Leesville Lake
Water Quality Monitoring Program

2008 Report

Prepared by

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EXECUTIVE SUMMARY

The Virginia Department of Environmental Quality (DEQ) monitors Leesville Lake water quality on a six-year rotation. DEQ last collected water quality data in 2006. In addition to the infrequent water sampling by DEQ, there are too few DEQ monitoring stations to get an adequate understanding of bacteria levels in the lake. Therefore, the Leesville Lake Association (Association) initiated a Citizen Water Quality Monitoring Program in 2007.

The goals of the program are to:

- Obtain a better understanding of Leesville Lake water quality.
- Supplement the DEQ water quality monitoring.
- Raise the awareness of the importance of water quality.
- Educate residents about the factors that cause water quality to deteriorate and age the lake more rapidly than necessary.

The 2008 monitoring season began in late April with volunteer training. Volunteers measured water clarity and collected water samples for bacteria testing from May 19th through September 8th on a biweekly basis. The Virginia Department of Environmental Quality loaned the Association a water quality monitoring probe that was used to measure dissolved oxygen (DO), temperature and pH. Dissolved oxygen, pH and water temperature data were collected from April 25th through October 11th on roughly a monthly basis.

The trophic status of Leesville Lake was monitored by measuring Secchi depth, which is an indicator of water clarity. Bacteria levels (E. coli) were monitored with the use of Coliscan Easygel® test kits. The Association purchased Secchi discs, the Coliscan Easygel® test kits and the other equipment necessary to test for E. coli.

<u>Conclusions – Trophic Status</u>

Based on the mean Secchi depth for all of the lake monitoring stations (excludes Pigg River data), the trophic state index (TSI) for 2008 was 50.2. The 50.2 TSI is slightly lower than the TSI for 2007, which was 50.6. The TSI for 2008 and 2007 were significantly lower than the DEQ mean for the period from 1990 through 2006, which was 57.7. The lower TSI results for 2007 and 2008 are likely a result of the below average rainfall in both years. The reduced rainfall resulted in less runoff and less silt in the lake. Less silt results in clearer water, higher Secchi depth numbers and lower TSI. Silt, or sediment, carries nutrients into the lake and the nutrients speed up the aging of the lake. A lower TSI number is better from the perspective of lake aging.

Since non-algal turbidity, e.g. silt, affects Secchi depth readings and therefore TSI, it would be better if chlorophyll *a* and total phosphorus data were also collected. The Association has a proposal from Lynchburg College to collect chlorophyll *a,* total phosphorus and other water quality data in 2009. If the Association can obtain funding, it will form a partnership with Lynchburg College for the 2009 water monitoring program.

Conclusions – Bacteria (Escherichia coli)

Coliscan Easygel® test kits were used to measure E. coli in water samples. Of the 66 water samples tested during the season, only one sample exceeded the state standard (235 CFUs/ 100 ml) for E. coli. The sample that exceeded the standard was taken from the Pigg River on September 8th. None of the lake water samples exceeded the standard.

Conclusions – Dissolved Oxygen, Temperature, and pH

In 2008, dissolved oxygen, temperature and pH data were collected at three stations: Toler's Bridge, Mile Mark 6 and Mile Mark 1. Those three stations provide a good representation of the various sections of the lake: riverine (Toler's Bridge), transition zone (Mile Mark 6) and lacustrine (Mile Mark 1). Data were collected at one meter increments from the surface to the bottom or to the end of the probe cable (14 meters). As expected, most of the dissolved oxygen (DO) values moved toward lower values as the summer progressed. In addition, DO generally decreased with increasing depth.

The DO and temperature values are relatively constant from the surface to the bottom at Toler's Bridge on any given day. This appears to be due to relatively high water flow rate and good mixing in this area.

At Mile Marker 6, which is in the transition zone between the riverine and lacustrine sections, temperature and DO data showed signs of stratification between late May and early July. By early August, the thermocline was at about 6 meters and the DO below 6 meters depth was below the state standard (minimum 4 mg/l). There was a significant rain event (over 4" rain at Roanoke Airport) in late August. When data was collected on August 30th, the lake was no longer stratified at Mile Mark 6 and all of the DO data were significantly above the state standard.

Temperature and DO data at Mile Marker 1 indicate that this section of the lake had stratified between late April and late May. By early August, DO was below the state standard below 6 meters depth. After the major rain event in late August, DO at depth began to increase and by early October, DO in the entire water column was significantly above the state standard.

None of the temperature data collected in 2008 exceeded the state standard (maximum 31 degrees Centigrade).

The pH values were generally higher at the surface indicating higher algal growth near the surface. pH levels at Toler's Bridge were relatively constant from the surface to the bottom. There was more variability in pH levels from the surface to the bottom at Mile Mark 6 than at Toler's Bridge, particularly in mid-summer. Mile Mark 1 pH data showed much more variability than the other two stations, particularly when that portion of the lake was stratified. On August 30th, the pH at the surface at Mile Mark 1 exceeded the state standard, which is a range from 6.0 to 9.0. That is the only data point that exceeded the state pH standard.

INTRODUCTION

Leesville Lake is the 3,270 acre lower lake in Appalachian Power Company's Smith Mountain pump-storage project. The Leesville Lake Association initiated a citizen water quality monitoring program in 2007.

The goals of the program are to:
- Obtain a better understanding of Leesville Lake water quality.
- Supplement the DEQ water quality monitoring.
- Raise the awareness of the importance of water quality.
- Educate residents about the factors that cause water quality to deteriorate and age the lake.

The Virginia Department of Environmental Quality (DEQ) monitors Leesville Lake water quality. Water quality monitoring by DEQ is currently on a six-year rotation. DEQ last collected water quality data in 2006. In addition to infrequent monitoring by DEQ, there are too few DEQ monitoring stations to get an adequate understanding of bacteria levels in the lake..

The 2008 monitoring season began in late April with volunteer training. Volunteers measured water clarity and collected water samples for bacteria testing from May 19th through September 8th on a biweekly basis. The Virginia Department of Environmental Quality loaned the Association a water quality monitoring probe that was used to measure dissolved oxygen (DO), temperature and pH. The conductivity probe was not working, so no conductivity data were collected in 2008. Dissolved oxygen, pH and water temperature data were collected from April 25th through October 11th on roughly a monthly basis.

The trophic status of Leesville Lake was monitored by measuring Secchi depth, which is an indicator of water clarity. Bacteria levels (Escherichia coli) were monitored with the use of Coliscan Easygel® test kits. The Commonwealth of Virginia's bacterial standard uses Escherichia coli (E. coli) as the indicator organism. The Association purchased Secchi disks, the Coliscan Easygel® test kits and the other equipment necessary to test for E. coli.

Below is a table that lists the water quality monitoring stations. Two monitoring stations were added to the program for 2008: Mile Mark 6 and the mouth of the Pigg River. In 2007, data was collected at Mile Mark 3. However, no data was collected at that site in 2008 since it was determined that the site provided no additional useful data. Data for the complete water column profile (DO, temperature and pH) were collected at three sites: Toler's Bridge, Mile Mark 6 and Mile Mark 1. Those three sites provide a good representation of the various sections lake. Toler's Bridge is far enough upstream that it provides good data on the riverine section of the lake after the confluence with the Pigg River; Mile Mark 6 provides data in the transition zone and Mile Mark 1 provides data in the lacustrine section. Secchi depth and E. coli data were collected at seven sites: mouth of the Pigg River, Toler's Bridge, Mile Mark 9, Tri-County Marina, Pit Stop Marina, Mile Mark 2 and Mile Mark 1. A map of the lake that shows the monitoring stations is on page 22 (Figure 13).

