Adirondack Lake Assessment Program
2010

**Thirteen Years in the program**
Cranberry Lake, Loon Lake, Oven Mountain Pond, Blue Mountain Lake, Silver Lake, Eagle Lake

**Twelve Years in the program**
Little Long Lake, Gull Pond, Stony Creek Ponds, Thirteenth Lake, Eli Pond

**Eleven Years in the program**
Austin Pond, Osgood Pond, Middle Saranac Lake, White Lake, Brandreth Lake, Trout Lake

**Ten Years in the program**
Hoel Pond, Great Sacandaga Lake, Tripp Lake, Sherman Lake, Wolf Lake, Twitchell Lake, Deer Lake, Arbutus Pond, Rich Lake, Catlin Lake, Pine Lake, Lake of the Pines, Pleasant Lake

**Nine Years in the program**
Spiffire Lake, Upper St. Regis, Lower St. Regis, Garnet Lake, Lens Lake, Snowshoe Pond, Lake Ozonia, Long Pond, Lower Saranac Lake

**Eight Years in the program**
Raquette Lake, Lake Colby, Kiwassa Lake, Canada Lake

**Seven Years in the program**
Indian Lake, Schroon Lake, Lake Eaton, Chazy Lake, Big Moose Lake

**Six Years in the program**
Dug Mountain Pond, Seventh Lake, Abanakee Lake, Moss Lake, Mountain View Lake, Indian Lake, Tupper Lake

**Five Years in the program**
Sylvia Lake, Fern Lake

**Four Years in the program**
Adirondack Lake, Lower Chateaugay Lake, Upper Chateaugay Lake, Lake Easka, Lake Teken

**Three Years in the program**
Simon Pond

**Two Years in the program**
Amber Lake, Jordan Lake, Otter Pond, Rondaxe Lake

**One Year in the program**
Auger Lake, Lake Titus, Star Lake
Adirondack Lake

Assessment Program

Dug Mountain Pond

Summer 2010

January 2011

Author

Michael De Angelo

Project Participants

Michael De Angelo, Environmental Chemist, Aquatics Director of the AWI
Cory Laxson, Research Associate, AWI
Elizabeth Yerger, Laboratory and Field Technician, AWI

Prepared by:
The Adirondack Watershed Institute at Paul Smith’s College
P.O. Box 244, Paul Smiths, NY 12970-0244
Phone: 518-327-6270; Fax: 518-327-6369; E-mail: mdeangelo@paulsmiths.edu

Program Management by:
Protect the Adirondacks! Inc.
P.O. Box 1180
Saranac Lake, NY 12983
E-mail: ALAP@protectadks.org

© The Adirondack Watershed Institute 2011
Introduction

The Adirondack Lake Assessment Program is a volunteer monitoring program established by the Residents’ Committee to Protect the Adirondacks (RCPA) and the Adirondack Watershed Institute (AWI). The program is now in its’ thirteenth year. The program was established to help develop a current database of water quality in Adirondack lakes and ponds. There were 70 participating lakes in the program in year 2010.

Methodology

Each month participants (trained by AWI staff) measured transparency with a secchi disk and collected a 2-meter composite of lake water for chlorophyll-a analysis and a separate 2-meter composite for total phosphorus and other chemical analyses. The participants filtered the chlorophyll-a sample prior to storage. Both the chlorophyll-a filter and water chemistry samples were frozen for transport to the laboratory at Paul Smith’s College.

In addition to the volunteer samples, AWI staff sampled water quality parameters in most of the participating lakes as time and weather allowed. In most instances, a 2-meter composite of lake water was collected for chlorophyll-a analysis. Samples were also collected at depths of 1.5 meters from the surface (epilimnion) and within 1.5 meters of the bottom (hypolimnion) for chemical analysis. Once collected, samples were stored in a cooler and transported to the laboratory at Paul Smith’s College.

All samples were analyzed by AWI staff in the Paul Smith’s College laboratory using the methods detailed in Standard Methods for the Examination of Water and Wastewater, 21st edition (Greenberg, et al, 2005). Volunteer samples were analyzed for pH, alkalinity, conductivity, color, nitrate, chlorophyll a and total phosphorus concentrations.

