LAKE & RESERVOIR ASSESSMENTS
CATAWBA RIVER BASIN

Lake Norman

Intensive Survey Unit
Environmental Sciences Section
Division of Water Quality

July 18, 2013

TABLE OF CONTENTS

Figures

Tables

GLOSSARY

Algae Small aquatic plants that occur as single cells, colonies, or filaments. May also be referred to as phytoplankton, although phytoplankton are a subset of algae.

Algal biovolume The volume of all living algae in a unit area at a given point in time. To determine biovolume, individual cells in a known amount of sample are counted. Cells are measured to obtain their cell volume, which is used in calculating biovolume

Algal density The density of algae based on the number of units (single cells, filaments and/or colonies) present in a milliliter of water. The severity of an algae bloom may be determined by the algal density as follows:

Mild bloom = 10,000 to 20,000 units/ml

Mild bloom = 20,000 to 30,000 units/ml

Severe bloom = 30,000 to 100,000 units/ml

Extreme bloom = Greater than 100,000 units/ml

Algal Growth Potential Test (AGPT) A test to determine the nutrient that is the most limiting to the growth of algae in a body of water. The sample water is split such that one sub-sample is given additional nitrogen, another is given phosphorus, a third may be given a combination of nitrogen and phosphorus, and one sub-sample is not treated and acts as the control. A specific species of algae is added to each sub-sample and is allowed to grow for a given period of time. The dry weights of algae in each sub-sample and the control are then measured to determine the rate of productivity in each treatment. The treatment (nitrogen or phosphorus) with the greatest algal productivity is said to be the limiting nutrient of the sample source. If the control sample has an algal dry weight greater than 5 mg/L, the source water is considered to be unlimited for either nitrogen or phosphorus.

Centric diatom Diatoms are photosynthetic algae that have a siliceous skeleton (frustule) found in almost every aquatic environment including fresh and marine waters, as well as moist soils. Centric diatoms are circular in shape and are often found in the water column.

Chlorophyll *a* Chlorophyll *a* is an algal pigment that is used as an approximate measure of algal biomass. The concentration of chlorophyll *a* is used in the calculation of the NCTSI, and the value listed is a lake-wide average from all sampling locations.

Clinograde In productive lakes where oxygen levels drop to zero in the lower waters near the bottom, the graphed changes in oxygen from the surface to the lake bottom produces a curve known as clinograde curve.

Coccoid Round or spherical shaped cell

Conductivity This is a measure of the ability of water to conduct an electrical current. This measure increases as water becomes more mineralized. The concentrations listed are the range of values observed in surface readings from the sampling locations.

Dissolved oxygen A measurement of oxygen concentrations found at the sampling locations.

Dissolved oxygen saturation The capacity of water to absorb oxygen gas. Often expressed as a percentage, the amount of oxygen that can dissolve into water will change depending on a number of parameters, the most important being temperature. Dissolved oxygen saturation is inversely proportion to temperature, that is, as temperature increases, water©s capacity for oxygen will decrease, and vice versa.

Eutrophic Describes a lake with high biological productivity and low water transparency.

Eutrophication	The process of physical, chemical, and biological changes associated with nutrient, organic matter, and silt enrichment and sedimentation of a lake.
Limiting nutrient	The plant nutrient present in lowest concentration relative to need limits growth such that addition of the limiting nutrient will stimulate additional growth. In northern temperate lakes, phosphorus (P) is commonly the limiting nutrient for algal growth
Manganese	A naturally occurring metal commonly found in soils and organic matter. As a trace nutrient, manganese is essential to all forms of biological life. Manganese in lakes is released from bottom sediments and enters the water column when the oxygen concentration in the water near the lake bottom is extremely low or absent. Manganese in lake water may cause taste and odor problems in drinking water and require additional treatment of the raw water at water treatment facilities to alleviate this problem.
Mesotrophic	Describes a lake with moderate biological productivity and water transparency
NCTSI	North Carolina Trophic State Index was specifically developed for North Carolina lakes as part of the state's original Clean Lakes Classification Survey (NRCD 1982). It takes the nutrients present along with chlorophyll *a* and Secchi depth to calculate a lake's biological productivity.
Oligotrophic	Describes a lake with low biological productivity and high water transparency.
pH	The range of surface pH readings found at the sampling locations. This value is used to express the relative acidity or alkalinity of water.
Photic zone	The portion of the water column in which there is sufficient light for algal growth. DWQ considers 2 times the Secchi depth as depicting the photic zone.
Secchi depth	This is a measure of water transparency expressed in meters. This parameter is used in the calculation of the NCTSI value for the lake. The depth listed is an average value from all sampling locations in the lake.
Temperature	The range of surface temperatures found at the sampling locations.
Total Kjeldahl nitrogen	The sum of organic nitrogen and ammonia in a water body. High measurements of TKN typically results from sewage and manure discharges in water bodies.
Total organic nitrogen (TON)	Total Organic Nitrogen (TON) can represent a major reservoir of nitrogen in aquatic systems during summer months. Similar to phosphorus, this concentration can be related to lake productivity and is used in the calculation of the NCTSI. The concentration listed is a lake-wide average from all sampling stations and is calculated by subtracting Ammonia concentrations from TKN concentrations.
Total phosphorus (TP)	Total phosphorus (TP) includes all forms of phosphorus that occur in water. This nutrient is essential for the growth of aquatic plants and is often the nutrient that limits the growth of phytoplankton. It is used to calculate the NCTSI. The concentration listed is a lake-wide average from all sampling stations.
Trophic state	This is a relative description of the biological productivity of a lake based on the calculated NCTSI value. Trophic states may range from extremely productive (Hypereutrophic) to very low productivity (Oligotrophic).
Turbidity	A measure of the ability of light to pass through a volume of water. Turbidity may be influenced by suspended sediment and/or algae in the water.
Watershed	A drainage area in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Overview

The Catawba River and the Broad River Basins form the headwaters of the Santee-Cooper River system, which flows through South Carolina to the Atlantic Ocean. The basin is the eighth largest river basin in the state covering 3,279 square miles in the south central portion of western North Carolina. The Catawba River has its source on the eastern slopes of the Blue Ridge Mountains in McDowell County, and flows eastward, then southward, to the state line near Charlotte. The headwaters of the river are formed by swift flowing, cold water streams originating in the steep terrain of the mountains. Although the topography of the upper basin is characterized by mountains, smaller hills give way to a rolling terrain near the state line. As the basin enters the Inner Piedmont, land use shifts from forest to agricultural and urban uses. Though urban areas are not numerous in the upper basin, the lower portion of the basin contains many cities, including the Charlotte metropolitan area.

Nine lakes were sampled in this river basin by DWQ staff in 2012. Two lakes appear on the 2012 303(d) List of Impaired Waters (Table 1). Mountain Island Lake had been previously placed on the 2010 303(d) List for low pH values observed in 2008. Water quality sampling of this lake in 2010 (Appendix A) confirmed the presence of pH values within the state's water quality limits and the lake was removed from the 303(d) List in 2012 (http://portal.ncdenr.org/web/wq/ps/mtu/assessment).

Table 1. Catawba River Basin Lakes on the 2012 303(d) List of Impaired Waters.

Lake	Location	Violation	303(d) Year
Lake Rhodhiss below elevation 995'	From Johns River to Rhodhiss Dam	Elevated pH	2006
Lake Wylie South Fork Catawba River Arm - NC portion	South Fork Catawba River Arm of Lake Wylie	Elevated copper Elevated surface water temperatures	2008

Following the description of the assessment methodology used for the Catawba River Basin, there are individual summaries for each of the lakes and a two-paged matrix that distills the information used to make the lakes use support assessments.

Assessment Methodology

For this report, data from January 1, 2008 through December 31, 2012 were reviewed. Lake monitoring and sample collection activities performed by DWQ field staff are in accordance with the Intensive Survey Unit Standard Operating Procedures Manual (http://portal.ncdenr.org/c/document_library/get_file?uuid=522a90a4-b593-426f-8c11-21a35569dfd8&groupId=38364) An interactive map of the state showing the locations of lake sites sampled by DWQ may be found at http://portal.ncdenr.org/web/wq/ambient-lakes-map.

All lakes were sampled during the growing season from May through September. Data were assessed for excursions of the state's Class C water quality standards for chlorophyll *a*, pH, dissolved oxygen, water temperature, turbidity, and surface metals. Other parameters discussed in this report include Secchi depth and percent dissolved oxygen saturation. Secchi depth provides a measure of water clarity and is used in calculating the trophic or nutrient enriched status of a lake. Percent dissolved oxygen saturation gives information on the amount of dissolved oxygen in the water column and may be increased by photosynthesis or depressed by oxygen-consuming decomposition.

For algae collection and assessment, water samples are collected from the photic zone, preserved in the field and taken concurrently with chemical and physical parameters. Samples were quantitatively analyzed to determine assemblage structure, density (units/ml) and biovolume (m^3/mm^3).

For the purpose of reporting, algal blooms were determined by the measurement of unit density (units/ml). Unit density is a quantitative measurement of the number of filaments, colonies or single celled taxa in a waterbody. Blooms are considered mild if they are between 10,000 and 20,000 units/ml. Moderate blooms are those between 20,000 and 30,000 units/ml. Severe blooms are between 30,000 and 100,000 units/ml. Extreme blooms are those 100,000 units/ml or greater.

An algal group is considered dominant when it comprises 40% or more of the total unit density or total biovolume. A genus is considered dominant when it comprises 30% or more of the total unit density or total biovolume.

Additional data considered as part of the use support assessment include historic DWQ water quality data, documented algal blooms and/or fish kills, problematic aquatic macrophytes, or listing on the EPA's 303(d) List of Impaired Waters.

For a more complete discussion of lake ecology and assessment, please go to http://portal.ncdenr.org/web/wq/ess/isu. The 1992 North Carolina Lake Assessment Report (downloadable from this website) contains a detailed chapter on ecological concepts that clarifies how the parameters discussed in this review relate to water quality and reservoir health.

Quality Assurance of Field and Laboratory Lakes Data

Data collected in the field via single or multiparameter water quality meters are entered into the Ambient Lakes Database within 24 hours of the sampling date. These data are then reviewed for accuracy and completeness within a week of entry. Data that have not been reviewed are given a óPôcode for óProvisionaló(data has been entered but not been verified for accuracy and/or completeness). Data that have been verified are given an óAôcode for óAcceptedô

Chemistry data from the DWQ Water Quality Laboratory are entered into the Lakes Database within 48 hours of receipt from the lab. As with the field data, laboratory results are coded óPôuntil the entered data is verified for entry accuracy and completeness, after which, the code is changed to óAô Generally, laboratory data entered into the Lakes Database are verified within a week following the initial entry.

Data, either laboratory or field, which appear to be out of range for the lake sampled are double checked against field sheets or the laboratory results form by the Lakes Data Administrator for possible data entry error. If there are data entry mistakes, possible equipment, sampling, and/or analysis errors, these are investigated and corrected if possible. If the possible source of an error cannot be determined, the data remains in the database. If an error is determined, the data value is removed from the appropriate database parameter field and placed in the óNotesôfield along with a comment regarding the error. Chemistry results received from the laboratory that have been given an qualification code are also entered into the óNotesôfield along with the assigned laboratory code. Laboratory qualification coded data or data which may be in error due to sampling, handling, and/or equipment problems are only entered into the óNotesôfield and never in the data field(s) in the Ambient Lakes Database.

Additional information regarding the Quality Assurance Program is covered in the Ambient Lake Monitoring Program Quality Assurance Plan. Version 1.1 (July 2012) of this document is available on the ISU website (http://portal.ncdenr.org/web/wq/ess/isu).

Weather Overview for Summer 2012

After a dry, warm winter, May brought beneficial rainfall to the state and ranked as the 10th wettest May on record since 1895 based on statewide average rainfall. The coastal plains and the northwestern region of the state received the most rainfall during this month (Figure 1).

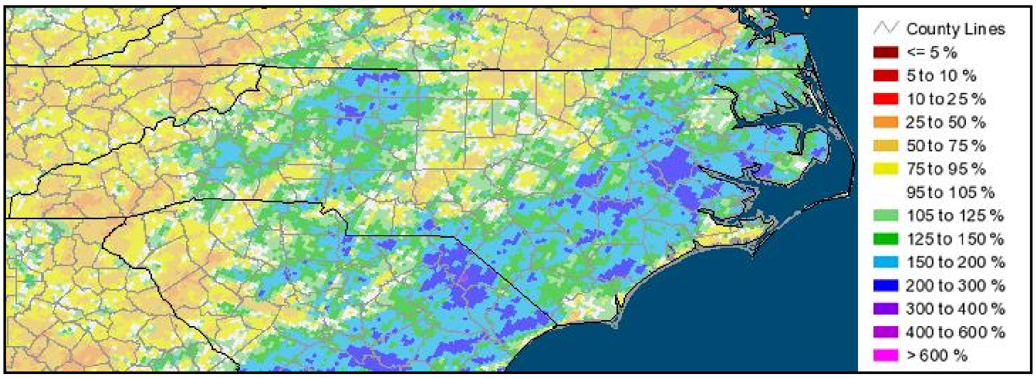

Figure 1. Precipitation for May 2012: Percent of Normal Based on Estimates From NWS Radar
(Data courtesy NWS/NCEP)

The wet conditions in May helped to alleviate most of the short-term concerns with hydrological drought in the state (Figure 2). Much of the Catawba River Basin started out the month in moderate drought conditions and improved to abnormally dry conditions. Temperatures in May were warm, averaging 3.5 °F above the normal for the month.

