LAKE & RESERVOIR ASSESSMENTS
LUMBER RIVER BASIN

Pages Lake

Intensive Survey Unit
Environmental Sciences Section
Division of Water Quality
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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 = 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	The range of surface 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 plant 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 plant 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 plant 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 Lumber River Basin, located along the North Carolina-South Carolina state border at the southeast corner of the state, consists of 2,283 miles of freshwater streams and rivers. The basin extends approximately 150 miles from the Sand Hills region of the state in southern Moore and Montgomery Counties to the Atlantic Ocean coastline in Brunswick County. Streams and rivers in the Lumber River Basin (with the exception of Lockwoods Folly and Shallotte Rivers) flows southwest into South Carolina and are tributaries of the Great Pee Dee River, which flow into the Atlantic Ocean near Georgetown, South Carolina.

Three lakes were sampled in this river basin by DWQ staff in 2011. These lakes were Pages Lake, Lake Waccamaw and Lake Tabor. Lake Waccamaw is part of Lake Waccamaw State Park and has an Outstanding Resource Water (ORW) designation. This unique Carolina Bay Lake supports populations of endemic fish, mussels, clams, and snails.

On April 2, 2008, a state-wide fish consumption advisory was placed on fish caught in the state which may be high in mercury. These include largemouth bass, blackfish (bowfin), catfish, and jackfish (chain pickerel) See http://www.epi.state.nc.us/epi/fish/current.html for additional information on fish consumption advisories in the state.

Following the description of the assessment methodology used for the Lumber River Basin, there are individual summaries for each of the lakes.

Assessment Methodology

For this report, data from January 1, 2007 through December 31, 2011 were reviewed. All lakes were sampled during the summer from May through September of 2011. 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.

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 1990 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 multiprobe meters are entered into the 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 'P' code for 'Provisional'(data has been entered but has not been verified for accuracy and/or completeness). Data that have been checked are given an 'A' code for 'Accepted'.

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 ‘P’ until the entered data is verified for entry accuracy and completeness, after which, the code is changed to ‘A’. 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 no entry mistakes, possible equipment, sampling, and/or analysis errors are investigated. 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 ‘Notes’ field 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 ‘Notes’ field 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 ‘Notes’ field and never in the data field(s) in the Lakes Database.

Weather Overview for Summer 2011

May 2011 saw temperatures in most locations of the state 1° to 3°F above normal on average. In the southern mountains, both Murphy and Brevard recorded the 5th driest May on record. In the eastern part of the state, New Bern, Kinston and Elizabeth City reported May 2011 at the driest May on record. Stream flow and shallow groundwater levels in the eastern portion of the state dropped in May with some groundwater wells in the coastal counties moving toward record low levels for this time of the year (NC State Climate Office, June 6, 2011).

Hot and dry conditions continued in June 2011. Temperatures across the state were generally greater than 3°F above normal for the month. June 2011 ranked as one of the ten warmest Junes on record from most locations. Cape Hatteras broke a record set in June 1952 for the warmest monthly mean temperature. The central and eastern portions of the state also received less than 75% of normal rainfall. Most regions east of I-95 ranked as the top five driest on record for the period April through June. Cape Hatteras, New Bern and Wilmington experienced the driest such period on record. Groundwater conditions at several eastern NC monitoring wells reached new record lows for June and some communities implemented water restrictions in response to the drought (NC State Climate Office, July 7, 2011).

Despite June drought conditions in central and eastern NC, substantial storm brought heavy rain, damaging winds and hail to the state in June. A series of intense thunderstorms produced localized flooding in the Triad region and numerous reports of quarter-size hail in the Asheville area.
July 2011 was the warmest July recorded at Raleigh-Durham Airport, Cape Hatteras, Elizabeth City and Aurora. Several individual daily records for maximum daily temperatures were broken in July 2011 and many locations recorded temperatures in excess of 100° F for several consecutive days. Rainfall in July was more prevalent as compared with previous months. Thunderstorms produced locally intense rainfall amounts resulting in flooding and providing some relief to the northern Piedmont and Yadkin River basin. However, much of eastern NC continued to experience very dry conditions. May through July rainfall totals were the driest on record for Wilmington, New Bern and Morehead City (Figure 1; NC State Climate Office, August 5, 2011).

