LAKE & RESERVOIR ASSESSMENTS
NEUSE RIVER BASIN

Wiggins Mill Reservoir

Intensive Survey Branch
Water Sciences Section
Division of Environmental 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 is determined by the algal density as follows:

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

Moderate 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) and are found in
almost every aquatic environment including fresh and marine waters, soils, in fact almost anywhere moist. 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 concentration 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.

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 dissolved 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 elevated biological productivity and low water transparency.

Eutrophication	The process of physical, chemical, and biological changes in a lake associated with the presence of one or more of the following: excessive nutrients, organic matter, silt enrichment and sedimentation.
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 north 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). Values for total organic nitrogen, total phosphorus, chlorophyll *a* and Secchi depth are used to calculate a numeric score representing the lake's degree of 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 Neuse River basin is the third largest basin in North Carolina and is one of only three basins that are located entirely within the state. The Neuse River Basin covers 6,192 square miles and spans 19 counties. The Neuse River originates northwest of the City of Durham in Person and Orange counties and the headwaters start in the Southern Outer Piedmont and the Carolina Slate Belt ecoregions. The uppermost 22 miles of the river's main stem is impounded behind Falls of the Neuse Reservoir dam just northeast of the city of Raleigh. Downstream of the dam, the river continues its course for approximately 185 miles southeasterly past the cities of Raleigh, Smithfield, Goldsboro, and Kinston after which it reaches the tidal waters near Street's Ferry just upstream of New Bern. Downstream of Street's Ferry, the Neuse River significantly broadens and changes into a tidal estuary that empties into the Pamlico Sound. Overall, most of the land use in the Neuse River Basin is agriculture or forest with the only major area of protected forest associated with the Croatan National Forest located in the lower reaches of the basin in Jones and Craven counties. There are several areas of rapidly expanding urban land use particularly associated with the cities of Durham, Raleigh, Clayton, Goldsboro, Kinston, and New Bern.

A statewide fish consumption advisory from the North Carolina Department of Health and Human Resources, Division of Public Health is in place due to mercury contamination (http://epi.publichealth.nc.gov/oee/programs/fish.html.) Fish such as blackfish (bowfin), largemouth bass and chained pickerel (jack fish) have been found to have high mercury levels.

Assessment Methodology

For this report, data from January 1, 2016 through December 31, 2020 were reviewed. Lake monitoring and sample collection activities performed by DWR field staff are in accordance with the Intensive Survey Unit Standard Operating Procedures Manual: (https://files.nc.gov/ncdeq/Water%20Quality/Environmental%20Sciences/ISU/2014LakesAll.pdf) An interactive map of the state showing the locations of lake sites sampled by DWR may be found at: http://www.arcgis.com/home/webmap/viewer.html?webmap=9dbc8edafb7743a9b7ef3f6fed5c4db0&extent=-87.8069,29.9342,-71.5801,38.7611.

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 and 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.

Quality Assurance of Field and Laboratory Lakes Data

Data collected in the field via multiparameter water quality meters are uploaded into the Labworks® Database within five days of the sampling date.

Chemistry data from the DWR Water Quality Laboratory are uploaded into Labworks®. If there are data entry mistakes, possible equipment, sampling, and/or analysis errors, these are investigated and corrected, if possible. Chemistry results received from the laboratory that are given a qualification code are entered along with the assigned laboratory code.

Information regarding the WSS Chemistry Laboratory Quality Assurance Program is available on the ISB website (https://DWR.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/microbiology-inorganics-branch/methods-pqls-qa).

Weather Overview for Summer 2020

The weather in North Carolina in May, 2020 was cool and wet, especially in the central portion of the state. The average statewide temperature was 63.7° F, making May 2020 the 13th coolest May since 1895. Despite the lower than normal temperatures, two tropical storms formed during this month. Tropical Storm Arthur formed from a low system over the Bahamas on May 17th and tracked up the southeast coast parallel to the North Carolina coast before turning eastward. Tropical Storm Bertha formed similarly to Tropical Storm Arthur. It's track, however, took it onshore north of Charleston, South Carolina on May 27th. The remnants of Bertha moved inland, with the center of low pressure tracking through North Carolina. Rainfall from the system produced two to four inches across the western and southern Piedmont. With the two tropical storms and a series of slow-moving low pressure systems, the statewide average precipitation in May was 7.5 inches.

The cool, late-spring pattern and wetter than normal conditions continued into June. The statewide average temperature was 73.3° F. Average maximum temperatures across the state were four degrees below normal and the average minimum temperatures were near-normal to slightly above normal. These daily temperatures were an indication of cloudy conditions which existed in June. The Raleigh region experienced approximately 200 hours of mostly cloudy to overcast conditions, giving this area of the state the cloudiest June since 2003 and 2004, respectively. Statewide average rainfall was 4.8 inches. The monthly average streamflow across the state also remained near to above-normal in June.

The cooler than normal temperatures of May and June came to an abrupt end in July 2020 with the statewide average temperature reaching 79.7° F, making it the 6th warmest July since 1895. High temperatures reached 90° F or greater for 28 days in Raleigh, NC. With the heat came a reduction in rainfall, with the statewide average dropping to 4.2 inches, making this month the 28th driest July out of the past 126 years. Of further concern was the comparison of the dry conditions across the state with those seen in 2007, which was the beginning of a multi-year extreme drought. However, unlike 2007 which experienced a dry and warm spring and early summer, the summer of 2020 started with cool, wet conditions that extended through June. While abnormally dry conditions formed in the northeastern Piedmont and northern Coastal Plain regions of the state by late July 2020, the Neuse River Basin remained in normal conditions.

August statewide average temperature was 77.5° F. The month started with the arrival of Hurricane Isaias, which was the ninth named storm to form in the Atlantic before the end of July. Hurricane Isaias came onshore in Brunswick County, North Carolina on August 3rd and quickly traveled northward across the Coastal Plain. Rainfall amounts in the Neuse River Basin ranged from two to four inches during the 24-hour period.

The statewide average precipitation for August was 7.8 inches, making this month the 13th wettest August since 1895 and the wettest August since 1992. A low-pressure system on August 15th accompanied by several lines of thunderstorms produced a daily precipitation total of more than three inches of rain in Clayton, NC (Neuse River Basin). August 31st brought a final round of slow-moving showers of Wake and Johnston County resulting in the cresting of the Neuse River at Smithfield to moderate flood stage. All of this rainfall eliminated the abnormally dry conditions in the Northern Coastal Plain and brought the statewide streamflow to near or above normal.

September brought a cooling of temperatures. The statewide average temperature for the month was 69.8° F. Statewide average precipitation was 6.6 inches and ranked as the 15th wettest September since 1895. On September 16-18, the remnants of Hurricane Sally crossed North Carolina, bringing two or more inches of rain to the Piedmont and Coastal Plain. On September 25-26, the remnants of Tropical Storm Beta produced thunderstorms that dropped 3.3 inches of rain on Sanford and produced hail in the Triangle region. The state remained free of drought conditions for the month of September.

West Fork Eno River Reservoir

Ambient Lakes Program Name	West Fork Eno River Reservoir		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	13.0		
Volume ($10^6 m^3$)	3.00		
Watershed Area (mi^2)	9.5		
Classification	WS-II; HQW, NSW, CA		
Stations	NEUWFE2	NEUWFE3	NEUWFE4
Number of Times Sampled	2	2	2

West Fork Eno River Reservoir is maintained by the Town of Hillsborough, which is the largest water system withdrawer. The reservoir was constructed on the West Fork of the Eno River beginning in 1999 and was completed in 2000. The watershed consists of forested and rural areas with agricultural fields, pastureland and residences.

