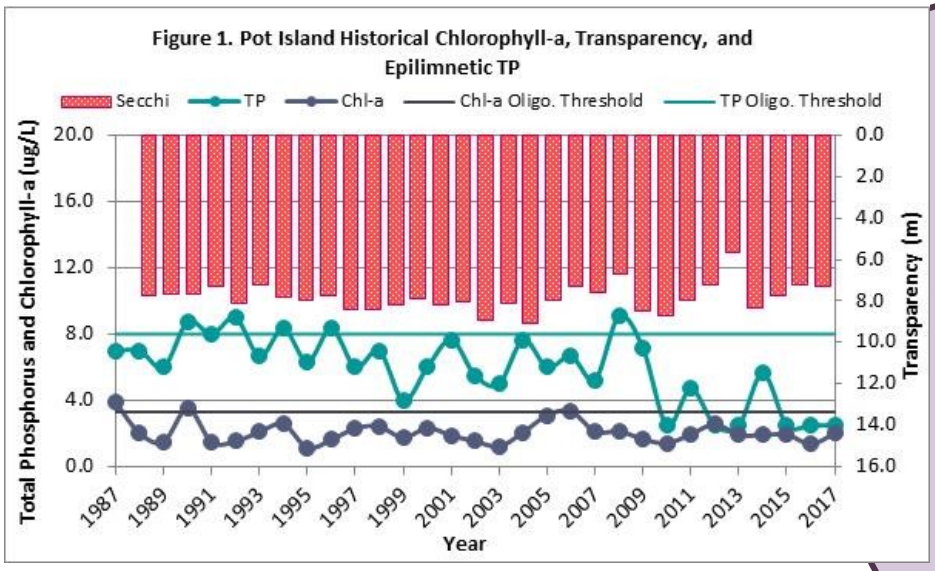


STATION	2017 AVERAGE WATER QUALITY DATA – LAKE WINNISQUAM, POT ISLAND									
	ANC (mg/L)	Apparent Color (PCU)	Chl-a (ug/L)	Chloride (mg/L)	Cond. (uS/cm)	Total P (ug/L)	Transparency (meters)		Turbidity (NTU)	pH (units)
							NVS	VS		
Epilimnion	8.7	10	2.01	19	99.8	3	7.33	8.17	0.39	7.30
Metalimnion					106.0	8			0.44	6.51
Hypolimnion					108.5	7			0.56	6.69
Black Brook				20	109.2	4			0.55	6.91
Winni. River				18	103.0	5			0.38	6.86

Status

Good	Fair	Poor

Parameter	Water Quality Evaluations			Current Status
pH (units)	<5 Acidified	5.0-6.4 Critical/Endangered	6.5-8.0 Satisfactory	pH levels represent ideal water quality conditions for aquatic life.
Alkalinity (mg/L)	<0 Acidified	0-25 Moderate to low vulnerability	>25 Not vulnerable	ANC levels represents less than ideal buffering capacity making the lake moderately vulnerable to acidic inputs from acid rain and pollutants.
Turbidity (NTU)	<0.1 Minimum	1.0 Median	22.0 Maximum	Turbidity levels are below the state median value (1 NTU) and represent good water quality conditions.
Total Phosphorus (ug/L)	1-8 Oligotrophic GOOD	>8-12 Mesotrophic FAIR	>12-28 Eutrophic POOR	Phosphorus levels throughout the water column are considered low (good) and below the threshold for oligotrophic lakes.
Conductivity (uS/cm)	<100 Minimal human disturbance	>100 Moderate to high human disturbance		Conductivity levels indicate low to moderate human disturbance in the watershed and are higher than the state median of 40.0 uS/cm.
Chloride (mg/L)	>860 Acute	>230 Chronic		Chloride levels indicate minor human disturbance from salted roads and/or septic systems.
Chlorophyll-A (ug/L)	0-3.3 Oligotrophic GOOD	>3.3-5 Mesotrophic FAIR	>5-11 Eutrophic POOR	Chlorophyll-a levels indicate very low levels of algal growth and are below the threshold for oligotrophic lakes.
Transparency (m)	>4.5 Oligotrophic GOOD	>2-4.5 Mesotrophic FAIR	<2 Eutrophic POOR	Water transparency (clarity) is very good and considered exceptional for NH lakes.
Apparent Color (PCU)	0-25 Clear	25-80 Tea color	>80 Highly Colored	Apparent color levels are representative of a clear lake with minimal dissolved organic matter.