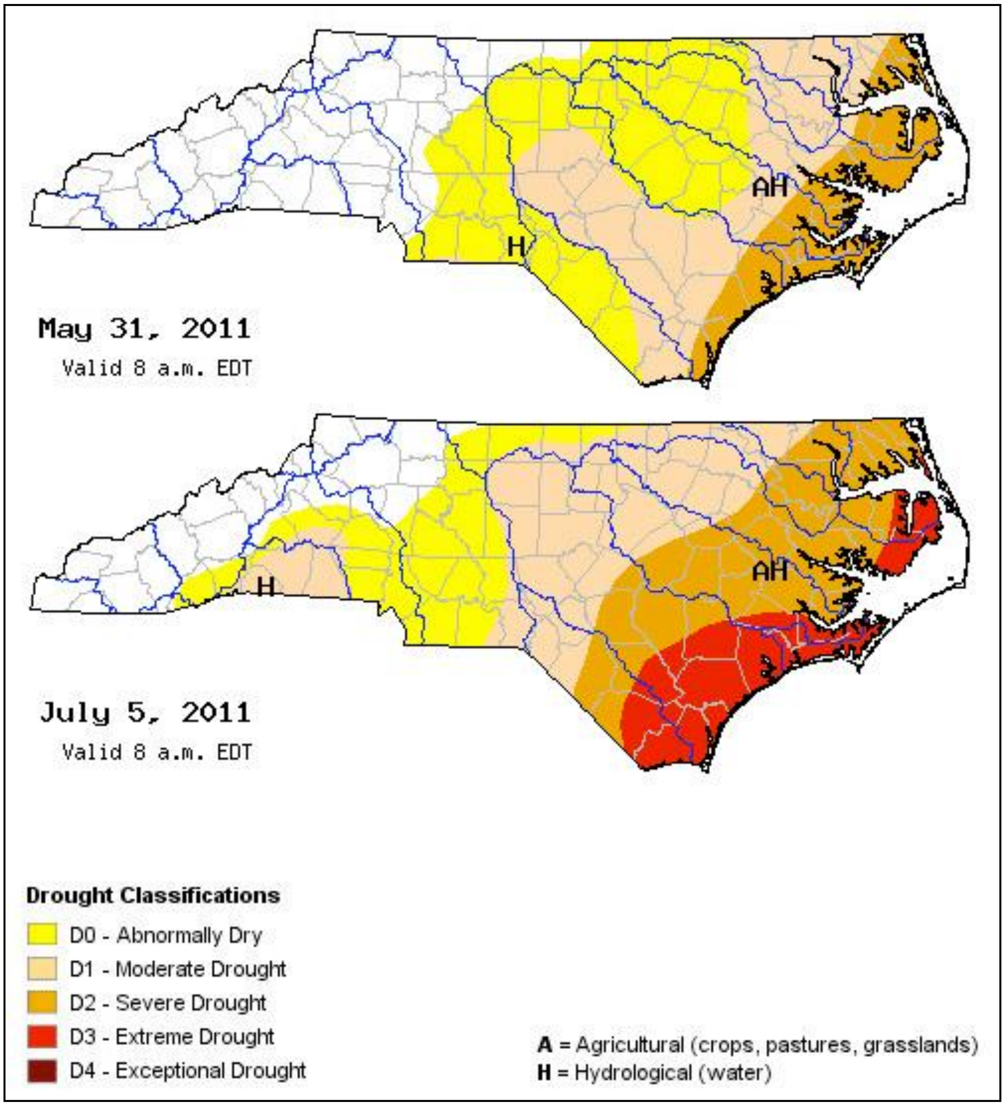

Figure 1. US Drought Monitor for North Carolina, May 31 and July 5, 2011 (Courtesy of NCDENR Division of Water Resources).

Warm and dry conditions continued in August 2011. While not as warm as July, many cities in NC ranked August 2011 in the top 25% for warmth, while most locations in western NC ranked in the top 25% for dryness. Hurricane Irene made a significant impact on eastern NC in late August. Prior to Hurricane Irene, the ongoing drought was the most significant concern for municipalities and agriculture. Rainfall from the hurricane resulted in an unprecedented four category improvement in the US Drought Monitor for parts of eastern NC (Figures 2 and 3). However, stream flow and groundwater levels continued to be below normal further inland, even in counties that experienced several inches of rainfall from Irene. Dry conditions persisted along the Yadkin River Basin. Reservoirs in this river basin exhibited drops in water level due to the combination of heat and low rainfall (NC State Climate Office, September 8, 2011).