This reservoir was sampled in May and June by DWR field staff. West Fork Eno River Reservoir was dropped from the 2020 lake sampling schedule after the June sampling trip due to manipulation of the lake water level and clearing of vegetation along the shoreline in preparation of permanently raising the lake level 10 feet. Obtaining normal conditions chemistry and physical data would not be possible and any data collected would be skewed by the changing water levels and the addition of nutrients and increase in turbidity due to tree and vegetation removal along the shoreline.

Secchi depths were 1.1 meter at each of the three lake sampling sites in May, but decreased to less than a meter in June (Appendix A). Mean total phosphorus in May was 0.04 mg/L and increased to 0.05 mg/L in June. Nitrogen followed a similar pattern with concentrations greater in June as compared with May. In response, chlorophyll *a* concentrations were greatest in June and the value at site NEUWFE3 greater than the state water quality standard of 40 ug/L (Appendix A). Lake-wide mean chlorophyll *a* concentrations, however, were not above 40 ug/L.

Based on the calculated NCTSI scores, this reservoir exhibited elevated biological productivity (eutrophic conditions) in 2020. West Fork Eno River Reservoir has varied between mesotrophic and eutrophic since it was first monitored by DWR in 2010.

Lake Orange

Ambient Lakes Program Name	Lake Orange		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	4.0		
Volume ($10^6 m^3$)	0.30		
Watershed Area (mi^2)	10.0		
Classification	WS-II; HQW, NSW, CA		
Stations	NEU00B	NEU00B2	NEU00B4
Number of Times Sampled	5	5	5

Lake Orange is a piedmont water supply reservoir for the City of Hillsborough. Maximum depth is 20 feet (six meters). Major tributaries to Lake Orange include the East and West Fork of the Eno River.

Lake Orange was sampled monthly from May through September by DWR field staff. Secchi depths ranged from 0.6 to 1.0 meter (Appendix A). Surface dissolved oxygen ranged from 3.7 to 12.2 mg/L with the lowest dissolved oxygen value, recorded at the sampling site near the dam in September (NEU00B4), below the state water quality standard of 4.0 mg/L for an instantaneous reading. Total phosphorus ranged from 0.03 to 0.06 mg/L and total organic nitrogen ranged from 0.50 to 0.92 mg/L. Chlorophyll *a* ranged from 24 to 45 *u*g/L. Five of the 14 chlorophyll *a* values recorded in 2020 for Lake Orange (35.7%) were greater than the state water quality standard of 40 *u*g/L.

Water samples collected from Lake Orange in August were used in an Algal Growth Potential Test (AGPT) conducted by the Region IV EPA laboratory. Results of this test indicated that algal growth in the upper and lower ends of this lake were limited by the nutrient, nitrogen (Table 1).

Table 1. Algal Growth Potential Test Results for Lake Orange, August 19, 2015.

Lake Orange
August 19, 2020

Station	Maximum Standing Crop, Dry Weight (mg/L)			Limiting Nutrient
	Control	C+N	C+P	
NEU00B	1.10	3.71	1.07	Nitrogen
NEU00B2	1.04	5.39	1.01	Nitrogen
NEU00B4	1.24	3.37	1.41	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, Lake Orange was determined to exhibit eutrophic conditions (elevated biological productivity) in 2020. Lake Orange has been eutrophic since it was first monitored by DWR in 1988 with the exception of a mesotrophic (moderate biological productivity) score in 1991.

Corporation Lake

Ambient Lakes Program Name	Corporation Lake	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	1.0	
Volume ($10^6 m^3$)	0.90	
Watershed Area (mi^2)	40.9	
Classification	WS-II; HQW, NSW, CA	
Stations	NEU00C	NEU00C1
Number of Times Sampled	5	5

Corporation Lake is a water supply reservoir located on the Eno River downstream of Lake Orange. This lake was built in 1967 by the Orange-Alamance Water Authority. The surface area is 28 acres (11 hectares) and the maximum depth is approximately eight feet (2.5 meters). McGowan Creek is a tributary of Corporation Lake. The watershed is composed of forested and agricultural areas with a rolling topography.

Corporation Lake was sampled monthly from May through September by DWR field staff. Surface dissolved oxygen ranged from 5.8 to 9.0 mg/L and surface pH ranged from 6.4 to 7.3 s.u. (Appendix A). Total phosphorus in 2020 ranged from 0.03 to 0.08 mg/L and total organic nitrogen ranged from 0.34 to 0.72 mg/L. Chlorophyll *a* values in Corporation Lake were low, ranging from 1.3 to 16.0 *u*g/L.

Based on the calculated NCTSI scores, Corporation Lake was determined to exhibit eutrophic conditions (elevated biological productivity) in 2020. The trophic state of Corporation Lake has ranged between mesotrophic and eutrophic since it was first monitored by DWR in 1988.

Lake Ben Johnson

Ambient Lakes Program Name	Lake Ben Johnson
Trophic Status (NC TSI)	Eutrophic
Mean Depth (meters)	1.5
Volume ($10^6 m^3$)	0.02
Watershed Area (mi^2)	64.9
Classification	WS-II; HQW, NSW, CA
Stations	NEU00D
Number of Times Sampled	5

Lake Ben Johnson is a run-of-the- river lake formed by a dam on the Eno River downstream of Corporation Lake. This lake has a maximum depth of approximately seven feet (two meters). The watershed consists of a mix of agricultural, urban and forested areas. The City of Hillsborough owns the lake, which is the back-up water supply source for this municipality.

Lake Ben Johnson was monitored monthly from May through September 2020. Secchi depths, a measurement of water clarity, were less than a meter, ranging from 0.5 to 0.9 meter (Appendix A). Surface dissolved oxygen ranged from 4.8 to 8.6 mg/L and surface pH ranged from 7.0 to 7.6 s.u. Total phosphorus ranged from 0.04 to 0.05 mg/L and total organic nitrogen ranged from 0.37 to 0.58 mg/L. Chlorophyll *a* in Lake Ben Johnson ranged from 2.9 to 25.0 *ug*/L.

Based on the calculated NCTSI scores, Lake Ben Johnson was determined to exhibit moderate biological productivity (mesotrophic conditions in May 2020 and elevated biological productivity in June, July, August and September. This lake has ranged between mesotrophic to eutrophic (elevated biological productivity) since it was first monitored by DWR in 1988.

Little River Reservoir

Ambient Lakes Program Name	Little River Reservoir		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	7.5		
Volume ($10^6 m^3$)	18.00		
Watershed Area (mi^2)	97.7		
Classification	WS-II; HQW, NSW, CA		
Stations	NEU006S	NEU006T	NEU006U
Number of Times Sampled	5	5	5

Little River Reservoir is an upper piedmont water supply for the City of Durham. Filled in February 1988, the lake has a maximum depth is 49 feet (15 meters). Retention time is normally about 74 days. Mountain Creek, Buffalo Creek, North Fork and South Fork Little River are the tributaries of this reservoir. The drainage area and is equally divided between forest, agriculture, and residences. The lake was previously classified WS-III, but was reclassified to WS-II on request from the City of Durham. An aerator operates near the lower end of this lake to breakdown lake stratification and improve the quality of the raw drinking water taken from this lake.