Results Summary

Dug Mt. Pond was sampled three times by a volunteer in 2010. Samples were collected on the following dates: 7/18/10, 8/02/10, and 9/05/10. Results for 2010 are presented in Appendix A and will be discussed in the following sections. Results are presented as concentrations in milligrams per liter (mg/L) or its equivalent of parts per million (ppm) and micrograms per liter (µg/L) or its equivalent of parts per billion (ppb).

\[
1 \text{ mg/L} = 1 \text{ ppm}; 1 \mu\text{g/L} = 1 \text{ ppb}; 1 \text{ ppm} = 1000 \text{ ppb}.
\]

Adirondack lakes are subject to the effects of acidic precipitation (i.e. snow, rain). A water body’s susceptibility to acid producing ions is assessed by measuring pH, alkalinity, calcium concentrations, and the Calcite Saturation Index (CSI). These parameters define both the acidity of the water and its buffering capacity. Based on the results of the 2010 Adirondack Lakes Assessment program, the acidity status of Dug Mt.
Pond is considered to be satisfactory but with a real threat from further acidic inputs. Based solely on pH, Dug Mt. Pond’s acidity levels should be considered satisfactory. Dug Mt. Pond’s alkalinity shows a pond that has a moderate sensitivity to further acidification. The calcium level shows a pond that is sensitive to further acidification and the calcite saturation index shows a pond that has a moderate sensitivity to further acidification.

Limnologists, the scientists who study bodies of fresh water, classify lake health (trophic status) into three main categories: oligotrophic, mesotrophic, and eutrophic. The trophic status of a lake is determined by measuring the level of three basic water quality parameters: total phosphorus, chlorophyll-a, and secchi disk transparency. These parameters will be defined in the sections that follow. Oligotrophic lakes are characterized as having low levels of total phosphorus, and, as a consequence, low levels of chlorophyll-a and high transparencies. Eutrophic lakes have high levels of total phosphorus and chlorophyll-a, and, as a consequence, low transparencies. Mesotrophic lakes have moderate levels of all three of these water quality parameters. Based upon the results of the 2010 Adirondack Lakes Assessment Program, Dug Mt. Pond is considered to be a mesotrophic water body.

pH

The pH level is a measure of acidity (concentration of hydrogen ions in water), reported in standard units on a logarithmic scale that ranges from 1 to 14. On the pH scale, 7 is neutral, lower values are more acidic, and higher numbers are more basic. In general, pH values between 6.0 and 8.0 are considered optimal for the maintenance of a healthy lake ecosystem. Many species of fish and amphibians have difficulty with growth and reproduction when pH levels fall below 5.5 standard units. Lake acidification status can be assessed from pH as follows:

- pH less than 5.0: Critical or Impaired
- pH between 5.0 and 6.0: Endangered or Threatened
- pH greater than 6.0: Satisfactory or Acceptable

The pH in the upper waters of Dug Mt. Pond ranged from 6.47 to 6.77. The average pH was 6.66. Based solely on pH, Dug Mt. Pond’s acidity levels should be considered satisfactory.

Alkalinity

Alkalinity (acid neutralizing capacity) is a measure of the buffering capacity of water, and in lake ecosystems refers to the ability of a lake to absorb or withstand acidic inputs. In the northeast, most lakes have low alkalinities, which mean they are sensitive to the effects of acidic precipitation. This is a particular concern during the spring when large amounts of low pH snowmelt runs into lakes with little to no contact with the soil’s natural buffering agents. Alkalinity is reported in milligrams per liter (mg/L) or microequivelents per liter (μeq/L). Typical summer concentrations of alkalinity in
northeastern lakes are around 10 mg/l (200 \, \text{\mu eq/L}). Lake acidification status can be assessed from alkalinity as follows:

- Alkalinity less than 0 ppm: Acidified
- Alkalinity between 0 and 2 ppm: Extremely sensitive
- Alkalinity between 2 and 10 ppm: Moderately sensitive
- Alkalinity between 10 and 25 ppm: Low sensitivity
- Alkalinity greater than 25 ppm: Not sensitive

The alkalinity of the upper waters of Dug Mt. Pond ranged from 3.2 ppm to 4.0 ppm. The average alkalinity was 3.73 ppm. These values indicate a moderate sensitivity to acidification.

**Calcium**

Calcium is one of the buffering materials that occurs naturally in the environment. However, it is often in short supply in Adirondack lakes and ponds, making these bodies of water susceptible to acidification by acid precipitation. Calcium concentrations provide information on the buffering capacity of that lake, and can assist in determining the timing and dosage for acid mitigation (liming) activities. Adirondack lakes containing less than 2.5 ppm of calcium are considered to be sensitive to acidification.