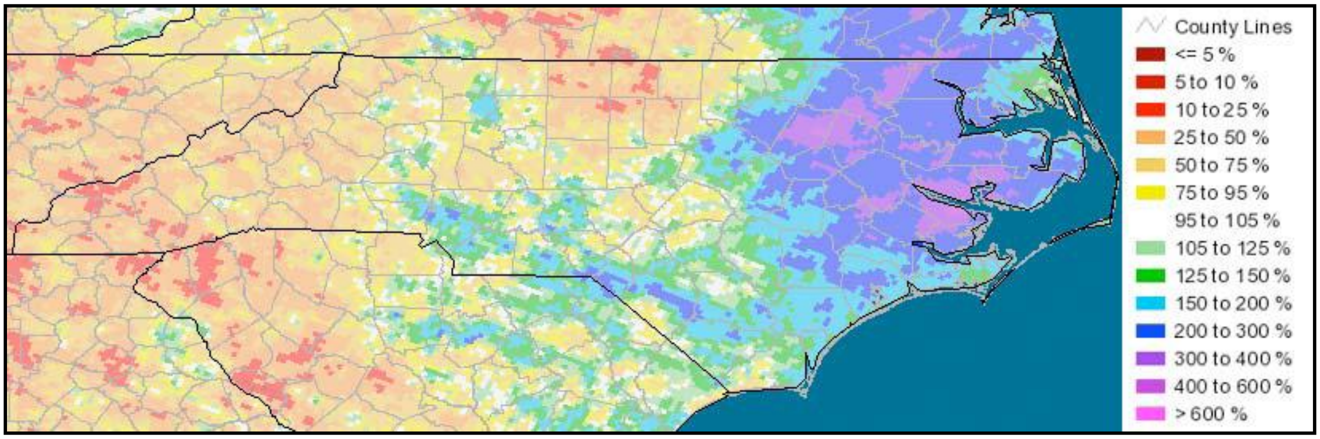

Figure 2. Percent of Normal Rainfall for North Carolina, August 2011 (Based on estimate Based on Radar Data*;Courtesy NWS/NCEP).*

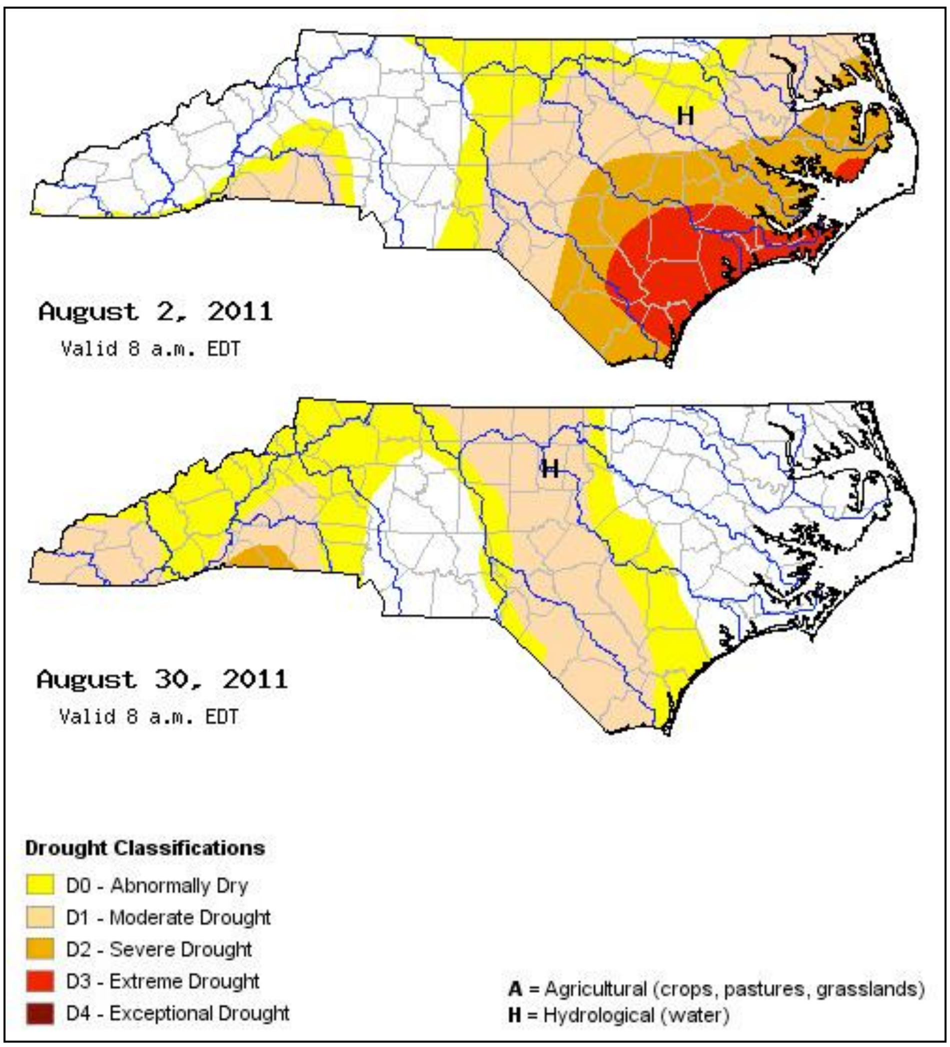

Figure 3. US Drought Monitor for North Carolina, August 2 and August 30, 2011 (Courtesy of NCDENR Division of Water Resources).