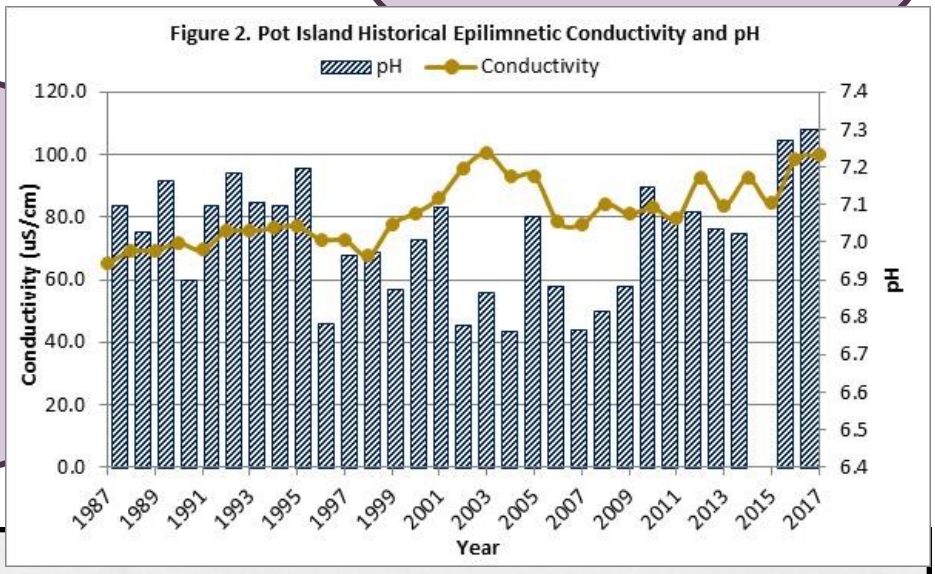


WATER QUALITY TRENDS (Figure 1)

WATER TRANSPARENCY: Historical data analysis indicates a stable water transparency trend since monitoring began.

CHLOROPHYLL-A: Historical data analysis indicates a relatively stable trend in chlorophyll-a levels with moderate variability since monitoring began.

TOTAL PHOSPHORUS: Historical data analysis indicates a significantly decreasing (improving) trend in epilimnetic total phosphorus levels since monitoring began.



WATER QUALITY TRENDS (Figure 2)

pH: Historical data analysis indicates a significantly decreasing (worsening) trend in pH levels since monitoring began.

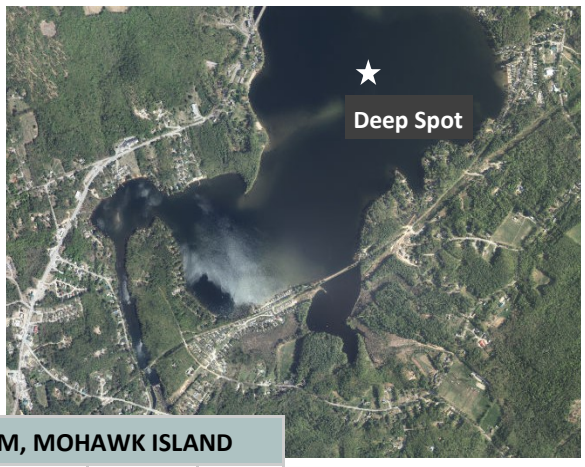
CONDUCTIVITY: Historical data analysis indicates a significantly increasing (worsening) trend in conductivity levels since