The calcium in Dug Mt. Pond was measured in 2010 and ranged from 1.72 ppm to 1.95 ppm. The average calcium concentration was found to be 1.82 ppm. This value shows a pond that is sensitive to further acidification.

**Calcite Saturation Index**

The Calcite Saturation Index (CSI) is another method that is used to determine the sensitivity of a lake to acidification. High CSI values are indicative of increasing sensitivity to acidic inputs. CSI is calculated using the following formula:

\[
CSI = - \log_{10} \frac{40000}{Ca} - \log_{10} \frac{50000}{Alk} + 2 - pH + 2
\]

Where \(Ca\) = Calcium level of water sample in ppm or mg/L
\(Alk\) = Alkalinity of the water sample in ppm or mg/L
\(pH\) = pH of the water sample in standard units

Lake sensitivity to acidic inputs is assessed from CSI as follows:

- CSI greater than 4: Very vulnerable to acidic inputs
- CSI between 3 \& 4: Moderately vulnerable to acidic inputs
- CSI less than 3: Low vulnerability to acidic inputs
CSI values for Dug Mt. Pond were calculated and found to be 3.5. This Calcite Saturation Index places Dug Mt. Pond as moderately vulnerable to further acidic inputs.

**Total Phosphorus**

Phosphorus is one of the three essential nutrients for life, and in northeastern lakes, it is often the controlling, or limiting, nutrient in lake productivity. Total phosphorus is a measure of all forms of phosphorus, both organic and inorganic. Total phosphorus concentrations are directly related to the trophic status (water quality conditions) of a lake. Excessive amounts of phosphorus can lead to algae blooms and a loss of dissolved oxygen within the lake. Surface water (epilimnion) concentrations of total phosphorus less than 10 ppb are associated with oligotrophic (clean, clear water) conditions. Concentrations greater than 25 ppb are associated with eutrophic (nutrient-rich) conditions.

The total phosphorus in the upper waters of Dug Mt. Pond ranged from 10 ppb to 19 ppb and averaged 13.0 ppb. This is indicative of mesotrophic conditions.

**Chlorophyll-a**

Chlorophyll-a is the green pigment in plants used for photosynthesis, and measuring it provides information on the amount of algae (microscopic plants) in lakes. Chlorophyll-a concentrations are also used to classify a lake’s trophic status. Concentrations less than 2 ppb is associated with oligotrophic conditions and those greater than 8 ppb are associated with eutrophic conditions.

The chlorophyll-a concentrations in the upper waters of Dug Mt. Pond ranged from 1.93 ppb to 5.65 ppb. The average concentration was 3.23 ppb. This is indicative of mesotrophic conditions.

**Secchi Disk Transparency**

Transparency is a measure of water clarity in lakes and ponds. It is determined by lowering a 20 cm black and white disk (Secchi) into a lake to the depth where it is no longer visible from the surface. This depth is then recorded in meters. Since algae are the main determinant of water clarity in non-stained, low turbidity (suspended silt) lakes, transparency is also used as an indicator of the trophic status of a body of water. Secchi disk transparencies greater than 4.6 meters (15.1 feet) are associated with oligotrophic conditions, while values less than 2 meters (6.6 feet) are associated with eutrophic conditions (DEC & FOLA, 1990).

Secchi disk transparency in Dug Mt. Pond ranged from 3.1 meters to 5.5 meters. The average Secchi disk transparency was found to be 4.52 meters. This value is indicative of early mesotrophic conditions.
Nitrate

Nitrogen is another essential nutrient for life. Nitrate is an inorganic form of nitrogen that is naturally occurring in the environment. It is also a component of atmospheric pollution. Nitrogen concentrations are usually less than 1 ppm in most lakes. Elevated levels of nitrate concentration may be indicative of lake acidification or wastewater pollution.

Nitrate in Dug Mt. Pond ranged from 0.14 ppm to 0.24 ppm and the average was 0.18 ppm.

Chloride

Chloride is an anion that occurs naturally in surface waters, though typically in low concentrations. Background concentrations of chloride in Adirondack Lakes are usually less than 1 ppm. Chloride levels 10 ppm and higher is usually indicative of pollution and, if sustained, can alter the distribution and abundance of aquatic plant and animal species. The primary sources of additional chloride in Adirondack lakes are road salt (from winter road de-icing) and wastewater (usually from faulty septic systems). The most salt impacted waters in the Adirondacks usually have chloride concentrations of 100 ppm or less.