September 2011 brought temperatures that were generally near normal and rain that fell in generous amounts in central and western NC where it was most needed. The coastal plain was able to dry out after the deluge brought by Hurricane Irene (NC State Climate Office, October 5, 2011). .

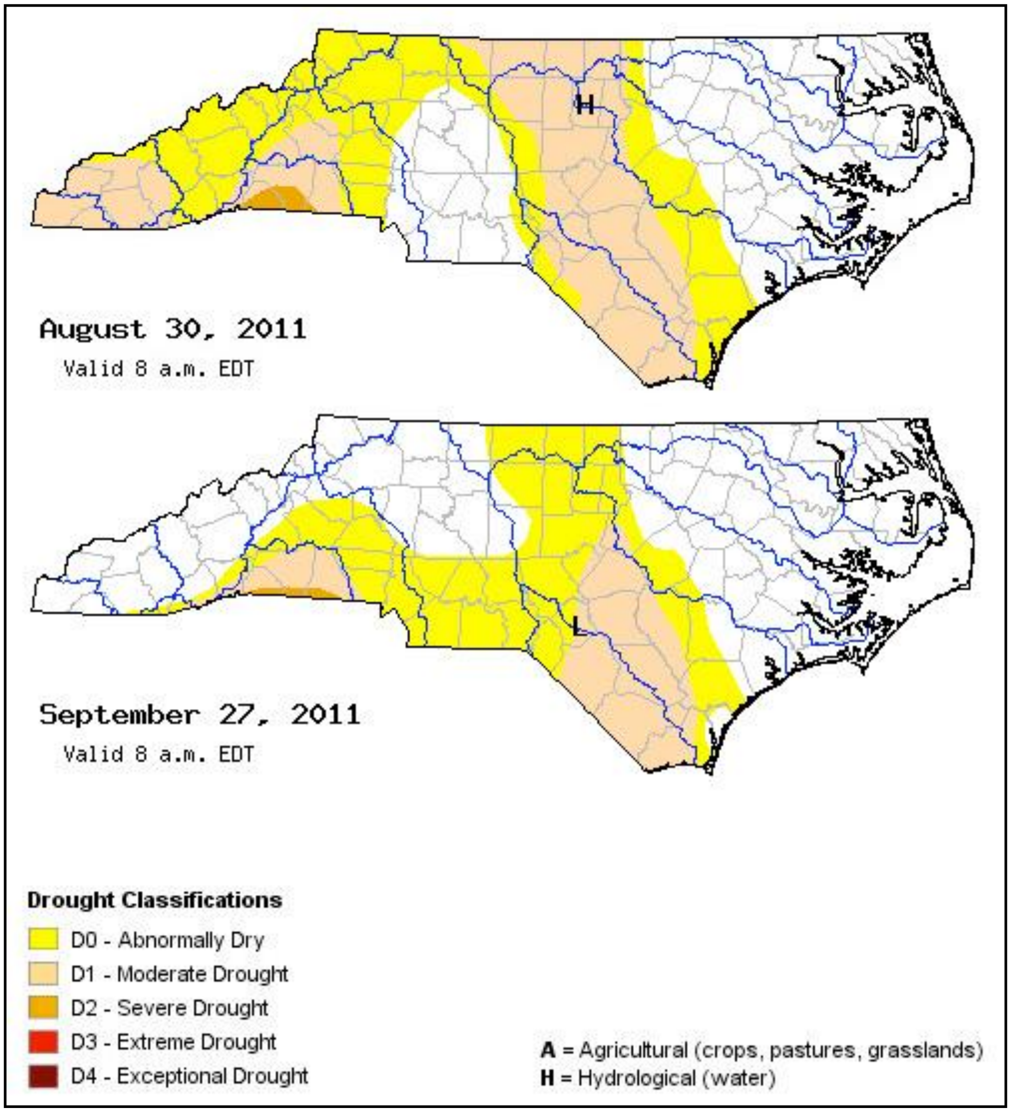

Figure 4. US Drought Monitor for North Carolina, August 30 and September 27, 2011 (Courtesy of NCDENR Division of Water Resources).