CONCLUSIONS

The increasing conductivity trend is an indication of human disturbances likely from the use of road salt on impervious surfaces that enters the lake through runoff and groundwater discharge. Chloride levels are well below the NH state chronic standard (230 mg/L), but they are above the state median of 4 mg/L indicating chloride may be contributing to conductivity levels in the lake. pH levels at all sampling locations in 2017 were within the desirable range of 6.5 to 8.0 units, however historical trend analysis indicates significantly decreasing (worsening) pH levels, particularly through 2009, and since then pH levels seem to have recovered. The ANC level at Pot Island indicates that the lake is moderately vulnerable to acidic inputs and this is typical of NH surface waters. The turbidity levels at each station were low, indicating minimal suspended sediments and particulate matter. Water clarity (transparency) was high (good) and apparent color values were low. These are representative of a clear lake with minimal dissolved organic matter and suspended sediments (silt, sand, clay, etc). The current and historical values of water transparency, chlorophyll-a, and total phosphorus are consistent with oligotrophic lake conditions. Chlorophyll-a levels and water clarity are stable, but there is a significant decreasing (improving) trend in total phosphorus concentrations. This is an indication that nutrient loading (from fertilizers, pesticides, agricultural runoff, septic failure, etc.) from the surrounding watershed has been minimized over time.

Lake Winnisquam Mohawk Island 2017 Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

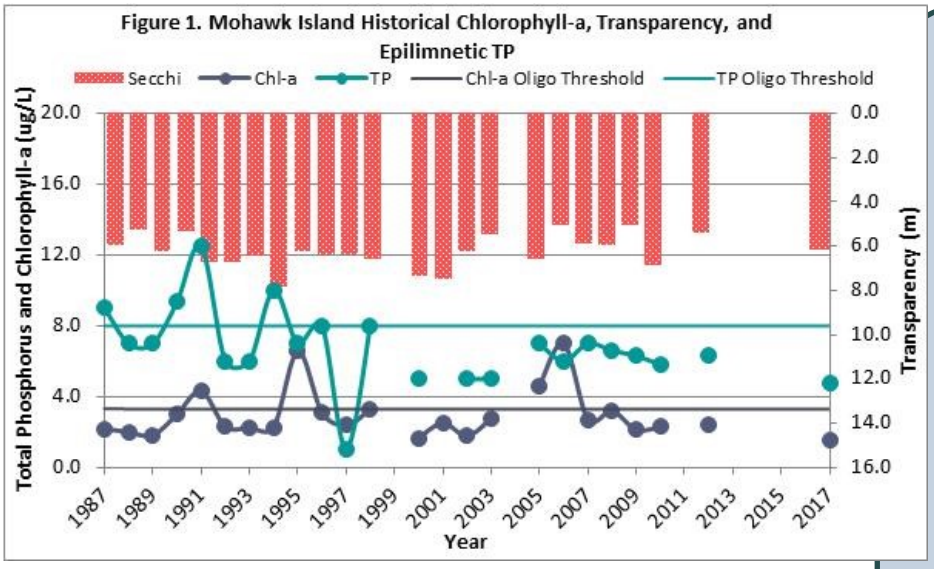


STATION	2017 AVERAGE WATER QUALITY DATA – LAKE WINNISQUAM, MOHAWK ISLAND									
	ANC (mg/L)	Apparent Color (PCU)	Chl-a (ug/L)	Chloride (mg/L)	Cond. (uS/cm)	Total P (ug/L)	Transparency (meters)		Turbidity (NTU)	pH (units)
							NVS	VS		
Epilimnion	9.1	20	1.58	21	102.6	5	6.21	7.79	0.65	7.19
Metalimnion					104.4	6			0.71	6.74
Hypolimnion					111.5	32			1.86	6.49