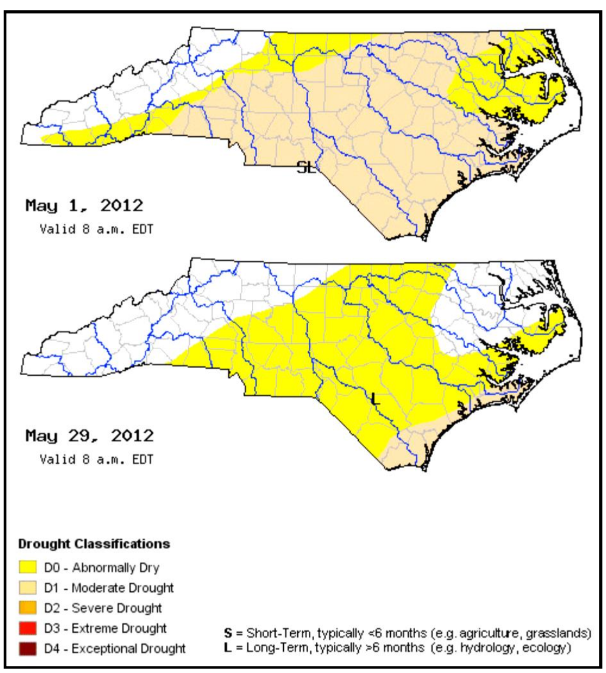

Figure 2. US Drought Monitor for North Carolina , May 2012
(Courtesy of NC DENR Division of Water Resources)

June temperatures in North Carolina were much cooler than normal, despite a heat wave that began on the last few days of the month. Overall, June 2012 ranked as the 29th coolest June since1895. The last half of June was also drier with most of the state receiving 75% less than the normal rainfall for the month (Figure 3). Much of the Catawba River Basin received 25% to 75% of the estimated rainfall for the month.

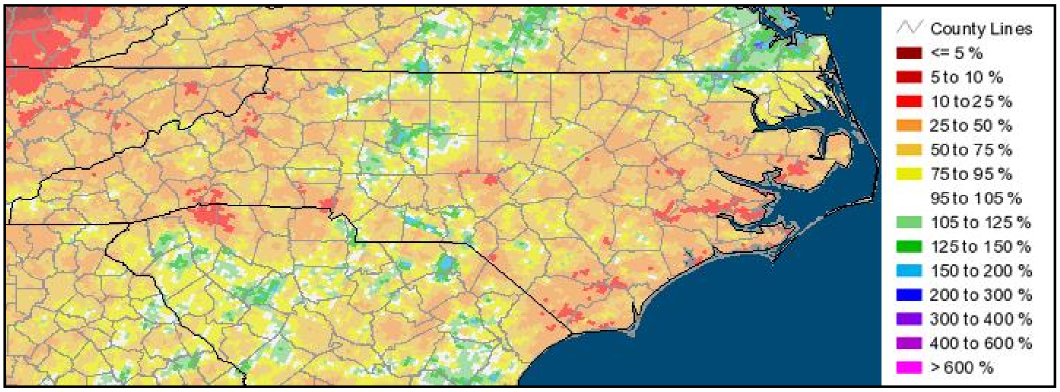

Figure 3. Precipitation for June 2012: Percent of Normal Based on Estimates From NWS Radar
(Data courtesy NWS/NCEP)

July 2012 remained warm and, overall, the temperatures for the month ranked as the 3rd warmest for the state since 1895. Rainfall was closer to normal for a typical July in the state (Figure 4).

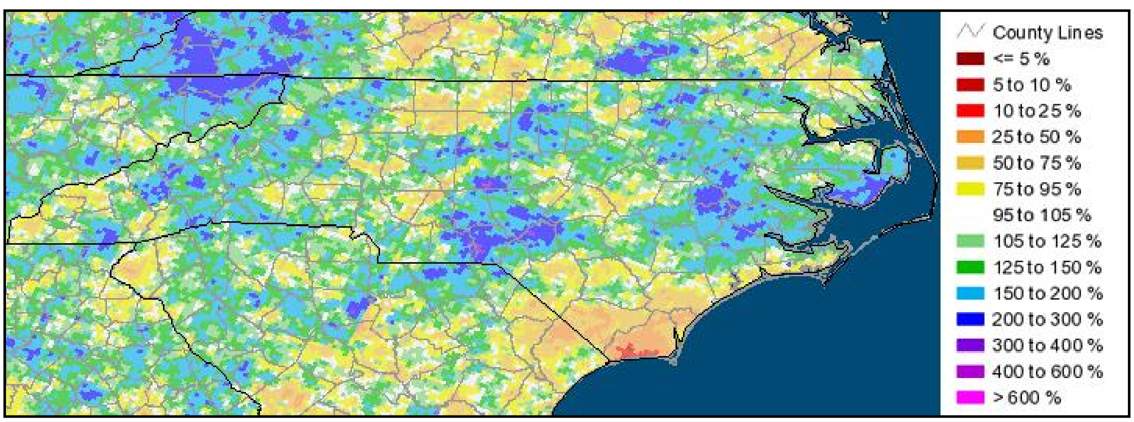

Figure 4. Precipitation for July 2012: Percent of Normal Based on Estimates From NWS Radar
(Data courtesy NWS/NCEP)

Although the southwestern region of the Catawba River Basin was in a moderate drought at the beginning of the month, the rainfall amounts improved conditions to abnormally dry in the southern part of the river basin by the end of the month (Figure 5).

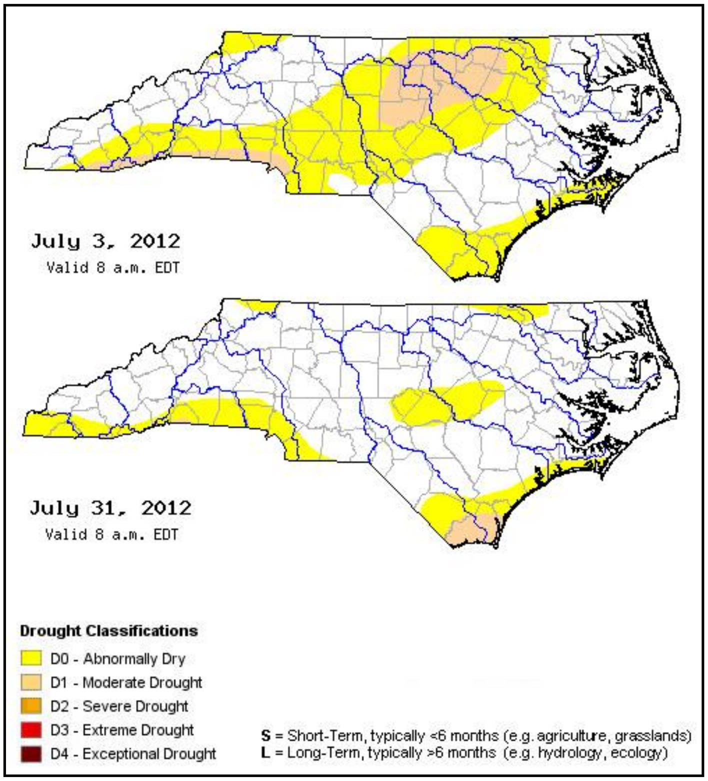

Figure 5. US Drought Monitor for North Carolina , July 2012
(Courtesy of NC DENR Division of Water Resources)

Temperatures in August 2012 averaged near normal in the state. Early August started out warmer while late August was cooler. Rainfall totals for the month were also closer to normal for the month, with wetter conditions occurring in the east and drier conditions present in the west. In August, some parts of the state experienced a few days of very heavy rainfall which resulted in localized flooding (Figure 6).

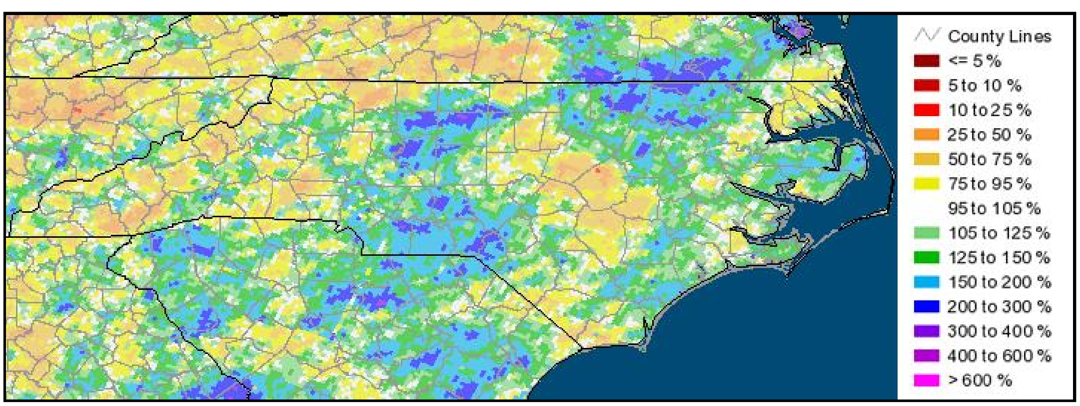

Figure 6. Precipitation for August 2012: Percent of Normal Based on Estimates From NWS Radar
(Data courtesy NWS/NCEP)

Drought conditions throughout the state were greatly diminished in August 2012 as compared to previous years. By the end of the month, only a few regions of abnormally dry conditions existed in the state, including the central region of the Catawba River Basin (Figure 7).

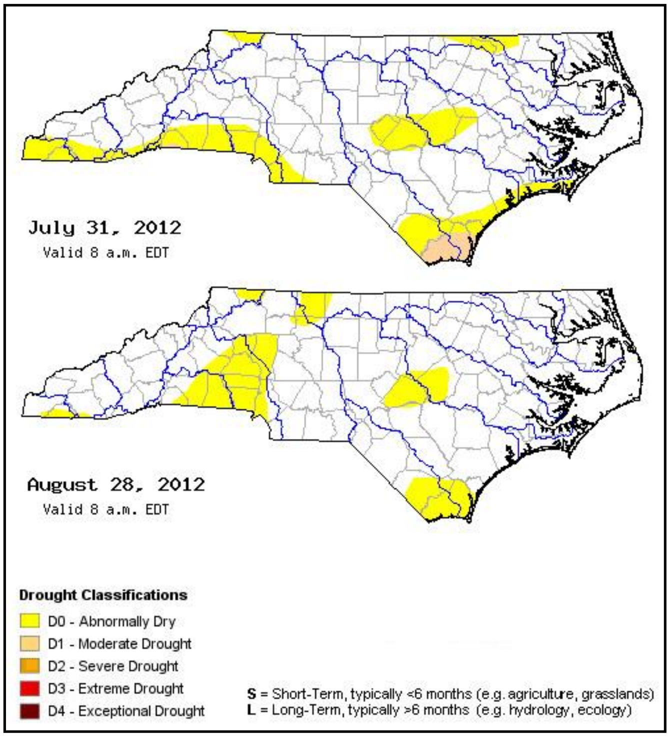

Figure 7. US Drought Monitor for North Carolina , August 2012
(Courtesy of NC DENR Division of Water Resources)

September storms brought substantial rainfall to central and western NC, while the coastal plain and southwestern corner of the state remained dry (Figure 8). Most of the Catawba River Basin received estimated rainfall amounts between 105% and 150% of normal for the month. The rainfall amounts helped to maintain stream and reservoir to at or near normal levels throughout most of the state. Temperatures were cooler than normal for the central piedmont and coastal plain and within the normal ranges for the mountains.

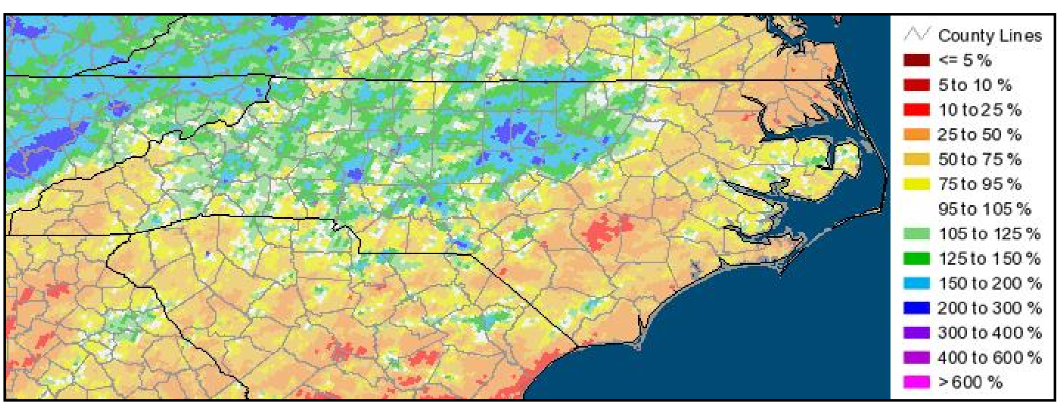

Figure 8. Precipitation for September 2012: Percent of Normal Based on Estimates From NWS Radar
(Data courtesy NWS/NCEP)

Drought conditions in the state continued to decline in September with abnormally dry conditions persisting in three isolated regions of the state (Figure 9). Abnormally dry conditions improved in the Catawba River Basin by the end of September.

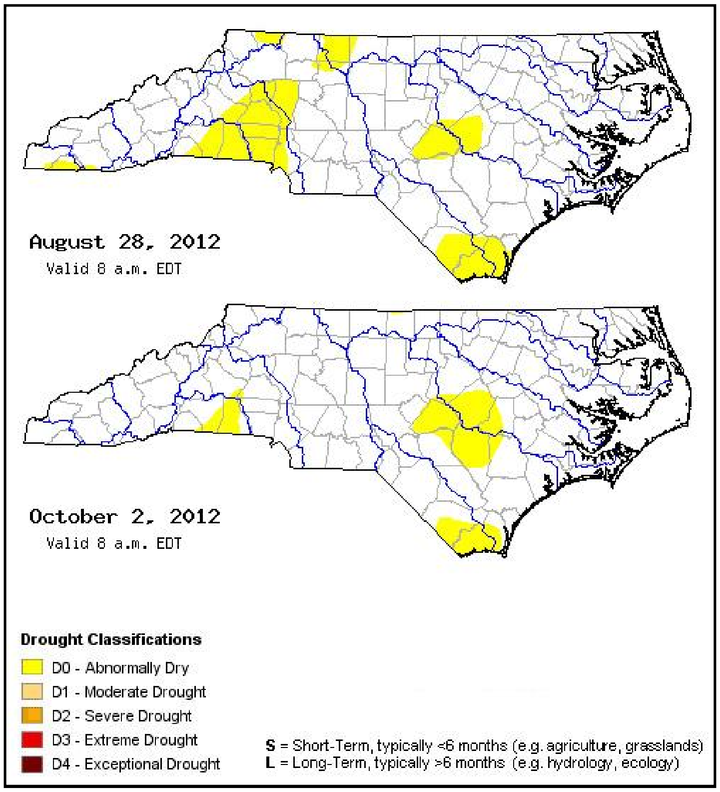

Figure 9. US Drought Monitor for North Carolina, September 2012
(Courtesy of NC DENR Division of Water Resources)

Lake James

Ambient Lakes Program Name	Lake James					
Trophic Status (NC TSI)	Oligotrophic					
Mean Depth (meters)	14.0					
Volume ($10^6 m^3$)	36.9					
Watershed Area (mi^2)	380					
Classification	WS-IV B C					
Stations	CTB013B	CTB013C	CTB015A	CTB015C	CTB023A1	CTB023B
Number of Times Sampled	5	5	5	5	5	5

Lake James is formed by the impoundment of the Catawba and Linville Rivers and is the most upstream reservoir of the Catawba Chain Lakes. The Catawba and Linville River portions of Lake James are joined by a small canal. Water flows from the Catawba River portion of Lake James through this canal into the Linville River side. Due to the shallowness of the canal as compared with the reservoir on either side, warm, oxygenated surface water from the Catawba River portions flows into the Linville River section during the summer months, and the colder, less oxygenated water is trapped within the Catawba River side of Lake James. Hypolimnetic water (the deeper, colder bottom water) from Lake James exits the reservoir from the Linville River portion. This leaves the warmer, more oxygenated water flowing in from the Catawba River. The result of these hydrologic dynamics produces distinct differences in the temperature profiles in each side of the reservoir.