Pages Lake

Ambient Lakes Program Name	Pages Lake	
Trophic Status (NC TSI)	Mesotrophic	
Mean Depth (meters)	2.0	
Volume ($10^6 m^3$)	0.03	
Watershed Area (mi^2)	14.0	
Classification	B	
Stations	LBR027D	LBR027E
Number of Times Sampled	5	5

Pages Lake (Aberdeen Town Lake) is located on Aberdeen Creek west of US Hwy 1 in the Town of Aberdeen. The lake was built in the 1930's and is used for recreation, bank fishing, and canoeing. Swimming is not allowed in Pages Lake. There is a town park adjacent to the lake and a wooden footbridge that crosses the center of the lake.

DWQ field staff monitored Pages Lake five times in 2011. The waters of the lake are slightly tannin-stained (tea colored) which is typical of Sand Hills streams and reservoirs. Surface pH in Pages Lake in 2011 ranged from 5.5 to 7.4 s.u. and surface water temperatures ranged from 21.2 to 29.3 °C (Appendix A). Surface dissolved oxygen was generally low, ranging from 6.8 to 3.6 mg/L. This latter reading was less that the state water quality standard of 4.0 mg/L for an instantaneous reading. Secchi depths in Pages Lake during the summer of 2011 ranged from 1.2 to 2.0 meters, indicating that the water clarity of this lake was very good.

Total phosphorus in Pages Lake ranged from <0.02 to 0.04 mg/L. Total Kjeldahl nitrogen ranged from 0.39 to 0.55 mg/L and total organic nitrogen ranged from 0.36 to 0.54 mg/L. Chlorophyll *a* ranged from 5.5 10 23.0 μg/L. Analysis of phytoplankton samples collected from Pages Lake in 2011 determined that the lake was dominated by the colonial blue-green alga *Aphanocapsa sp.* by density and by another colonial blue-green alga (*Trachelomonas sp.*) by biovolume. Blue-green algae are indicators of nutrient enrichment and can produce discoloration of the lake water, surface films, flecks and mats. Based on calculated NCTSI scores, Pages Lake was determined to have moderate biological productivity (mesotrophic conditions) in 2011.

Aquatic plants present in Pages Lake include parrotfeather (*Myriophyllum aquaticum*) and hydrilla (*Hydrilla verticillata*). These plants were treated with herbicides in 2007 to 2011 as part of the state's aquatic weed control program. Pages Lake is also on the 2010 303(d) List of Impaired Waters as a result of a fish consumption advisory for high levels of mercury found in fish taken from this lake.

LAKE & RESERVOIR ASSESSMENTS

HUC 03040206

Lake Waccamaw

Ambient Lakes Program Name	Lake Waccamaw		
Trophic Status (NC TSI)	Mesotrophic		
Mean Depth (meters)	1.5		
Volume ($10^6 m^3$)	54.30		
Watershed Area (mi^2)	70.0		
Classification	B Sw ORW		
Stations	LBR076A	LBR076K	LBR076P
Number of Times Sampled	5	5	5

Lake Waccamaw is one of the few natural lakes in North Carolina. Located in Columbus County, this is a shallow, elliptical lake owned by the State of North Carolina as part of Lake Waccamaw State Park. Recreational uses include swimming, boating and fishing. Lake Waccamaw, a Carolina Bay Lake, is an Outstanding Resource Water (ORW). Waters designated as ORW have outstanding state or national recreational or ecological significance.

The term ‘Bay’ comes from the presence of bay trees commonly found growing in swampy oval depressions that may have been lakes at one time. Unlike the majority of Carolina Bay Lakes that have an acidic pH, Lake Waccamaw is unique for its neutral pH, which is important in the support of numerous endemic species including the Waccamaw Silverside (*Menidia extensa*), Waccamaw Darter (*Etheostema perlongum*), and Waccamaw Killifish (*Fundulus waccamensis*). This lake also has 15 species of mussels and clams including the endemic Waccamaw Fatmucket (*Lampsilis fullerkati)* and Waccamaw Spike (*Elliptio waccamawensis*). Two species of snails, the Waccamaw Amnicola (*Amnicola* sp.1) and the Waccamaw Siltsnail (*Cincinnatia* sp. 1) are also endemic to this lake. Lake Waccamaw provides high recreational and scenic value and is an important component of the Lake Waccamaw State Park
Division staff sampled Lake Waccamaw monthly from May through September 2006.

DWQ field staff monitored Lake Waccamaw five times in 2011. Surface dissolved oxygen ranged from 6.9 to 8.1 mg/L. The lowest surface water temperature for this shallow lake was observed in May (23.5 °C) and the greatest surface water temperature was observed in August (29.9 °C). Surface pH values ranged from 7.0 to 8.5 s.u. during the summer of 2011 and surface conductivity values ranged from 94 to 106 umhos/cm. Secchi depths, which are a measure of water clarity, ranged from 1.1 meters to 1.9 meters.