Status

Good	Fair	Poor
●	●	●

Parameter	NH Water Quality Evaluations			Current Status
pH (units) ●	<5 Acidified	5.0-6.4 Critical/Endangered	6.5-8.0 Satisfactory	pH levels represent ideal water quality conditions for aquatic life.
Alkalinity (mg/L) ●	<0 Acidified	0-25 Moderate to low vulnerability	>25 Not vulnerable	ANC levels represents less than ideal buffering capacity making the lake moderately vulnerable to acidic inputs from acid rain and pollutants.
Turbidity (NTU) ●	<0.1 Minimum	1.0 Median	22.0 Maximum	Turbidity levels are below the state median value (1 NTU) and represent good water quality conditions.
Total Phosphorus (ug/L) ●	1-8 Oligotrophic GOOD	>8-12 Mesotrophic FAIR	>12-28 Eutrophic POOR	Epilimnion (upper water layer) and Metalimnion (middle water layer) TP levels were low (good) and less than the oligotrophic threshold, but the hypolimnion (lower water layer) TP level was elevated and indicates potential oxygen depletion and internal phosphorus loading at this site.
Conductivity (uS/cm) ●	<100 Minimal human disturbance	>100 Moderate to high human disturbance		Conductivity levels indicate low to moderate human disturbance in the watershed and are higher than the state median of 40.0 uS/cm.
Chloride (mg/L) ●	>860 Acute	>230 Chronic		Chloride levels indicate minor human disturbance from salted roads and/or septic systems.
Chlorophyll-a (ug/L) ●	0-3.3 Oligotrophic GOOD	>3.3-5 Mesotrophic FAIR	>5-11 Eutrophic POOR	Chlorophyll-a levels indicates very low levels of algal growth and are below the threshold for oligotrophic lakes.
Transparency (m) ●	>4.5 Oligotrophic GOOD	>2-4.5 Mesotrophic FAIR	<2 Eutrophic POOR	Water transparency (clarity) is very good and considered exceptional for NH lakes.
Apparent Color (PCU) ●	0-25 Clear	25-80 Tea color	>80 Highly Colored	Apparent color levels are representative of a clear lake with minimal dissolved organic matter.



WATER QUALITY TRENDS (Figure 1)

WATER TRANSPARENCY: There is insufficient data to establish a historical trend analysis, but visual inspection indicates relatively stable water transparency since monitoring began.

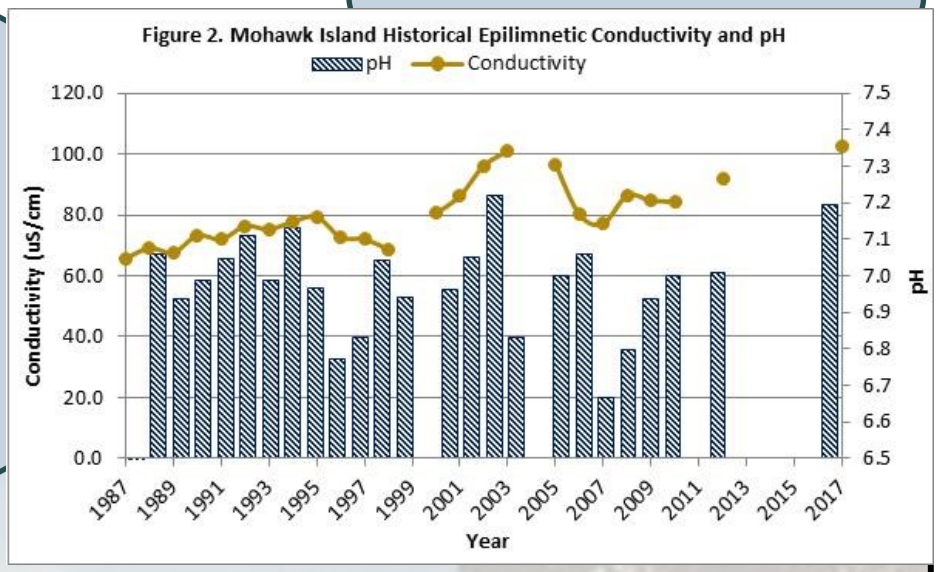
CHLOROPHYLL-A: There is insufficient data to establish a historical trend analysis, but visual inspection indicates relatively stable chlorophyll-a levels since monitoring began.

TOTAL PHOSPHORUS: There is insufficient data to establish a historical trend analysis, but visual inspection indicates relatively stable epilimnetic total phosphorus levels since monitoring began.

WATER QUALITY TRENDS (Figure 2)

PH: There is insufficient data to establish a historical trend analysis, but visual inspection indicates highly variable epilimnetic pH levels since monitoring began.

CONDUCTIVITY: There is insufficient data to establish a historical trend analysis, but visual inspection indicates increasing (worsening) conductivity levels since monitoring began.



CONCLUSIONS

The hypolimnion turbidity and phosphorus levels were elevated compared to Three and Pot Island deep spots. Mohawk Island is located at the southern end of the lake where water flows towards the lake outlet. This is downstream from the other deep spots and from some of the most highly developed areas in the watershed (see Figure 3). This likely results in additional pollutants, such as suspended sediments and nutrients, settling at the bottom of this basin. This additional layer of organic matter and its decomposition depletes dissolved oxygen resulting in phosphorus being released from bottom sediments, a process referred to as internal loading. Additional monitoring will help to confirm if this process is occurring.