Table 1: Leesville Lake Water Quality Monitoring Stations

LVLA Station Number	DEQ Station ID	Station Location Description	Latitude	Longitude
1	LVLAROA153.47	Toler's Bridge	37.01090	-79.47530
2	LVLAROA149.94	Mile Mark 9	37.03993	-79.48233
3	LVLATER000.33	Tri-County Marina	37.05942	-79.44489
4	LVLAROA143.84	Mile Mark 3	37.06182	-79.42066
5	LVLAOWC000.58	Pit Stop Marina	37.05939	-79.39574
6	LVLAROA142.50	Mile Mark 2	37.06637	-79.40333
7	LVLAROA141.42	Mile Mark 1	37.08151	-79.40160
8	LVLAROA146.87	Mile Mark 6	37.06320	-79.47110
9	LVLAPGG000.47	Pigg River Mouth	37.00430	-79.48790

Trophic Status of Leesville Lake

The cloudiness of lake water and how far down one can see is often related to the amount of nutrients in the water. Nutrients promote growth of microscopic plant cells (phytoplankton) that are fed upon by microscopic animals (zooplankton). The more the nutrients, the more the plants and animals and the cloudier the water is. Measuring water clarity is a common, but indirect, way to roughly estimate the condition of the lake. The promotion of growth by nutrients is called eutrophication and is a natural aging process of lakes. Eutrophication is unnaturally accelerated by too many nutrients. Nutrients can come from many sources including fertilizers applied to agricultural areas and lawns, erosion of soil containing nutrients and sewage discharges.

A Secchi disk is commonly used to measure the depth to which you can easily see through the water, also called its transparency. Secchi disk transparency, chlorophyll *a* (an indirect measure of phytoplankton), and total phosphorus (an important nutrient and potential pollutant) are often used to define the degree of eutrophication, or trophic status of a lake.

The concept of trophic status is based on the fact that changes in nutrient levels (measured by total phosphorus) causes changes in algal biomass (measured by chlorophyll *a*) which in turn causes changes in lake clarity (measured by Secchi disk transparency). A trophic state index is a convenient way to quantify this relationship. One popular index was developed by Dr. Robert Carlson of Kent State University. Carlson's index uses a logarithmic transformation of Secchi disk values as a measure of algal biomass on a scale from 0 - 110. Each increase of ten units on the scale represents a doubling of algal biomass. Because chlorophyll *a* and total phosphorus are usually closely correlated to Secchi disk measurements, these parameters can also be assigned trophic state index values. The Carlson trophic state index is useful for comparing lakes within a region and for assessing changes in trophic status over time.

Ranges of trophic state index values are often grouped into trophic state classifications.

- Oligotrophic lakes are very low in nutrients, so few algae grow and the water is very clear. Oligotrophic lakes have the lowest level of biological productivity and support very few plants and fish. These lakes have a visible depth greater than 12 feet and a tropic state index (TSI) of less than 40.

- Mesotrophic lakes are moderately productive, with slightly green water. Mesotrophic lakes have a visible depth between 8 and 12 feet and a TSI between 40 and 50.
- Eutrophic lakes are productive lakes with murkier water, and/or lots of plants, a visible depth of 3 to 8 feet and a TSI greater than 50.

A lake's trophic state can change over time. For many reasons, a mesotrophic lake can change into a eutrophic lake within a few years. That is why it is important to monitor lake clarity, chlorophyll *a* and phosphorus on an annual basis to determine trends.

As part of its relicensing process, Appalachian Power Company (Appalachian) conducted a water quality study on Leesville Lake. Part of the water quality study included a compilation of the water quality data collected by the Virginia Department of Environmental Quality (DEQ) from 1990 through 2006. Based on DEQ data for chlorophyl *a*, total phosphorus and Secchi depth, Leesville Lake is considered mesotrophic.

The Association collected Secchi depth data from May 19 through September 8, 2008. Below are charts showing the data. Also below is a table that lists the 2007 and 2008 Secchi depth data collected by the Association and the mean of the Secchi depth collected by DEQ from 1993 through 2003. The mean Secchi depth for all of the data collected in 2008 is 1.8. The mean Secchi depth for data collected in 2008 in the lake only (excluding Pigg River data) is 2.0. The mean Secchi depth for data collected in the lake in 2007 was 1.9. Therefore, the mean Secchi depth in 2008 was slightly higher than in 2007. DEQ collected Secchi depth data from 1993 through 2003. The mean Secchi depth from 1993 through 2003 was 1.4. The year 2003 was a wet year and Secchi depths were lower than typical. If the 2003 data is excluded, the mean Secchi depth would have been 1.6. Therefore, the mean Secchi depth for 2008 was substantially higher than the mean from 1993 through 2003 with or without the 2003 data.

Based on the mean Secchi depth for all of the lake monitoring stations (excluding Pigg River data), the TSI for 2008 is 50.2. That number is significantly lower than the mean for the DEQ data (1993 through 2003), which is 57.7, and about the same as the TSI for 2007 (50.6). The lower TSI for 2007 and 2008 is likely a result of the below average rainfall in both years. The reduced rainfall resulted in less runoff and less silt in the lake. Less silt results in clearer water, higher Secchi depth numbers and lower TSI. A lower TSI number is better from the perspective of lake aging.

Table 2: Summary of Trophic State Indicators

	1993 – 2003	2007	2008
Mean Secchi Depth, m	1.4	1.9	2.0
TSI	57.7	50.6	50.2

Since non-algal turbidity such as silt affects Secchi depth readings and, therefore TSI, it would be better if chlorophyll *a* and total phosphorus data were also collected. The Association has a proposal from Lynchburg College to collect chlorophyll *a,* total phosphorus and other water quality data in 2009. If the Association can obtain funding, it will form a partnership with Lynchburg College for the 2009 water quality monitoring program.

Figure 1 (below) shows mean Secchi depth at each monitoring station. Note that Secchi depth increases closer to the dam. Also note that the Secchi depth in the Pigg River is significantly lower than the Secchi depth in the lake. The lower Secchi depth in the Pigg River is primarily a result of the silt in the water.

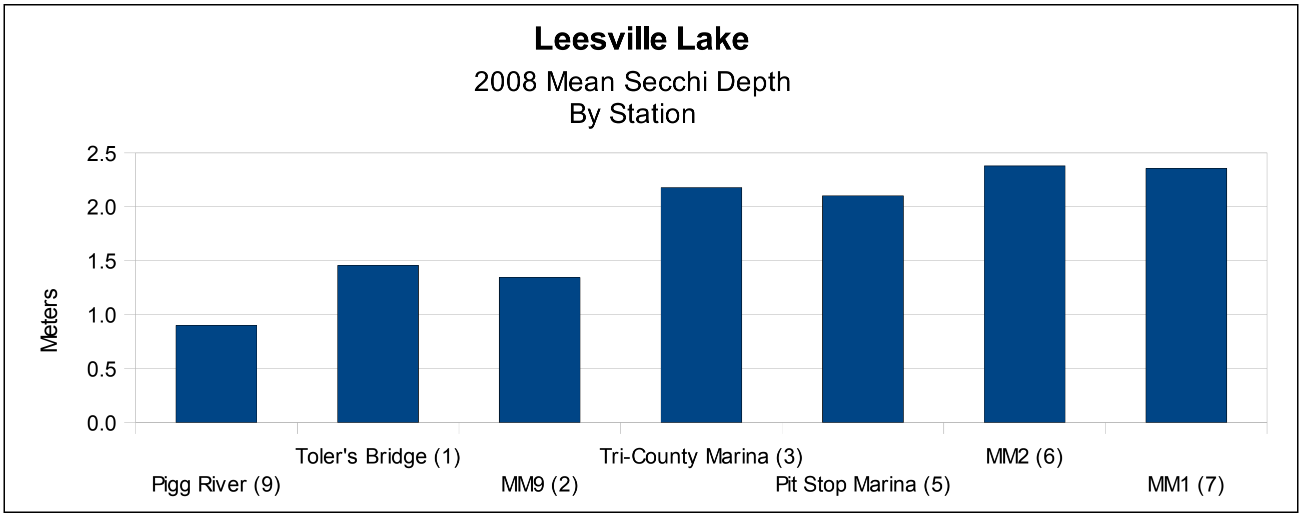

Figure 1: Mean Secchi Depth by Station
(numbers in parentheses after station name are station numbers)

Figure 2 (below) shows how Secchi depth changed over the season.