Total phosphorus concentrations in 2011 were similar to those previously observed in this lake (Appendix A). Total Kjeldahl nitrogen ranged from 0.62 to 0.81 mg/L and total organic nitrogen ranged from 0.61 to 0.80 mg/L while ammonia and nitrite plus nitrate values were below the DWQ Laboratory detection levels.

Chlorophyll *a* concentrations in 2011 were slightly greater than those observed from previous DWQ sampling trips to Lake Waccamaw (range = 2.8 to 8.0 μg/L) but remained well below the state water quality standard of 40 μg/L.

In the summer of 2008, Lake Waccamaw experienced an algae bloom that raised concerns regarding nutrient loading to the lake. The Wilmington Regional Office of the NC Division of Water Quality received a public complaint of nuisance algae washing up on several locations along the lakeshore along with a 'sewage smell' in Lake Waccamaw in July 2008. Wilmington Regional Office staff investigated this complaint. Samples of the algae were identified as filamentous green and blue-green algae. Prevailing winds had washed algae up along the western shore of the lake adjacent to residential areas. Decomposition of these algae may have been the source of the odor complaints (Garret,S. September 29, 2008. E-mail communication).

In 2011, another bloom of filamentous blue-green algae was present in the Lake Waccamaw. When mats of dead and decaying algae washed up along the swimming beach located in front of Dale's Seafood, the Columbus County Health Department closed the beach and set up warning signs advising the public not to swim in this area as a health precaution. Analysis of algae samples collected in July 2011 determined that the sample was dominated by the colonial blue-green algae *Aphanocapsa sp*. and *Pseudanabaena sp*. In August, algae samples were dominated by *Aphanocapsa sp*. and the euglenoid, *Trachelomonas sp*. The flow of water from the Canal Cove canal into Lake Waccamaw is a potential source of nutrients that contribute to the algae blooms in Lake Waccamaw. To reduce nutrient loading to the lake, the connection between the Canal Cove canal and the lake would need to be blocked and the canal water directed away from lake (Cahoon L.B. September 23, 2008. E-mail communication).

Based on the calculated NCTSI scores for 2001, Lake Waccamaw was determined to moderately productive (mesotrophic) in June, July and August and highly productive (eutrophic) in May and September. This is consistent with previous NCTSI scores calculated for this lake.

Lake Tabor

Ambient Lakes Program Name	Lake Tabor	
Trophic Status (NC TSI)	Hypereutrophic	
Mean Depth (meters)	1.0	
Volume ($10^6 m^3$)	0.03	
Watershed Area (mi^2)	10.0	
Classification	B Sw	
Stations	LBR091B	LBR091C
Number of Times Sampled	6	6

Lake Tabor is a 70-acre shallow town lake located northeast of Tabor City at the US Hwy 701 Business/Bypass split. Recreational facilities at the lake include bait and tackle shop, piers, boat launches, picnic areas, and ball fields. The lake, built in 1952 from what had been an old millpond at the confluence of Grissett Swamp (a cypress gum swamp), Simmons Branch and Black Creek, contains tannic swamp waters. The dam was breached in 1996 during Hurricane Fran and rebuilt in 2000. There are houses around the lake with a residential area on the northwest; shoreline development is 50% to 75%.

Lake Tabor was sampled six times in 2011 by DWQ Field staff. Surface dissolved oxygen in May and June ranged from 6.7 to 7.9 mg/L (Appendix A), then increased to 13.4 mg/L in July. From July through September 1, 2011, surface dissolved oxygen values were greater than those previously observed in this lake since monitoring first began in August 1981. Surface water temperature ranged from 22.9 °C to 30.9 °C. Surface pH values ranged from 7.0 to 9.6 s.u. Five of 12 pH observations were greater than the state water quality standard of 9.0 s.u. (41.7%). Surface conductivity values in the summer of 2011 were greater than values previously measured in this lake. Secchi depths, a measurement of water clarity, were less than a meter from June through September. This indicated that the clarity of the lake water was limited.

Total phosphorus ranged from 0.07 to 0.14 mg/L and total Kjeldahl nitrogen ranged from 0.81 to 2.40 mg/L. Total organic nitrogen ranged from 0.75 to 2.39 mg/L. Both total Kjeldahl nitrogen and total organic nitrogen concentrations in 2011 were greater than those previously observed in this lake. Ammonia and nitrite plus nitrate values were generally below DWQ Laboratory detection levels

In response to the availability of nutrients, chlorophyll *a* values in Lake Tabor ranged from 18 μg/L in May to 160 μg/L in August (Appendix A). Chlorophyll *a* values for August and September 21 were greater than chlorophyll *a* values previously observed for this lake. Ten of 12 chlorophyll *a* samples collected in 2011 were greater than the state water quality standard of 40 μg/L (83.3%).