DWQ staff monitored Lake James from May through September 2012. Secchi depths ranged from 0.8 meter at the upper end of the Catawba River arm of the reservoir (CTB013B) in May 2012 to 4.6 meters at the lower end of the Linville River arm (CTB023B) in June 2012 (Appendix A). Surface dissolved oxygen ranged from 6.8 to 9.1 mg/L and surface pH values ranged from 7.2 to 8.2 s.u. Surface conductivity values in 2012 were similar to those previously observed at this lake by DWQ staff.

Total phosphorus concentrations were generally below DWQ laboratory detection levels with the exception of values recorded for CTB013B in the upper end of the Catawba River arm. These values ranged from 0.04 mg/L in May to 0.02 mg/L in June, August and September. Total Kjeldahl nitrogen concentrations ranged from <0.2 mg/L to 0.28 mg/L. As with total phosphorus, the greatest total Kjeldahl nitrogen values were observed at CTB013B. Ammonia concentrations were <0.02 mg/L while nitrite plus nitrate ranged from <0.02 mg/L to 0.06 mg/L. Turbidity values were also similar to those previously observed for this reservoir, ranging from <1.0 mg/L to 14 mg/L. Chlorophyll *a* values in 2012 were similar to those previously observed in this reservoir, and ranged from 2.0 to 14.0 μg/L.

An algal sample analysis was conducted at four sampling sites on Lake James. These locations were located at the upper lake site in the Catawba River segment (CTB013B) and near the dam in the same segment (CTB015A), the upper sampling site in the Linville River segment (CTB023A1) and the site near the dam in this segment (CTB0015C). During the 2012 sampling period, algal blooms in both segments of the reservoir ranged from mild to severe. Algal assemblages remained diverse with golden-brown algae (chrysophytes), diatoms and bluegreen algae comprising the dominant algal groups in the Catawba and Linville River segments. Despite algal densities frequently above bloom levels, the biovolume of the algae in Lake James remained low, indicating a low potential for water quality problems associated with excessive algal productivity. In general a dominance of diatoms and chrysophytes in the algal assemblages are characteristic of cool, clear, oligotrophic water while the dominance of bluegreen algas are indicative of nutrient enrichment.

Water samples were collected from the six lake sampling sites on July 23, 2012 and shipped to the US Environmental Protection Agency Region IV Laboratory in Athens, Georgia for Algal Growth Potential Tests (AGPTs). This analysis determines which nutrients (nitrogen, phosphorus or both) are limiting in regards to algal productivity in the lake. One sample from Lake James was lost in transit to the lab, but the remaining five samples arrived intact. The results of the test are presented in Table 2. The three sampling sites located in the Linville River portion of Lake James were determined to be co-limited for both nitrogen and phosphorus. Two sites located in the Catawba River portion of the lake were found to be limited for one nutrient each; one site was nitrogen limited and one was phosphorus limited. Co-limitation for nitrogen and phosphorus is frequently observed in lake with exceptionally low inputs of nutrients.

Table 2. Algal Growth Potential Test Results for Lake James, July 23, 2012.

	Maximum Standing Crop, Dry Weight (mg/L)				
Station	Control	C+N	C+P	C+N+P	Limiting Nutrient
CTB013B	0.56	6.32	0.39		Nitrogen
CTB015A	0.11	0.11	0.74		Phosphorus
CTB015C	0.30	0.31	0.21	13.18	Nitrogen + Phosphorus
CTB023A1	0.19	0.21	0.29	14.50	Nitrogen + Phosphorus
CTB023B	0.16	0.16	0.21	8.86	Nitrogen + Phosphorus

Freshwater AGPT using *Selenastrum capricornutum* as test alga

C+N = Control + 1.0 mg/L Nitrate-N

C+P = Control + 0.05 mg/L Phosphate-P

C+N+P = Control + 1.0 mg/L Nitrate-N + 0.05 mg/L Phosphate-P

Based on the calculated NCTSI scores, Lake James was found to exhibit very low biological productivity (oligotrophic conditions). The invasive aquatic weed, *Hydrilla verticillata*, is present in Lake James. In an effort to control the spread of this plant in the reservoir, Duke Energy partnered with the Division of Water Resources Aquatic Weed Control Program to restock Lake James with 3,750 grass carp in 2012 (NCDWR, 2012).

References:

NCDWR. 2012. North Carolina Aquatic Weed Control Program, 2012 Work Plan. North Carolina Division of Water Resources. Raleigh, NC.
(http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/2012_work_plan.pdf)

Lake Rhodhiss

Ambient Lakes Program Name	Lake Rhodhiss		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	6.0		
Volume ($10^6 m^3$)	36.70		
Watershed Area (mi^2)	1090.0		
Classification	WS-IV CA		
Stations	CTB034A	CTB040A	CTB040B
Number of Times Sampled	10	10	10

Lake Rhodhiss is a run-of-the-river reservoir located on the Catawba River downstream of Lake James and upstream of Lake Hickory. Constructed in 1925 and owned by Duke Energy, Lake Rhodhiss has a mean residence time of 21 days. This reservoir is used for hydropower generation, as a water supply, and for public recreation.

DWQ staff monitored Lake Rhodhiss from May through September, 2011 and 2012. Secchi depths ranged from 0.6 to 2.1 meters with the lowest Secchi depths frequently observed at the most upstream lake sampling site (CTB034A) in 2011 and 2012. Surface dissolved oxygen ranged from 6.8 to 10.7 mg/L and surface pH values ranged from 7.2 to 9.2 s.u. (Appendix A). Lake Rhodhiss had been placed on the 303(d) List of Impaired waters in 2006 for elevated pH values. Only one value in the two years of monitoring exceeded this water quality standard. Conductivity values were similar to those observed in other Catawba River chain lakes, ranging from 52 to 75 μmhos/cm.

Total phosphorus concentrations in Lake Rhodhiss in 2011 and 2012 ranged from 0.02 to 0.08 mg/L. Lake Rhodhiss had the greatest total phosphorus values of all the Catawba River chain lakes in 2012, including Lake Wylie. Total Kjeldahl nitrogen ranged from 0.22 to 0.72 mg/L and ammonia ranged from <0.02 to 0.09 mg/L. Nitrite plus nitrate in Lake Rhodhiss ranged from <0.02 to 0.29 mg/L in 2011 and 2012. The availability of nutrients in this reservoir supported algal productivity which was reflected in chlorophyll *a* values that ranged from 3.2 to 49 μg/L at the upstream lake sampling site (CTB034A) on July 19, 2012. This value was greater than the state water quality standard of 40 μg/L for chlorophyll *a*.

Overall these chlorophyll *a* values were lower than those previously observed in this reservoir in 2007 and 2002.

Field notes by DWQ staff noted that the water in Lake Rhodhiss appeared consistently green in color, but no algal mats or flecks were observed. Algal assemblages were assessed in 2012 at two lake sampling sites in this lake ï the upper reservoir sampling site (CTB040A) and the sampling site near the dam (CTB040B). The lowest algal densities were observed in June and the highest densities (at severe blooms levels or greater than 40,000 units/ml) were observed in August. Diatoms dominated the blooms in the early part of the 2012 sampling period, but shifted to a predominance of bluegreen algae, most specifically *Cylindrospermopsis*, in the latter growing season months. Algal densities were greater in 2012 as compared with those observed in 2011. Severe to extreme algal blooms of bluegreen algae are indicative of water quality problems associated with this excessive phytoplankton productivity (such as taste and odor problems in processed drinking water).

Water samples collected from the three lake sampling sites on July 6, 2011 and July 19, 2012 were shipped to the US Environmental Protection Agency Region IV Laboratory in Athens, Georgia for Algal Growth Potential Tests (AGPTs). This analysis determines which nutrients (nitrogen, phosphorus or both) are limiting in regards to algal productivity in the lake. The results of these tests are presented in Table 3 below. All three lake sites were determined to be limited for nitrogen (i.e., an increase in nitrogen in Lake Rhodhiss would support nuisance algal blooms) in 2011 and 2012.

Table 3. Algal Growth Potential Test Results for Lake Rhodhiss, July 2011 and July 2012.

July 6, 2011

	Maximum Standing Crop, Dry Weight (mg/L)			
Station	Control	C+N	C+P	Limiting Nutrient
CTB034A	9.70	13.90	10.70	Nitrogen
CTB040A	1.10	10.00	0.71	Nitrogen
CTB040B	0.85	2.50	0.59	Nitrogen

July 19, 2012

	Maximum Standing Crop, Dry Weight (mg/L)			
Station	Control	C+N	C+P	Limiting Nutrient
CTB034A	1.94	13.11	1.70	Nitrogen
CTB040A	1.33	6.13	1.25	Nitrogen
CTB040B	1.52	2.73	1.16	Nitrogen

Freshwater AGPT using *Selenastrum capricornutum* as test alga

C+N = Control + 1.0 mg/L Nitrate-N

C+P = Control + 0.05 mg/L Phosphate-P

Based on the calculated NCTSI scores for 2011 and 2012, Lake Rhodhiss was determined to exhibit moderate biological productivity (or mesotrophic conditions) in May, June and July of 2011. In August and September, 2011 and from May through September, 2012, Lake Rhodhiss exhibited elevated biological productivity or eutrophic conditions. Historically, DWQ monitoring of this lake determined that this lake was eutrophic each year it was sampled with the exception of 1989 when the calculated trophic state indicated mesotrophic conditions were present.

Lake Hickory

Ambient Lakes Program Name	Lake Hickory			
Trophic Status (NC TSI)	Mesotrophic			
Mean Depth (meters)	10.0			
Volume ($10^6 m^3$)	16.60			
Watershed Area (mi^2)	1310.0			
Classification	WS-IV B CA			
Stations	CTB048A	CTB056A	CTB058C	CTB058D
Number of Times Sampled	5	5	5	5

Lake Hickory is located immediately downstream of Lake Rhodhiss on the Catawba River. This reservoir, which is owned by Duke Energy, has an average retention time of 33 days and a maximum depth of 18 meters. DWQ field staff monitored this reservoir from May through September, 2012. New residential development was observed by DWQ field staff along the shoreline of the lake.

Secchi depths in 2012 ranged from 1.3 to 2.4 meters. Surface dissolved oxygen ranged from 5.7 mg/L at the sampling site located at the upper end of the reservoir (CTB048A) on October 3, 2012 to 9.8 mg/L at the same sampling site on May 7, 2012 (Appendix A.). The low dissolved oxygen reading in October was an indication of the turnover of the reservoir due cooling air temperatures. Water temperatures in Lake Hickory on that day were not stratified at the four lake sampling sites, which was another indicator of the turnover event. Surface pH values in Lake Hickory ranged from 6.9 to 8.7 s.u. and surface conductivity ranged from 52 to 60 μmhos/cm.

Total phosphorus ranged from <0.02 to 0.04 mg/L and total Kjeldahl nitrogen ranged from 0.24 to 0.45 mg/L. Ammonia concentrations ranged from <0.02 to 0.06 mg/L and nitrite plus nitrate ranged from <0.02 to 0.13 mg/L. The greatest concentrations of ammonia and nitrite plus nitrate were observed at the most upstream sampling site, (CTB048A) on October 3, 2012 and were related to lake turnover exchanging the nutrient-rich bottom water with lower nutrient surface water.

Chlorophyll *a* values in Lake Hickory ranged from 3.7 μg/L at the upper end of the lake in October to 18.0 μg/L at the same sampling site in June. These values were slightly lower than the chlorophyll *a* values observed in 2007. Phytoplankton samples collected at two sampling sites in Lake Hickory, the upper lake site (CTB048A) and the site near the dam (CTB058D), were analyzed in 2012. Moderate to severe algal blooms occurred in May, June and August based on algal unit densities. These blooms were dominated by bluegreen algas, either as multiple taxa or by single taxa such as *Planktolyngbya*, *Cylindrospermopsis* or *Chroococcus*. The fluctuating densities and dominance of these bluegreen algas suggest Lake Hickory may periodically experience water quality issues such as elevated pH or taste and odor problems in processed drinking water.

Based on the calculated NCTSI scores for 2012, Lake Hickory was determined to exhibit moderate biological productivity (mesotrophic conditions). The Town of Longview cooperated in the North Carolina Aquatic Weed Control Program in 2012 to survey and apply herbicides in a half acre area of Lake Hickory to control Creeping Water Primrose (*Ludwigia grandiflora*; NCDWR, 2012)..

References:

NCDWR. 2012. North Carolina Aquatic Weed Control Program, 2012 Work Plan. North Carolina Division of Water Resources. Raleigh, NC.
(http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/2012_work_plan.pdf)

Lookout Shoals Lake

Ambient Lakes Program Name	Lookout Shoals Lake		
Trophic Status (NC TSI)	Mesotrophic		
Mean Depth (meters)	9.0		
Volume ($10^6 m^3$)	4.60		
Watershed Area (mi^2)	1450.0		
Classification	WS-IV B CA		
Stations	CTB0581F	CTB058F	CTB058G
Number of Times Sampled	5	5	5

Lookout Shoals Lake is one of the smaller Catawba chain lakes with a surface area of 1,270 acres and 39 miles of shoreline. The lake is owned by Duke Energy and is located between Lake Hickory and Lake Norman on the Catawba River. Construction of the Lookout Shoals Dam was begun in 1914 and was completed in 1916, making it the first dam built on the Catawba River in North Carolina by J. B. Duke. Lookout Shoals Lake has a maximum depth of 18.3 meters and a mean hydraulic retention time of nine days, the shortest of any lake in the Catawba River basin. The waters of the lake are used to generate electricity at the Lookout Shoals Hydroelectric plant as well as for public recreation.

