OBSERVATIONS & RECOMMENDATIONS

We would like to recognize the Manchester Urban Ponds Restoration Project volunteers for their second year of participation in the New Hampshire Volunteer Lake Assessment Program. Manchester's volunteers collected a large number of samples this summer and we applaud them for their efforts! While many of the results again this year indicate that the Manchester ponds are degraded, we hope that this project will continue to encourage the citizens of the city to participate in water quality sampling. Through sampling, education, and various water quality improvement projects initiated by the City of Manchester, we ultimately expect that the degraded conditions of the ponds will be improved!

After reviewing data collected from **NUTTS POND,** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- **Figure 1:** These graphs show the historical and current year concentration of chlorophyll-a in the water column. Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae is a microscopic plant that contains chlorophyll-a and is naturally found in lake ecosystems, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae.

  The summer of 2001 was filled with many warm and sunny days and there was a lack of significant rain events during the latter-half of the summer. The combination of these factors resulted in relatively warm surface waters throughout the state, and even stagnant water in some of the smaller lakes and ponds. Consequently, many lakes and ponds experienced increased algae growth, including filamentous green algae (the billowy clouds of green algae typically seen floating near shore) and nuisance blue-green algae blooms.

  The current year data (the top graph) show that the chlorophyll-a concentration *decreased slightly* from May to June, *increased* from June to July, and then *decreased slightly* from July to

October. The chlorophyll-a concentration *equaled* the state mean in May and was *slightly less than* the state mean in June. The concentration in July and October was *well above* the state mean. Specifically, in July and October, the concentration approached what DES considers to be a "*nuisance amount*" which is indicative of an algal bloom.

The dominant phytoplankton species observed this season were as follows: *Asterionella* (a diatom) in April; *Dinobryon* (a golden brown alga), *Mougeotia* (a green alga), and *Microcystis* (a blue-green alga) in May; *Asterionella, Ceratium* (a dinoflagellate), and *Sphaerocystis* (a green alga) in June; *Ceratium, Fragilaria* (a diatom), and *Staurastrum* (a green alga) in July; and *Ceratium, Mallamonas* (a golden-brown alga), and *Oscillatoria* (a blue-green alga) in early October. In June, July, and August this season, the density of phytoplankton cells in the plankton sample was *very abundant*, indicating that the pond is highly productive. It is natural for diatoms to be the dominant species in the spring, then green algae in the early summer, followed by blue-green algae dominating in mid to late summer.

Overall, the historical data show that the mean chlorophyll-a concentration in 2001 was *well below* the 2000 mean but is still *greater than* the state median. (Remember that the 2000 sampling season was much wetter than the 2001 season so it is difficult to compare the two seasons.) As additional sampling seasons are conducted, we will be able to generate long-term trends for chlorophyll-a concentration.

While algae is naturally present in all lakes, an excessive or increasing amount of any type is not welcomed. In freshwater lakes, phosphorus is the nutrient that algae depend upon for growth. Therefore, algal concentrations may increase when there is an increase in nonpoint sources of nutrient loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the lake sediments). It is important to continue to educate residents about how activities within your lake's watershed can affect phosphorus loading and lake quality.

- **Figure 2:** The graphs on this page show historical and current year data for lake transparency. Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water.

The numerous big snowstorms during the late spring of 2001 contributed a large amount of snowmelt runoff to most of the lakes and ponds throughout the state, which may have increased phosphorus loading and the amount of soil particles washing into the waterbodies. Many lakes and ponds experienced lower than typical transparency readings during late May and June. However, the summer was filled with many warm and sunny days and there was a lack of significant rain during the latter-half of the summer, therefore, some lakes reported their best-ever Secchi-disk readings in July and August, a time when we often observe reduced clarity due to increased algal growth!