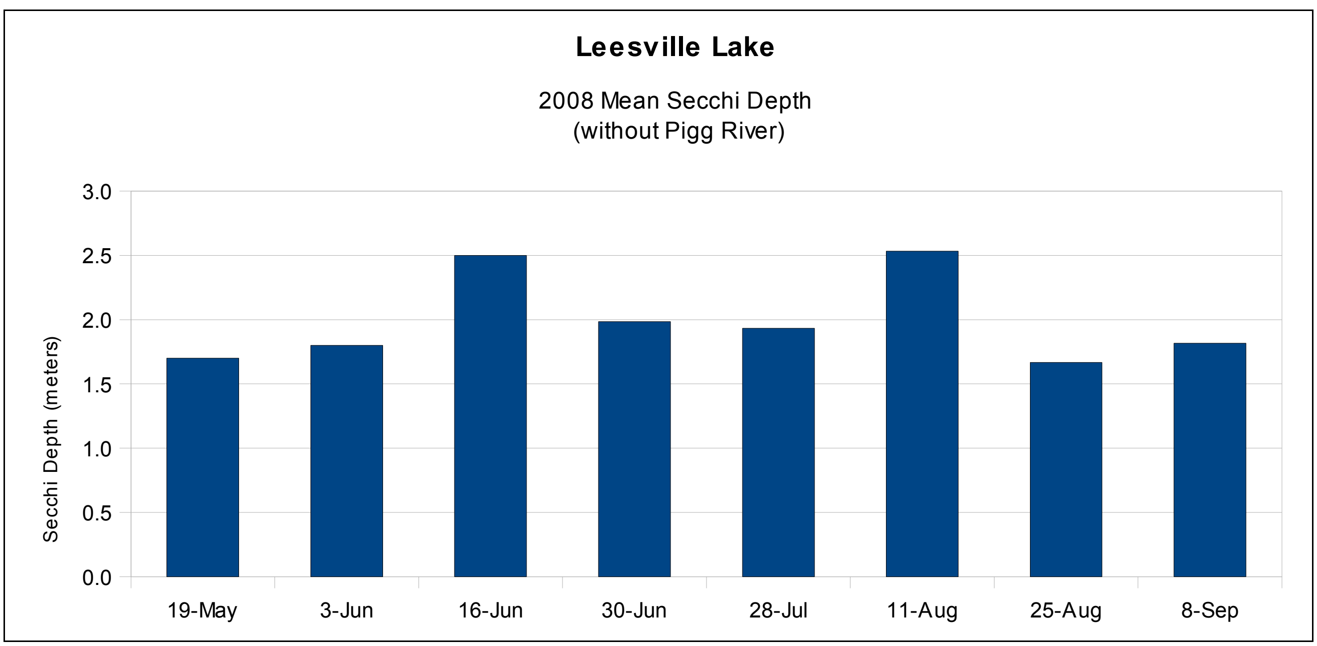

Figure 2: Mean Secchi Depth by Date (without Pigg River)

Bacteria (Escherichia coli) Profiles

Water samples collected from May 19th through September 8th from the following seven monitoring stations were tested for E. coli using Coliscan Easygel® test kits: Mile Mark 1, Mile Mark 2, Pit Stop Marina, Tri-County Marina, Mile Mark 9, Toler's Bridge and near the mouth of the Pigg River. Samples were collected on roughly a biweekly basis.

Figure 3 (below) is a chart of the E. coli data. Only one water sample exceeded the state standard (235 CFUs/100ml) for E. coli. The sample that exceeded the standard was collected near the mouth of the Pigg River on September 8th. On that same date, the water sample collected at the first collection point downstream, Toler's Bridge, had E. coli levels that were below the state standard. The lower E. coli level at Toler's Bridge was a result of dilution with water coming out of the Smith Mountain Lake dam and settling.

The mean E. coli level in 2008 in lake water samples (excluding Pigg River samples) was 22 CFUs/100ml. The minimum detectable level for the Coliscan Easygel® test is 20 CFUs/100ml, so the mean is just slightly above the minimum detectable limit. This compares with a 2007 mean of 29 CFUs/100ml. Therefore, the mean E. coli level in the lake in 2008 was lower than 2007. Both 2007 and 2008 were relatively dry years, which contributes to the low E. coli levels in both years.

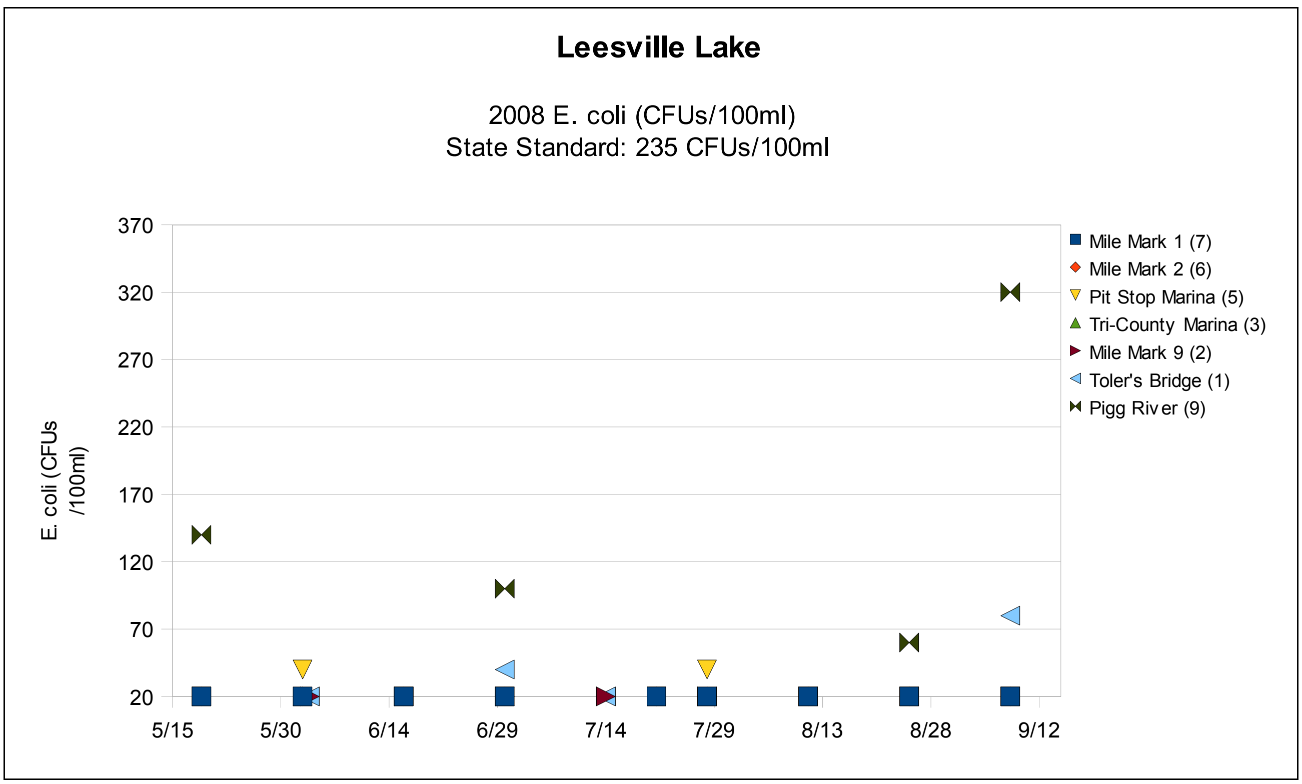

Figure 3: E. coli Profiles
(numbers in parentheses after station name are station numbers)

Dissolved Oxygen (DO), Temperature and pH Profiles

The Virginia Department of Environmental Quality (DEQ) loaned the Association a Hydrolab water quality monitoring probe with a 15-meter cable that was used to measure dissolved oxygen (DO), temperature and pH at three locations: Toler's Bridge, Mile Mark 6 and Mile Mark 1. These three stations provide a good representation of the various sections of the lake. The Toler's Bridge station is below the confluence with the Pigg River and represents the riverine portion of the lake. Mile Mark 6 is roughly in the transition zone between the riverine section and the lacustrine section. Mile Mark 1 is one mile from the Leesville dam and represents the lacustrine section of the lake.