A very dense blue-green algae bloom was observed on Lake Tabor on August 7, 2011 by DWQ staff sampling the lake (Figures 1 and 2). The water had a very distinctive green color lake-wide and small clumps of algae were floating on the surface of this green water. DWQ field staff collected water samples for algae analysis. Both the Wilmington Regional Office and the Public Works Manager for the City of Tabor were notified of the algae bloom.

Analysis of the phytoplankton samples determined that the bloom consisted of multiple genera of blue-green algae and included *Microcystis sp.* and *Anabaena sp*. Other algae present in the samples included *Euglena sp.* and *Botryococcus sp*. Euglenas tend to occur in waters rich in organic matter and are often associated with animal wastes. They tend to discolor the water red, brown or green and may form dense surface films that are often described as appearing like 'spilled paint'. *Botryococcus sp.* is rare but may become abundant in summer. This alga possesses a unique pigment that may turn orange in contrast to other bloom forming algae. The algal productivity in Lake Tabor may have contributed to elevated values for both surface dissolved oxygen and pH.

Figure 5. Green colored water at boat ramp at Lake Tabor, August 7, 2011.

Figure 6. Secchi disk at the surface of Lake Tabor during the August 7, 2011 algae bloom.

Based on the calculated NCTSI scores, the biological productivity of Lake Tabor was determined to be extremely elevated (hypereutrophic) in 2011. Further assessment of this lake and its watershed may be necessary to determine input sources of nutrients, which contributed to the algal bloom observed in 2011.

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Appendix A - Lumber River Basin Lakes Data
January 1, 2007 through December 31, 2011