The current year data (the top graph) show that the in-lake transparency *increased* from April to June, *decreased* from June to July, and then *increased by a large amount* from July to October. This increase in transparency from July to October is ironic since we generally expect that as chlorophyll-a concentration increases the transparency decreases. This increase in transparency is likely due to the lack of significant rain event that occurred during latter-half of the summer and the consequent lack of sediments being washed into the pond. The transparency in April, May, June, and July was *below* the state mean, while the transparency in October was *slightly greater* than the state median.

The historical data (the bottom graph) show that the 2001 mean transparency is *less than* the 2000 mean and *less than* the state mean. Again, as additional sampling seasons are conducted, we will be able to generate long-term trends for in-lake transparency with more confidence.

Typically, high intensity rainfall causes erosion of sediments into the lake and streams, thus decreasing clarity. Efforts should be made to stabilize stream banks, lake shorelines, and disturbed soils within the watershed and especially dirt roads located immediately adjacent to the edge of the waterbody. In addition, catch basins should be cleaned out and street-sweeping measures should be implemented on a regular basis throughout the watershed. Guides to Best Management Practices are available from NHDES upon request.

- **Figure 3:** These graphs show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire freshwater lakes and ponds. Too much phosphorus in a lake can lead to increases in plant and algal growth over time.

The current year data for the upper layer (the top inset graph) show that the total phosphorus concentration *decreased by a large amount* from April to May, *decreased slightly* from May to

June, *increased slightly* from June to July, and then *increased* from July to October. The total phosphorus concentration on all sampling events this season was *greater than* the state median, with the April concentration being *well above* the state median.

The current year data for the lower layer (the bottom inset graph) show that the total phosphorus concentration *remained stable* in April and May, *increased greatly* from May to June, *remained stable* in June and July, and then *increased greatly* from July to October. The total phosphorus concentration for all sampling events this season was *greater than* the state median, with the concentration in June, July, and October being *much greater* than the state median.

In addition, it is important to note that the total phosphorus concentration in the lower layer this season and last season was *significantly greater than* in the upper layer. This is likely because the turbidity in the lower layer is *typically greater than* in the upper layer. (Remember that turbidity is caused by suspended matter, such as clay and silt, which typically contains attached phosphorus.) This season the turbidity was *particularly high* in June, July, and August (30 – 48 NTU's!). This elevated turbidity is probably due to the *degraded* conditions of the pond, not sampling error. It is also possible that the total phosphorus in the lower layer is elevated because *internal phosphorus loading* may be occurring in the pond (Refer to the *"Other Comments"* section for a more detailed explanation for internal loading.)

The historical data for the upper layer and the lower layer show that total phosphorus concentration this season was *less than* in 2000, but was still *well above* the state median.

One of the most important approaches to reducing phosphorus loading to a waterbody is to educate the public. Phosphorus sources within a lake's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Sediment depth mapping and sediment core sampling was conducted at **NUTTS POND** during 2001. Sediment depth mapping was done during ice cover and sediment core sample collection was conducted in May. Sediment cores were analyzed for pesticides, PCB's, PAH's and metals. High levels of arsenic, copper, lead, mercury, zinc, the pesticide constituent DDE, DDT, the PAH's Fluoranthene and Phenanthrene were recorded. Average sediment depth in **NUTTS POND** is 10.8 feet. A fish survey was also conducted with the help of the NH Fish & Game Department. A healthy warm-water fish population was present. Five largemouth bass were collected for tissue analysis. These will be analyzed for pesticides, PCB's and metals content.

- The mean conductivity was even higher than last year at all sampling stations this season (Table 6). The conductivity in the hypolimnion (the lower layer) continued to be the station with the highest conductivity (1959 uMhos/cm!). Again this season, the hypolimnion sample was usually colored orange from iron precipitate and had a very potent smell of Hydrogen Sulfide (a rotten-egg smell). Typically, sources of elevated conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake), agricultural runoff, and stormwater runoff from urbanized areas (which typically contains road salt during the spring snow melt). In addition, natural sources, such as iron deposits in bedrock, can influence conductivity. Sampling has shown that the pond has high metal content. Therefore, due to the history and present status of this highly urbanized watershed, the high conductivity levels in the pond are probably inevitable. As recommended last year, more wet weather sampling will be valuable in finding the sources of pollution to the pond.