Lookout Shoals Lake was monitored by DWQ staff once a month from May through September 2012. Secchi depths were consistently greater than a meter, ranging from 1.1 to 2.1 meters (Appendix A). Surface dissolved oxygen ranged from 5.3 to 9.3 mg/L and pH values ranged from 7.2 to 8.7 s.u. Conductivity ranged from 50 to 61 μmhos/cm.

Total phosphorus concentrations were 0.02 mg/L with the exception of a value of 0.03 mg/L at CTB0581F located in the upper end of the reservoir in Alexander County in September (Appendix A). Total Kjeldahl nitrogen in Lookout Shoals Lake ranged from 0.23 to 0.39 mg/L while ammonia and nitrite plus nitrate concentrations ranged from <0.02 mg/L to 0.12 mg/L. Chlorophyll *a* values for Lookout Shoals Lake ranged from 4.4 to 19.0 μg/L and were well below the state water quality standard of 40 μg/L. Phytoplankton samples collected near the dam (CTB058G) were assessed in 2012. Algal densities were low with mild bluegreen blooms occurring in June and August. No particular taxa of bluegreen algas dominated these samples.

Based on the calculated NCTSI scores for 2012, Lookout Shoals Lake was determined to exhibit moderate biological productivity (mesotrophic conditions). The trophic state of this reservoir has varied from oligotrophic (2002) to eutrophic since it was first monitored by DWQ in 1981.

Lake Norman

Ambient Lakes Program Name	Lake Norman						
Trophic Status (NC TSI)	Oligotrophic						
Mean Depth (meters)	10.0						
Volume ($10^6 m^3$)	131.5						
Watershed Area (mi^2)	1790						
Classification	WS-IV B CA						
Stations	CTB079A	CTB082A	CTB082AA	CTB082B	CTB082BB	CTB082M	CTB082Q	CTB082R
Number of Times Sampled	5	5	5	5	5	5	5	5

Lake Norman, North Carolina's largest man-made lake is located between Lookout Shoals Lake and Mountain Island Lake on the Catawba River. Owned by Duke Energy, Lake Norman is used to generate electricity at Cowans Ford Dam, the Marshall Steam Station and McGuire Nuclear Station. This reservoir is also a popular public recreation lake. Recreational activities include fishing, boating and swimming.

Lake Norman was monitored by DWQ staff once a month from May through September 2012. Secchi depths, a measure of water clarity, ranged from 1.0 to 4.0 meters (Appendix A). Surface dissolved oxygen ranged from 5.5 to 8.8 mg/L and surface water temperatures ranged from 24.5 °C to 34.6 °C. The warmest water temperatures for Lake Norman were observed in late June through July. Surface pH values in the reservoir ranged from 6.2 to 8.0 s.u and surface conductivity ranged from 56 to 71 µmhos/cm.

Nutrient concentrations in Lake Norman were similar to those previously recorded for this reservoir by DWQ. Total phosphorus ranged from <0.02 to 0.03 mg/L and total Kjeldahl nitrogen ranged from <0.20 to 0.40 mg/L. Ammonia concentrations ranged from <0.02 to 0.11 mg/L and nitrite plus nitrate ranged from <0.02 to 0.15 mg/L. Chlorophyll *a* values in 2012 ranged from 2.4 to 23 µg/L. These values were within range of those previously observed in this lake. Phytoplankton samples collected at three sites ï the uppermost lake sampling site (CTB082B), the mid-lake sampling site (CTB082R) and the sampling site near the dam (CTB082BB) ï were analyzed in 2012. Algal unit densities were greatest at the upper lake sampling site in May, June and September while a severe algal bloom based on cell densities occurred near the dam in July (33,000 units/ml). The majority of the algal blooms in Lake Norman were dominated by the small colonial bluegreen *Aphanothece*. Despite the evidence of algal blooms based on unit densities, the algae present were small with a relatively low biomass.

Based on the 2012 calculated NCTSI scores, Lake Norman exhibited very low biological productivity (oligotrophic conditions) in June, August and September and moderate biological productivity (mesotrophic conditions) in May and August. In 2012, Lake Norman was re-stocked with approximately 1,200 sterile grass carp as part of an ongoing effort to control the aquatic weed, *Hydrilla verticillata* (NCDWR, 2012).

Duke Energy monitors Lake Norman in accordance with NPDES permit number NC0024392 for the McGuire Nuclear Station (Duke Energy, December 2011). Assessments of macroinvertebrates and fish populations in Lake Norman are also conducted in accordance with an agreement with the North Carolina Department of Environment and Natural Resources (NCDENR) in support of permitted thermal limits for the Marshall Steam Station located on Lake Norman. The Marshall Steam Station is located on the western shore of Lake Norman in Catawba County and operates four power generating units which receive once-through condenser cooling water from below a skimmer wall located at the mouth of a 1.3 mile long cove (Duke Energy, October 2009).

The Marshall Steam Station operated continuously from 2004 through 2008. Monthly average discharge water temperatures from this facility were in compliance with the NPDES permitted thermal limits of 93.9 °F (34.4 °C) July 1 through October 31 and 91.9 °F (33.3 °C) the rest of the year of this five year period (Duke Energy, October 2009). Both temporal and spatial trends in dissolved oxygen and water temperature in 2010 were similar to historically observed values and were within range of previous measurements made by Duke Energy. Lake chemical parameters measured in 2010 were similar to 2009 values and within concentration ranges previously reported during preoperational and operational years of the Marshal Steam Station. All values for lead, cadmium, copper and zinc in 2010 were below the North Carolina water quality standards or action levels (Duke Energy, December 2011).

References:

Duke Energy. October 2009. Assessment of Balanced and Indigenous Populations in Lake Norman near Marshall Steam Station. NPDES Permit No. NC0004987. McGuire Environmental Center, Huntersville, NC.

Duke Energy. December 2011. Lake Norman Maintenance Monitoring Program: 2010 Summary. McGuire Nuclear Station: NPDES No. NC0024392. McGuire Environmental Center, Huntersville, NC.

NCDWR. 2012. North Carolina Aquatic Weed Control Program, 2012 Work Plan. North Carolina Division of Water Resources. Raleigh, NC.
(http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/2012_work_plan.pdf

Mountain Island Lake

Ambient Lakes Program Name	Mountain Island Lake					
Trophic Status (NC TSI)	Oligotrophic					
Mean Depth (meters)	5.0					
Volume ($10^6 m^3$)	71.0					
Watershed Area (mi^2)	1860					
Classification	WS-IV B CA					
Stations	CTB083B	CTB086A	CTB086B	CTB086C	CTB087	CTB087A
Number of Times Sampled	5	5	5	5	5	5

Mountain Island Lake is owned by Duke Energy and receives the outflow of Lake Norman upstream. The lake was filled when construction on the Mountain Island Hydroelectric Station was completed in 1924. Mountain Island is a relatively small and narrow lake with a surface area of 3,235 acres and 61 miles of shoreline. The lake has a mean hydraulic retention time of only ten days. Mountain Island Lake is a water supply source for the City of Charlotte and is used by Duke Energy to generate electricity at both the Riverbend Steam Station and the Mountain Island Steam Station.

Mountain Island Lake was monitored by DWQ staff once a month from May through September 2012. Secchi depths ranged from 0.9 to 3.1 meters in 2012 and surface dissolved oxygen ranged from 6.1 to 8.6 mg/L (Appendix A). Surface water temperatures ranged from 22.4 to 31.8 °C and surface pH values ranged from 7.2 to 7.9 s.u.

Total phosphorus concentrations in Mountain Island Lake were generally at or below DWQ laboratory detection levels as were the concentrations of ammonia. Total Kjeldahl nitrogen ranged from <0.20 to 0.48 mg/L and nitrite plus nitrate values ranged from <0.02 to 0.36 mg/L. Chlorophyll *a* values ranged from 1.2 to 15.0 µg/L. In 2012, algal assemblages were assessed at the upper lake sampling site (CTB083B) and at the sampling site near the dam (CTB087A). Algal densities were low with a mild bloom of diatoms observed in samples collected near the dam in August. The assemblages of algae were diverse with the dominant taxa shifting between golden-brown algas (chrysophytes), diatoms and bluegreen algae (primarily the of the taxa *Aphanocapsa* and *Chroococcus*).

Based on the calculated NCTSI scores for 2012, Mountain Island Lake was determined to have very low biological productivity (oligotrophic conditions) in May, June and September, and moderate biological productivity (mesotrophic conditions) in July and August. Overall, the lake was evaluated as oligotrophic. Mountain Island Lake has fluctuated between oligotrophic and mesotrophic states since it was first monitored by DWQ in 1981.

Mountain Island Lake was previously monitored by DWQ in 2010 as part of a follow-up to public concerns regarding the water quality of the lake following listing on the 303(d) List of Impaired Surface Waters in 2008 for low pH (http://portal.ncdenr.org/web/wq/ps/mtu/assessment). Water quality monitoring of Mountain Island Lake by DWQ field staff in 2010 determined that values for surface pH were within the state's water quality standards (i.e., values were not less than 6.0 s.u. or greater than 9.0 s.u.). As a result of this sampling effort, this lake was removed from the 303(d) List for 2012.

On January 6, 2011, fish consumption advisories were placed on channel catfish and largemouth bass in Mountain Island Lake. Channel catfish were found to have elevated levels of PCBs (polychlorinated biphenyls) and largemouth bass had elevated levels of mercury. More information regarding the advisories can be found at http://epi.publichealth.nc.gov/fish/current.html .

Annual monitoring of macroinvertebrates and fish in Mountain Island Lake is conducted by Duke Energy to assess potential impacts of the Riverbend Steam Station condenser cooling water discharge on balanced and indigenous aquatic populations in the lake. These studies are conducted per an agreement with the North Carolina Department of Environment and Natural Resources (NCDENR). A study report was prepared by Duke Energy to compare monitoring data collected in 2004 through 2008 with past studies (Duke Energy, August 2009). The Riverbend Steam Station is located northwest of Charlotte, NC in Gaston County on Mountain Island Lake. The facility went into operation in 1929 and currently operates four coal-fired units which use the lake as a source of once-through condenser cooling water. Water quality and biological monitoring data are collected each year from established sampling sites on the lake, upstream of, with in the immediate influence of and downstream of the steam station thermal discharge.

During the 2004 through 2008 period, water quality in Mountain Island Lake was similar to that observed by Duke Energy in previous years. Nutrient concentrations, lake-wide, were similar to historic levels and continued to result in the lake being classified as oligotrophic. Concentrations of dissolved and suspended sediments as well as nutrients entering the lake from the McDowell Creek drainage were slightly lower during the study period as compared with previous years. Seasonal lake thermal stratification and dissolved oxygen concentrations were consistent with historic ranges observed in Mountain Island Lake (Duke Energy, August 2009).

Reference:

Duke Energy. August 2009. Assessment of Balanced and Indigenous Populations in Mountain Island Lake near Riverbend Steam Station. NPDES Permit No. NC0004961. McGuire Environmental Center, Huntersville, NC.

Lake Wylie

Ambient Lakes Program Name	Lake Wylie							
Trophic Status (NC TSI)	Eutrophic							
Mean Depth (meters)	7.0							
Volume ($10^6 m^3$)	35.3							
Watershed Area (mi^2)	3020							
Classification	WS-IV, V B CA							
Stations	CTB103	CTB105B	CTB174	CTB177	CTB178	CTB198B5	CTB198C5	CTB198D
Number of Times Sampled	5	5	5	5	5	5	5	5

Lake Wylie is a man-made impoundment which was constructed in 1904 with a hydroelectric dam located near Fort Mills, South Carolina. The dam was rebuilt in 1924, creating the present shoreline with the upper portion of the lake in North Carolina and the majority of the lower portion in South Carolina. The lake is owned by Duke Energy and is located in Gaston and Mecklenburg Counties in North Carolina and York County in South Carolina. Major tributaries to Lake Wylie including the Catawba River, the South Fork Catawba River, Crowders Creek, Catawba Creek and Allison Creek. This lake is used to generate electricity and for public recreation.

Lake Wylie was monitored by DWQ field staff once a month from May through September, 2012. Surface dissolved oxygen during the 2012 sampling season ranged from 5.6 to 10.7 mg/L and surface pH ranged from 7.1 to 8.7 s.u. (Appendix A). Secchi depths ranged from 0.7 to 1.9 meters. These Secchi depths were similar to those previously observed in Lake Wylie by DWQ field staff and were suggestive of limited light penetration into the water column. Staff field observation indicated that the lake water appeared green to green-brown in color.

Total phosphorus concentrations ranged from 0.02 to 0.06 mg/L, total Kjeldahl nitrogen ranged from 0.23 to 0.62 mg/L and total organic nitrogen ranged from 0.22 to 0.64 mg/L. The ready availability of nutrients in Lake Wylie supported algal productivity as reflected by the chlorophyll *a* values which ranged from 4.9 to 38 μg/L, none of which exceeded the state water quality standard of 40 μg/L. Phytoplankton samples were analyzed for three lake sampling sites, CTB198B5 in the Crowders Creek Arm, CTB178 located mid-lake and CTB198D near the dam. Moderate to severe blooms based on algal cell densities occurred during the early summer sampling period (May and June) but were not dominated by a particular algal group. July and August samples were dominated with blue-green algae by unit density but not by biovolume. The frequency and magnitude of algal blooms in Lake Wylie based on phytoplankton analysis suggest that this reservoir is susceptible to water quality issues associated with excessive algal productivity.

Results of an Algal Growth Potential Test conducted by the EPA Region IV laboratory with water samples collected on July 2, 2012 indicated that the lake at these four sampling sites was limited for the nutrient, nitrogen (Table 4).

Table 4. Algal Growth Potential Test Results for Lake Wylie, July 2, 2012

	Maximum Standing Crop, Dry Weight (mg/L)			
Station	Control	C+N	C+P	Limiting Nutrient
CTB105B	3.52	7.21	3.68	Nitrogen
CTB174	6.70	11.99	6.81	Nitrogen
CTB178	2.08	6.85	1.88	Nitrogen
CTB198D	1.74	4.49	1.54	Nitrogen

Freshwater AGPT using *Selenastrum capricornutum* as test alga

C+N = Control + 1.0 mg/L Nitrate-N

C+P = Control + 0.05 mg/L Phosphate-P

C+N+P = Control + 1.0 mg/L Nitrate-N + 0.05 mg/L Phosphate-P

The invasive aquatic weed, *Hydrilla verticillata*, is present in Lake James. In an effort to control the spread of this plant in the reservoir, Duke Energy partnered with the Division of Water Resources Aquatic Weed Control Program to restock Lake James with 3,750 grass carp in 2012 (NCDWR, 2012).

