OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from the **Ossipee Lake System (Lake Ossipee, Lower Danforth Pond, Broad Bay, Leavitt Bay, and Berry Bay)**, the program coordinators have made the following observations and recommendations.

Thank you for your continued hard work sampling the deep spots of these five waterbodies this year. As you know, conducting multiple sampling events each year enables DES to more accurately detect water quality changes. Keep up the good work!

If your monitoring group's sampling events this year were limited due to not having enough time to pick-up or drop-off samples at the Limnology Center in Concord, please remember the Plymouth State University Center for the Environment Satellite Laboratory is open in Plymouth. This laboratory was established to serve the large number of lakes/ponds in the greater North region of the state. This laboratory is inspected by DES and operates under a DES approved quality assurance plan. We encourage your monitoring group to utilize this laboratory next summer for all sampling events, except for the annual DES biologist visit. To find out more about the Center for the Environment Satellite Laboratory, and/or to schedule dates to pick up bottles and equipment, please call Aaron Johnson, laboratory manager, at (603) 535-3269.

Volunteers from **Ossipee Lake** participated in the Lake Host™ Program this year. The Lake Host™ Program is funded through DES and Federal grants. The program was developed in 2002 by NH LAKES and NHDES to educate and prevent boaters from spreading exotic aquatic plants to lakes/ponds in New Hampshire. Since then, the number of participating lakes/ponds and volunteers has doubled, the number of boats inspected has tripled, and the number of "saves" (exotic plants discovered) has increased from four in 2002 to a total of 297 in 2009. The program is invaluable in educating boaters and protecting NH's waterbodies from exotic aquatic plant infestations, thereby preventing recreational hazards, property value decline, aquatic ecosystem decline, aesthetic issues, and saving costly remediation efforts. Lake Host™ staff made **two** "saves" at your lake and discovered the following aquatic vegetation entering or leaving your lake in 2009:

Variable milfoil (exotic)
Water starwort (native)

Great work! We encourage volunteers to continue participating in the Lake Host™ Program to protect the future of your lake.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** Figure 1 in Appendix A shows the historical and current year chlorophyll-a concentration in the water column. Table 1 in Appendix B lists the maximum, minimum, and mean concentration for each sampling year that the lake, pond, and bays have been monitored through VLAP.

  Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m^3.**

Ossipee System 2009 Chlorophyll-a Data

	2009 Annual Mean Result (mg/m^3)	Comparison to NH Median	Comparison to Similar Lake Median
Berry Bay	2.69	Much less than	Much less than
Broad Bay	2.59	Much less than	Slightly less than
Lower Danforth Pond	4.53	Slightly less than	Slightly greater than
Leavitt Bay	2.04	Much less than	Much less than
Ossipee Lake	1.93	Much less than	Much less than

The mean annual chlorophyll-a concentration was ***highest*** at the **Lower Danforth Pond (4.53 mg/m^3)** deep spot and ***lowest*** at the **Ossipee Lake (1.93 mg/m^3)** deep spot. The mean chlorophyll concentration at the **Berry Bay, Broad Bay and Leavitt Bay** deep spots was ***similar***.

Ossipee System Historic Chlorophyll-a Data

	Sampling Period	Visual Analysis Trend
Berry Bay	2003 - 2009	Stable (ranging from 1.92 to 2.94 mg/m^3)
Broad Bay	1990 - 2009	Slightly Variable (ranging from 1.23 to 3.46 mg/m^3)
Lower Danforth Pond	2003 - 2009	Slightly Variable (ranging between approx. 2.21 – 4.53 mg/m^3)
Leavitt Bay	1990 – 2009	Slightly Variable (ranging from 1.07 to 3.24 mg/m^3, but relatively stable since 1995)
Ossipee Lake	2003 - 2009	Relatively Stable (ranging from 1.57 to 3.01 mg/m^3)

Overall, visual inspection of the historical data trend lines for **Ossipee Lake** and **Berry Bay** shows a ***relatively stable*** in-lake chlorophyll-a trend since monitoring began in **2003**. Visual inspection of the historical data trend line for **Lower Danforth Pond** shows a ***variable*** in lake chlorophyll-a trend since **2003**. After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began at these three deep spots.

Overall, the statistical analysis of the **Broad Bay and Leavitt Bay** historical data shows that the mean annual chlorophyll-a concentration has ***not significantly changed*** since monitoring began. Specifically, the mean annual chlorophyll-a concentration has ***fluctuated slightly,*** but has ***not continually increased or decreased*** since **1990**. Please refer to Appendix E for a detailed statistical analysis explanation and data print-out.