- Dissolved oxygen in the hypolimnion (the lower layer) was again low this season throughout the summer (Table 9 and 10). As lakes age, oxygen becomes ***depleted*** in the hypolimnion by the process of decomposition. The ***low*** oxygen level in the hypolimnion is a sign of the lake's ***degraded*** health.

- During this season and last season, **NUTTS POND** had a lower dissolved oxygen and a higher total phosphorus concentration in the hypolimnion (the lower layer) than in the epilimnion (the upper layer). This data suggests that the process of ***internal total phosphorus loading*** (commonly referred to as ***internal loading***) is occurring in the pond. The process of decomposition of organic matter in the sediments ***depletes*** dissolved oxygen in the bottom layer of thermally stratified lakes and ponds. Specifically, as bacteria break down organic matter, oxygen is consumed. When the oxygen concentration is depleted to ***less than 1 mg/L*** in the hypolimnion (as was the case on each sampling event this season) the phosphorus that is normally bound up in the sediment may be re-released into the water column. Again, this may explain why the phosphorus concentration in the hypolimnion is ***greater*** than the phosphorus concentration in epilimnion. Since an internal source of phosphorus in pond is likely present, it is even more important that City of Manchester and watershed residents act proactively to minimize external phosphorus loading form the lake's watershed.

- The *E. coli* concentration at the ***Inlet*** was elevated in ***September*** (Table 12). The concentration of 110 counts per 100 mL ***was not above*** the state standard of 406 counts per 100 mL designated for Class B waters. If you are concerned *E. coli* levels at this station, you may want to conduct a more intensive sampling regime in this area using the bracketing technique to determine the source(s) of the high readings. Please contact the VLAP Coordinator for instructions on sampling protocol and methods.

NOTES

- Monitor's Note (4/25/01): Cormorants observed; Two fisherman observed.
- Monitor's Note (5/29/01); Two fishermen on a boat observed and dour fishermen observed on shore; Wildlife observed includes Canadian geese, ducks, pair of Cormorants, jumping fish, and sunfish nests at southwest end of pond; sulfur odor observed in bottom layer sample.
- Monitor's Note (6/26/01): Motor cross motorcycle observed on west trail.
- Monitor's Note (7/25/01); Three fishermen observed and 1 dog; A grayish tint was observed in 7.5 meter bottom layer sample.
- Monitor's Note (10/02/01): Strong chemical odor observed in 7.5 meter sample.

USEFUL RESOURCES

Combined Sewer Overflows (CSO's), WD-WEB-9, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wwt/web-9.htm

Impacts of Development Upon Stormwater Runoff, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or www.des.state.nh.us/factsheets/wqe/wqe-7.htm

Stormwater Management and Erosion and Sediment Control Handbook. NHDES, Rockingham County Conservation District, USDA Natural Resource Conservation Service, 1992. (603) 679-2790.

Snow Disposal Guidelines, WD-WMB-3, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-3.htm