The chloride in the upper waters of Dug Mt. Pond was measured and ranged from 1.54 ppm to 2.50 ppm. The average chloride concentration was found to be a very low 1.92 ppm as is typical for most Adirondack Lakes.

Conductivity

Conductivity is a measure of the ability of water to conduct electric current, and will increase as dissolved minerals build up within a body of water. As a result, conductivity is also an indirect measure of the number of ions in solution, mostly as inorganic substances. High conductivity values (greater than 50 μohms/cm) may be indicative of pollution by road salt runoff or faulty septic systems. Conductivities may be naturally high in water that drains from bogs or marshes. Eutrophic lakes often have conductivities near 100 μohms/cm, but may not be characterized by pollution inputs. Clean, clear-water lakes in our region typically have conductivities up to 30 μohms/cm, but values less than 50 μohms/cm are considered normal.

The conductivity in the upper waters of Dug Mt. Pond ranged from 15.9 μohms/cm to 16.5 μohms/cm. The average conductivity was 16.2 μohms/cm.

Color

The color of water is affected by both dissolved materials (e.g., metallic ions, organic acids) and suspended materials (e.g., silt and plant pigments). Water samples are collected and compared to a set of standardized chloroplatinate solutions in order to
assess the degree of coloration. The measurement of color is usually used in lake classification to describe the degree to which the water body is stained due to the accumulation of organic acids. The standard for drinking water color, as set by the United States Environmental Protection Agency (US EPA) using the platinum-cobalt method, is 15 Pt-Co. However, dystrophic lakes (heavily stained, often the color of tea) are common in this part of the country, and are usually found in areas with poorly drained soils and large amounts of coniferous vegetation (i.e., pines, spruce, hemlock). Dystrophic lakes usually have color values upwards of 75 Pt-Co.

Color can often be used as a possible index of organic acid content since higher amounts of total organic carbon (TOC) are usually found in colored waters. TOC is important because it can bond with aluminum in water, locking it up within the aquatic system and resulting in possible toxicity to fish (see Aluminum).

The color in the upper waters of Dug Mt. Pond ranged from 24 Pt-Co to 55 Pt-Co. The average color was 43.7 Pt-Co.

Aluminum

Aluminum is one of the most abundant elements found within the earth’s crust. Acidic runoff (from rainwater and snowmelt) can leach aluminum out of the soil as it flows into streams and lakes. If a lake is acidic enough, aluminum may also be leached from the sediment at the bottom of it. Low concentrations of aluminum can be toxic to aquatic fauna in acidified water bodies, depending on the type of aluminum available, the amount of dissolved organic carbon available to bond with the aluminum, and the pH of the water. Aluminum can form thick mucus that has been shown to cause gill destruction in aquatic fauna (i.e., fish, insects) and, in cases of prolonged exposure, can cause mortality in native fish populations (Potter, 1982). Aluminum concentrations are reported as mg/L of total dissolved aluminum.

The aluminum in Dug Mt. Pond was measured and the concentration ranged from 0.016 ppm to 0.047 ppm. The average aluminum concentration was found to be 0.028 ppm.

Dissolved Oxygen

The dissolved oxygen in a lake is an extremely important parameter to measure. If dissolved oxygen decreases as we approach the bottom of a lake we know that there is a great amount of bacterial decay that is going on. This usually means that there is an abundance of nutrients, like phosphorous that have collected on the lake bottom. Oligotrophic lakes tend to have the same amount of dissolved oxygen from the surface waters to the lake bottom, thus showing very little bacterial decay. Eutrophic lakes tend to have so much decay that their bottom waters will have very little dissolved oxygen. Cold-water fish need 6.0 ppm dissolved oxygen to thrive and reproduce. Warm water fish need 4.0 ppm oxygen.
The dissolved oxygen profiles for Dug Mt. Pond for 2010 were not measured due to the lack of a site visit.

Summary

Dug Mt. Pond was a moderately productive mesotrophic lake during 2010. Based on the results of the 2010 Adirondack Lakes Assessment program, the acidity status of Dug Mt. Pond is considered to be satisfactory but with a real threat from further acidic inputs. Based solely on pH, Dug Mt. Pond’s acidity levels should be considered satisfactory. Dug Mt. Pond’s alkalinity shows a pond that has a moderate sensitivity to further acidification. The calcium level shows a pond that is sensitive to further acidification and the calcite saturation index shows a pond that has a moderate sensitivity to further acidification.