Little River Reservoir was sampled monthly from May through September 2020 by DWR field staff. Secchi depths were less than a meter in May and rose to slightly greater than a meter at each of the three sampling sites through the remainder of the summer (Appendix A). Total phosphorus ranged from 0.02 to 0.08 ug/L. NH3 was bellow DWR laboratory detection level (<0.02 mg/L) in 2020 with the exception of a value of 0.05 mg/L at the sampling site near the dam (NEU006U) in June. Total Kjeldahl nitrogen ranged from 0.46 to 0.91 mg/L and total organic nitrogen ranged from 0.45 to 0.90 mg/L on 2020. Chlorophyll *a* was elevated, ranging from 13 to 160 ug/L. The highest chlorophyll *a* values occurred in May and June and the corresponding lake-wide mean scores for those two months was greater than the state water quality standard of 40 ug/L. Six of the 12 chlorophyll *a* values (50%) were greater than the state water quality standard.

The calculated NCTSI score for Little River Reservoir in 2020 indicated that the reservoir was eutrophic, or very biologically productive. In May, the mid-lake sampling site (NEU00T) and lower lake site (NEU006U) had NCTSI scores indicative of hypereutrophic trophic state, (exceptionally high biological productivity).

Lake Michie

Ambient Lakes Program Name	Lake Michie		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	8.0		
Volume ($10^6 m^3$)	15.60		
Watershed Area (mi^2)	170.0		
Classification	WS-III; NSW CA		
Stations	NEU0061G	NEU0061J	NEU0061L
Number of Times Sampled	5	5	5

The City of Durham built Lake Michie in 1926 to serve as a water supply. The drainage area of this piedmont reservoir consists of a combination of rural, forested, agricultural and urban land uses. The primary tributary to Lake Michie is the Flat River. In addition to serving as a water supply source, Lake Michie provides public recreation such as fishing and boating.

Lake Michie was sampled monthly from May through September by DWR field staff. Secchi depths ranged from 0.05 to 1.70 meters (Appendix A). Surface dissolved oxygen ranged from 7.2 to 12.8 mg/L and surface pH values ranged from 7.0 to 9.4 s.u. In June, the pH concentrations at the sampling site located near the dam (NEU0061L) as well as the mid-lake sampling site (NEU0061J) were greater than the state water quality standard of 9.0 s.u. Total phosphorus in Lake Michie ranged from 0.03 to 0.09 mg/L and total organic nitrogen ranged from 0.49 to 0.91 mg/L. Chlorophyll *a*, in response to the availability of nutrients in this lake, ranged from 18 to 55 *u*g/L. Five of the 15 chlorophyll *a* measurements in 2020 (33.3%) were greater than the state water quality standard of 40 *u*g/L.

Based on the calculated NCTSI scores, Lake Michie was determined to exhibit elevated biological productivity (eutrophic conditions). Lake Michie was previously determined to be eutrophic in 1988 when it was first monitored by DWR and again in 1995 and 2010. In 1991, Lake Michie exhibited moderate biological productivity (mesotrophic).

Lake Butner

Ambient Lakes Program Name	Lake Butner	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	9.0	
Volume ($10^6 m^3$)	1.40	
Watershed Area (mi^2)	30.1	
Classification	WS-II; HQW, NSW, CA	
Stations	NEU007	NEU007B
Number of Times Sampled	5	5

Lake Butner (also known as R.D. Holt Reservoir) is located on Knap of Reeds Creek in Granville County. The Town of Butner uses this lake for water supply and for recreational fishing and boating. The maximum depth is 49 feet (15 meters). The watershed is composed of rolling topography characterized by farmland and forests.

Lake Butner was sampled monthly from May through September by DWR field staff. Secchi depths in this reservoir ranged from 0.7 to 1.8 meters (Appendix A). Surface dissolved oxygen ranged from 7.1 to 9.6 mg/L and surface pH ranged from 6.2 to 7.7 s.u. Total phosphorus concentrations ranged from 0.02 to 0.04 mg/L and total organic nitrogen ranged from 0.43 to 0.61 mg/L. Chlorophyll *a* values ranged from 8.6 to 62.0 *u*g/L (which was greater than the state water quality standard of 40 *u*g/L).

Lake Butner NCTSI scores indicated that the reservoir was mesotrophic in August and eutrophic in May, June, July and September. Overall, for 2020 this lake was determined to be eutrophic. Lake Butner's trophic state has ranged between oligotrophic (very low biological productivity) to eutrophic since it was first monitored by DWR in 1988.

Lake Rogers

Ambient Lakes Program Name	Lake Rogers
Trophic Status (NC TSI)	Hypereutrophic
Mean Depth (meters)	1.0
Volume ($10^6 m^3$)	0.50
Watershed Area (mi^2)	17.4
Classification	WS-II; HQW, NSW, CA
Stations	NEU017A
Number of Times Sampled	5

Lake Rogers is the water supply reservoir for the Town of Creedmoor. This reservoir was built in 1939 and has a surface area of approximately 210 acres (57 hectares). The maximum depth of the reservoir is approximately nine feet (three meters). Tributaries to Lake Rogers include Ledge Creek and Holman Creek. Land in the drainage area consists of mostly of forested land along with some residential, agricultural, and wetland areas.

Lake Rogers was sampled monthly from May through September by DWR field staff. Secchi depths at the single lake sampling site were consistently less than one meter (Appendix A). Total phosphorus ranged from 0.06 to 0.15 mg/L and total organic nitrogen ranged from 0.80 to 1.99 mg/L. In response to the availability of nutrients in the lake, chlorophyll *a* values ranged from a low of 32 *u*g/L in May to 99 *u*g/L in August. Three of the four chlorophyll *a* measurements for 2020 (75%) were greater than the state water quality standard of 40 *u*g/L. Surface dissolved oxygen was 10.3 mg/L and the surface pH value of 9.1 s.u. was greater than the state water quality standard of 9.0 s.u.

Based on the calculated NCTSI scores, Lake Rogers was found to have elevated biological productivity (eutrophic conditions) in May 2020. From June through September 2020, the NCTSI scores indicated the presence of excessive biological productivity or hypereutrophic conditions. The NCTSI score for August could not be calculated due to the missing chlorophyll *a* value. The trophic status of Lake Rogers has varied from eutrophic to hypereutrophic since monitoring by DWR began in 1991.

Beaverdam Lake

Ambient Lakes Program Name	Beaverdam Lake
Trophic Status (NC TSI)	Eutrophic
Mean Depth (meters)	
Volume ($10^6 m^3$)	
Watershed Area (mi^2)	52.5
Classification	WS-IV B NSW CA
Stations	NEU019C
Number of Times Sampled	5

Beaverdam Lake is a small reservoir located on the Beaverdam Creek arm of Falls of the Neuse Reservoir. The shoreline is forested, and the lake is used for recreational fishing, swimming and boating. No data currently is available for the mean depth and volume of Beaverdam Lake.

Beaverdam Lake was sampled monthly from May through September by DWR field staff. Secchi depth were less than a meter, ranging from 0.6 to 0.9 meter (Appendix A). Surface dissolved oxygen ranged from 6.4 to 8.9 mg/L. Total phosphorus in Beaverdam Reservoir ranged from 0.04 to 0.05 mg/L while NH3 and NOx concentrations were below DWR laboratory detection level. Total organic nitrogen, however, ranged from 0.48 t0 0.91 mg/L. Chlorophyll *a* values were below the state water quality standard of 40 ug/L, ranging from 25 to 39 *u*g/L. In 2020, the trophic state of Beaverdam Lake was biologically elevated or eutrophic. This reservoir has exhibited this productivity state since routine monitoring by DWR began in 2010.