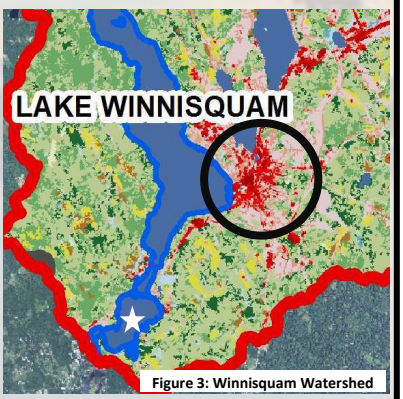
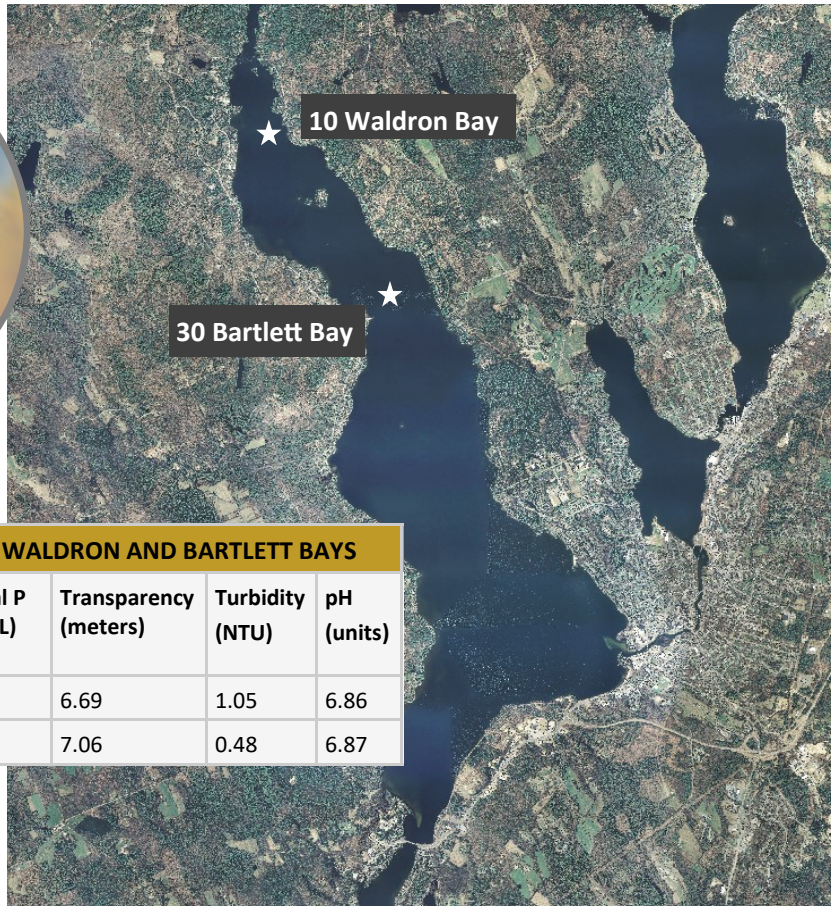


Figure 3: Winnisquam Watershed

The conductivity levels have increased and are an indication of human disturbance most likely from salting of impervious surfaces that enters the lake through runoff and groundwater discharges. Chloride levels are well below the NH state chronic standard (230 mg/L), but they are above the state median of 4 mg/L indicating chloride may be contributing to conductivity levels in the lake. The current ANC level characterizes the lake as moderately vulnerable to acidic input from acid rain, and this is typical of NH lakes. The pH level is ideal for water quality and aquatic life conditions. Although turbidity levels were slightly higher, the water clarity and apparent color values remain representative of a clear lake with minimal dissolved organic matter and suspended sediments (silt, sand, clay, etc). The current and historical levels of water transparency, chlorophyll-a, and total phosphorus are consistent with oligotrophic lake conditions, and have remained relatively stable and low since monitoring began.