DO, temperature and pH data were collected for the complete water column profile. That is, data was collected at the surface and then at one meter incremental depths down to the bottom of the lake or until the end of the cable was reached. The conductivity probe did not work, so no conductivity data was collected in 2008.

Dissolved oxygen is important to aquatic life in the lake. DO is also useful in evaluating the health and trophic status of the lake. The lacustrine and transition sections of the lake stratify during the warmer months. The warmer surface waters (epilimnion) are separated from the cooler bottom waters (hypolimnion) by a transition zone called the thermocline. Water temperatures change rapidly in the thermocline, which acts as a barrier to mixing between the epilimnion and the hypolimnion. The oxygen levels in the lower layer of the lake are depleted when nutrient enrichment increases algal production and the organic matter consumes the oxygen. Because of the thermal stratification, the oxygen in the surface layer does not mix with the bottom layer.

Water Temperature Profiles

Table 3 (page 14) contains the complete set of temperature data. Figures 4 through 6 (below) show the temperature profiles for the three monitoring stations: Toler's Bridge, Mile Mark 6 and Mile Mark 1.

Figure 4 (below) shows that at Toler's Bridge, temperatures are relatively constant from the surface to the bottom. This is due to the fact that the lake is relatively shallow and narrow in that section, so flow rates are relatively high and there is good mixing. Temperature levels increased from the end of April through the end of August and then began to decrease.

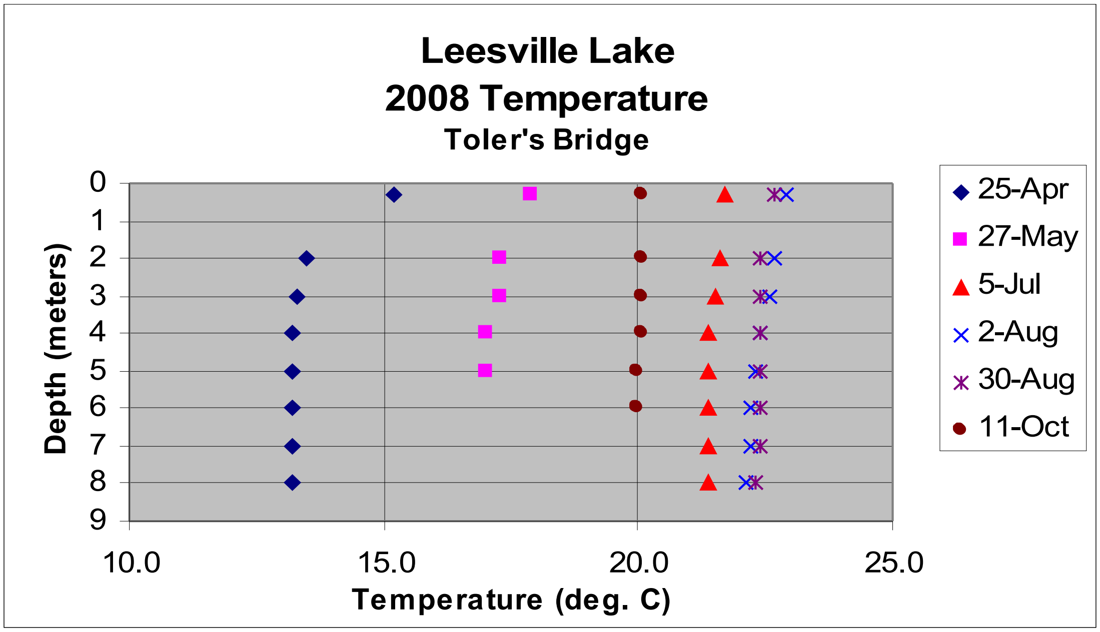

Figure 4: Water Temperature at Toler's Bridge

Figure 5 (below) shows water temperature profiles at Mile Mark 6. The temperature data showed indications of stratification in early July and early August. During the August 26 through 28 period, the region experienced a substantial rain event (4.6" at the Roanoke airport) with cool temperatures (daytime highs in the 60s and 70s ºF). By August 30th when data was collected, water temperatures near the surface had dropped and this section of the lake was no longer stratified.

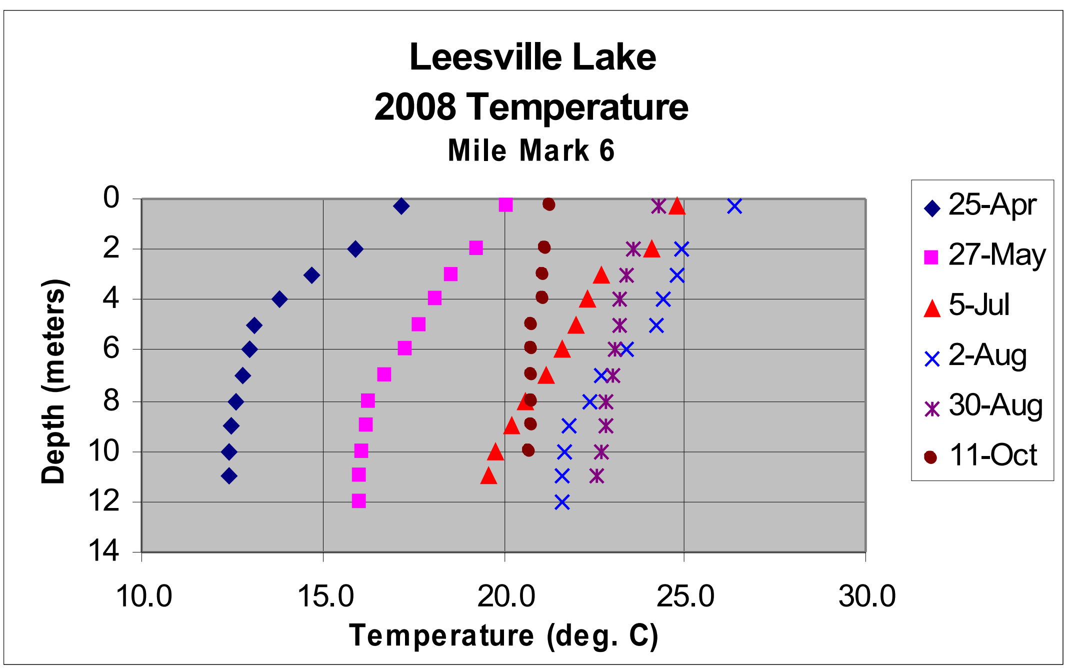

Figure 5: Water Temperature at Mile Mark 6

Figure 6 (below) shows the water temperature profiles at Mile Mark 1. This section of the lake stratified between late April and late May. As with Mile Mark 6, the substantial amount of rain and cool daytime temperatures caused lake water temperatures near the surface to drop in late August. By August 30th when data was collected, surface temperatures had dropped sufficiently so that this section of the lake was no longer stratified. By October 11th, the water temperature was nearly the same from the surface to the bottom.