Falls of the Neuse Reservoir

Ambient Lakes Program Name	**Falls of the Neuse Reservoir**										
Trophic Status (NC TSI)	**Eutrophic**										
Mean Depth (meters)	**5.0**										
Volume ($10^6 m^3$)	**176.70**										
Watershed Area (mi^2)	**769.9**										
Classification	**WS-IV, B; NSW, CA**										
Stations	**LC01**	**LI01**	**LLC01**	**NEU013**	**NEU013B**	**NEU0171B**	**NEU018E**	**NEU019E**	**NEU019L**	**NEU019P**	**NEU020D**
Number of Times Sampled	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**

Falls of the Neuse Reservoir (Falls Lake) is a large impoundment of the upper Neuse River Basin. This reservoir is used for a variety of purposes including recreation, and as the main water supply reservoir for the City of Raleigh and surrounding towns in Wake County, NC. Falls Lake Dam was constructed in 1981 by the US Army Corps of Engineers (ACOE) and the reservoir began filling in 1983. This reservoir is located on the headwaters of the Neuse River, which is formed by the confluence of the Eno and Flat Rivers in Durham County. Other tributaries include the Little River, and Knap of Reeds, Ellerbe, Ledge, Lick, Little Lick, and Beaverdam Creeks. The watershed of this lake contains a mixture of urban, residential, agricultural and forested areas.

Falls of the Neuse Reservoir was monitored twice in June and monthly from July through September 2020. Surface dissolved oxygen ranged from 3.1 mg/L in September to 10.0 mg/L in June (Appendix A). Overall, the lowest surface dissolved oxygen measurements were observed in September and may have been associated with a lake turnover event. Secchi depths were generally less than a meter, suggesting reduced water clarity in this reservoir. Total phosphorus ranged from <0.02 mg/L to 0.12 mg/L and total organic nitrogen ranged from 0.48 to 1.09 mg/L. Chlorophyll *a* concentrations ranged from 13 to 71 ug/L. Of the 50 chlorophyll *a* measurements made from June through September, 12 (or 24%) were greater than the state water quality standard of 40 ug/L.

An Algal Growth Potential Test was run by the Region IV EPA Laboratory on water samples from three lake sampling sites in Falls of the Neuse Reservoir (Table 2). Results of this test indicated that the most upstream (NEU013B) and mid-lake (NEU018E) sampling sites were nitrogen limited while the site near the dam (NEU020D) was limited by both nitrogen and phosphorus (co-limited).

Table 2. Algal Growth Potential Test Results for Falls of the Neuse Reservoir, August 27, 2020

Falls of the Neuse Reservoir
August 27, 2020

Station	Maximum Standing Crop, Dry Weight (mg/L)			Limiting Nutrient
	Control	C+N	C+P	
NEU013B	0.97	2.54	0.87	Nitrogen
NEU018E	2.00	5.24	2.26	Nitrogen
NEU020D	0.94	0.98	0.57	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 calculated NCTSI scores, Falls of the Neuse Reservoir was determined to exhibit elevated biological productivity (eutrophic conditions) during the summer months of 2020. Eutrophic conditions have been present in Falls of the Neuse Reservoir since it was impounded in the early 1980's.

Due to nutrient enrichment and sediment load, upper portions of both Jordan and Falls Lakes are listed on North Carolina's 303d list for impaired waters. Impairments are a result of chlorophyll a, turbidity water quality standards violations. Section 5 (a) of 15A NCAC 02B .0275 FALLS WATER SUPPLY NUTRIENT STRATEGY describes required monitoring for evaluating progress in reducing nutrients and nutrient related pollution in this water supply reservoirs

In 2005, the North Carolina General Assembly passed Session Law 2005-190 (also known as Senate Bill 981), which directed the Environmental Management Commission (EMC) to study water supply reservoirs in general and to develop and implement a nutrient management strategy based on a calibrated nutrient response model for certain reservoirs, including Falls Lake. In 2009, Senate Bill 1020 was ratified and signed into law as Session Law 2009-486. This revised the EMC adoption deadline to January 15, 2011 and added certain requirements for water quality improvements in the watershed. A nutrient management strategy was developed and presented to the EMC as draft rules 15A NCAC 2B .0275 through .0282 and .0213(q) in March 2010. Section 5(a) of the draft Goals Rules (15A NCAC 2B .0275) includes provisions for water quality monitoring of Falls Lake and to utilize the data to produce load reduction estimates and to perform periodic use support assessments. Monthly monitoring of Falls Lake began in May 2010 and will continue until 2021 or as required by the nutrient management strategy rules. The Falls of the Neuse monitoring reports and study plan can be found at this web site:
https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/intensive-survey-branch/falls-jordan-lakes-monitoring

Wake Forest Reservoir

Ambient Lakes Program Name	Wake Forest Reservoir	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)		
Volume ($10^6 m^3$)		
Watershed Area (mi^2)		
Classification	WS-II HQW NSW CA	
Stations	NEUWFR010	NEUWFR020
Number of Times Sampled	1	2

Wake Forest Reservoir was constructed on Smith Creek in the early 1960s to serve as a drinking water source for the Town of Wake Forest. Following the construction of Falls of the Neuse Reservoir in the late 1980s, Wake Forest tied into the new reservoir and retired Wake Forest Reservoir. The lake is currently used for recreational fishing, canoeing and kayaking. A 1.6-mile soft trail for hiking was constructed on one side of the lake, with plans to extend the trail around the lake in the future. Currently, the mean depth and volume of Wake Forest Reservoir is not known.

In 2020, DWR field staff sampled Wake Forest Reservoir twice (August and September). Secchi depths ranged from 0.8 to 1.6 meters (Appendix A). Surface dissolved oxygen ranged from 8.7 to 9.5 mg/L and surface pH ranged from 7.0 to 7.7 s.u. Total phosphorus in this reservoir ranged from 0.03 to 0.06 mg/L. Total organic nitrogen ranged from 0.45 to 0.63 mg/L. Chlorophyll *a* ranged from 21 to 42 *u*g/L with the value measured at the sampling site near the dam (NEUWFR020) in September greater than the state water quality standard of 40 *u*g/L. Based on the calculated NCTSI scores, Wake Forest Reservoir was determined to exhibit elevated biological productivity (eutrophic conditions) in August and September 2020.

Lake Crabtree

Ambient Lakes Program Name	Lake Crabtree		
Trophic Status (NC TSI)	Hypereutrophic		
Mean Depth (meters)	2.0		
Volume (10^6 m^3)	0.50		
Watershed Area (mi^2)	51.4		
Classification	B; NSW		
Stations	NEUCL1	NEUCL2	NCECL3
Number of Times Sampled	5	5	5

Lake Crabtree was built in 1989 by the Soil Conservation Service as one of 11 lakes constructed for flood control. Wake County owns a park around the lake which is used for recreation. The maximum depth is approximately 13 feet (four meters). Several point sources discharge upstream of the lake which is located in an urban area. Three tributaries - Crabtree Creek, Haleys Branch, and Stirrup Iron Creek - drain portions of Cary, Morrisville, and the Raleigh-Durham International Airport.

Lake Crabtree was sampled monthly from May through September by DWR field staff. Secchi depths were very low (range = 0.2 to 0.5 meter) indicating poor water clarity in this lake (Appendix A). Surface dissolved oxygen ranged from 2.4 to 7.6 mg/L. The very low surface dissolved reading at the sampling site located near the center of the lake (NEUCL2) in July and September (3.8 mg/L; 13.3%) were below the state water quality standard for an instantaneous dissolved oxygen reading of 4.0 mg/L.

Total phosphorus ranged from 0.08 to 0.20 mg/L and total organic nitrogen ranged from 0.62 to 1.19 mg/L. Chlorophyll *a* values, in response to the ready availability of nutrients, ranged from 8.6 to 89.0 *u*g/L. Of the 15 chlorophyll *a* observations made in 2020, five (33.3%) were greater than the state water quality standard of 40 *u*g/L. Turbidity in Lake Crabtree ranged from 13 to 74 NTUs with eight of the 15 observations (53.3%) greater than the state water quality standard of 25 NTUs for lakes.