Lake Winnisquam
10 Waldron Bay &
30 Bartlett Bay
2017 Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services



STATION	2017 AVERAGE WATER QUALITY DATA – WALDRON AND BARTLETT BAYS							
	Apparent Color (PCU)	Chl-a (ug/L)	Chloride (mg/L)	Cond. (uS/cm)	Total P (ug/L)	Transparency (meters)	Turbidity (NTU)	pH (units)
Waldron Bay	20	2.06	20	104.0	9	6.69	1.05	6.86
Bartlett Bay	10	1.84	23	103.4	7	7.06	0.48	6.87

Status

Good	Fair	Poor

Parameter	Water Quality Evaluation			Current Status
pH (units)	<5 Acidified	5.0-6.4 Critical/Endangered	6.5-8.0 Satisfactory	pH levels represent ideal water quality conditions for aquatic life.
Turbidity (NTU)	<0.1 Minimum	1.0 Median	22.0 Maximum	Turbidity levels are less than/approximately equal to the state median value (1 NTU) and represent good water quality conditions.
Conductivity (uS/cm)	<100 Minimal human disturbance	>100 Moderate to high human disturbance		Conductivity levels indicate low to moderate human disturbance in the watershed and are higher than the state median of 40.0 uS/cm.
Chloride (mg/L)	>860 Acute	>230 Chronic		Chloride levels indicate minor human disturbance from salted roads and/or septic systems.
Total Phosphorus (ug/L)	1-8 Oligotrophic GOOD	>8-12 Mesotrophic FAIR	>12-28 Eutrophic POOR	Bartlett Bay TP levels are considered low (good) and below the threshold for oligotrophic lakes. Waldron Bay TP levels were slightly higher than the threshold for oligotrophic lakes.
Chlorophyll-A (ug/L)	0-3.3 Oligotrophic GOOD	>3.3-5 Mesotrophic FAIR	>5-11 Eutrophic POOR	Chlorophyll-a levels indicates very low levels of algal growth and are below the threshold for oligotrophic lakes.
Transparency (m)	>4.5 Oligotrophic GOOD	>2-4.5 Mesotrophic FAIR	<2 Eutrophic POOR	Water transparency (clarity) is very good and considered exceptional for NH lakes.
Apparent Color (PCU)	0-25 Clear	35-80 Tea color	>80 Highly Colored	Apparent color levels are representative of a clear lake with minimal dissolved organic matter.

WATER QUALITY TRENDS

WATER TRANSPARENCY: There is insufficient data to conduct a statistical trend analysis, but visual inspection of the historical data indicates a decreasing (worsening) trend in transparency at both Bays since monitoring began 20 years ago (see Figures 1 and 2).

TOTAL PHOSPHORUS: There is insufficient data to conduct a statistical trend analysis, but visual inspection detects a decreasing (improving) trend at both Bays since monitoring began 20 years ago (see Figure 3).

CHLOROPHYLL-A: There is insufficient data to conduct a statistical trend analysis, but visual inspection of the data indicates a slightly decreasing (improving) trend at both Bartlett and Waldron Bay since monitoring began 20 years ago (see Figure 4).