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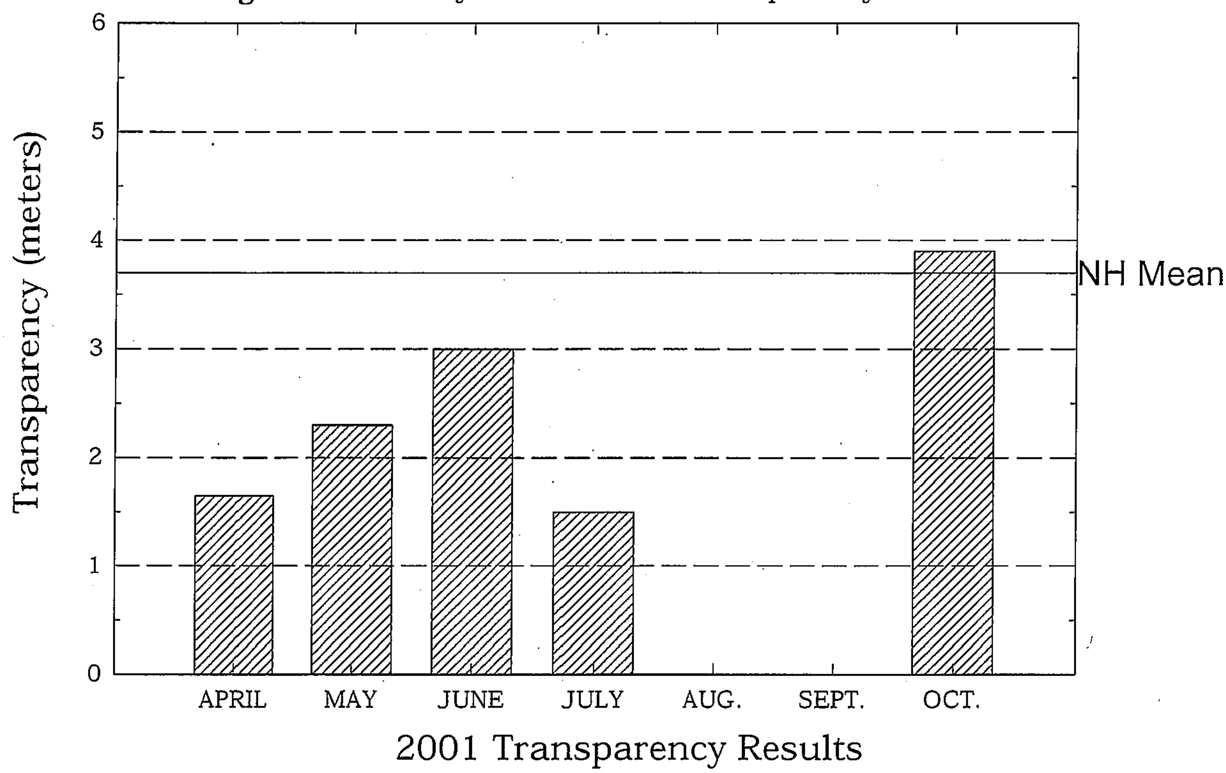
Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm

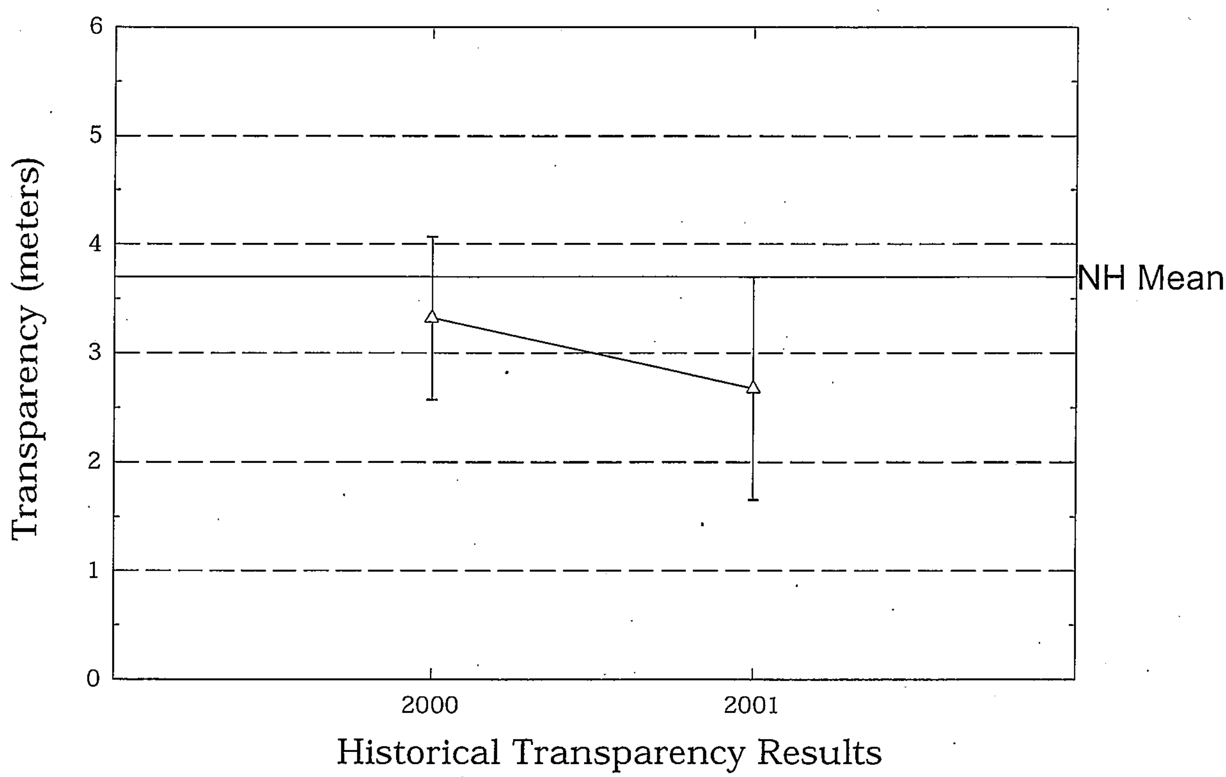
The Canada Goose: A Beautiful Pest, NHDES VLAP Annual Newsletter The Sampler, Spring 2001, Article written by Alicia Carlson, (603) 271-2658 or www.des.state.nh.us/wmb/vlap/samplr01.pdf

Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf

Nutts Pond

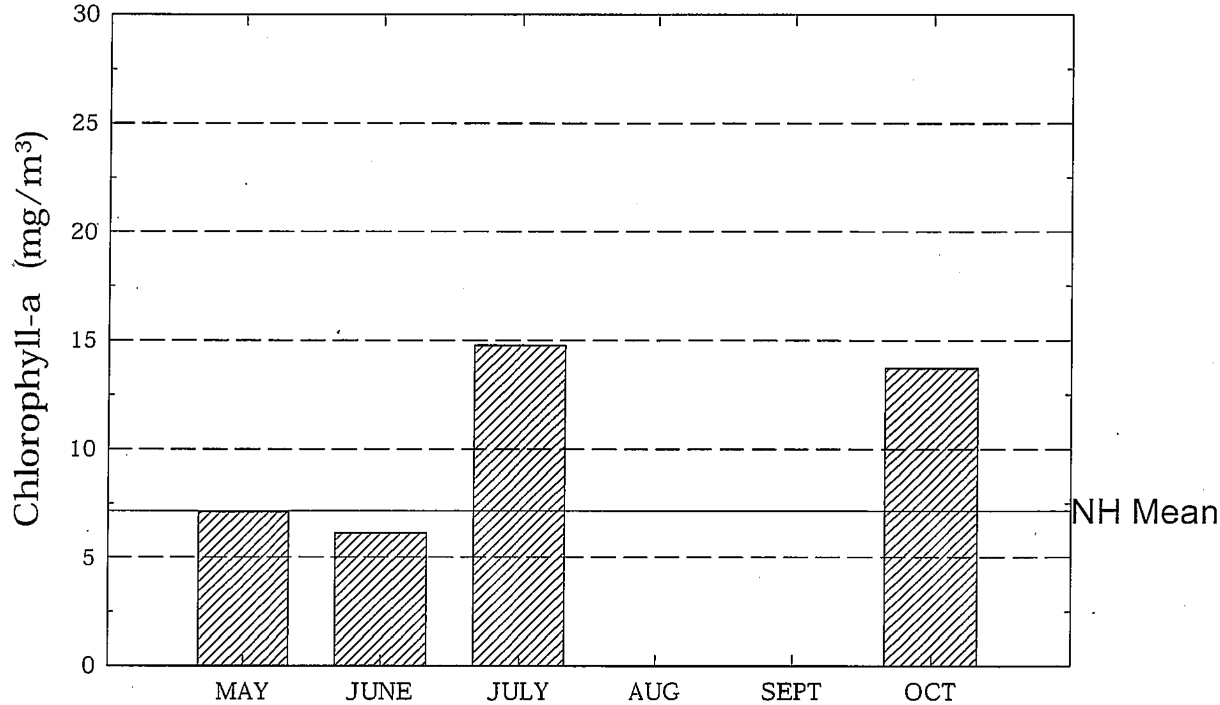
Figure 2. Monthly and Historical Transparency Results