Based on the calculated NCTSI scores for 2020 this lake was determined to exhibit excessive biological productivity or hypereutrophic conditions. Lake Crabtree is on the 2018 303(d) List of Impaired Waters for exceedances of the turbidity standard and for a fish consumption advisory related to elevated levels of PCB in fish taken from the lake (https://epi.dph.ncdhhs.gov/oee/fish/advisories.html#lake_crabtree)

Reedy Creek Lake

Ambient Lakes Program Name	Reedy Creek Lake
Trophic Status (NC TSI)	Eutrophic
Mean Depth (meters)	2.0
Volume ($10^6 m^3$)	0.14
Watershed Area (mi^2)	4.0
Classification	B; NSW
Stations	NEU035A7
Number of Times Sampled	5

Reedy Creek Lake is located in Umstead State Park, which is adjacent to the Raleigh Durham International Airport. This lake is relatively small with a surface area of 20 acres (eight hectares), a maximum depth of 13 feet (four meters) and a retention time of 11 days. Land use within the watershed is primarily forest and urban. This lake is one of three lakes (Big Lake, Reedy Creek and Sycamore) located within Umstead State Park. Reedy Creek Lake is used primarily for education and recreation.

Reedy Creek Lake was sampled monthly from May through September by DWR field staff. Secchi depths were less than a meter (range = 0.4 to 0.7 meter; Appendix A). Surface dissolved oxygen ranged from 9.1 to 11.7 mg/L. Total phosphorus in Reedy Creek Lake ranged from 0.6 to 0.10 mg/L and total organic nitrogen ranged from 0.70 to 1.19 mg/L. In response to the readily available nutrients in the lake, chlorophyll *a* concentrations ranged from 26 to 77 ug/L with two of the five (40%) observations greater than the state water quality standard of 40 *u*g/L.

Based on the calculated NCTSI scores, Reedy Creek Lake exhibited elevated biological productivity (eutrophic conditions) in May, July, August and September. Biological productivity was excessive orf hypereutrophic in June. Reedy Creek Lake has been predominantly eutrophic since DWR monitoring began in 1991.

Big Lake

Ambient Lakes Program Name	Big Lake	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	2.0	
Volume ($10^6 m^3$)	0.05	
Watershed Area (mi^2)	7.0	
Classification	B; NSW	
Stations	NEU035G	NEU035H
Number of Times Sampled	5	5

Big Lake is located in Umstead State Park in northwestern Wake County, adjacent to the Raleigh-Durham International Airport. Sycamore Creek is impounded twice within the park, first forming Big Lake and then Sycamore Lake. Land use in Big Lake's watershed is primarily forest and agriculture, and urban development. Big Lake has a maximum depth of 16 feet (five meters) and a mean hydraulic retention time of 25 days.

Big Lake was sampled monthly from May through September by DWR field staff. Surface dissolved oxygen ranged from 7.1 to 9.8 mg/L and secchi depths were less than one meter (range = 0.4 to 0.8 m; Appendix A). Total phosphorus in Big Lake ranged from 0.04 to 0.08 mg/L and total organic nitrogen ranged from 0.68 to 0.96 mg/L. Chlorophyll *a* values ranged from 23 to 43 *u*g/L with two of the five observations (40%) greater than the state water quality standard of 40 *u*g/L. A turbidity value of 27 NTUs was observed in August and was slightly greater than the state water quality standard of 25 NTUs for lakes.

Based on the calculated NCTSI scores, Big Lake was determined to exhibit eutrophic conditions (elevated biological productivity) in 2020. Big Lake has been consistently eutrophic since it was first monitored by DWR in 1981.

Sycamore Lake

Ambient Lakes Program Name	Sycamore Lake
Trophic Status (NC TSI)	Eutrophic
Mean Depth (meters)	6.6
Volume ($10^6 m^3$)	0.17
Watershed Area (mi^2)	4.2
Classification	B; NSW
Stations	NEU035J
Number of Times Sampled	5

Sycamore Lake is the third of the three lakes monitored in Umstead State Park. Sycamore Lake, with a surface area of 22 acres and is relatively small. The maximum depth of 13 feet (four meters). Land use in the watershed is primarily forest and agriculture. Sycamore is used for recreation and education.

Sycamore Lake was sampled monthly from May through September by DWR field staff. Secchi depths for this lake were less than or at meter (range = 0.3 to 1.0 m; Appendix A). Surface dissolved oxygen ranged from 6.3 to 10.1 mg/L and surface pH values ranged from 6.8 to 8.1 s.u. Total phosphorus ranged from 0.04 to 0.08 mg/L and total organic nitrogen ranged from 0.71 to 0.86 mg/L. Values for chlorophyll *a* in 2020 ranged from 17 to 82 *u*g/L with two of the five observations (40%) greater than the state water quality standard of 40 *u*g/L. A turbidity value of 29 NTUs was recorded in August and was greater than the state water quality standard of 25 NTUs for a lake.

Based on the calculated NCTSI scores, Sycamore Lake exhibited excessive biological productivity or eutrophic conditions in 2020. This lake has been eutrophic since monitoring by DWR began in 1991

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Lake Johnson

Ambient Lakes Program Name	Lake Johnson	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	3.0	
Volume ($10^6 m^3$)	0.70	
Watershed Area (mi^2)	7.1	
Classification	B; NSW	
Stations	NEU042C	NEU0431A
Number of Times Sampled	5	5

Lake Johnson is owned by the City of Raleigh and is located in Wake County. The original use of the lake was as an auxiliary water supply for the City of Raleigh, but the lake is now used solely for recreation. Lake Johnson is subdivided into two basins by a road crossing at mid-lake. The lake has a maximum depth of 20 feet (six meters) and Walnut Creek is the major lake tributary. In recent years, the predominantly forested and agricultural watershed has become increasingly urban.

Lake Johnson was sampled monthly from May through September by DWR field staff. Secchi depths ranged from 0.2 to 1.2 meters, indicating poor to fair water clarity (Appendix A). Surface dissolved oxygen ranged from 5.4 to 10.3 mg/L and surface pH ranged from 6.9 to 8.6 s.u. Total phosphorus in Lake Johnson ranged from 0.03 to 0.06 mg/L and total organic nitrogen ranged from 0.48 to 0.64 mg/L. Chlorophyll *a* ranged from 12 to 61 *u*g/L and three of the nine chlorophyll *a* values (33.3%) were greater than the state water quality standard of 40 *u*g/L.

Based on the calculated NCTSI scores, Lake Johnson was determined to exhibit excessive biological productivity or eutrophic conditions in 2020. This reservoir has been eutrophic since it was first monitored by DWR in 1981.

Lake Raleigh

Ambient Lakes Program Name	Lake Raleigh	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	2.0	
Volume ($10^6 m^3$)	0.07	
Watershed Area (mi^2)	12.0	
Classification	B NSW	
Stations	NEU043A	NEU0433A
Number of Times Sampled	2	2

Lake Raleigh is a man-made impoundment that was once used as a water supply for the City of Raleigh. The original earthen dam which was constructed in 1914 was raised two feet in 1919. The lake has a maximum depth of 10 feet (three meters). The water from the lake primarily served the downtown Raleigh area. In 1986, North Carolina State University gained control of Lake Raleigh and the surrounding land to build the Centennial Campus. Walnut Creek is the main tributary of Lake Raleigh. Land use in the drainage area is primarily urban and residential

Lake Raleigh monitoring was performed in August and September 2020 by DWR field staff. Secchi depths ranged from 0.6 to 1.1 meters (Appendix A). Surface dissolved oxygen ranged from 7.3 to 9.4 mg/L and surface pH values ranged from 7.1 to 8.1 s.u. Total phosphorus ranged from 0.3 to 0.4 mg/L and total organic nitrogen concentrations ranged from 0.47 to 0.59 mg/L. Chlorophyll *a* values were within state water quality standard, ranging from 14 to 30 *u*g/L. Lake Raleigh was determined to exhibit elevated biological productivity (i.e., eutrophic conditions) based on the NCTSI calculations.