Lake	Date	Sampling Station	DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Depth Secchi 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
		SURFACE PHYSICAL DATA							PHOTIC ZONE DATA										
PAGES LAKE	September 29, 2011	LBR027D	4.9	25.2	5.9	40	1.3	65.4%	0.03	0.50	<0.02	0.030	0.53	0.49	0.04	92.0	35	10.0	6.1
	September 29, 2011	LBR027E	6.6	25.2	5.5	39	1.6	52.5%	0.04	0.45	<0.02	0.020	0.47	0.44	0.03	9.2	44	<6.2	4.5
	August 30, 2011	LBR027D	3.6	26.5	5.7	38	1.3	44.8%	0.02	0.41	<0.02	<0.02	0.42	0.40	0.02	23.0	47	<6.2	2.2
	August 30, 2011	LBR027E	4.9	26.2	5.9	41	1.3	60.6%	0.02	0.51	<0.02	<0.02	0.52	0.50	0.02	12.0	44	<6.2	2.8
	July 14, 2011	LBR027D	5.0	29.3	6.9	41	1.4	58.8%	0.02	0.54	0.020	<0.02	0.55	0.52	0.03	9.8	38	<6.2	2.5
	July 14, 2011	LBR027E	5.2	29.3	6.6	42	1.3	68.0%	<0.02	0.41	<0.02	<0.02	0.42	0.40	0.02	5.9	38	<6.2	2.5
	June 9, 2011	LBR027D	5.1	28.2	6.9	41	1.8	65.4%	0.02	0.44	0.020	<0.02	0.45	0.42	0.03	7.3	37	<6.2	1.6
	June 9, 2011	LBR027E	4.1	28.1	6.3	42	1.8	52.5%	0.03	0.55	<0.02	<0.02	0.56	0.54	0.02	12.0	34	6.2	3.7
	May 5, 2011	LBR027D	6.5	21.2	7.4	46	1.8	73.2%	0.02	0.45	0.06	0.08	0.53	0.39	0.14	5.5	38	16.0	2.5
	May 5, 2011	LBR027E	6.8	22.6	6.9	43	2.0	78.7%	0.02	0.39	0.03	0.08	0.47	0.36	0.11	10.0	48	<6.2	2.1
LAKE WACCAMAW	September 1, 2011	LBR076A	7.4	26.6	8.4	97	1.1	92.2%	0.02	0.70	<0.02	<0.02	0.71	0.69	0.02	4.0			2.4
	September 1, 2011	LBR076K	8.1	26.9	8.2	97	1.1	101.5%	0.03	0.63	<0.02	<0.02	0.64	0.62	0.02	7.5			4.8
	September 1, 2011	LBR076P	8.1	26.8	8.5	96	1.1	101.3%	0.02	0.73	<0.02	<0.02	0.74	0.72	0.02	6.4			4.1
	August 17, 2011	LBR076A	7.8	29.5	8.2	104	1.5	102.3%	0.02	0.71	<0.02	<0.02	0.72	0.70	0.02	6.7	92	<6.2	2.4
	August 17, 2011	LBR076K	7.9	29.9	8.3	104	1.5	104.4%	<0.02	0.68	<0.02	<0.02	0.69	0.67	0.02	2.8	93	<6.2	1.3
	August 17, 2011	LBR076P	8.1	29.9	8.3	104	1.5	107.0%	0.02	0.69	<0.02	<0.02	0.70	0.68	0.02	5.4	89	<6.2	2.4
	July 20, 2011	LBR076A	7.7	29.0	7.7	106	1.6	100.1%	0.02	0.71	<0.02	<0.02	0.72	0.70	0.02	4.6	95	4.6	2.2
	July 20, 2011	LBR076K	7.2	29.6	7.3	104	1.5	96.9%	0.02	0.68	<0.02	<0.02	0.69	0.67	0.02	4.0	94	<6.2	3.0
	July 20, 2011	LBR076P	7.5	28.6	7.5	103	1.5	94.6%	0.02	0.70	<0.02	<0.02	0.71	0.69	0.02	6.3	92	<6.2	4.2
	June 8, 2011	LBR076A	6.9	28.9	7.7	102	1.9	89.6%	0.02	0.68	<0.02	<0.02	0.69	0.67	0.02	3.9	84	<12	3.1
	June 8, 2011	LBR076K	7.1	28.9	7.7	101	1.2	92.2%	0.03	0.76	<0.02	<0.02	0.77	0.75	0.02	5.4	86	7.2	4.2
	June 8, 2011	LBR076P	7.3	28.8	7.9	101	1.9	94.6%	0.02	0.62	<0.02	<0.02	0.63	0.61	0.02	4.2	86	<6.2	3.3
	May 4, 2011	LBR076A	8.0	23.5	7.0	94	1.3	94.2%	0.02	0.71	<0.02	<0.02	0.72	0.70	0.02	8.0	98	8.5	5.5
	May 4, 2011	LBR076K	8.0	23.5	7.1	95	1.2	94.2%	0.02	0.72	<0.02	<0.02	0.73	0.71	0.02	7.0	92	8.5	4.9
	May 4, 2011	LBR076P	8.1	23.6	7.1	95	1.2	95.5%	0.03	0.81	<0.02	<0.02	0.82	0.80	0.02	8.1	101	<12	4.8
LAKE TABOR	September 21, 2011	LBR091B	10.4	22.9	8.6	129	0.6	121.0%	0.08	1.40	<0.02	<0.02	1.41	1.39	0.02	80.0	108	13.0	17.0
	September 21, 2011	LBR091C	9.9	23.0	8.7	127	0.5	115.4%	0.10	1.70	<0.02	<0.02	1.71	1.69	0.02	99.0	109	12.5	27.0
	September 1, 2011	LBR091B	11.0	27.4	9.1	129	0.7	139.1%	0.09	1.40	<0.02	<0.02	1.41	1.39	0.02	51.0			16.0
	September 1, 2011	LBR091C	10.8	27.5	8.8	130	0.7	136.8%	0.09	1.40	<0.02	<0.02	1.41	1.39	0.02	52.0			15.0
	August 17, 2011	LBR091B	12.2	29.7	9.3	155	0.3	160.6%	0.14		<0.02	<0.02			0.02	150.0	137	18.0	37.0
	August 17, 2011	LBR091C	11.5	29.8	9.4	151	0.3	151.7%	0.14	2.40	<0.02	<0.02	2.41	2.39	0.02	160.0	137	17.0	36.0
	July 20, 2011	LBR091B	12.9	30.3	9.6	163	0.5	171.6%	0.08	1.20	<0.02	<0.02	1.21	1.19	0.02	46.0	130	18.0	7.3
	July 20, 2011	LBR091C	13.4	30.9	9.6	163	0.5	180.1%	0.07	1.30	<0.02	0.15	1.45	1.29	0.16	51.0	131	16.0	10.0
	June 8, 2011	LBR091B	7.9	30.9	7.8	140	0.3	106.2%	0.12	1.80	<0.02	<0.02	1.81	1.79	0.02	50	117	16.0	23.0
	June 8, 2011	LBR091C	6.7	29.9	7.6	143	0.4	88.5%	0.09	1.60	0.05	<0.02	1.61	1.55	0.06	42	116	13.0	19.0
	May 4, 2011	LBR091B	6.8	23.9	7.0	130	1.1	80.7%	0.07	0.81	0.060	0.030	0.84	0.75	0.09	18	106	6.8	7.2
	May 4, 2011	LBR091C	6.9	23.8	7.2	130	1.0	81.7%	0.08	0.90	0.060	0.030	0.93	0.84	0.09	19	112	6.8	8.5