While algae are 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 typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

- **Figures 2a and 2b and Tables 3a and 3b:** Figure 2a in Appendix A shows the historical and current year data for transparency without the use of a viewscope and Figure 2b shows the current year data for transparency with the use of a viewscope. Table 3a in Appendix B lists the maximum, minimum and mean transparency data without the use of a viewscope and Table 3b lists the maximum, minimum and mean transparency data with the use of a viewscope for each year that the lake has been monitored through VLAP.

  Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure 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 in the water, as well as the natural color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

  Ossipee System 2009 Non-Viewscope Transparency Data

	2009 Annual Mean	Comparison to NH Median	Comparison to Similar Lake Median
Berry Bay	2.91	Slightly less than	Much less than
Broad Bay	3.31	Slightly greater than	Much less than
Lower Danforth Pond	3.80	Slightly greater than	Slightly less than
Leavitt Bay	3.22	Approximately equal to	Less than
Ossipee Lake	2.59	Slightly less than	Slightly less than

  The **2009** non-viewscope transparency annual means ***decreased, meaning worsened*** over the 2008 annual means for each of the five deep spots. It is likely that wet weather conditions increased the amount of stormwater runoff, which increased the amount of sediment and organic material entering the system, leading to the decreased transparency.

  The current year data (the top graph) show that the transparency at each deep spot was also measured with the viewscope on each sampling event. The transparency measured with the viewscope was generally ***greater than*** the transparency measured without the viewscope, and was ***much greater than*** the non-viewscope transparency on the **June** sampling event at each of the deep spots. A comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data is not compared to a New Hampshire median or similar lake median. This is because lake transparency has not been historically measured by DES with a viewscope. At some point in the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

Ossipee System Historic Transparency Data

	Sampling Period	Visual Analysis Trend
Berry Bay	2003 - 2009	Decreasing (worsening)
Broad Bay	1990 - 2009	Decreasing (worsening)
Lower Danforth Pond	2003 - 2009	Stable
Leavitt Bay	1990 - 2009	Decreasing (worsening)
Ossipee Lake	2003 – 2009	Variable (but overall decreasing)

Visual inspection of the historical data trend line (the bottom graph) shows a ***decreasing*** transparency trend for **Berry Bay**, a ***stable*** trend for **Lower Danforth Pond**, and a ***variable*** trend for **Ossipee Lake**.

As previously discussed, after 10 consecutive years of sample collection at the **Berry Bay, Lower Danforth Pond,** and **Ossipee Lake** deep spots, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Overall, the statistical analysis of the historical data for **Broad Bay** shows that the non-viewscope transparency has ***significantly decreased*** (meaning ***worsened***) on average by ***approximately 3.128 percent*** per year during the sampling period **1990** to **2009**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

Overall, the statistical analysis of the historical data for **Leavitt Bay** shows that the non-viewscope transparency has ***significantly decreased*** (meaning ***worsened***) on average by ***approximately 2.33 percent*** per year during the sampling period **1990** to **2009**. Please refer to Appendix E for the statistical analysis explanation and data print-out.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, lake shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake has been sampled through VLAP.

Phosphorus is typically the limiting nutrient for plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a lake can lead to increased plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

Ossipee System 2009 Deep Spot Epilimnetic Phosphorus Data

	2009 Epilimnetic Annual Mean (ug/L)	**Comparison to NH Median**	**Comparison to Similar Lake Median**
Berry Bay	8.5	Slightly less than	Slightly greater than
Broad Bay	8.9	Slightly less than	Slightly greater than
Lower Danforth Pond	10.0	Slightly less than	Slightly greater than
Leavitt Bay	9.0	Slightly less than	Slightly greater than
Ossipee Lake	13.7	Slightly greater than	Greater than

The mean annual epilimnetic total phosphorus concentration was the ***highest*** measured at **Ossipee Lake** since monitoring began.

Ossipee System 2009 Deep Spot Hypolimnetic Phosphorus Data

	2009 Hypolimnetic Annual Mean (ug/L)	Comparison to NH Median	Comparison to Similar Lake Median
Berry Bay	9.2	Less than	Less than
Broad Bay	8.7	Less than	Slightly less than
Lower Danforth Pond	12.0	Slightly less than	Slightly less than
Leavitt Bay	6.9	Much less than	Much less than
Ossipee Lake	9.1	Less than	Slightly greater than

The mean annual hypolimnetic phosphorus concentration was the ***highest*** total phosphorus concentration measured at **Ossipee Lake** since monitoring began.