When comparing the results for 2010 with the results for 2009, the pH, alkalinity, color, total phosphorus and chlorophyll-a were all higher in 2010 than in 2009. The conductivity, Secchi disk transparency and nitrate levels were lower in 2010 than in 2009. The lake seems to be effected by weather conditions. 2007 was a very dry summer and 2008 and 2009 were very wet summers. A wet summer led to more acid rain entering the lake thus lowering the pH and alkalinity. This extra acid began to have a very big effect on the pond in 2009. This also led to more runoff from the surrounding watershed and this could have diluted the lake water more causing the lower color and total phosphorous readings. The lower total phosphorous concentration led to less algae growth as shown by the lower chlorophyll-a levels. This lower algal growth meant that the lake water would be much clearer as shown by the increased Secchi disk transparency.

Overall, the water quality for Dug Mountain Pond has not changed much over the last six years. When the water quality does go through temporary changes it seems to be the result of weather conditions.

Literature Cited


Appendix A

Water Quality Data
<table>
<thead>
<tr>
<th>Source</th>
<th>Lake/Pond Name</th>
<th>Sampling Location</th>
<th>Sampling Date</th>
<th>pH (units)</th>
<th>Alkalinity (ppm)</th>
<th>Conductivity (µhos/cm)</th>
<th>Color (Pt-Co)</th>
<th>Total P (ppm)</th>
<th>Chlor a (µg/l)</th>
<th>Secchi (meters)</th>
<th>Nitrate (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>6/28/2005</td>
<td>6.3700</td>
<td>6.0000</td>
<td>27.3000</td>
<td>48.0000</td>
<td>0.0120</td>
<td>3.0700</td>
<td>4.5000</td>
<td>0.1000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>7/29/2005</td>
<td>6.2700</td>
<td>7.6000</td>
<td>20.9000</td>
<td>17.0000</td>
<td>0.0110</td>
<td>2.1900</td>
<td>4.7000</td>
<td>0.1000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>8/29/2005</td>
<td>6.5000</td>
<td>7.6000</td>
<td>41.2000</td>
<td>5.0000</td>
<td>0.0160</td>
<td>2.2600</td>
<td>6.5000</td>
<td>0.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>6.3800</td>
<td>7.0667</td>
<td>29.8000</td>
<td>23.3333</td>
<td>0.0130</td>
<td>2.5067</td>
<td>5.2333</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std Dev</td>
<td>0.1153</td>
<td>0.9238</td>
<td>10.3783</td>
<td>22.1868</td>
<td>0.0026</td>
<td>0.4891</td>
<td>1.1015</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>7/26/2006</td>
<td>6.1300</td>
<td>6.0000</td>
<td>18.0000</td>
<td>36.0000</td>
<td>0.0180</td>
<td>4.4100</td>
<td>3.0000</td>
<td>0.4000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>8/22/2006</td>
<td>6.1200</td>
<td>6.0000</td>
<td>17.4000</td>
<td>61.0000</td>
<td>0.0100</td>
<td>1.8600</td>
<td>6.7500</td>
<td>0.1000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>9/17/2006</td>
<td>6.2600</td>
<td>7.8000</td>
<td>24.9000</td>
<td>19.0000</td>
<td>0.0080</td>
<td>1.6500</td>
<td>8.5000</td>
<td>0.0800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>6.1700</td>
<td>6.6000</td>
<td>20.1000</td>
<td>38.6667</td>
<td>0.0120</td>
<td>2.6400</td>
<td>6.0833</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std Dev</td>
<td>0.0781</td>
<td>1.0392</td>
<td>4.1677</td>
<td>21.1266</td>
<td>0.0053</td>
<td>1.5365</td>
<td>2.8100</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>7/26/2007</td>
<td>6.8900</td>
<td>10.8000</td>
<td>23.6000</td>
<td>34.0000</td>
<td>0.0140</td>
<td>3.2700</td>
<td>3.7000</td>
<td>0.1000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>8/19/2007</td>
<td>6.8200</td>
<td>10.6000</td>
<td>23.8000</td>