Based on the calculated NCTSI scores for 2012, Lake Wylie was determined to have elevated biological productivity or eutrophic conditions on the days it was sampled. This reservoir has been found to be consistently eutrophic since it was first monitored by DWQ in 1981.

Annual monitoring of macroinvertebrates and fish is conducted by Duke Energy at selected locations in Lake Wylie in the vicinity of the Allen Steam Station. The purpose of this monitoring is to assess these organisms in respect to the operation of the steam station and to evaluate the renewal of thermal limits in the station's NPDES permit. Data collected from 2004 through 2008 were reviewed and compared with data previously collected at Lake Wylie. The Allen Steam Station is located on Lake Wylie in Gaston County and consists of five fossil-fueled steam generating units. This facility began operation in 1957 with the fifth steam generating unit added in 1961 (Duke Energy, November 2009).

Water quality monitoring for the Allen Steam Station consisted primarily of thermal and dissolved oxygen monitoring. The Lake Wylie thermal profile in August 2008 indicated temperatures were generally similar to seasonal conditions previously observed in the lake. The dissolved oxygen profiles in August 2008 were also consistent with recent historical trends with the exception of the near surface concentrations which were similar to slightly lower than the previous historical minima. These dissolved oxygen readings, however, were greater than the instantaneous 4.0 mg/L dissolved oxygen standard. The 2008 operation of a temporary condenser cooling water bypass system at the Allen Steam Station did not appreciably affect Lake Wylie water quality (Duke Energy, November 2009).

References:

Duke Energy. November 2009. Assessment of Balanced and Indigenous Populations in Lake Wylie near Allen Steam Station. NPDES Permit No. NC0004979. McGuire Environmental Center, Huntersville, NC.

NCDWR. 2012. North Carolina Aquatic Weed Control Program, 2012 Work Plan. North Carolina Division of Water Resources. Raleigh, NC.
(http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/2012_work_plan.pdf)

LAKE & RESERVOIR ASSESSMENTS

HUC 03050102

Newton City Lake

Ambient Lakes Program Name	Newton City Lake
Trophic Status (NC TSI)	Oligotrophic
Mean Depth (meters)	2.5
Volume ($10^6 m^3$)	0.10
Watershed Area (mi^2)	100.0
Classification	WS-III CA
Stations	CTBNCL1
Number of Times Sampled	5

Newton City Lake is a small water supply reservoir located on an unnamed tributary of Clark Creek. Constructed in the 1930, the watershed is forested close to the lake with some residential development.

This reservoir was monitored by DWQ field staff once a month from May through September, 2012. Secchi depths ranged from 1.2 to 2.4 meters and surface dissolved oxygen ranged from 6.7 to 7.5 mg/L (Appendix A). Surface pH values in 2012 ranged from 5.6 to 7.1 s.u. The surface pH value observed in August was the lowest value recorded for this small reservoir since it was first monitored by DWQ in 1992 as well as being below the state water quality standard of 6.0 s.u.

Total phosphorus concentrations in Newton City Lake were at or below DWQ laboratory detection levels. Total Kjeldahl nitrogen ranged from 0.20 to 0.30 mg/L and ammonia ranged from <0.02 to 0.04 mg/L. Chlorophyll *a* values in 2012 ranged from 1.2 to 2.6 µg/L. Lake turbidity ranged from 3.6 to 7.6 NTUs. Staff field notes indicated that Newton City Lake's water appeared clear and slightly green in color. However, no algal mats or flecks were seen in the water. These observations, along with the low chlorophyll *a* values were indicative of very low algal productivity in the lake. Algal assemblages were assessed from samples collected near the dam. Algal unit densities were consistently low with only a mild algal bloom noted in June (14,000 units/ml). The assemblages were dominated by golden-brown algas (chrysophytes) and bluegreens by unit density, and dominated by green algas and diatoms by biovolume.

Based on the calculated NCTSI scores for 2012, Newton City Lake was determined to exhibit low biological productivity or oligotrophic conditions. This lake has been consistently oligotrophic since it was first monitored in 1992.

Bessemer City Lake

Ambient Lakes Program Name	Bessemer City Lake
Trophic Status (NC TSI)	Oligotrophic
Mean Depth (meters)	3.0
Volume ($10^6 m^3$)	0.02
Watershed Area (mi^2)	0.4
Classification	WS-II HQW CA
Stations	CTBBCL1
Number of Times Sampled	5

This small impoundment is the water supply source for Bessemer City in Gaston County. The drainage area is approximately one square kilometer, and is characterized by rolling hills. Land use in the watershed is mostly forest with small residential and agricultural areas. Public access to this lake is restricted.

Bessemer City Lake was monitored by DWQ staff once a month from May through September, 2012. Surface dissolved oxygen ranged from 6.6 to 8.1 mg/L and surface pH values ranged from 7.1 to 8.5 s.u. (Appendix A). The highest surface dissolved oxygen and pH values were observed in August and may have been suggestive of increased algal productivity. Notes by field staff indicate that the lake water appeared slightly green in color on this sampling date, but no algal mats or flecks in the water were observed. Secchi depths in Bessemer City Lake in 2012 ranged from 1.9 to 2.9 meters, indicating good water clarity. Turbidity values, which ranged from 2.1 to 2.6 NTUs, correlate with Secchi depth observations.

Total phosphorus, ammonia and nitrite plus nitrate concentrations ranged from <0.02 to 0.02 mg/L. Total Kjeldahl nitrogen concentrations ranged from 0.23 to 0.36 mg/L. Chlorophyll *a* values ranged from 2.4 to 9.1 μg/L, with the highest value observed in September. Phytoplankton samples collected at the sampling site near the dam were analyzed in 2012. Algal unit densities fluctuated between non-bloom conditions to moderate blooms conditions. The mild bloom observed in May was dominated by small bluegreen algas (*Chroococcus*) while a moderate bloom in August was dominated by green algas (*Coelastrum*). By biovolume, the September phytoplankton sample was dominated by the taxa *Botryococcus*, which are known to form surface blooms which may discolor the water green or orange.

Bessemer City Lake was determined to exhibit very low biological productivity, or oligotrophic conditions, based on the calculated NCTSI scores for 2012. This lake has exhibited predominantly oligotrophic conditions since it was first monitored by DWQ in 1990.

Appendix A - Catawba River Basin Data
January 1, 2008 Through December 31, 2012

	SURFACE PHYSICAL DATA								PHOTIC ZONE DATA											
Lake	Date	Sampling Station	DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	TP mg/L	TKN mg/L	NH3 mg/L	NOx mg/L	TN mg/L	TON mg/L	TIN mg/L	Chla µg/L	Solids Total mg/L	Total Solids Suspended mg/L	Turbidity NTU	Total Hardness mg/L
LAKE JAMES	September 11, 2012	CTB013B	8.0	26.0	7.7	60	1.3	98.6%	0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	14.0	54	<6.2	3.1	
	September 11, 2012	CTB013C	7.2	26.4	7.6	60	2.8	89.4%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.4	48	<6.2	1.2	
	September 11, 2012	CTB015A	6.9	26.7	7.4	59	3.3	86.2%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.0	46	<6.2	<1.0	
	September 11, 2012	CTB015C	6.8	26.1	7.4	53	3.1	84.0%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.0	42	<6.2	1.3	16.0
	September 11, 2012	CTB023A1	7.3	26.7	7.5	52	2.8	91.1%	<0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	5.3	40	<12	1.2	
	September 11, 2012	CTB023B	7.0	26.8	7.4	52	3.8	87.6%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.4	41	<6.2	1.2	
	August 20, 2012	CTB013B	8.1	27.7	7.6	58	1.2	103.0%	0.02	0.28	<0.02	<0.02	0.29	0.27	0.02	11.0	47	<6.2	5.8	
	August 20, 2012	CTB013C	7.5	27.7	7.7	59	2.7	95.3%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	5.3	44	<6.2	1.3	
	August 20, 2012	CTB015A	8.1	27.6	7.9	57	2.5	102.8%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	5.2	42	<6.2	1.5	
	August 20, 2012	CTB015C	7.6	27.5	7.7	53	3.1	96.3%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.4	41	<6.2	1.3	16.0
	August 20, 2012	CTB023A1	7.5	27.6	7.5	52	2.3	95.2%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	6.3	36	<6.2	2.1	
	August 20, 2012	CTB023B	7.6	27.7	7.8	51	2.6	96.6%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	5.5	36	<12	1.3	
	July 23, 2012	CTB013B	7.8	29.3	7.4	59	1.7	102.0%	0.03	0.24	<0.02	<0.02	0.25	0.23	0.02	9.6	48	<12	3.6	
	July 23, 2012	CTB013C	7.4	29.8	7.5	58	3.9	97.6%	0.02	<0.2	<0.02	0.06	0.16	0.09	0.07	4.1	44	<6.2	3.2	
	July 23, 2012	CTB015A	7.3	29.5	7.4	55	3.8	95.8%	<0.02	<0.2	<0.02	0.02	0.12	0.09	0.03	3.9	43	<6.2	1.4	
	July 23, 2012	CTB015C	7.1	28.8	7.2	53	3.1	92.0%	<0.02	<0.2	<0.02	<0.02	0.11	0.09	0.02	2.5	36	<6.2	1.6	15.0
	July 23, 2012	CTB023A1	7.0	29.3	7.5	51	4.0	91.5%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	2.6	34	<6.2	1.0	
	July 23, 2012	CTB023B	7.4	29.1	7.4	52	3.8	96.4%	<0.02	<0.2	<0.02	<0.02	0.11	0.09	0.02	3.0	37	<6.2	1.3	
	June 21, 2012	CTB013B	7.9	29.2	8.2	57	1.5	103.1%	0.02	0.22	<0.02	<0.02	0.23	0.21	0.02	5.2	42	<6.2	2.6	
	June 21, 2012	CTB013C	7.9	28.9	8.1	56	3.3	102.6%	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	4.3	40	<6.2	1.8	
	June 21, 2012	CTB015A	8.0	28.7	7.9	57	3.8	103.5%	<0.02	<0.2	<0.02	<0.02	0.11	0.09	0.02	3.2	39	<12	1.2	
	June 21, 2012	CTB015C	8.0	28.6	8.1	54	4.3	103.3%	<0.02	<0.2	<0.02	<0.02	0.11	0.09	0.02	2.0	36	<6.2	1.0	15.0
	June 21, 2012	CTB023A1	7.5	28.6	8.0	51	3.6	96.9%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	2.8	33	<6.2	1.3	
	June 21, 2012	CTB023B	7.7	28.1	8.1	52	4.6	98.6%	<0.02	<0.2	<0.02	<0.02	0.11	0.09	0.02	3.6	36	<6.2	<1.0	
	May 10, 2012	CTB013B	8.8	21.7	7.7	55	0.8	100.1%	0.04	0.22	<0.02	0.09	0.31	0.21	0.10	13.0	59	9.2	14.0	
	May 10, 2012	CTB013C	8.6	21.8	7.8	60	1.7	98.0%	0.02	0.20	<0.02	0.05	0.25	0.19	0.06	5.8	45	<6.2	4.6	
	May 10, 2012	CTB015A	9.1	21.8	7.6	57	2.0	103.7%	<0.02	0.22	<0.02	<0.02	0.23	0.21	0.02	4.8	42	<6.2	2.3	
	May 10, 2012	CTB015C	8.8	21.7	7.9	56	2.5	100.1%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	3.6	40	<6.2	2.4	14.0
	May 10, 2012	CTB023A1	8.7	21.4	7.7	51	1.8	98.4%	<0.02	0.22	<0.02	0.04	0.26	0.21	0.05	6.2	38	<6.2	1.8	
	May 10, 2012	CTB023B	9.1	21.5	7.8	54	2.1	103.1%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	5.7	34	<12	2.3	
LAKE RHODHISS	September 24, 2012	CTB034A	9.2	20.2	7.9	57	0.9	101.6%	0.05	0.44	<0.02	0.04	0.48	0.43	0.05	18.0	54	6.5	9.5	17.0
	September 24, 2012	CTB040A	8.2	21.9	7.6	60	1.2	93.6%	0.03	0.37	<0.02	<0.02	0.38	0.36	0.02	18.0	55	<6.2	6.0	15.0
	September 24, 2012	CTB040B	9.7	23.3	8.2	65	1.2	113.8%	0.03	0.44	<0.02	<0.02	0.45	0.43	0.02	18.0	56	<6.2	2.8	17.0
	August 27, 2012	CTB034A	9.1	27.0	8.3	64	1.1	114.2%	0.04	0.49	<0.02	<0.02	0.50	0.48	0.02	19.0	54	<12	3.9	15.0
	August 27, 2012	CTB040A	9.8	27.4	8.5	62	0.6	123.9%	0.04	0.51	0.02	<0.02	0.52	0.49	0.03	21.0	56	<6.2	5.4	16.0
	August 27, 2012	CTB040B	8.5	26.0	8.6	63	1.0	104.8%	0.03	0.51	<0.02	<0.02	0.52	0.50	0.02	21.0	52	<6.2	3.6	16.0
	July 19, 2012	CTB034A	10.4	28.1	8.6	58	0.7	133.1%	0.08	0.72	<0.02	<0.02	0.73	0.71	0.02	49.0	56	7.8	8.2	14.0
	July 19, 2012	CTB040A	9.7	28.2	8.2	61	1.1	124.4%	0.04	0.46	<0.02	<0.02	0.47	0.45	0.02	24.0	54	<12.0	4.0	11.0
	July 19, 2012	CTB040B	9.4	29.5	9.2	63	1.1	123.3%	0.03	0.40	<0.02	<0.02	0.41	0.39	0.02	17.0	52	<6.2	2.9	15.0
	June 12, 2012	CTB034A	9.4	24.2	8.6	58	1.4	112.1%	0.04	0.44	<0.02	<0.02	0.45	0.43	0.02	13.0	51	<6.2	3.4	16.0
	June 12, 2012	CTB040A	10.0	24.7	8.6	58	1.8	122.8%	0.03	0.33	<0.02	<0.02	0.34	0.32	0.02	15.0	50	<6.2	2.8	16.0
	June 12, 2012	CTB040B	9.1	24.3	8.7	56	1.6	108.7%	0.03	0.31	<0.02	<0.02	0.32	0.30	0.02	15.0	50	<6.2	3.4	15.0
	May 7, 2012	CTB034A	9.1	21.4	7.7	57	0.8	102.9%	0.05	0.30	0.02	0.18	0.48	0.28	0.20	21.0	52	<12	6.5	16.0
	May 7, 2012	CTB040A	10.2	23.2	8.1	57	1.2	119.4%	0.04	0.36	<0.02	0.03	0.39	0.35	0.04	20.0	48	<6.2	2.7	14.0
	May 7,2012	CTB040B	10.9	22.9	8.0	56	2.0	126.9%	0.04	0.39	<0.02	<0.02	0.40	0.38	0.02	15.0	47	<6.2	2.2	14.0
	September 22, 2011	CTB034A	8.5	21.8	8.0	72	0.9	96.9%	0.05	0.45	<0.02	<0.02	0.46	0.44	0.02	23.0	58	7.0	5.0	16.0
	September 22, 2011	CTB040A	8.3	22.0	7.9	72	1.3	95.0%	0.03	0.32	<0.02	0.03	0.35	0.31	0.04	17.0	56	<6.2	2.8	16.0
	September 22, 2011	CTB040B	6.4	21.8	8.1	63	1.6	72.9%	0.02	0.32	0.05	0.10	0.42	0.27	0.15	16.0	50	<6.2	2.6	15.0
	August 30, 2011	CTB034A	10.7	26.6	8.9	72	0.9	133.4%	0.07	0.52	<0.02	<0.02	0.53	0.51	0.02	32.0	62	8.2	7.8	18.0
	August 30, 2011	CTB040A	8.9	27.2	8.8	75	1.2	112.1%	0.04	0.37	<0.02	<0.02	0.38	0.36	0.02	22.0	63	<6.2	3.8	17.0
	August 30, 2011	CTB040B	8.4	27.1	8.7	74	1.3	105.6%	0.03	0.42	<0.02	<0.02	0.43	0.41	0.02	19.0	63	<6.2	2.9	15.0
	July 6, 2011	CTB034A	7.0	20.3	7.2	58	0.8	77.5%	0.04	0.22	<0.02	0.29	0.51	0.21	0.30	3.2	53	7.0	9.7	16.0
	July 6, 2011	CTB040A	7.3	27.6	8.3	64	1.3	92.6%	0.03	0.32	<0.02	<0.02	0.33	0.31	0.02	15.0	56	<6.2	3.1	16.0
	July 6, 2011	CTB040B	7.3	28.4	8.4	65	1.4	93.9%	0.02	0.29	<0.02	0.02	0.31	0.28	0.03	12.0	54	12.0	2.7	16.0
	June 2, 2011	CTB034A	6.9	28.1	7.9	58	0.8	88.3%	0.06	0.26	0.09	0.45	0.71	0.17	0.54	7.9	53	<6.2	6.7	17.0
	June 2, 2011	CTB040A	9.4	29.6	8.3	57	1.6	123.5%	0.02	0.26	<0.02	<0.02	0.27	0.25	0.02	11.0	74	<6.2	5.4	15.0
	June 2, 2011	CTB040B	9.3	29.8	8.3	60	2.1	122.7%	0.03	0.29	<0.02	0.06	0.35	0.28	0.07	12.0	82	<6.2	3.1	14.0
	May 12, 2011	CTB034A	6.8	21.7	7.8	54	0.8	77.3%	0.05	0.26	0.09	0.25	0.51	0.17	0.34	3.2	56	15.0	14.0	16.0
	May 12, 2011	CTB040A	9.4	24.6	8.1	53	1.7	113.0%	0.03	0.29	<0.02	0.11	0.40	0.28	0.12	11.0	41	<12.0	2.8	13.0
	May 12, 2011	CTB040B	9.8	22.9	8.2	52	2.0	114.1%	0.02	0.28	<0.02	0.10	0.38	0.27	0.11	12.0	44	12.0	3.6	13.0
LAKE HICKORY	October 3, 2012	CTB048A	5.7	20.4	6.9	59	1.5	63.2%	0.03	0.39	0.06	0.13	0.52	0.33	0.19	3.7	50	<6.2	4.6	
	October 3, 2012	CTB056A	8.7	23.3	7.7	57	1.8	102.0%	0.02	0.30	<0.02	0.02	0.32	0.29	0.03	17.0	49	<6.2	2.0	
	October 3, 2012	CTB058C	7.9	23.2	7.4	58	2.0	92.5%	0.02	0.32	0.02	0.03	0.35	0.30	0.05	16.0	44	<6.2	2.0	
	October 3, 2012	CTB058D	8.1	23.4	7.6	60	2.0	95.2%	0.02	0.32	0.03	0.05	0.37	0.29	0.08	15.0	46	<6.2	2.1	16.0
	August 28, 2012	CTB048A	8.6	28.8	8.7	54	1.4	111.5%	0.02	0.37	<0.02	<0.02	0.38	0.36	0.02	15.0	46	<6.2	3.7	
	August 28, 2012	CTB056A	8.0	28.1	8.4	52	2.1	102.4%	0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	11.0	50	<6.2	1.9	
	August 28, 2012	CTB058C	7.9	28.2	8.6	53	2.3	101.3%	0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	11.0	51	<6.2	1.8	
	August 28, 2012	CTB058D	7.3	28.2	7.9	54	2.4	93.6%	<0.02	0.24	<0.02	<0.02	0.25	0.23	0.02	8.6	48	<1.6	1.9	16.0
	August 1, 2012	CTB048A	7.5	28.4	7.7	56	1.3	96.5%	0.02	0.41	<0.02	<0.02	0.42	0.40	0.02	16.0	56	<6.2	3.9	
	August 1, 2012	CTB056A	8.2	29.3	7.8	57	1.6	107.2%	0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	16.0	46	<6.2	2.6	
	August 1, 2012	CTB058C	7.3	29.6	7.9	56	1.8	95.9%	0.02	0.36	<0.02	<0.02	0.37	0.35	0.02	13.0	44	<6.2	3.0	
	August 1, 2012	CTB058D	7.7	29.6	7.6	56	2.0	101.2%	<0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	9.2	42	<6.2	1.8	14.0