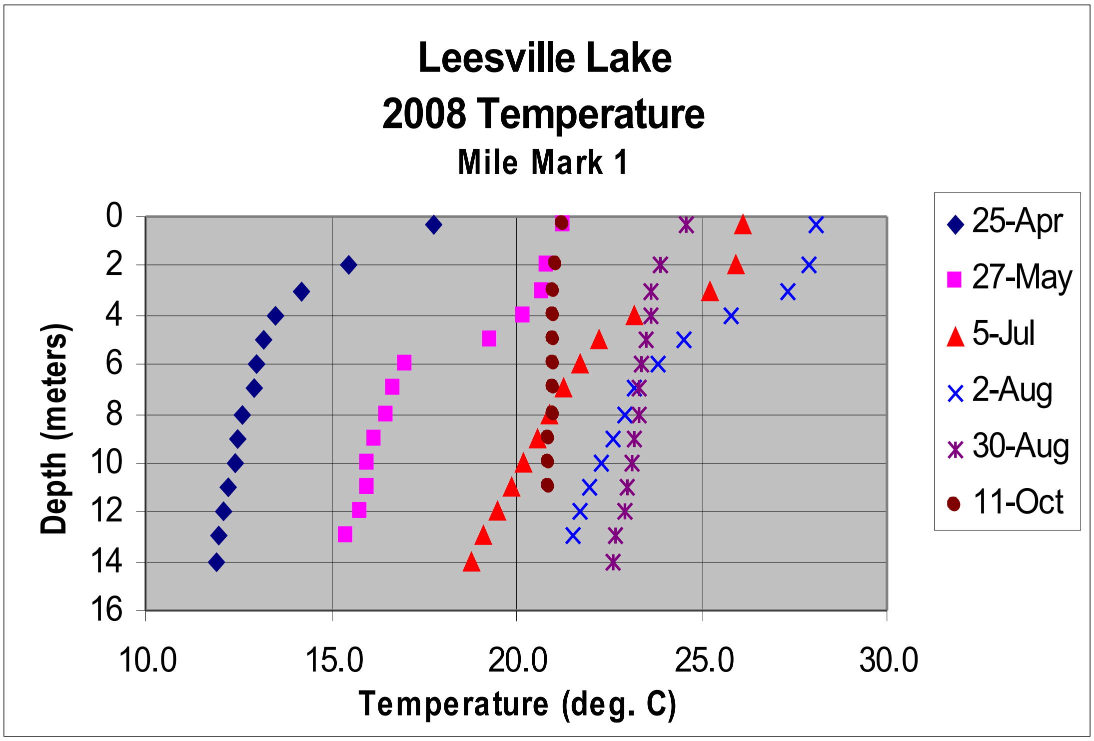

Figure 6: Water Temperature at Mile Mark 1

Table 3: Water Temperature Data
(numbers in parentheses after site name are station numbers)

Leesville Lake
2008 Water Temperature (deg C)

Station	Depth (m)	25-Apr	27-May	5-Jul	2-Aug	30-Aug	11-Oct
Mile Mark 1 (7)	0.3	17.8	21.3	26.1	28.1	24.6	21.3
	2	15.5	20.8	25.9	27.9	23.9	21.1
	3	14.2	20.7	25.2	27.3	23.6	21.0
	4	13.5	20.2	23.2	25.8	23.6	21.0
	5	13.2	19.3	22.2	24.5	23.5	21.0
	6	13.0	17.0	21.7	23.8	23.4	21.0
	7	12.9	16.7	21.3	23.2	23.3	21.0
	8	12.6	16.5	20.9	22.9	23.3	21.0
	9	12.5	16.2	20.6	22.6	23.2	20.9
	10	12.4	16.0	20.2	22.3	23.1	20.9
	11	12.2	16.0	19.9	22.0	23.0	20.9
	12	12.1	15.8	19.5	21.7	22.9	
	13	12.0	15.4	19.1	21.5	22.7	
	14	11.9		18.8		22.6	
Mile Mark 6 (8)	0.3	17.2	20.1	24.8	26.4	24.3	21.3
	2	15.9	19.3	24.1	24.9	23.6	21.2
	3	14.7	18.6	22.7	24.8	23.4	21.1
	4	13.8	18.1	22.3	24.4	23.2	21.1
	5	13.1	17.7	22.0	24.2	23.2	20.8
	6	13.0	17.3	21.6	23.4	23.1	20.8
	7	12.8	16.7	21.2	22.7	23.0	20.8
	8	12.6	16.3	20.6	22.4	22.8	20.8
	9	12.5	16.2	20.2	21.8	22.8	20.8
	10	12.4	16.1	19.8	21.7	22.7	20.7
	11	12.4	16.0	19.6	21.6	22.6	
	12		16.0		21.6		
Toler's Bridge (1)	0.3	15.2	17.9	21.7	22.9	22.7	20.1
	2	13.5	17.3	21.6	22.7	22.4	20.1
	3	13.3	17.3	21.5	22.6	22.4	20.1
	4	13.2	17.0	21.4	22.4	22.4	20.1
	5	13.2	17.0	21.4	22.3	22.4	20.0
	6	13.2		21.4	22.2	22.4	20.0
	7	13.2		21.4	22.2	22.4	
	8	13.2		21.4	22.1	22.3	

Dissolved Oxygen (DO) Profiles

Table 4 (page 17) contains the complete set of dissolved oxygen (DO) data. Figures 7 through 9 show the dissolved oxygen (DO) profiles for the three monitoring stations: Toler's Bridge, Mile Mark 6 and Mile Mark 1.

Figure 7 (below) shows that at Toler's Bridge, DO levels are relatively constant from the surface to the bottom. This is due to the fact that the lake is relatively shallow and narrow in that section, so flow rates are relatively high and there is good mixing. DO levels declined from the end of April through the end of August and then began to increase. All of the DO levels were well above the state standard, which is a minimum of 4 mg/l.

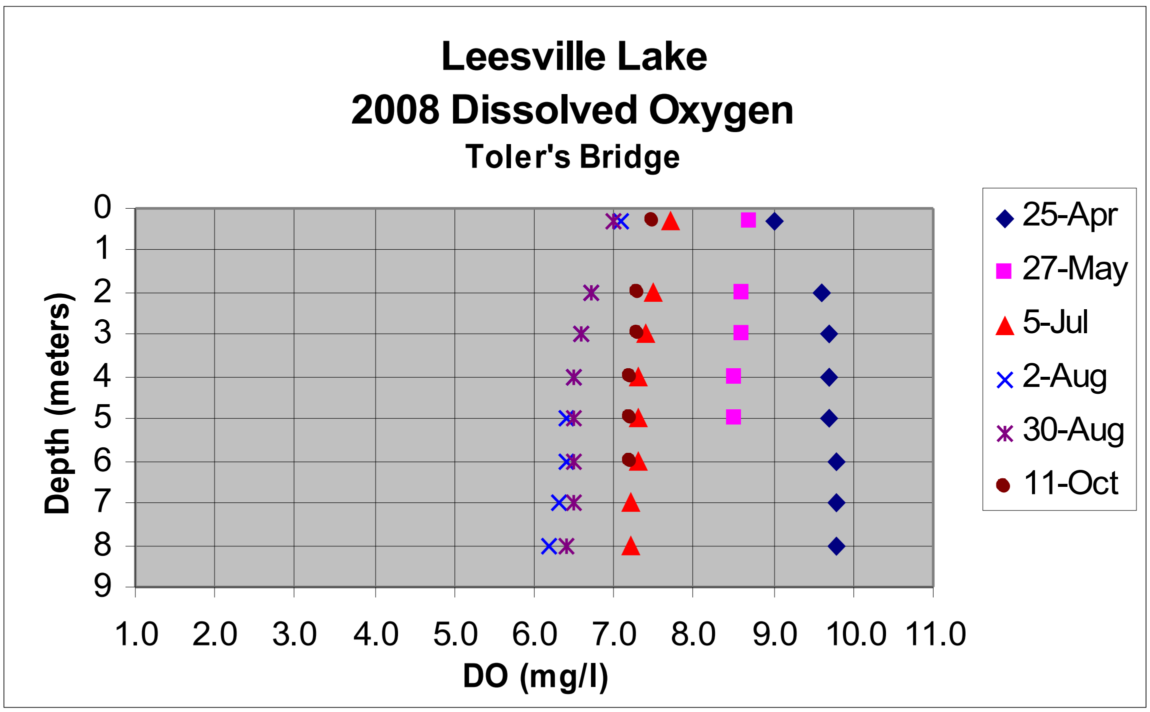

Figure 7: Dissolved Oxygen Profiles at Toler's Bridge

Figure 8 (below) shows dissolved oxygen data for Mile Mark 6. In early July, the DO below 10 meters depth was below the state standard (minimum of 4 mg/l). In early August, the DO below 6 meters depth was below the state standard. By late August, this section of the lake was no longer stratified and all of the data showed DO levels above the state standard.