Because Lake Raleigh is located on Walnut Creek, a fish consumption advisory is in place related to elevated levels of PCB in fish taken from the creek and lake: (https://epi.dph.ncdhhs.gov/oee/fish/advisories.html#rocky)

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Lake Wheeler

Ambient Lakes Program Name	Lake Wheeler	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	4.0	
Volume ($10^6 m^3$)	7.60	
Watershed Area (mi^2)	28.2	
Classification	WS-III; NSW	
Stations	NEU055A01	NEU055A02
Number of Times Sampled	5	5

Lake Wheeler is located in southwestern Wake County upstream of Lake Benson on Swift Creek. Approximately half of the watershed is forested, but urban and residential areas are also significant. This lake has a maximum depth of 30 feet (nine meters) and an average hydraulic retention time of 72 days. Lake Wheeler provides water for the City of Raleigh via flow to Lake Benson, which is located immediately downstream. This lake is also used extensively for recreational purposes including canoeing and kayaking.

Lake Wheeler was sampled monthly from May through September 2020 by DWRQ field staff. With the exception of one measurement in September, secchi depths were less than a meter (range = 0.5 to 1.0 m; Appendix A). Surface dissolved oxygen ranged from 7.4 to 11.1 mg/L and surface pH ranged from 7.1 to 9.4 s.u. Two pH values (20%) were greater than the state water quality standard of 9.0 s.u. Total phosphorus in Lake Wheeler ranged from 0.03 to 0.07 mg/L and total organic nitrogen ranged from 0.59 to 0.86 mg/L. Chlorophyll *a* values ranged from 26 to 49 *u*g/L, with two of the ten chlorophyll *a* values greater than the state water quality standard of 40 *u*g/L.

Lake Wheeler was determined to exhibit elevated biological productivity (eutrophic conditions) in 2020 based on the calculated NCTSI scores. This lake has been predominantly eutrophic since it was first monitored by DWR in 1981.

Apex Reservoir

Ambient Lakes Program Name	Apex Reservoir
Trophic Status (NC TSI)	Eutrophic
Mean Depth (meters)	3.0
Volume (10^6 m^3)	0.34
Watershed Area (mi^2)	2.0
Classification	WSA-III NSW
Stations	NEU055A
Number of Times Sampled	5

Apex Reservoir is a former water supply reservoir for the Town of Apex located in Wake County. The lake was filled in 1923 and has a drainage area of two square miles (six square kilometers). The lake has maximum depth of 13 feet (four meters). Land uses in the watershed consist of residential as well as forested areas. The lake was discontinued as a water supply in 1989 although it is still classified WS-III NSW. The Town of Apex now uses Jordan Lake for their water supply. Apex Reservoir is currently part of a municipal park.

This reservoir was sampled monthly from May through September by DWR field staff. Secchi depths ranged from 0.6 to 1.0 meters at the single sampling site near the dam (Appendix A). Surface dissolved oxygen ranged from 7.3 to 10.2 mg/L and surface pH ranged from 7.4 to 8.8. Total phosphorus in Apex Reservoir ranged from 0.03 to 0.05 mg/L and total organic nitrogen ranged from 0.51 to 0.88 mg/L. Chlorophyll *a* values ranged from 13 to 36 *u*g/L.

Based on the calculated NCTSI scores, Apex Reservoir was determined to exhibit elevated biological productivity (eutrophic conditions) for each of the five sampling trips. Apex reservoir was previously monitored by DWR in 1991 and 1995 and exhibited eutrophic conditions on both sampling trips.

Lake Benson

Ambient Lakes Program Name	Lake Benson	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	3.0	
Volume (10^6 m^3)	3.60	
Watershed Area (mi^2)	64.9	
Classification	WS-III; NSW	
Stations	NEU055A3	NEU055A4
Number of Times Sampled	5	5

Lake Benson is a man-made impoundment located in southern Wake County. The first impoundment on the site, called Rand's Mill Pond, was built in 1844. In 1927, the City of Raleigh purchased the land and the dam for use as a water supply. Lake Benson was a water supply source for the City of Raleigh from 1953 to 1987. With the increasing growth of Raleigh and surrounding areas in Wake County, a new water treatment facility was constructed at Lake Benson. The Dempsey E. Benton Water Treatment Plant was dedicated in May 2010 and has a capacity of producing 20 million gallons of drinking water per day (MGD) with the possibility of a future increase in production of up to 40 MGD. The primary tributary to the lake is Swift Creek. The topography of the drainage area is characterized by rolling hills with approximately half of the area forested.

Lake Benson was sampled monthly from May through September by DWR field staff. Secchi depths in this reservoir were less than a meter, ranging from 0.6 to 0.8 meter (Appendix A). Surface pH ranged from 6.3 to 8.3 s.u. and surface dissolved oxygen ranged from 6.8 to 11.3 mg/L. Total organic nitrogen ranged from 0.62 to 0.88 mg/L and total phosphorus ranged from 0.04 t0 0.07 mg/L. Chlorophyll *a* values ranged from 19 to 45 *u*g/L, with three of the ten observations (30%) greater than the state water quality standard of 40 *u*g/L.

Water samples were collected at the sampling sites in this reservoir in July for an Algal Growth Potential Test (AGPT). Results from the Region IV EPA Laboratory determined that the water at this sampling site was limited for the nutrient (Table 3).

Table 3. Algal Growth Potential Test Results for Lake Benson, July 9, 2020.

Lake Benson
July 9, 2020

Station	Maximum Standing Crop, Dry Weight (mg/L)			Limiting Nutrient
	Control	C+N	C+P	
NEU055A3	1.71	8.54	1.59	Nitrogen
NEU055A4	1.75	8.58	1.76	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, Lake Benson was determined to exhibit elevated biological productivity (eutrophic conditions) in 2020. This lake has been predominantly eutrophic since it was first monitored in 1981 by DWR.

Bass Lake

Ambient Lakes Program Name	Bass Lake	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	3.0	
Volume ($10^6 m^3$)	0.10	
Watershed Area (mi^2)	9.0	
Classification	B; NSW	
Stations	NEU057C	NEU057C1
Number of Times Sampled	5	5

Bass Lake is a 54-acre recreational lake located near Holly Springs in Wake County. Although the lake is primarily fed by Basal Creek, there are also two intermittent unnamed tributaries entering the lake. The original impoundment was created when Basal Creek was dammed to create a rice paddy. This effort was unsuccessful and subsequently the dam was raised, and a gristmill installed. Currently, this lake is part of Bass Lake Park in Holly Springs. The lake is used for activities such as fishing, canoeing and kayaking. The lake is stocked with catfish, along with bream, bass and crappie. A waking trail circles the lake and a conference center is located at the lake.

Bass Lake was sampled monthly from May through September by DWR field staff. Secchi depths were less than a meter, ranging from 0.5 to 0.9 meter (Appendix A). Surface dissolved oxygen ranged from 8.0 to 9.6 mg/L and surface pH ranged from 7.0 to 8.7 s.u. Total phosphorus in Bass Lake ranged from 0.04 to 0.07 mg/L and total organic nitrogen ranged from 0.57 to 0.79 mg/L. Chlorophyll *a* values ranged from 11 to 48 *u*g/L. The latter value, which occurred at the upstream sampling site, NEU057C, was greater than the state water quality standard of 40 *u*g/L. This was the only value out of eight observations (12.5%) which exceeded the state chlorophyll *a* standard.