Appendix A - Catawba River Basin Data
January 1, 2008 Through December 31, 2012

Lake	Date	Sampling Station	DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	TP mg/L	TKN mg/L	NH3 mg/L	NOx mg/L	TN mg/L	TON mg/L	TIN mg/L	Chla µg/L	Solids Total mg/L	Total Solids Suspended mg/L	Turbidity NTU	Total Hardness mg/L
	SURFACE PHYSICAL DATA								PHOTIC ZONE DATA											
LAKE HICKORY	June 18, 2012	CTB048A	8.5	26.4	7.5	52	1.1	105.6%	0.04	0.45	<0.02	<0.02	0.46	0.44	0.02	18.0	48	<6.2	4.1	
	June 18, 2012	CTB056A	8.7	26.5	7.7	52	1.4	108.2%	0.02	0.39	<0.02	<0.02	0.40	0.38	0.02	13.0	43	<6.2	3.3	
	June 18, 2012	CTB058C	8.8	26.6	7.9	52	1.3	109.7%	0.02	0.37	<0.02	<0.02	0.38	0.36	0.02	13.0	49	<6.2	2.6	
	June 18, 2012	CTB058D	9.0	26.4	8.1	51	1.4	14.9%	0.02	0.35	<0.02	<0.02	0.36	0.34	0.02	12.0	46	<6.2	2.9	14.0
	May 7, 2012	CTB048A	9.8	21.6	7.6	56	1.4	111.3%	0.02	0.25	<0.02	0.05	0.30	0.24	0.06	12.0	53	<6.2	2.1	
	May 7, 2012	CTB056A	9.2	23.0	7.8	58	1.9	107.3%	0.02	0.29	<0.02	0.07	0.36	0.28	0.08	10.0	54	<6.2	1.6	
	May 7, 2012	CTB058C	9.1	23.1	7.9	58	2.0	106.3%	0.02	0.28	<0.02	0.08	0.36	0.27	0.09	10.0	54	<6.2	2.4	
	May 7, 2012	CTB058D	9.2	23.4	8.0	58	2.4	108.1%	0.02	0.26	<0.02	0.08	0.34	0.25	0.09	8.8	52	<6.2	1.3	14.0
LOOKOUT SHOALS LAKE	September 26, 2012	CTB0581F	7.0	23.4	7.5	61	1.1	82.2%	0.03	0.39	0.08	0.12	0.51	0.31	0.20	19.0	50	<6.2	3.3	
	September 26, 2012	CTB058F	6.1	23.8	7.2	60	1.7	72.2%	0.02	0.35	0.10	0.10	0.45	0.25	0.20	8.6	48	<6.2	2.6	
	September 26, 2012	CTB058G	5.3	23.7	7.5	60	1.5	62.6%	0.02	0.31	0.12	0.10	0.41	0.19	0.22	6.6	50	<6.2	2.6	16.0
	August 29, 2012	CTB0581F	6.1	28.3	7.6	57	1.4	78.4%								7.8	51	<6.2	2.4	
	August 29, 2012	CTB058F	7.3	28.2	7.8	59	1.4	93.6%	0.02	0.29	0.04	0.04	0.33	0.25	0.08	7.7	50	<6.2	2.4	
	August 29, 2012	CTB058G	8.5	27.7	7.8	57	1.8	108.0%	0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	8.9	48	<6.2	1.7	16.0
	July 24, 2012	CTB0581F	8.2	29.1	7.6	55	1.6	106.8%	0.02	0.26	<0.02	<0.02	0.27	0.25	0.02	10.0	44	<6.2	3.3	
	July 24, 2012	CTB058F	8.0	28.9	7.6	57	1.5	103.9%	0.02	0.25	<0.02	<0.02	0.26	0.24	0.02	11.0	45	<12	2.6	
	July 24, 2012	CTB058G	8.9	29.4	8.0	54	1.7	116.6%	0.02	0.24	<0.02	<0.02	0.25	0.23	0.02	10.0	44	<6.2	2.3	14.0
	June 20, 2012	CTB0581F	8.1	26.9	8.1	50	1.7	101.5%	0.02	0.33	<0.02	0.11	0.44	0.32	0.12	6.2	45	<6.2	3.3	
	June 20, 2012	CTB058F	8.4	27.4	8.2	50	1.9	106.2%	0.02	0.29	<0.02	0.07	0.36	0.28	0.08	7.7	46	<6.2	3.0	
	June 20, 2012	CTB058G	9.3	27.1	8.7	51	1.8	117.0%	0.02	0.32	<0.02	0.09	0.41	0.31	0.10		46	<6.2	2.5	13.0
	May 9, 2012	CTB0581F	7.9	22.1	7.5	55	1.8	90.6%	0.02	0.29	0.03	0.18	0.47	0.26	0.21	7.5	53	<12	2.6	
	May 9, 2012	CTB058F	8.4	22.1	7.6	56	2.0	96.3%	0.02	0.26	0.03	0.19	0.45	0.23	0.22	4.4	47	<6.2	2.2	
	May 9, 2012	CTB058G	8.5	22.3	7.8	56	2.1	97.8%	0.02	0.24	0.03	0.19	0.43	0.21	0.22	5.5	48	<6.2	1.6	13.0
LAKE NORMAN	September 20, 2012	CTB079A	5.6	24.5	6.9	60	1.0	67.2%	0.03	0.28	0.11	0.15	0.43	0.17	0.26	2.8	54	7.0	9.6	16.0
	September 20, 2012	CTB082A	6.7	26.1	6.7	69	1.7	82.8%	<0.02	0.26	0.04	0.02	0.28	0.22	0.06	10.0	54	<6.2	4.1	19.0
	September 20, 2012	CTB082AA	5.7	30.4	6.8	68	2.7	76.0%	<0.02	<0.20	<0.02	0.04	0.14	0.09	0.05	3.2	50	<6.2	2.1	19.0
	September 20, 2012	CTB082B	5.7	26.7	6.2	71	2.0	71.2%	<0.02	0.20	0.04	0.07	0.27	0.16	0.11	4.7	52	<6.2	2.2	20.0
	September 20, 2012	CTB082BB	6.2	27.6	6.8	69	2.8	78.7%	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	3.8	52	<6.2	1.3	19.0
	September 20, 2012	CTB082M	6.6	26.9	7.0	71	2.3	82.7%	<0.02	0.23	0.03	0.03	0.26	0.20	0.06	6.4	54	<6.2	2.4	21.0
	September 20, 2012	CTB082Q	6.8	27.2	6.8	68	2.8	85.7%	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.4	54	<6.2	2.0	19.0
	September 20, 2012	CTB082R	6.5	27.6	7.0	69	2.8	82.5%	<0.02	0.20	0.02	0.02	0.22	0.18	0.04	4.0	50	<6.2	1.5	19.0
	August 23, 2012	CTB079A	7.9	27.4	6.9	61	1.1	99.9%	0.02	0.36	<0.02	0.02	0.38	0.35	0.03	18.0	54	<6.2	5.4	17.0
	August 23, 2012	CTB082A	6.3	28.3	7.0	69	1.9	80.9%	<0.02	0.29	<0.02	<0.02	0.30	0.28	0.02	7.8	54	<6.2	2.8	20.0
	August 23, 2012	CTB082AA	5.6	32.8	6.6	69	2.3	77.7%	<0.02	0.22	<0.02	0.04	0.26	0.21	0.05	3.1	52	<6.2	1.6	19.0
	August 23, 2012	CTB082B	5.5	28.3	7.6	69	2.5	70.7%	<0.02	0.27	0.02	0.06	0.33	0.25	0.08	5.8	51	<6.2	1.9	19.0
	August 23, 2012	CTB082BB	6.0	30.9	6.7	68	2.4	80.6%	<0.02	0.22	<0.02	0.03	0.25	0.21	0.04	3.8	50	<6.2	2.0	17.0
	August 23, 2012	CTB082M	6.1	28.5	6.8	71	2.5	78.6%	<0.02	0.22	<0.02	<0.02	0.23	0.21	0.02	6.3	52	<6.2	2.0	19.0
	August 23, 2012	CTB082Q	6.9	28.3	6.8	68	2.9	88.6%	<0.02	0.22	<0.02	<0.02	0.23	0.21	0.02	4.8	52	<6.2	1.7	17.0
	August 23, 2012	CTB082R	6.7	28.5	6.8	68	2.9	86.4%	<0.02	0.24	<0.02	<0.02	0.25	0.23	0.02	4.5	54	<6.2	1.3	18.0
	July 26, 2012	CTB079A	8.3	29.5	7.7	58	1.1	108.9%	0.03	0.39	<0.02	0.04	0.43	0.38	0.05	23.0	53	<6.2	5.9	14.0
	July 26, 2012	CTB082A	8.0	31.3	7.5	68	1.7	108.3%	0.02	0.33	<0.02	<0.02	0.34	0.32	0.02	10.0	52	<6.2	2.7	17.0
	July 26, 2012	CTB082AA	6.5	34.6	7.1	66	2.7	93.0%	<0.02	0.24	<0.02	0.04	0.28	0.23	0.05	6.3	50	<6.2	2.0	16.0
	July 26, 2012	CTB082B	7.7	30.9	7.3	69	1.6	103.5%	0.02	0.29	<0.02	<0.02	0.30	0.28	0.02	14.0	52	<6.2	2.6	19.0
	July 26, 2012	CTB082BB	7.1	33.3	7.1	68	2.3	99.4%	<0.02	0.22	<0.02	0.02	0.24	0.21	0.03	6.6	50	<6.2	2.1	17.0
	July 26, 2012	CTB082M	7.3	30.7	7.7	68	2.6	97.8%	0.02	0.25	<0.02	<0.02	0.26	0.24	0.02	6.3	50	<6.2	2.9	33.0
	July 26, 2012	CTB082Q	7.2	32.8	6.8	67	2.6	99.9%	<0.02	0.22	<0.02	<0.02	0.23	0.21	0.02	7.4	50	<6.2	2.4	16.0
	July 26, 2012	CTB082R	6.8	32.8	7.3	66	1.9	94.4%	0.02	0.24	<0.02	0.02	0.26	0.23	0.03	7.1	48	<6.2	1.5	16.0
	June 21, 2012	CTB079A	8.4	31.1	7.8	58	1.7	113.3%	0.02	0.33	<0.02	<0.02	0.34	0.32	0.02	11.0	44	<12	3.1	15.0
	June 21, 2012	CTB082A	8.3	30.4	8.0	63	1.8	110.6%	<0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	7.6	47	<6.9	1.8	18.0
	June 21, 2012	CTB082AA	6.9	32.0	6.9	63	3.3	94.5%	<0.02	0.20	<0.02	0.12	0.32	0.19	0.13	2.5	44	<6.2	1.5	16.0
	June 21, 2012	CTB082B	7.6	30.0	7.3	68	1.6	100.6%	<0.02	0.25	<0.02	0.06	0.31	0.24	0.07	13.0	47	<6.2	2.9	19.0
	June 21, 2012	CTB082BB	6.9	30.6	7.0	64	3.5	92.3%	<0.02	0.20	<0.02	0.09	0.29	0.19	0.10	2.9	48	<6.2	1.6	17.0
	June 21, 2012	CTB082M	8.5	29.4	8.0	68	2.1	111.3%	<0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	9.1	48	<6.4	2.2	20.0
	June 21, 2012	CTB082Q	7.3	30.3	7.1	64	4.0	97.1%	<0.02	0.20	<0.02	0.09	0.29	0.19	0.10	3.1	46	<6.2	1.3	17.0
	June 21, 2012	CTB082R	7.2	30.3	7.2	64	2.8	95.8%	<0.02	0.20	<0.02	0.09	0.29	0.19	0.10	2.7	48	<6.2	1.4	17.0
	May 29, 2012	CTB079A	8.8	28.0	7.2	56	1.5	112.5%	0.02	0.37	<0.02	0.11	0.48	0.36	0.12	10.0	57		5.5	13.0
	May 29, 2012	CTB082A	8.8	27.8	7.2	62	1.6	112.1%	<0.02	0.33	<0.02	<0.02	0.34	0.32	0.02	11.0	54	<6.2	2.7	16.0
	May 29, 2012	CTB082AA	7.3	30.0	6.9	64	3.0	96.6%	<0.02	0.20	<0.02	0.12	0.32	0.19	0.13	2.4	52	<6.2	1.2	14.0
	May 29, 2012	CTB082B	8.0	27.6	6.5	67	1.7	101.5%	<0.02	0.40	<0.02	0.14	0.54	0.39	0.15	8.8	56	<6.2	2.9	16.0
	May 29, 2012	CTB082BB	7.6	29.1	6.9	66	2.7	99.0%	<0.02	0.26	<0.02	0.12	0.38	0.25	0.13	2.9	55	<6.2	1.1	15.0
	May 29, 2012	CTB082M	8.1	27.8	6.8	65	2.3	103.1%	<0.02	0.22	<0.02	0.04	0.26	0.21	0.05	7.4	56	<6.2	2.3	18.0
	May 29, 2012	CTB082Q	7.7	28.5	6.9	64	2.8	99.3%	<0.02	0.21	<0.02	0.10	0.31	0.20	0.11	3.1	59	<6.2	1.5	16.0
	May 29, 2012	CTB082R	7.5	28.9	6.9	65	2.4	97.4%	<0.02	<0.20	<0.02	0.11	0.21	0.09	0.12	3.2	62	<6.2	1.3	16.0
MOUNTAIN ISLAND LAKE	September 13, 2012	CTB083B	6.8	26.7	7.9	70	3.1	84.9%	<0.02	0.20	<0.02	0.02	0.22	0.19	0.03	2.6	54	<6.2	1.3	
	September 13, 2012	CTB086A	7.4	27.1	7.2	87	1.4	93.1%	<0.02	0.23	<0.02	0.12	0.35	0.22	0.13	6.5	66	<6.2	3.4	
	September 13, 2012	CTB086B	6.7	27.1	7.2	73	1.8	84.3%	<0.02	0.23	<0.02	0.04	0.27	0.22	0.05	4.0	58	<6.2	4.4	
	September 13, 2012	CTB086C	7.0	27.3	7.4	74	1.5	88.3%	0.02	0.29	<0.02	<0.02	0.30	0.28	0.02	11.0	60	<6.2	4.5	
	September 13, 2012	CTB087	6.5	27.5	7.6	71	1.8	82.3%	<0.02	0.22	0.02	0.04	0.26	0.20	0.06	4.0	51	<6.2	3.2	
	September 13, 2012	CTB087A	6.4	27.7	7.8	71	1.8	81.4%	<0.02	0.20	0.04	0.03	0.23	0.16	0.07	2.8	50	<6.2	2.6	20.0
	August 2, 2012	CTB083B	6.2	31.0	7.4	65	1.4	83.5%	<0.02	0.28	<0.02	0.03	0.31	0.27	0.04	6.9	49	<12	3.0	
	August 2, 2012	CTB086A	8.3	31.1	7.5	81	1.2	111.9%	0.02	0.32	<0.02	0.04	0.36	0.31	0.05	14.0	59	<6.2	5.7	
	August 2, 2012	CTB086B	7.4	31.4	7.3	70	1.3	100.3%	<0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	11.0	57	<6.2	4.2	
	August 2, 2012	CTB086C	7.5	31.8	7.4	71	1.4	102.4%	0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	13.0	59	<6.2	4.9	
	August 2, 2012	CTB087	6.5	31.5	7.2	69	2.2	88.3%	<0.02	0.30	<0.02	<0.02	0.31	0.29	0.02	6.5	54	<6.2	2.7	
	August 2, 2012	CTB087A	6.8	31.5	7.2	69	2.4	92.3%	<0.02	0.26	<0.02	0.02	0.28	0.25	0.03	5.5	49	<6.2	2.1	20.0