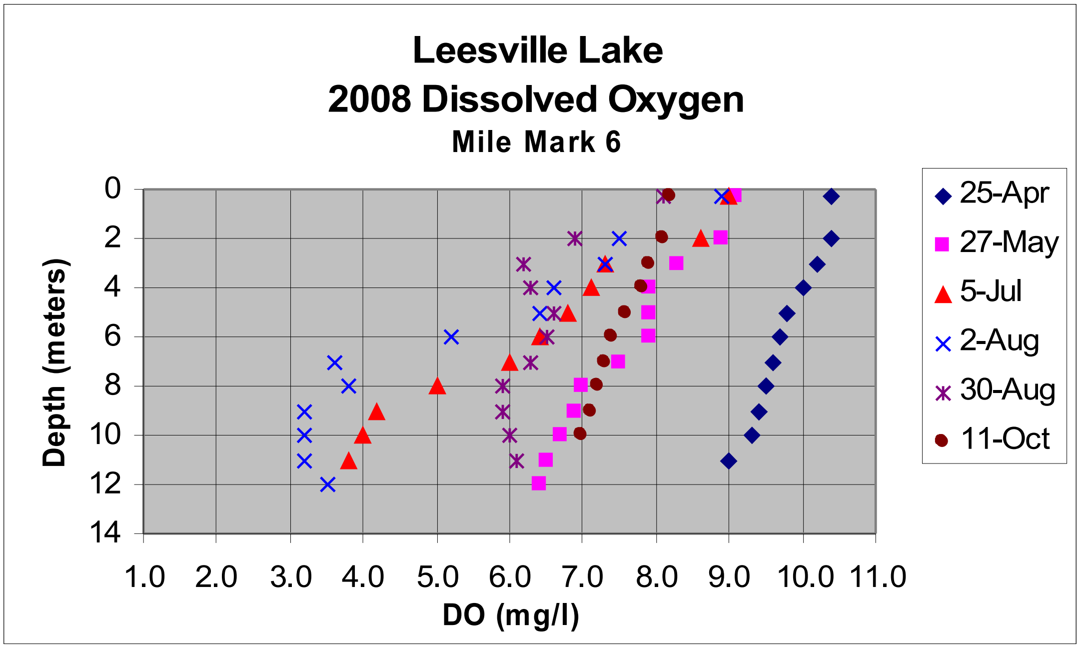

Figure 8: Dissolved Oxygen Profiles at Mile Mark 6

Figure 9 (below) shows dissolved oxygen data for Mile Mark 1. In early July, DO was below the state standard below 9 meters of depth. In early August, DO was below the state standard below 6 meters of depth. By late August, this section of the lake was no longer stratified and DO began to increase in the lower waters. By October 11th, DO was significantly above the state standard at all depths.

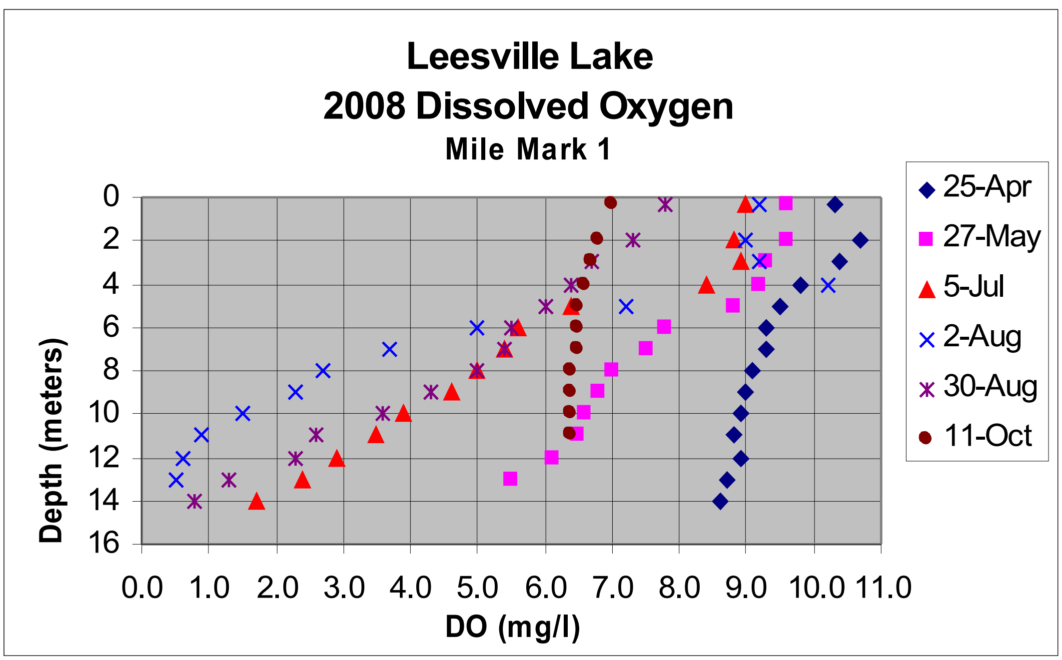

Figure 9: Dissolved Oxygen Profiles at Mile Mark 1

Table 4: 2008 Dissolved Oxygen Data
(numbers in parentheses after site name are station numbers)

Leesville Lake
2008 Dissolved Oxygen (DO) (mg/l)

Station	Depth (m)	25-Apr	27-May	5-Jul	2-Aug	30-Aug	11-Oct
Mile Mark 1 (7)	0.3	10.3	9.6	9.0	9.2	7.8	7.0
	2	10.7	9.6	8.8	9.0	7.3	6.8
	3	10.4	9.3	8.9	9.2	6.7	6.7
	4	9.8	9.2	8.4	10.2	6.4	6.6
	5	9.5	8.8	6.4	7.2	6.0	6.5
	6	9.3	7.8	5.6	5.0	5.5	6.5
	7	9.3	7.5	5.4	3.7	5.4	6.5
	8	9.1	7.0	5.0	2.7	5.0	6.4
	9	9.0	6.8	4.6	2.3	4.3	6.4
	10	8.9	6.6	3.9	1.5	3.6	6.4
	11	8.8	6.5	3.5	0.9	2.6	6.4
	12	8.9	6.1	2.9	0.6	2.3	
	13	8.7	5.5	2.4	0.5	1.3	
	14	8.6		1.7		0.8	
Mile Mark 6 (8)	0.3	10.4	9.1	9.0	8.9	8.1	8.2
	2	10.4	8.9	8.6	7.5	6.9	8.1
	3	10.2	8.3	7.3	7.3	6.2	7.9
	4	10.0	7.9	7.1	6.6	6.3	7.8
	5	9.8	7.9	6.8	6.4	6.6	7.6
	6	9.7	7.9	6.4	5.2	6.5	7.4
	7	9.6	7.5	6.0	3.6	6.3	7.3
	8	9.5	7.0	5.0	3.8	5.9	7.2
	9	9.4	6.9	4.2	3.2	5.9	7.1
	10	9.3	6.7	4.0	3.2	6.0	7.0
	11	9.0	6.5	3.8	3.2	6.1	
	12		6.4		3.5		
Toler's Bridge (1)	0.3	9.0	8.7	7.7	7.1	7.0	7.5
	2	9.6	8.6	7.5	6.7	6.7	7.3
	3	9.7	8.6	7.4	6.6	6.6	7.3
	4	9.7	8.5	7.3	6.5	6.5	7.2
	5	9.7	8.5	7.3	6.4	6.5	7.2
	6	9.8		7.3	6.4	6.5	7.2
	7	9.8		7.2	6.3	6.5	
	8	9.8		7.2	6.2	6.4	

pH Profiles

When algae grows during the day, it consumes carbon dioxide, which is a weak acid, and the water becomes more basic (pH increases). When algae and other organisms respire at night and carbon dioxide levels increase, the pH decreases. The pH increase and decrease from daytime to nighttime results in a diurnal pH cycle. High pH levels and large diurnal swings in pH and dissolved oxygen stress aquatic organisms. All of the 2008 pH data were collected mid-day, so there was no attempt to quantify the diurnal pH cycle. Table 5 (page 20) contains the complete set of pH data.