<td>15.0000</td>
<td>0.0150</td>
<td>3.5000</td>
<td>3.0000</td>
<td>0.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>6.7133</td>
<td>9.8667</td>
<td>24.8333</td>
<td>29.3333</td>
<td>0.0157</td>
<td>3.6200</td>
<td>3.6000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std Dev</td>
<td>0.2479</td>
<td>1.4468</td>
<td>1.9655</td>
<td>12.6623</td>
<td>0.0021</td>
<td>0.4950</td>
<td>0.1414</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>7/4/2008</td>
<td>6.0900</td>
<td>5.8000</td>
<td>18.3000</td>
<td>20.0000</td>
<td>0.0160</td>
<td>4.3600</td>
<td>X</td>
<td>0.0000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>7/30/2008</td>
<td>6.3400</td>
<td>7.6000</td>
<td>12.8000</td>
<td>15.0000</td>
<td>0.0180</td>
<td>5.7800</td>
<td>3.1000</td>
<td>0.3000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>8/30/2008</td>
<td>6.3700</td>
<td>7.6000</td>
<td>19.9000</td>
<td>20.0000</td>
<td>0.0120</td>
<td>3.3400</td>
<td>4.0000</td>
<td>0.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>6.2667</td>
<td>7.0000</td>
<td>17.0000</td>
<td>18.3333</td>
<td>0.0153</td>
<td>4.4933</td>
<td>3.5500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std Dev</td>
<td>0.1537</td>
<td>1.0392</td>
<td>3.7242</td>
<td>2.8868</td>
<td>0.0031</td>
<td>1.2255</td>
<td>0.6364</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>6/28/2009</td>
<td>5.5100</td>
<td>1.2000</td>
<td>19.1000</td>
<td>-6.0000</td>
<td>0.0080</td>
<td>3.0400</td>
<td>0.3000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>8/18/2009</td>
<td>5.9900</td>
<td>2.8000</td>
<td>23.3000</td>
<td>30.0000</td>
<td>0.0110</td>
<td>2.1700</td>
<td>5.0000</td>
<td>0.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>5.7500</td>
<td>2.0000</td>
<td>21.2000</td>
<td>12.0000</td>
<td>0.0095</td>
<td>2.6050</td>
<td>5.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std Dev</td>
<td>0.3394</td>
<td>1.1314</td>
<td>2.9698</td>
<td>25.4558</td>
<td>0.0021</td>
<td>0.6152</td>
<td>#DIV/0!</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>7/18/2010</td>
<td>6.7700</td>
<td>4.0000</td>
<td>16.5000</td>
<td>52.0000</td>
<td>0.0100</td>
<td>1.9300</td>
<td>5.5000</td>
<td>0.2370</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>8/2/2010</td>
<td>6.7300</td>
<td>4.0000</td>
<td>16.3000</td>
<td>24.0000</td>
<td>0.0190</td>
<td>5.6500</td>
<td>3.0600</td>
<td>0.1570</td>
</tr>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
<td>9/5/2010</td>
<td>6.4700</td>
<td>3.2000</td>
<td>15.9000</td>
<td>55.0000</td>
<td>0.0100</td>
<td>2.1200</td>
<td>5.0000</td>
<td>0.1380</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>6.6567</td>
<td>3.7333</td>
<td>16.2333</td>
<td>43.6667</td>
<td>0.0130</td>
<td>3.2333</td>
<td>4.5200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std Dev</td>
<td>0.1629</td>
<td>0.4619</td>
<td>0.3055</td>
<td>17.0978</td>
<td>0.0052</td>
<td>2.0950</td>
<td>1.2889</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calcium (ppm)</th>
<th>Chloride (ppm)</th>
<th>Aluminum (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol</td>
<td>Dug Mountain</td>
<td>Deephole</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calcium (ppm)</th>
<th>Chloride (ppm)</th>
<th>Aluminum (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/18/2010</td>
<td>1.9530</td>
<td>2.5000</td>
</tr>
<tr>
<td>8/2/2010</td>
<td>1.7960</td>
<td>1.7300</td>
</tr>
<tr>
<td>9/5/2010</td>
<td>1.7200</td>
<td>1.5400</td>
</tr>
<tr>
<td>Mean</td>
<td>1.8230</td>
<td>1.9233</td>
</tr>
<tr>
<td>Std Dev</td>
<td>0.1188</td>
<td>0.5084</td>
</tr>
</tbody>
</table>