Based on the calculated NCTSI scores, Bass Lake was determined to exhibit elevated biological productivity or eutrophic conditions.

Cliffs of the Neuse Lake

Ambient Lakes Program Name	Cliffs of the Neuse Lake
Trophic Status (NC TSI)	Mesotrophic
Mean Depth (meters)	9.0
Volume (10^6 m^3)	0.10
Watershed Area (mi^2)	0.4
Classification	B; NSW
Stations	NEU07113A
Number of Times Sampled	2

Cliffs of the Neuse Lake is located in a state-owned park of the same name in Wayne County. The lake has a maximum depth of 18 meters. Mill Creek, the only significant tributary, was impounded to form the lake in 1953. The small forested watershed is entirely contained in the park. The lake is used for recreational swimming, boating and education.

This lake was monitored in May and June 2020 by DWR field staff. Cliffs of the Neuse Lake was dropped from the sampling schedule in July due to lowering of the lake water level to permit repairs to the dam. The decrease in the water level would introduce changes to the lake's chemistry and physical data which would not be representative of the normal water levels of the lake.

Secchi depths in Cliffs of the Neuse Lake ranged from 2.0 to 2.3 meters, indicating very good water clarity (Appendix A). Surface dissolved oxygen ranged from 8.2 to 9.4 mg/L and surface pH ranged from 4.1 to 4.3 s.u. The low pH values observed in this lake are due to the presence of an aquifer beneath the state park that contains iron sulfite, which forms sulfuric acid. Springs are present in the bottom of Cliffs of the Neuse Lake that release this acidic water from the aquifer into the lake. Total phosphorus was less than the DWR laboratory detection level of <0.02 mg/L and total organic nitrogen ranged from 0.20 to 0.32 mg/L. Chlorophyll *a* values ranged from 8.3 to 10.0 *u*g/L.

This small reservoir was determined to have very low biological productivity (oligotrophic conditions) in May and moderate biological productivity (mesotrophic conditions) in June based on the calculated NCTSI scores. Cliffs of the Neuse Lake has fluctuated between oligotrophic and mesotrophic conditions since it was first monitored by DWR in 1981.

LAKE & RESERVOIR ASSESSMENTS

HUC 03020203

Buckhorn Reservoir

Ambient Lakes Program Name	Buckhorn Reservoir	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	1.0	
Volume ($10^6 m^3$)	3.80	
Watershed Area (mi^2)	154.8	
Classification	WS-V; NSW	
Stations	NEU084B	NEU084C
Number of Times Sampled	5	5

Buckhorn Reservoir is a shallow impoundment, which serves as the water supply for the City of Wilson. Completed in 1976, this reservoir has a maximum depth of eight feet (2.4 meters). The drainage area consists of flat land used for agriculture and forests. Turkey Creek and Moccasin Creek are the primary tributaries to Buckhorn Reservoir.

This lake was sampled monthly from May through September by DWR field staff. Secchi depths were less than a meter, ranging from 0.6 to 0.8 meter. Surface dissolved oxygen ranged from 6.5 to 9.4 mg/L surface pH ranged from 6.7 to 7.7 s.u. Total phosphorus in 2020 ranged from 0.04 to 0.06 mg/L and total organic nitrogen ranged from 0.71 to 0.99 mg/L. Chlorophyll *a* ranged from 22 to 39 *u*g/L

This reservoir was determined to exhibit elevated biological productivity (eutrophic conditions) each month it was sampled in 2020. Buckhorn Reservoir has been consistently eutrophic since it was first monitored by DWR in 1988.

Wiggins Mill Reservoir

Ambient Lakes Program Name	Wiggins Mill Reservoir	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	0.5	
Volume ($10^6 m^3$)	0.60	
Watershed Area (mi^2)	237.1	
Classification	WS-IV; NSW, CA	
Stations	NEU084D	NEU084F
Number of Times Sampled	5	5

Contentnea Creek was impounded in 1915 to form Wiggins Mill Reservoir. Forty years later, the dam was raised by a foot, increasing the lake to 200 acres (81 hectares) in surface area. The City of Wilson owns Wiggins Mill Reservoir, which uses it as a water supply. Access is restricted to boats with electric motors. Land use in the Contentnea Creek watershed is dominated by agriculture with some forested areas and residential development. The water of Wiggins Mill Reservoir has a distinctive tannin or tea-color which is due to water from Bloomery and Contentnea Creek Swamps flowing into the reservoir.

Wiggins Mill Reservoir was sampled monthly from May through September by DWR field staff. Secchi depths were consistently less than a meter and ranged from 0.4 to 0.8 meter (Appendix A). Surface dissolved oxygen ranged from 4.4 to 8.1 mg/L and surface pH ranged from 6.1 to 6.6 s.u. Total phosphorus in Wiggins Mill Reservoir ranged from 0.05 to 0.14 mg/L and total organic nitrogen ranged from 0.71 to 0.99 mg/L. Chlorophyll *a* ranged from 22 t0 39 *u*g/L.

Based on the calculated NCTSI scores for 2020, Wiggins Mill Reservoir was determined to have elevated biological productivity (eutrophic conditions). This reservoir has been consistently eutrophic since it was first monitored by DWR in 1988.

Lake Wilson

Ambient Lakes Program Name	Lake Wilson
Trophic Status (NC TSI)	Hypereutrophic
Mean Depth (meters)	1.5
Volume (10^6 m^3)	0.70
Watershed Area (mi^2)	40.2
Classification	WS-III; NSW
Stations	NEU096B4
Number of Times Sampled	5

Lake Wilson is a small reservoir located on Toisnot Swamp, downstream of Silver Lake. The maximum depth of this lake is 8.5 feet (2.6 meters) and the drainage area consists of swamps and areas used agriculture and residential homes.

Lake Wilson was sampled monthly from May through September by DWR field staff. Secchi depths ranged from 0.5 to 0.8 meter (Appendix A). These low secchi depths were similar to those previously measured in this lake. Turbidity values in 2020 were below the state water quality standard of 25 NTUs. Surface dissolved oxygen ranged from 7.9 to 10.0 mg/L and surface pH ranged from 6.9 to 8.0 s.u. Total phosphorus ranged from 0.08 to 0.13 mg/L and total organic nitrogen ranged from 0.92 to 1.09 mg/L. Chlorophyll *a* in Lake Wilson ranged from 34 to 84 *u*g/L; three out of the five chlorophyll *a* observations (60%) were greater than the state water quality standard of 40 *u*g/L.

Lake Wilson was determined to be hypereutrophic (exhibiting extremely high biological productivity) in 2020 based on the calculated NCTSI scores. Lake Wilson was previously determined to be eutrophic (having elevated biological productivity) or hypereutrophic since it was first monitored by DWR in 1991.

Toisnot Reservoir

Ambient Lakes Program Name	Toisnot Reservoir	
Trophic Status (NC TSI)	Eutrophic	
Mean Depth (meters)	1.5	
Volume ($10^6 m^3$)	0.01	
Watershed Area (mi^2)	51627.0	
Classification	WS-III; NSW, CA	
Stations	NEU096C	NEU096E
Number of Times Sampled	5	5

Toisnot Reservoir was constructed between 1961 and 1963 just north of the City of Wilson and serves as the backup water supply for the City. This lake has experienced sedimentation and nutrient problems related to nonpoint source pollution. The maximum depth of this small reservoir is approximately three meters. Toisnot Swamp is the primary inflow to the reservoir. This drainage area is swampy and flat. Land use within the watershed consists of agricultural land, forested land and residential areas. The land immediately adjacent to the reservoir is used for a city park and for residential/urban development.