Ossipee System Historic Epilimnetic Phosphorus Data

	Sampling Period	Visual Analysis Trend
Berry Bay	2003 – 2009	Relatively stable (ranging between 6.5 and 9.5 ug/L)
Broad Bay	1990 – 2009	Variable (ranging from 3 to 11.2 ug/L)
Lower Danforth Pond	2003 – 2009	Relatively stable (ranging between 8 and 12.4 ug/L)
Leavitt Bay	1990 – 2009	Variable (ranging between approx 3 and 12 ug/L)
Ossipee Lake	2003 – 2009	Slightly variable (ranging between 6 to 13.7 ug/L)

Overall, visual inspection of the historical epilimnetic phosphorus data shows a ***stable*** trend for **Berry Bay and Lower Danforth Pond**, and shows a ***variable*** trend for **Broad Bay, Leavitt Bay and Ossipee Lake** since monitoring began.

Ossipee System Historic Hypolimnetic Phosphorus Data

	Sampling Period	Visual Analysis Trend
Berry Bay	2003 – 2009	Relatively stable (ranging from 6.4 to 10 ug/L)
Broad Bay	1990 – 2009	Variable (ranging from 4 to 11 ug/L)
Lower Danforth Pond	2003 – 2009	Relatively stable (ranging from 9 to 15.5 ug/L, excluding 2003 data)
Leavitt Bay	1990 – 2009	Variable (ranging from 4 to 14 ug/L)
Ossipee Lake	2003 – 2009	Stable (ranging from 5.9 to 9.1 ug/L)

Overall, visual inspection of the historical hypolimnetic phosphorus data shows a ***variable*** trend for **Broad Bay and Leavitt Bay,** and shows a ***relatively stable*** trend for **Berry Bay, Lower Danforth Pond and Ossipee Lake** since monitoring began.

As previously discussed, after 10 consecutive years of sample collection at the **Berry Bay, Lower Danforth Pond and Ossipee Lake** deep spots, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean epilimnetic and hypolimnetic phosphorus concentration since monitoring began.

Overall, the statistical analysis of the historical data for Broad and Leavitt Bays shows that the phosphorus concentration in the epilimnion (upper layer) and the hypolimnion (lower layer) has ***not significantly changed*** since monitoring began. Specifically, the **Broad Bay** epilimnetic phosphorus concentration has ***fluctuated between approximately 3 and 11.2 ug/L,*** and the **Leavitt Bay** epilimnetic phosphorus concentration has ***fluctuated between approximately 3 and 12 ug/L***. The **Broad Bay** hypolimnetic phosphorus concentration has ***fluctuated between approximately 4 and 11 ug/L***, and the **Leavitt Bay** hypolimnetic phosphorus concentration has ***fluctuated between approximately 4 and 14 ug/L*** since **1990**. Please refer to Appendix E for the detailed statistical analysis explanation and data print-out.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the sources of phosphorus in a watershed and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**

  Table 2 in Appendix B lists the current and historical phytoplankton species observed in the lake. Specifically, this table lists the three most dominant phytoplankton species observed in the sample and their relative abundance in the sample.

  The dominant phytoplankton and/or cyanobacteria observed in the **Berry Bay** September sample were ***Rhizosolenia* (Diatom)**, ***Dinobryon* (Golden Brown)**, and ***Merismopedia* (Cyanobacteria)**.

The dominant phytoplankton and/or cyanobacteria observed in the **Broad Bay** September sample were ***Dinobryon* (Golden-Brown)**, ***Rhizosolenia* (Diatom)**, and ***Tabellaria* (Diatom)**.

The dominant phytoplankton and/or cyanobacteria observed in the **Lower Danforth Pond** September sample were ***Dinobryon* (Golden-Brown)**, ***Synura* (Golden-Brown)**, and ***Chrysosphaerella* (Golden-Brown)**.

The dominant phytoplankton and/or cyanobacteria observed in the **Leavitt Bay** September sample were ***Rhizosolenia* (Diatom)**, ***Dinobryon* (Golden-Brown)**, and ***Gleocystis* (Green)**.

The dominant phytoplankton and/or cyanobacteria observed in the **Ossipee Lake** September sample were ***Dinobryon* (Golden-Brown)**, ***Tabellaria* (Diatom)**, and ***Rhizosolenia* (Diatom)**.

