LAKE WINNIPESAUKEE (ALTON) 2010 EXECUTIVE SUMMARY

Water quality data were collected by the Lake Winnipesaukee (Alton) volunteer monitors between April 21 and October 19, 2010 while supplemental water quality data were collected by the Center for Freshwater Biology field team on August 4, 2010.

Generally speaking, the 2010 Alton water quality remained excellent as summarized in Table 3; the 2010 Alton water clarity was high while the microscopic plant (greenness) and the total phosphorus (nutrient) concentrations were generally low and remained below nuisance levels.

Water quality data collected in the general vicinity of Alton/Alton Bay, Long Island, Meredith Bay, Governor's Island, Paugus Bay, Saunders Bay, Tuftonbo, Winter Harbor and Wolfeboro Bay were compared among regions to examine the water quality variations around Lake Winnipesaukee (Figure 9). The 2010 median Lake Winnipesaukee (Alton) water clarity and amount of microscopic plant growth (measured as chlorophyll *a*) in and around Alton was about average, relative to the other geographic areas around Lake Winnipesaukee (Figures 13 and 14).

The following section discusses the 2010 and historical Lake Winnipesaukee (Alton) water quality data. *Refer to Appendix D for a complete listing of the 2010 Alton water quality data and refer to Appendix E for an overview of the Box and Whisker plots that are included in this annual report.*

Table 3: 2010 Lake Winnipesaukee (Alton) Seasonal Average Water Quality Readings and Water Quality Classification Criteria used by the New Hampshire Lakes Lay Monitoring Program.

Parameter	Oligotrophic "Pristine"	Mesotrophic "Transitional"	Eutrophic "Enriched"	Lake Winnipesaukee Alton Average (range)	Lake Winnipesaukee Alton Classification
Water Clarity (meters)	> 4.0	2.5 - 4.0	< 2.5	8.9 meters (range: 4.0 – 11.5)	Oligotrophic
Chlorophyll a (ppb)	< 3.0	3.0 - 7.0	> 7.0	1.9 ppb (range: 0.7 – 3.9)	Oligotrophic
Phosphorus (ppb)	< 15.0	15.0 - 25.0	> 25.0	*9.4 ppb (range: 3.7 – 47.8)	Oligotrophic

** Total Phosphorus data were collected in the surface waters (epilimnion) by the volunteer monitors.*

1) Water Clarity (measured as Secchi Disk transparency) - The 2010 Alton water clarity values were high and were consistently greater than or equal to the transparency of 4 meters that is considered the boundary between an unproductive "pristine" and more nutrient enriched "transitional" New Hampshire lake (Tables 3 & 4 and Appendix A). The shallowest 2010 water transparency measurement of 4.0 meters (13.2 feet) was documented at the most embayed sampling location, the Pavillion Site, on May 1. The Pavillion site is shallower than the other Alton sampling locations and is more susceptible to the influence of the Merrymeeting River and concentrated shoreline development, relative to the other Alton Sites.

Table 4: 2010 Water Clarity data summary for the Lake Winnipesaukee deep sampling stations.

Site	Seasonal Average Water Transparency (meters)
22A Alton	9.2 meters (range: 6.0 – 11.5)
24 Alton	8.9 meters (range: 6.1 – 10.3)
25 Alton	9.6 meters (range: 6.5 – 11.5)
26 Alton	8.3 meters (range: 6.9 – 9.5)
Pavillion	4.9 meters (range: 4.0 – 5.5)

The 2010 median Secchi Disk transparencies documented at sites 22A, 24, 25 and 26 increased (i.e. more clear water) relative to the 2009 median (Appendix B). The 2010 median Secchi Disk transparency measured at Site 25 is the highest median water transparency measurement recorded since volunteer water quality monitoring was initiated on Lake Winnipesaukee (Alton) in 1983 (Appendix B).

2) Microscopic plant abundance "greenness" (measured as chlorophyll *a*) – The 2010 seasonal chlorophyll *a* measurements remained below the concentration of 3 parts per billion (ppb) that is considered the boundary between a nutrient poor and more nutrient enriched "greener" lake (Table 5 and Appendix A).

Table 5: 2010 Chlorophyll *a* data summary for the Lake Winnipesaukee deep sampling stations.

Site	Seasonal Average Chlorophyll *a* (ppb)
22A Alton	1.8 ppb (range: 1.2 – 2.4)
24 Alton	2.0 ppb (range: 1.1 – 3.3)
25 Alton	1.7 ppb (range: 0.7 – 2.9)
26 Alton	2.2 ppb (range: 1.6 – 3.3)
Pavillion	2.4 ppb (range: 1.4 – 3.9)

The 2010 median chlorophyll *a* concentrations increased at Sites 22A, 24, 25 and 26 during the 2010 when compared to the 2009 median values (Appendix B) and included a record high median chlorophyll *a* concentration was documented at Site 26 (Appendix B). However, all of the 2010 chlorophyll *a* concentrations remained below nuisance concentrations.