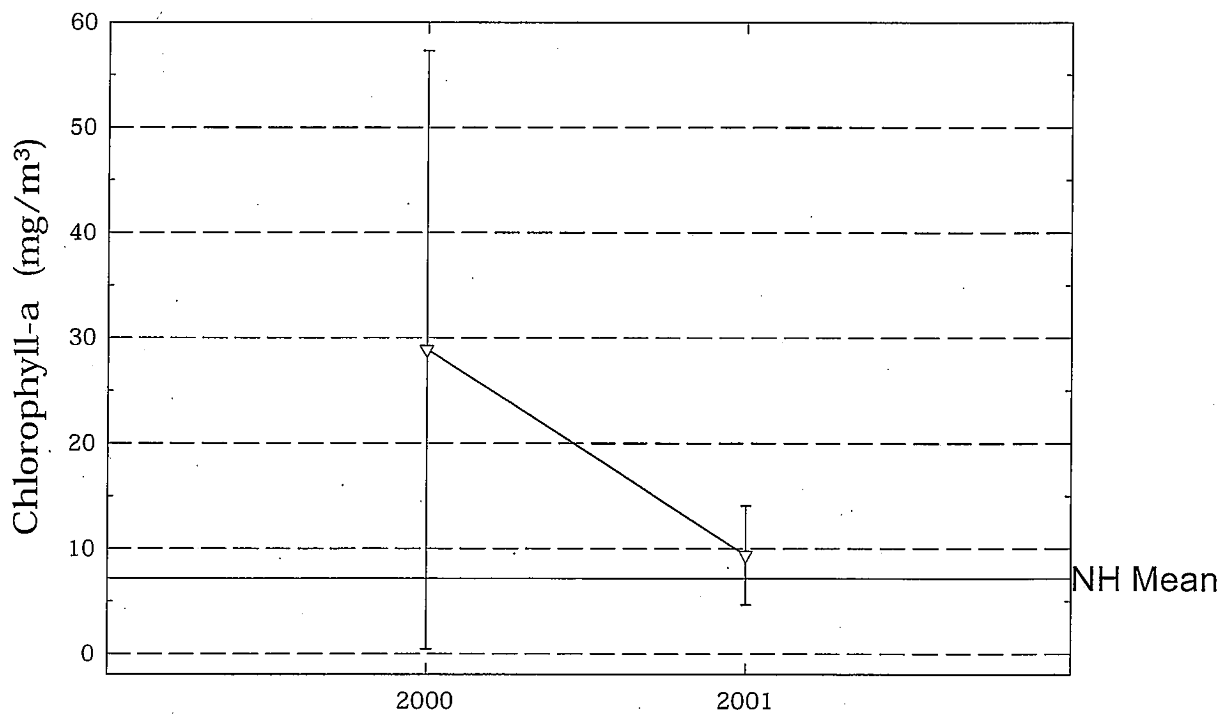


Nutts Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



2001 Chlorophyll-a Results



Historical Chlorophyll-a Results

Nutts Pond

Figure 3. Monthly and Historical Total Phosphorus Data.