The three figures below show that pH values were generally higher at the surface indicating higher algal growth near the surface. pH levels at Toler's Bridge were relatively constant from the surface to the bottom. There was more variability in pH levels from the surface to the bottom at Mile Mark 6 than at Toler's Bridge, particularly in mid-summer. Mile Mark 1 pH data showed much more variability than the other two stations, particularly when that portion of the lake was stratified. On August 30th, the pH at the surface at Mile Mark 1 exceeded the state standard, which is a range from 6.0 to 9.0. That is the only data point that exceeded the state pH standard.

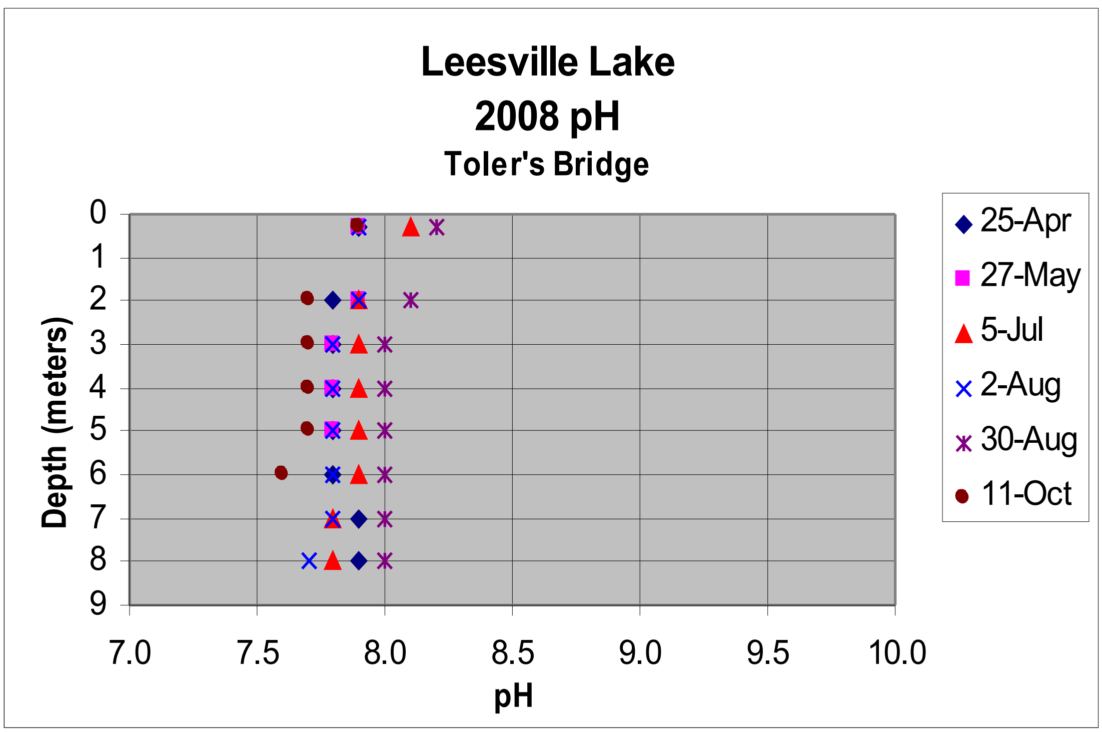

Figure 10: pH Profiles at Toler's Bridge

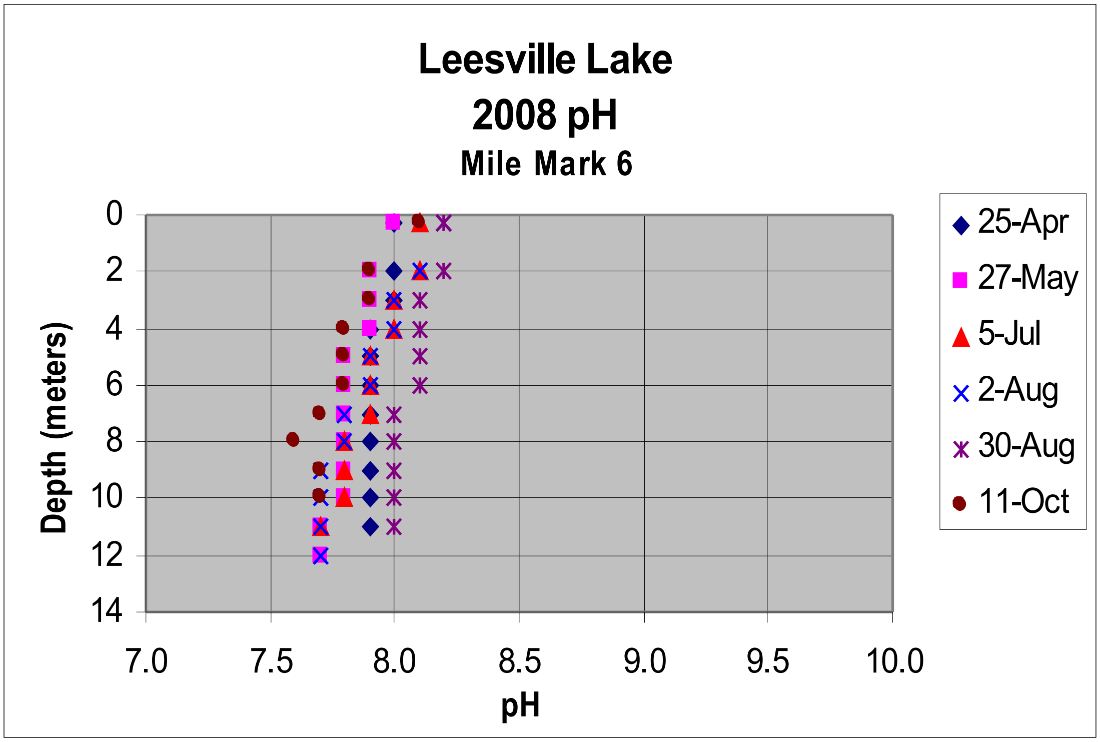

Figure 11: pH Profiles at Mile Mark 6

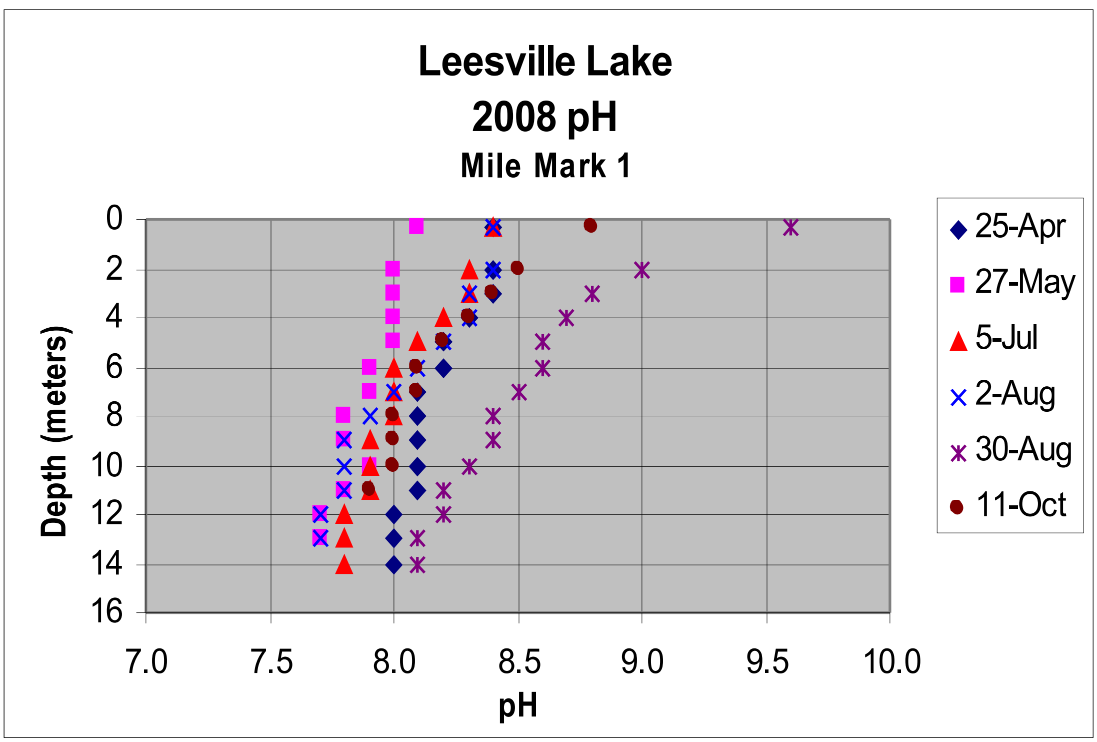

Figure 12: pH Profiles at Mile Mark 1

Table 5: 2008 pH Data
(numbers in parentheses after site name are station numbers)

Leesville Lake
2008 pH

Station	Depth (m)	25-Apr	27-May	5-Jul	2-Aug	30-Aug	11-Oct