3) Background (dissolved) water color : often perceived as a "tea" color in more highly stained lakes – The 2010 Alton dissolved color concen-

tration averaged 9.6 chloroplatinate units (cpu) and fell within the classification of a clear lake (Table 6). Dissolved color, or true color as it is sometimes called, is indicative of dissolved organic carbon levels in the water (a by-product of microbial decomposition). Small increases in water color from the natural breakdown of plant materials in and around a lake are not considered to be detrimental to water quality. However, increased color can lower water transparency, and hence, change the public perception of water quality.

Table 6. Dissolved Color Classification Criteria used by the New Hampshire Lakes Lay Monitoring Program.

Range	Classification
0 - 10	Clear
10 - 20	Slightly colored
20 - 40	light tea color
40 - 80	tea colored
> 80	highly tea colored

4) Total Phosphorus: the nutrient considered most responsible for elevated microscopic plant growth in our New Hampshire Lakes. - Total phosphorus concentrations, measured in the surface waters (epilimnion), were generally low when collected by the Alton volunteer monitors and by the **University of New Hampshire Center for Freshwater Biology** field team members but included short-term total-phosphorus spikes. The 2010 Alton total phosphorus values ranged from 3.7 to 47.8 parts per billion (ppb) and generally remained below the concentration of 15 ppb that is considered the boundary between an unproductive and a moderately productive New Hampshire lake (Table 3). Samples collected at Sites 24 and 25 included short-term total phosphorus spikes that exceeded 15 ppb and the highest concentrations corresponding to periods of windy conditions and rough water that may have stirred up particles from the deeper waters and in-turn would have resulted in elevated total phosphorus concentrations.

5) Resistance against acid precipitation (measured as total alkalinity) – The 2010 seasonal average Lake Winnipesaukee (Alton) alkalinity measured 6.9 milligrams per liter (mg/l) and is considered typical of a lake with a moderate vulnerability to acid precipitation according to the standards developed by the New Hampshire Department of Environmental Services (Table 7). Generally speaking, the geology of the region does not contain the mineral content (i.e. limestone) which increases the buffering capacity in our surface waters. Thus, lakes in the vicinity (Merrymeeting Lake and Lake Wentworth) naturally have low alkalinities.

Table 7. Alkalinity Classification Criteria used by the New Hampshire Department of Environmental Services

Range	Classification
< 0	Acidified
0 -2	Extremely Vulnerable
2.1 - 10.0	Moderately Vulnerable
10.1 - 25.0	Low Vulnerability
> 25.0	Not Vulnerable

Lake acidity (measured as pH) - The 2010 Lake Winnipesaukee (Alton) pH data, collected by the **Center for Freshwater Biology**, ranged from

7.0 to 7.5 units in the surface waters and remained within the tolerable range for most aquatic organisms.

6) Dissolved salts: measured as specific conductivity – Specific Conductivity levels, documented in Lake Winnipesaukee (Alton) by the **Center for Freshwater Biology,** were low and ranged from 68.4 to 74.2 micro-Siemans per centimeter (uS/cm) when measured on August 4, 2010. High specific conductivity values can be an indication of problem areas around a lake where failing septic systems, heavy fertilizer applications and sedimentation are contributing "excessive" nutrients that are subsequently flushed into the lake. High values can also be an indication of heavy road salt applications within the Lake Winnipesaukee watershed. The specific conductivity data did not suggest any gross water quality problems on the August 4, 2010 sampling date.

7) Temperature and dissolved oxygen profiles – Temperature profiles collected by the volunteer monitors indicate Lake Winnipesaukee (Alton) becomes stratified into three distinct thermal layers during the summer months; a warm upper water layer, the **epilimnion**, overlies a layer of rapidly decreasing temperatures, the **thermocline**, followed by a deep cold-water layer, the **hypolimnion**. The formation of thermal stratification limits the replenishment of oxygen in the deeper waters and under certain conditions can correspond to oxygen depletion near the lake-bottom.

8) Dissolved oxygen concentrations required for a healthy fishery – Dissolved oxygen concentrations documented by the **Center for Freshwater Biology** on August 4, 2010 remained high throughout the water column (Appendix C). The 2010 Lake Winnipesaukee (Alton) dissolved oxygen concentrations remained above the concentration of 5 milligrams per liter (mg/l) that is considered the minimum oxygen concentration required for the successful growth and reproduction of most coldwater fish that include trout and salmon (Appendix C). Generally speaking, the year 2010 dissolved oxygen concentrations were within the optimal range for the Lake Winnipesaukee fishery and were capable of supporting salmanoid populations.

9). Based on the current and historical water quality data, Lake Winnipesaukee (Alton), would be considered a relatively unproductive segment of the lake that has infrequently experienced short-term algal blooms A first step towards preserving the high water quality that is characteristic of Lake Winnipesaukee is to take action at the local level and do your part to minimize the number of pollutants (particularly sediment and the nutrient phosphorus) that enter the lake. Refer to the sections, "10 Recommendations for Healthy Lakeshore and Streamside Living", "Go with the Flow: Understanding how water moves onto, through and away from your house site" and "Lake Friendly Lawn Care", that discuss measures landowners can take to improve water quality.