- **Table 4: pH**
  Table 4 in Appendix B presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.6**, which indicates that the surface waters in the state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

Ossipee System 2009 pH Data

	Mean Epilimnetic pH	Mean Hypolimnetic pH
Berry Bay	6.54	6.48
Broad Bay	6.62	6.05
Lower Danforth Pond	6.69	6.19
Leavitt Bay	6.56	6.57
Ossipee Lake	6.52	6.13

Overall, the mean pH among the five deep spots ranged from **6.05 (Broad Bay)** to **6.57 (Leavitt Bay)** in the hypolimnion and from **6.52 (Ossipee Lake)** to **6.69 (Lower Danforth Pond)** in the epilimnion, which means that the water is ***slightly acidic***.

It is important to point out that the hypolimnetic (lower layer) pH was ***lower (more acidic)*** than in the epilimnion (upper layer) at **Broad**

Bay, Lower Danforth Pond and Ossipee Lake. This increase in acidity near the lake bottom is likely due to the decomposition of organic matter and the release of acidic by-products into the water column.

Due to the presence of granite bedrock in the state and acid deposition received from snowmelt, rainfall, and atmospheric particulates, there is not much that can be feasibly done to effectively increase lake pH.

- **Table 5: Acid Neutralizing Capacity**
Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the lake has been monitored through VLAP.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.9 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The Acid Neutralizing Capacity (ANC) in the epilimnion (the upper layer) at the five deep spots, ranged from **4.5 mg/L (Lake Ossipee) to 8.0 mg/L (Lower Danforth Pond)**, which indicates that the surface water at each deep spot is ***moderately vulnerable*** to acidic inputs.

- **Table 6: Conductivity**
Table 6 in Appendix B presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **40.0 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean epilimnetic conductivity at the deep spots ranged from **34.91 uMhos/cm (Lake Ossipee)** to **54.54 uMhos/cm (Lower Danforth Pond)**, which is ***approximately equal to*** the state median.

Overall, the **2009** conductivity results for the five deep spots were ***lower than*** has been measured ***during the past few years***. The record rainfall during the **2009 summer season** possibly diluted the ion concentration in surface waters throughout the watershed. Specifically, the significant summer rainfalls likely increased the flushing rate for many lakes allowing potential watershed pollutants to flush through the system and not concentrate in the stratified surface waters.

The epilimnetic conductivity has ***gradually increased*** at the **Broad Bay** and **Leavitt Bay** deep spots since monitoring began in **1990**. Typically, increasing conductivity indicates the influence of pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff which contains road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct a shoreline conductivity survey of the lakes to help identify the sources of conductivity.

To learn how to conduct a shoreline or tributary conductivity survey, please refer to the 2004 special topic article, which is posted on the VLAP website at http://www.des.nh.gov/wmb/vlap/2004/documents/Appendix_D.pdf or contact the VLAP Coordinator.

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the lake system. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

Therefore, we recommend that the **epilimnions** (upper layers) be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.

- **Table 8: Total Phosphorus**
  Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

Tributary sampling is not conducted as part of the routine VLAP monitoring program and is monitored through the Green Mountain Conservation Group. Consequently, DES cannot discuss the tributary data for the ***Lake Ossipee System****.*

It would be best to sample the tributaries in the spring during snow-melt and during rainstorms to determine the quality of water that flows into each waterbody.

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) collected during **2007**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

  The dissolved oxygen concentration was greater than **100 percent** saturation between the **surface** and **three** meters at the **Lower Danforth Bay** deep spot on the **September** sampling event. Wave action from wind can also dissolve atmospheric oxygen into the upper layers of the water column. Layers of algae can also increase the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering that the depth of sunlight penetration into the water column was approximately **5.1** meters on this sampling event, as shown by the Secchi disk transparency depth, we suspect that an abundance of algae in the epilimnion caused the oxygen super-saturation.

  The dissolved oxygen concentration was ***much lower in the hypolimnion (lower layer) than in the epilimnion (upper layer)*** at the **Berry Bay and Lower Danforth Pond** deep spots on the **September** sampling event. As stratified lakes age, and as the summer progresses, oxygen typically becomes ***depleted*** in the hypolimnion by the process of decomposition. Specifically, the reduction of hypolimnetic oxygen is primarily a result of biological organisms using oxygen to break down organic matter, both in the water column and particularly at the bottom of the lake or pond where the water meets the sediment. When hypolimnetic oxygen concentration is depleted to less than 1 mg/L, **as it was on the annual biologist visit this year and on many previous annual visits,** the phosphorus that is normally bound up in the sediment may be re-released into the water column, a process referred to as ***internal phosphorus loading***.