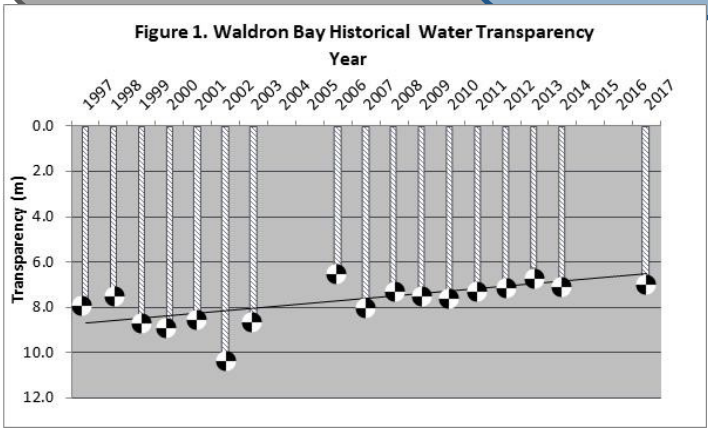


Figure 1. Waldron Bay Historical Water Transparency

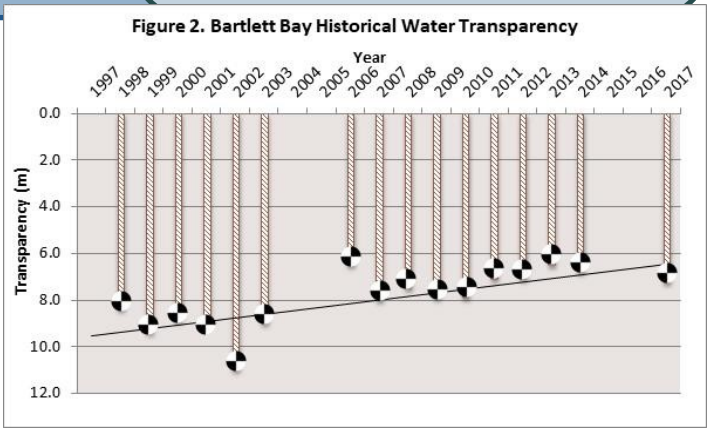


Figure 2. Bartlett Bay Historical Water Transparency

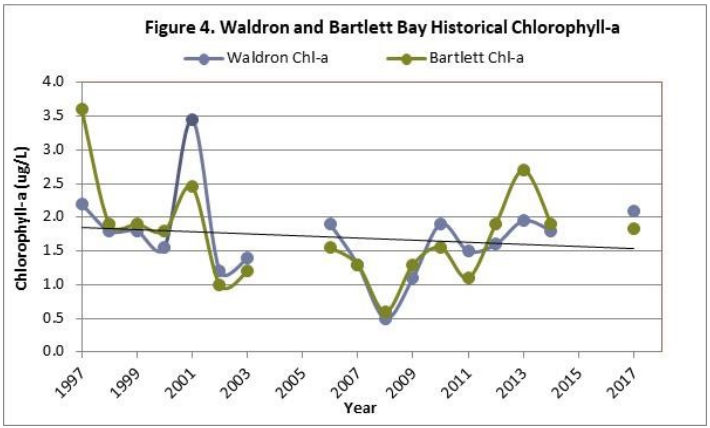


Figure 4. Waldron and Bartlett Bay Historical Chlorophyll-a

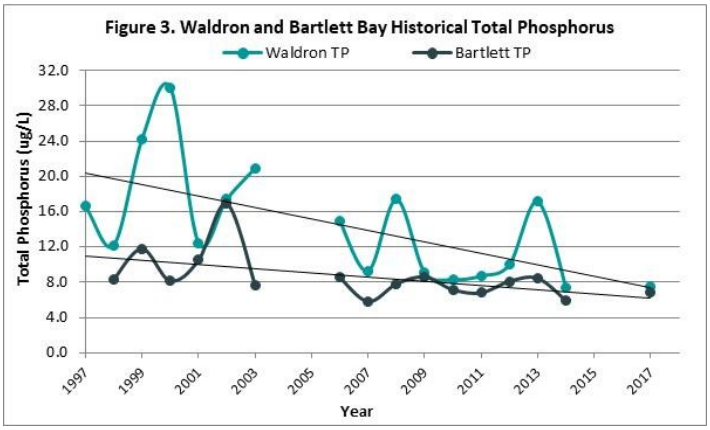


Figure 3. Waldron and Bartlett Bay Historical Total Phosphorus

CONCLUSIONS

Transparency (water clarity) at Waldron and Bartlett Bay appears to be worsening despite slightly improving chlorophyll-a and phosphorus levels. This may be due to the shallower depth and near-shore location of these stations and recreational activities disturbing sediments, stormwater runoff, and the increased frequency and intensity of storm events flushing wetland systems rich in dissolved organic matter. Apparent color characterizes the lake as clear, but visual inspection of true color historical data collected by the UNH LLMP indicates that there is a slightly increasing (worsening) trend in color. This could explain some of the variation in water clarity.

pH levels were within the desirable range for aquatic life. Conductivity levels were slightly elevated and above the state median of 40.0 uS/cm. Chloride levels were above the NH state median value of 4 mg/L, but they were below the state chronic chloride standard of 230 mg/L. Conductivity and chloride levels are indicative of human disturbance most likely from road salting and other activities occurring on impervious surfaces in the surrounding watershed. Turbidity levels fluctuated within a low range indicating a lack of particulate matter and suspended sediments. Maintain current monitoring program to better assess the worsening transparency trends and to establish a long-term data set to conduct statistical analyses.