]

Appendix A - Catawba River Basin Data

January 1, 2008 Through December 31, 2012

Lake	Date	Sampling Station	DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	TP mg/L	TKN mg/L	NH3 mg/L	NOx mg/L	TN mg/L	TON mg/L	TIN mg/L	Chla µg/L	Solids Total mg/L	Total Solids Suspended mg/L	Turbidity NTU	Total Hardness mg/L
	SURFACE PHYSICAL DATA								PHOTIC ZONE DATA											
MOUNTAIN ISLAND LAKE	July 12, 2012	CTB083B	6.4	28.4	7.4	65	1.4	82.4%	<0.02	0.28	<0.02	0.07	0.35	0.27	0.08	4.9	50	<6.2	3.6	
	July 12, 2012	CTB086A	6.2	28.7	7.3	94	0.9	80.2%	0.03	0.37	0.02	0.25	0.62	0.35	0.27	9.0	70	7.5	12.0	
	July 12, 2012	CTB086B	6.5	28.9	7.4	68	1.4	84.4%	<0.02	0.26	0.02	0.07	0.33	0.24	0.09	6.7	50	<6.2	4.5	
	July 12, 2012	CTB086C	6.4	29.7	7.3	69	1.3	84.3%	0.02	0.48	0.02	0.03	0.51	0.46	0.05	10.0	56	<6.2	5.5	
	July 12, 2012	CTB087	6.4	29.8	7.2	69	1.9	84.4%	<0.02	0.34	<0.02	0.07	0.41	0.33	0.08	4.8	50	<6.2	3.9	
	July 12, 2012	CTB087A	6.1	30.0	7.3	68	2.4	80.7%	<0.02	0.28	<0.02	0.08	0.36	0.27	0.09	1.6	48	<6.2	2.9	17.0
	June 6, 2012	CTB083B	7.2	23.6	7.5	64	3.0	84.9%	<0.02	0.20	0.04	0.14	0.34	0.16	0.18	1.2	52	<12	3.1	
	June 6, 2012	CTB086A	7.0	24.1	7.3	101	1.1	83.3%	0.03	0.32	0.02	0.36	0.68	0.30	0.38	15.0	88	6.8	9.2	
	June 6, 2012	CTB086B	7.0	24.7	7.4	66	1.3	84.3%	<0.02	0.26	0.02	0.14	0.40	0.24	0.16	2.7	60	<6.2	3.6	
	June 6, 2012	CTB086C	7.4	25.5	7.3	67	1.0	90.4%	<0.02	0.24	<0.02	0.09	0.33	0.23	0.10	4.9	59	<6.2	3.8	
	June 6, 2012	CTB087	7.3	25.4	7.3	67	1.6	89.0%	<0.02	0.22	<0.02	0.14	0.36	0.21	0.15	3.2	53	<6.2	3.4	
	June 6, 2012	CTB087A	7.1	25.6	7.3	67	1.9	86.9%	<0.02	0.21	<0.02	0.14	0.35	0.20	0.15	3.2	48	<6.2	2.6	18.0
	May 3, 2012	CTB083B	8.0	22.4	7.8	80	1.5	92.2%	<0.02	0.22	<0.02	0.22	0.44	0.21	0.23	1.9	56	<6.2	2.1	
	May 3, 2012	CTB086A	8.3	23.7	7.8	100	1.3	98.1%	<0.02	0.29	<0.02	0.27	0.56	0.28	0.28	4.7	62	<6.2	3.7	
	May 3, 2012	CTB086B	8.4	24.0	7.8	72	1.3	99.8%	<0.02	0.22	<0.02	0.15	0.37	0.21	0.16	2.3	53	<6.2	2.4	
	May 3, 2012	CTB086C	8.0	24.0	7.6	7.2	2.3	95.1%	<0.02	0.20	<0.02	0.12	0.32	0.19	0.13	4.2	58	<12	4.3	
	May 3, 2012	CTB087	8.3	24.0	7.7	71	2.5	98.6%	<0.02	0.22	<0.02	0.16	0.38	0.21	0.17	2.5	54	<6.2	2.1	
	May 3, 2012	CTB087A	8.6	23.8	7.7	72	2.8	101.8%	<0.02	<0.20	<0.02	0.16	0.26	0.09	0.17	2.2	55	<6.2	1.3	18.0
	September 13, 2010	CTB083B	5.8	27.7	7.1	65	2.5	73.7%	<0.02	<0.20	0.030	0.04	0.14	0.07	0.07	2.5	54	<12	2.4	
	September 13, 2010	CTB086A	6.7	27.5	7.0	80	0.9	84.9%	0.02	0.20	0.030	0.11	0.31	0.17	0.14	7.4	62	<6.2	4.4	
	September 13, 2010	CTB086B	6.3	27.6	6.9	67	1.3	79.9%	<0.02	<0.20	0.030	0.05	0.15	0.07	0.08	4.8	52	<6.2	3.6	
	September 13, 2010	CTB086C	7.0	27.9	6.9	63	1.1	89.3%	0.02	0.21	<0.02	<0.02	0.22	0.20	0.02	11.0	52	<6.2	4.2	
	September 13, 2010	CTB087	6.4	28.2	6.3	64	1.4	82.1%	<0.02	<0.20	0.020	0.05	0.15	0.08	0.07	5.0	54	<6.2	3.3	
	September 13, 2010	CTB087A	6.2	28.4	6.9	65	1.5	79.8%	0.02	<0.20	0.030	0.05	0.15	0.07	0.08	3.4	50	<6.2	2.6	18.0
	August 16, 2010	CTB083B	7.1	31.2	7.1	72	1.2	95.9%	<0.02	0.22	0.020	0.09	0.31	0.20	0.11	8.9	60	<6.2	4.7	
	August 16, 2010	CTB086A	6.7	31.2	7.0	68	1.0	90.5%	0.02	0.22	<0.02	0.08	0.30	0.21	0.09	15.0	62	<6.2	5.9	
	August 16, 2010	CTB086B	6.4	32.1	7.0	64	1.6	87.8%	<0.02	<0.20	<0.02	0.06	0.16	0.09	0.07	8.9	52	<6.2	3.2	
	August 16, 2010	CTB086C	6.8	31.7	7.3	63	1.5	92.6%	<0.02	0.22	<0.02	0.03	0.25	0.21	0.04	13.0	56	<6.2	3.4	
	August 16, 2010	CTB087	6.9	32.4	7.1	64	2.1	95.1%	<0.02	<0.20	0.030	0.08	0.18	0.07	0.11	5.0	54	<6.2	2.5	
	August 16, 2010	CTB087A	6.2	34.3	6.9	63	1.6	88.2%	<0.02	<0.20	<0.02	0.07	0.17	0.09	0.08	6.4	55	<6.2	1.7	17.0
	July 19, 2010	CTB083B	7.1	30.4	7.2	68	0.8	94.6%	0.02	0.21	<0.02	0.15	0.36	0.20	0.16	9.3	66	<12	8.6	
	July 19, 2010	CTB086A	7.1	30.6	7.3	66	0.9	94.9%	0.02	0.29	<0.02	0.13	0.42	0.28	0.14	14.0	65	<6.2	7.4	
	July 19, 2010	CTB086B	6.4	31.1	7.0	63	1.4	86.3%	<0.02	<0.20	<0.02	0.14	0.24	0.09	0.15	7.0	46	<6.2	3.8	
	July 19, 2010	CTB086C	7.3	31.0	7.5	62	1.3	98.3%	<0.02	0.25	<0.02	0.06	0.31	0.24	0.07	17.0	50	<6.2	4.1	
	July 19, 2010	CTB087	6.5	31.4	6.8	62	1.7	88.1%	<0.02	<0.20	<0.02	0.14	0.24	0.09	0.15	5.8	55	<6.2	2.4	
	July 19, 2010	CTB087A	6.2	31.2	6.9	63	2.0	83.8%	<0.02	<0.20	0.020	0.13	0.23	0.08	0.15	5.7	42	<6.2	2.1	18.0
	June 17, 2010	CTB083B	7.1	30.1	7.2	64	1.5	94.1%	<0.02	<0.20	<0.02	0.22	0.32	0.09	0.23	3.5	61	<6.2	4.5	
	June 17, 2010	CTB086A	7.9	30.6	7.8	76	1.3	105.6%	0.02	0.23	<0.02	0.22	0.45	0.22	0.23	11.0	83	<6.2	5.8	
	June 17, 2010	CTB086B	7.3	31.5	7.3	63	2.0	99.1%	<0.02	0.23	<0.02	0.22	0.45	0.22	0.23	4.9	74	<6.2	3.7	
	June 17, 2010	CTB086C	7.4	31.7	7.6	65	1.9	100.8%	<0.02	0.22	<0.02	0.12	0.34	0.21	0.13	6.4	70	6.4	4.5	
	June 17, 2010	CTB087	6.8	32.7	6.7	61	2.0	94.2%	<0.02	<0.20	<0.02	0.24	0.34	0.09	0.25	4.0	70	<6.2	4.1	
	June 17, 2010	CTB087A	7.0	31.6	7.2	62	2.2	95.2%	<0.02	<0.20	<0.02	0.23	0.33	0.09	0.24	4.3	64	<6.2	2.8	18.8
	May 26, 2010	CTB083B	7.7	24.4	7.5	60	1.9	92.2%	<0.02	0.27	0.020	0.28	0.55	0.25	0.30	2.6	54	<6.2	2.9	
	May 26, 2010	CTB086A	8.3	24.2	7.5	74	1.6	99.0%	0.02	0.22	<0.02	0.29	0.51	0.21	0.30	8.8	62	<6.2	4.2	
	May 26, 2010	CTB086B	7.5	24.3	7.2	63	1.8	89.6%	0.02	<0.20	<0.02	0.27	0.37	0.09	0.28	4.2	58	<6.2	4.4	
	May 26, 2010	CTB086C	8.0	25.3	7.4	67	1.9	97.4%	0.02	0.25	<0.02	0.21	0.46	0.24	0.22	5.8	56	<6.2	3.5	
	May 26, 2010	CTB087	7.4	27.0	7.3	63	2.6	92.9%	<0.02	<0.20	<0.02	0.28	0.38	0.09	0.29	3.0	48	<12	3.0	
	May 26, 2010	CTB087A	7.7	25.5	7.3	63	2.6	94.1%	<0.02	0.29	0.100	0.28	0.57	0.19	0.38	3.4	55	<6.2	2.4	18.0
LAKE WYLIE	September 10, 2012	CTB103	7.1	28.4	7.8	75	1.0	91.4%	0.03	0.23	<0.02	0.11	0.34	0.22	0.12	9.5	62	<6.2	7.2	