Mile Mark 1 (7)	0.3	8.4	8.1	8.4	8.4	9.6	8.8
	2	8.4	8.0	8.3	8.4	9.0	8.5
	3	8.4	8.0	8.3	8.3	8.8	8.4
	4	8.3	8.0	8.2	8.3	8.7	8.3
	5	8.2	8.0	8.1	8.2	8.6	8.2
	6	8.2	7.9	8.0	8.1	8.6	8.1
	7	8.1	7.9	8.0	8.0	8.5	8.1
	8	8.1	7.8	8.0	7.9	8.4	8.0
	9	8.1	7.8	7.9	7.8	8.4	8.0
	10	8.1	7.9	7.9	7.8	8.3	8.0
	11	8.1	7.8	7.9	7.8	8.2	7.9
	12	8.0	7.7	7.8	7.7	8.2	
	13	8.0	7.7	7.8	7.7	8.1	
	14	8.0		7.8		8.1	
Mile Mark 6 (8)	0.3	8.0	8.0	8.1	8.2	8.2	8.1
	2	8.0	7.9	8.1	8.1	8.2	7.9
	3	8.0	7.9	8.0	8.0	8.1	7.9
	4	7.9	7.9	8.0	8.0	8.1	7.8
	5	7.9	7.8	7.9	7.9	8.1	7.8
	6	7.9	7.8	7.9	7.9	8.1	7.8
	7	7.9	7.8	7.9	7.8	8.0	7.7
	8	7.9	7.8	7.8	7.8	8.0	7.6
	9	7.9	7.8	7.8	7.7	8.0	7.7
	10	7.9	7.8	7.8	7.7	8.0	7.7
	11	7.9	7.7	7.7	7.7	8.0	
	12		7.7		7.7		
Toler's Bridge (1)	0.3	7.9	7.9	8.1	7.9	8.2	7.9
	2	7.8	7.9	7.9	7.9	8.1	7.7
	3	7.8	7.8	7.9	7.8	8.0	7.7
	4	7.8	7.8	7.9	7.8	8.0	7.7
	5	7.8	7.8	7.9	7.8	8.0	7.7
	6	7.8		7.9	7.8	8.0	7.6
	7	7.9		7.8	7.8	8.0	
	8	7.9		7.8	7.7	8.0	

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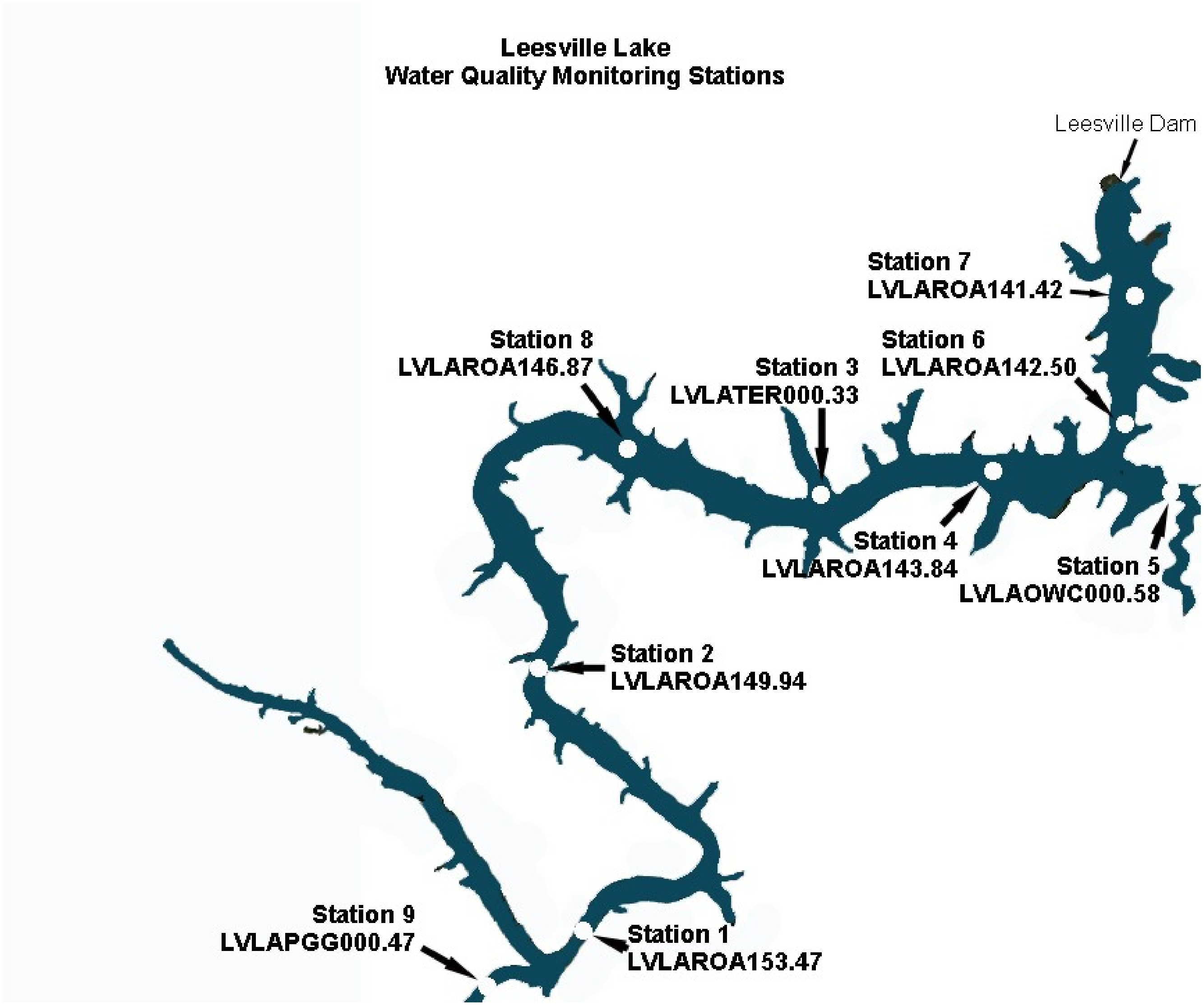

Figure 13: Leesville Lake Water Quality Monitoring Stations