The dissolved oxygen concentration was ***relatively high*** at all deep spot depths sampled at **Broad Bay, Leavitt Bay and Ossipee Lake** on the **September** sampling event. As thermally stratified lakes age, and as the summer progresses, oxygen typically becomes ***depleted*** in the hypolimnion (lower layer) by bacterial decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from biological organisms using oxygen to break down organic matter, both in the water column and particularly at the bottom of the lake or pond where the water meets the sediment. The ***high*** oxygen level in the hypolimnion is a sign of the lake's overall good health. We hope this continues!

- **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.

The deep spot turbidity was ***relatively low*** this year, which is good news.

However, we recommend that your group sample the pond and any surface water runoff areas during significant rain events to determine if stormwater runoff contributes turbidity and phosphorus to the pond.

For a detailed explanation on how to conduct rain event sampling, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at http://www.des.nh.gov/wmb/vlap/2002/documents/Appndxd_monitoring.pdf, or contact the VLAP Coordinator.

- **Table 12: Bacteria (*E.coli*)**

Table 12 in Appendix B lists the current year and historical data for bacteria *(E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

Bacteria sampling was **not** conducted during **2009**. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or immediately after rain events.

- **Table 13: Chloride**
  Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl^-) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  Chloride sampling was **not** conducted during **2009**.

- **Table 14: Current Year Biological and Chemical Raw Data**
  Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year "raw," meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

- **Table 15: Station Table**
  As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake system, the biologist conducted a sampling procedures assessment audit for your monitoring group. Specifically, the biologist observed the performance of your monitoring group and completed an assessment audit sheet to document the volunteer monitors' ability to follow the proper field sampling procedures, as outlined in the VLAP Monitor's Field Manual. This assessment is used to identify any aspects of sample collection in which volunteer monitors failed to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group performed ***very well*** while collecting samples on the annual biologist visit this year! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures. However, the biologist did identify a few aspects regarding sample collection that the volunteer monitors could improve upon, as follows:

- **Anchoring at deep spot:** Please remember to use an anchor with sufficient weight and a sufficient amount of rope to prevent the boat from drifting while sampling at the deep spot. It is difficult for the biologist to collect an accurate and representative dissolved oxygen/temperature profile when the boat is drifting. In addition, it is difficult to view the Secchi disk and collect samples from the proper depths when the boat is drifting. Depending on the depth of the lake and the wind conditions, it may be necessary to use two anchors!

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an ***excellent*** job when collecting samples and submitting them to the laboratory this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

USEFUL RESOURCES

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, DES Booklet WD-03-42, (603) 271-2975.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, DES fact sheet WD-SP-1, (603) 271-2975 or www.des.nh.gov/factsheets/sp/sp-1.htm.

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, DES fact sheet WD-BB-9, (603) 271-2975 or www.des.nh.gov/factsheets/bb/bb-9.htm.

Low Impact Development Hydrologic Analysis. Manual prepared by Prince George's County, Maryland, Department of Environmental Resources. July 1999. To access this document, visit www.epa.gov/owow/nps/lid_hydr.pdf or call the EPA Water Resource Center at (202) 566-1736.

Low Impact Development: Taking Steps to Protect New Hampshire's Surface Waters, DES fact sheet WD-WMB-16, (603) 271-2975 or www.des.nh.gov/factsheets/wmb/wmb-17.htm.

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, DES fact sheet WD-SP-2, (603) 271-2975 or www.des.nh.gov/factsheets/sp/sp-2.htm.

Road Salt and Water Quality, DES fact sheet WD-WMB-4, (603) 271-2975 or www.des.nh.gov/factsheets/wmb/wmb-4.htm.

Sand Dumping - Beach Construction, DES fact sheet WD-BB-15, (603) 271-2975 or www.des.nh.gov/factsheets/bb/bb-15.htm.

Through the Looking Glass: A Field Guide to Aquatic Plants, North American Lake Management Society, 1988, (608) 233-2836 or www.nalms.org.

Watershed Districts and Ordinances, DES fact sheet WD-WMB-16, (603) 271-2975 or www.des.nh.gov/factsheets/wmb/wmb-16.htm.