	September 10, 2012	CTB105B	7.7	28.8	7.5	91	1.3	99.8%	0.03	0.24	0.02	0.05	0.29	0.22	0.07	13.0	72	6.5	6.8	
	September 10, 2012	CTB174	7.2	29.7	7.6	103	1.1	94.8%	0.03	0.32	0.03	0.13	0.45	0.29	0.16	19.0	76	<12	4.0	
	September 10, 2012	CTB177	8.0	29.5	7.5	93	1.3	105.0%	0.04	0.39	<0.02	0.06	0.45	0.38	0.07	35.0	73	<6.2	4.4	
	September 10, 2012	CTB178	6.2	28.4	7.2	92	1.3	79.8%	0.03	0.34	0.04	0.05	0.39	0.30	0.09	12.0	70	<6.2	3.8	
	September 10, 2012	CTB198B5	7.6	28.0	7.3	136	1.0	97.1%	0.05	0.50	<0.02	0.02	0.52	0.49	0.03	28.0	100	<6.2	6.2	
	September 10, 2012	CTB198C5	6.8	28.2	7.5	105	1.2	87.2%	0.03	0.36	<0.02	<0.02	0.37	0.35	0.02	17.0	81	<6.2	5.0	
	September 10, 2012	CTB198D	5.6	28.1	7.4	96	1.8	71.7%	0.02	0.24	<0.02	0.06	0.30	0.23	0.07	11.0	72	<6.2	2.3	22.0
	August 6, 2012	CTB103	6.5	30.6	7.4	75	0.9	86.9%	0.03	0.29	0.02	0.08	0.37	0.27	0.10	11.0	60	<6.2	7.1	
	August 6, 2012	CTB105B	6.9	31.0	7.4	102	1.1	92.9%	0.02	0.32	<0.02	0.07	0.39	0.31	0.08	11.0	73	<6.2	4.0	
	August 6, 2012	CTB174	7.0	33.2	7.6	42	1.1	97.8%	0.03	0.33	<0.02	0.08	0.41	0.32	0.09	13.0	67	<6.2	3.8	
	August 6, 2012	CTB177	8.3	31.6	7.5	94	1.2	112.9%	0.03	0.36	0.02	0.04	0.40	0.34	0.06	18.0	70	<6.2	4.2	
	August 6, 2012	CTB178	6.0	30.6	7.6	94	1.6	80.2%	0.02	0.30	<0.02	0.04	0.34	0.29	0.05	13.0	66	<6.2	3.9	
	August 6, 2012	CTB198B5	6.2	30.8	7.7	114	1.0	83.2%	0.04	0.43	0.02	<0.02	0.44	0.41	0.03	17.0	80	<12	6.3	
	August 6, 2012	CTB198C5	6.8	30.8	7.6	107	1.3	91.2%	0.02	0.40	<0.02	<0.02	0.41	0.39	0.02	14.0	74	<6.2	3.1	
	August 6, 2012	CTB198D	6.3	30.1	7.1	91	1.4	83.5%	0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	10.0	62	<6.2	1.7	22.0
	July 2, 2012	CTB103	7.2	30.2	7.6	72	1.1	95.6%	0.02	0.31	<0.02	0.10	0.41	0.30	0.11	8.6	55	<12	4.7	
	July 2, 2012	CTB105B	7.3	30.1	7.5	87	1.2	96.8%	0.02	0.32	<0.02	0.06	0.38	0.31	0.07	8.0	62	<6.2	4.4	
	July 2, 2012	CTB174	6.7	33.6	7.7	93	1.1	94.2%	0.03	0.34	<0.02	0.12	0.46	0.47	0.13	12.0	63	<6.2	4.1	
	July 2, 2012	CTB177	8.1	30.8	7.7	93	1.2	108.7%	0.03	0.48	<0.02	0.03	0.51	0.47	0.04	14.0	68	<6.2	3.3	
	July 2, 2012	CTB178	8.1	29.9	7.7	91	1.3	107.0%	0.02	0.35	<0.02	<0.02	0.36	0.34	0.02	10.0	64	<6.2	2.2	
	July 2, 2012	CTB198B5	8.2	30.7	7.8	147	0.9	109.8%	0.05	0.64	<0.02	<0.02	0.65	0.63	0.02	15.0	104	6.2	7.3	
	July 2, 2012	CTB198C5	8.4	30.1	8.6	107	1.4	111.4%	0.03	0.44	<0.02	<0.02	0.45	0.43	0.02	18.0	76	<6.2	3.6	
	July 2, 2012	CTB198D	7.9	29.7	8.5	89	1.4	104.0%	0.02	0.37	<0.02	<0.02	0.38	0.36	0.02	12.0	66	<6.2	2.6	22.0
	June 4, 2012	CTB103	8.3	26.3	7.4	74	0.7	102.9%	0.03	0.31	<0.02	0.11	0.42	0.30	0.12	14.0	56	6.5	7.6	
	June 4, 2012	CTB105B	8.1	26.9	7.3	83	1.1	101.5%	0.03	0.38	<0.02	0.09	0.47	0.37	0.10	9.6	63	<6.2	6.5	
	June 4, 2012	CTB174	7.8	28.6	7.5	88	0.8	100.7%	0.04	0.41	<0.02	0.18	0.59	0.40	0.19	17.0	68	<6.2	8.1	
	June 4, 2012	CTB177	8.2	27.3	7.4	82	1.0	103.5%	0.03	0.39	<0.02	0.09	0.48	0.38	0.10	14.0	58	<6.2	4.1	
	June 4, 2012	CTB178	7.6	26.9	7.1	79	1.5	95.2%	0.03	0.38	<0.02	0.09	0.47	0.37	0.10	10.0	55	<6.2	3.0	
	June 4, 2012	CTB198B5	8.1	26.5	7.3	135	0.8	100.8%	0.06	0.62	<0.02	0.02	0.64	0.61	0.03	31.0	102	7.8	8.5	
	June 4, 2012	CTB198C5	7.5	26.6	7.3	110	1.2	93.5%	0.03	0.41	<0.02	<0.02	0.42	0.40	0.02	13.0	89	<6.2	3.7	
	June 4, 2012	CTB198D	8.7	27.0	7.6	87	1.5	109.2%	0.02	0.41	<0.02	<0.02	0.42	0.40	0.02	15.0	72	<6.2	2.2	20.0

Appendix A - Catawba River Basin Data
January 1, 2008 Through December 31, 2012

	SURFACE PHYSICAL DATA								PHOTIC ZONE DATA											
Lake	Date	Sampling Station	DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	TP mg/L	TKN mg/L	NH3 mg/L	NOx mg/L	TN mg/L	TON mg/L	TIN mg/L	Chla µg/L	Solids Total mg/L	Total Solids Suspended mg/L	Turbidity NTU	Total Hardness mg/L
LAKE WYLIE	May 1, 2012	CTB103	8.7	23.0	8.2	77	1.2	101.5%	0.02	0.24	<0.02	0.18	0.42	0.23	0.19	4.9	60	<6.2	6.0	
	May 1, 2012	CTB105B	9.3	22.8	8.2	79	1.1	108.0%	0.02	0.28	<0.02	0.13	0.41	0.27	0.14	13.0	62	<6.2	4.6	
	May 1, 2012	CTB174	10.0	24.2	8.2	91	1.1	119.3%	0.03	0.33	<0.02	0.16	0.49	0.32	0.17	14.0	68	<6.2	4.0	
	May 1, 2012	CTB177	9.8	23.9	8.2	92	1.2	116.2%	0.03	0.42	<0.02	0.12	0.54	0.41	0.13	10.0	69	<6.2	2.6	
	May 1, 2012	CTB178	9.4	21.5	8.4	94	1.9	106.5%	0.02	0.30	<0.02	0.14	0.44	0.29	0.15	12.0	68	<6.2	2.8	
	May 1, 2012	CTB198B5	10.7	24.4	8.7	125	0.9	128.1%	0.04	0.47	<0.02	0.08	0.55	0.46	0.09	38.0	92	<6.2	5.0	
	May 1, 2012	CTB198C5	9.9	24.1	8.6	110	1.1	117.9%	0.02	0.42	<0.02	0.05	0.47	0.41	0.06	16.0	82	<12	3.9	
	May 1, 2012	CTB198D	9.8	22.1	8.5	98	1.9	112.3%	0.02	0.27	<0.02	0.10	0.37	0.26	0.11	11.0	69	<6.2	1.9	21.0
NEWTON CITY LAKE	September 24, 2012	CTBNCL1	7.3	22.3	6.7	36	2.2	84.0%	<0.02	0.20	0.03	0.22	0.42	0.17	0.25	2.6	40	<6.2	3.2	12.0
	August 27, 2012	CTBNCL1	7.0	26.6	5.6	38	2.2	87.2%	<0.02	0.22	0.03	0.15	0.37	0.19	0.18	1.6	32	<6.2	3.3	11.0
	July 12, 2012	CTBNCL1	6.7	27.9	7.1	38	1.2	85.5%	<0.02	0.30	0.03	0.22	0.52	0.27	0.25	1.4	40	<6.2	7.0	14.0
	June 26, 2012	CTBNCL1	7.5	28.0	7.0	39	2.4	95.8%	<0.02	0.20	<0.02	0.28	0.48	0.19	0.29	2.0	44	<6.2	4.0	15.0
	May 22, 2012	CTBNCL1	7.2	25.5	7.1	39	1.6	88.0%	0.02	0.24	0.04	0.38	0.62	0.20	0.42	1.2	50	<6.2	7.6	11.0
BESSEMER CITY LAKE	September 24, 2012	CTBBCL1	7.4	24.3	7.2	79	1.9	88.4%	0.02	0.32	<0.02	<0.02	0.33	0.31	0.02	9.1	64	<6.2	2.4	28.0
	August 27, 2012	CTBBCL1	8.1	27.8	8.5	78	1.9	103.1%	<0.02	0.36	<0.02	<0.02	0.37	0.35	0.02	7.6	60	<6.2	2.1	29.0
	July 12, 2012	CTBBCL1	6.6	28.5	7.5	79	2.3	85.1%	<0.02	0.32	0.02	<0.02	0.33	0.30	0.03	2.4	62	<6.2	2.6	28.0
	June 26, 2012	CTBBCL1	6.9	29.1	7.4	80	2.3	89.9%	<0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	3.2	62	<6.2	2.0	29.0
	May 22, 2012	CTBBCL1	7.4	25.6	7.1	82	2.9	90.6%	0.02	0.26	<0.02	0.02	0.28	0.25	0.03	3.2	72	<6.2	2.4	29.0