Toisnot Reservoir was sampled monthly from May through September by DWR field staff. Secchi depths were less than a meter and ranged from 0.4 to 0.7 meter (Appendix A). Surface dissolved oxygen ranged from 4.8 to 8.5 mg/L and surface pH values ranged from 5.3 to 6.4 s.u. Total phosphorus concentrations ranged from 0.06 to 0.11 mg/L and total organic nitrogen ranged from 0.64 to 0.99 mg/L. Chlorophyll *a* values in Toisnot Reservoir ranged from 2.1 to 44.0 ug/L (which was the only observation out of 10 (10%) that was greater than the state water quality standard of 40 *u*g/L.

Based on the calculated NCTSI scores for 2020, Toisnot Reservoir was determined to exhibit excessive biological productivity or eutrophic conditions. This lake has been eutrophic since monitoring by DWR began in 1988.

Appendix A - Neuse River Basin Lakes Data
October 1, 2015 through September 31, 2020

Lake	Date	Sampling Station	SURFACE PHYSICAL DATA DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	PHOTIC ZONE DATA 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 Hardnes mg/L
HUC 03020201																				
WEST FORK ENO RIVER RESERVOIR	June 16, 2020	NEUWFE2	2.4	23.0	6.7	59	0.6	28.8%	0.07	0.95	0.04	0.06	1.01	0.91	0.10	26.0	67	<8.3	11.0	
	June 16, 2020	NEUWFE3	3.6	23.7	6.7	60	0.8	43.6%	0.07	1.10	0.05	0.07	1.17	1.05	0.12	47.0	73	<7.1	9.3	
	June 16, 2020	NEUWFE4	5.6	23.2	6.9	64	0.8	66.7%	0.02	0.90	0.06	0.04	0.94	0.84	0.10	20.0	61	<6.2	8.5	25.0
	May 19, 2020	NEUWFE2	7.2	21.8	6.7	68	1.1	84.2%	0.04	0.79	0.03	<0.02	0.80	0.76	0.04	14.0		6.8	6.2	
	May 19, 2020	NEUWFE3	8.0	21.8	6.7	67	1.1	93.5%	0.04	0.73	0.03	<0.02	0.74	0.70	0.04	21.0	82	<6.2	4.8	
	May 19, 2020	NEUWFE4	8.0	20.8	7.6	66	1.1	90.9%	0.04	0.88	0.03	<0.02	0.89	0.85	0.04	24.0	72	<6.2	5.1	25.0
LAKE ORANGE	September 23, 2020	NEU00B	5.7	20.9	6.9	74	0.6	64.6%	0.04	0.86	0.15	0.02	0.88	0.71	0.17	42.0	72	6.2	6.5	
	September 23, 2020	NEU00B2	6.9	21.3	7.0	73	0.6	79.0%	0.04	0.95	0.14	0.03	0.98	0.81	0.17	33.0	61	<6.2	7.0	
	September 23, 2020	NEU00B4	3.7	20.7	7.0	76	0.6	42.3%	0.04	0.87	0.21	0.02	0.89	0.66	0.23	38.0	78	<6.2	6.1	29.0
	August 19, 2020	NEU00B	9.9	29.3	8.8	68	0.8	132.1%	0.04	0.75	<0.02	<0.02	0.76	0.74	0.02	43.0	74	<6.2	5.5	
	August 19, 2020	NEU00B2	9.8	29.1	8.8	69	0.9	130.8%	0.05	0.88	<0.02	<0.02	0.89	0.87	0.02		74	<6.2	5.6	
	August 19, 2020	NEU00B4	9.8	29.6	8.8	68	0.9	131.3%	0.04	0.80	<0.02	<0.02	0.81	0.79	0.02	33.0	71	<12.0	4,9	23.0
	July 15, 2020	NEU00B	9.2	32.1	8.8	65	0.9	128.1%	0.04	0.72	<0.02	<0.02	0.73	0.71	0.02	26.0	76	<6.2	6.0	
	July 15, 2020	NEU00B2	8.9	33.1	8.9	66	0.9	126.3%	0.04	0.80	<0.02	0.02	0.82	0.79	0.03	32.0	70	<6.2	6.2	
	July 15, 2020	NEU00B4	9.2	33.0	8.9	65	1.0	130.4%	0.03	0.79	<0.02	<0.02	0.80	0.78	0.02	24.0	60	<6.2	5.7	22.0
	June 18, 2020	NEU00B	7.7	21.7	7.2	56	0.7	89.3%	0.04	0.89	<0.02	<0.02	0.90	0.88	0.02	38.0	60	6.2	7.3	
	June 18, 2020	NEU00B2	9.0	22.3	7.3	58	0.7	105.7%	0.05	0.90	<0.02	0.02	0.92	0.89	0.03	43.0	68	7.2	7.2	
	June 18, 2020	NEU00B4	8.3	22.0	7.2	57	0.7	96.0%	0.04	0.95	0.03	<0.02	0.96	0.92	0.04	43.0	49	<6.2	7.1	19.0
	May 26, 2020	NEU00B	11.9	25.2	8.5	56	0.8	146.6%	0.05	0.90	<0.02	<0.02	0.53	0.50	0.03	32.0	70	9.2	10.0	
	May 26, 2020	NEU00B2	12.2	25.3	8.2	54	0.6	150.9%	0.06	0.86	<0.02	<0.02	0.71	0.68	0.03	45.0	78	9.2	11.0	
	May 26, 2020	NEU00B4	11.1	26.4	8.1	58	0.8	139.7%	0.04	0.74	<0.02	<0.02	0.57	0.54	0.03	32.0	66	7.0	9.1	23.0
CORPORATION LAKE	September 23, 2020	NEU00C	9.0	16.9	7.3	72	0.8	94.5%	0.04	0.50	<0.02	0.22	0.72	0.49	0.23	15.0	168	<12.0	7.0	
	September 23, 2020	NEU00C1	9.0	17.9	7.2	75	0.6	95.8%	0.04	0.54	<0.02	0.22	0.76	0.53	0.23	16.0	81	9.0	9.3	30.0
	August 19, 2020	NEU00C	7.0	22.8	7.2	69	0.6	82,5%	0.06	0.54	0.02	0.21	0.75	0.52	0.23	9.9	78	9.8	15.0	
	August 19, 2020	NEU00C1	6.8	22.5	7.3	65	0.4	80.4%	0.08	0.75	0.03	0.23	0.98	0.72	0.26	12.0	97	17.0	26.0	
	July 15, 2020	NEU00C	6.4	24.7	7.2	81	1.0	78.0%	0.03	0.36	0.02	0.52	0.88	0.34	0.54	1.3	79	<6.2	6.9	
	July 15, 2020	NEU00C1	5.8	25.0	7.1	84	0.5	70.8%	0.06	0.53	0.03	0.41	0.94	0.50	0.44	16.0	83	12.0	13.0	31.0
	June 18, 2020	NEU00C	8.4	19.1	7.2	62	0.5	91.6%	0.05	0.67	0.04	0.23	0.90	0.63	0.27	16.0	64	12.0	18.0	
	June 18, 2020	NEU00C1	8.4	19.5	7.2	63	0.5	92.0%	0.05	0.64	0.02	0.24	0.88	0.62	0.26		93	15.0	20.0	21.0
	May 26, 2020	NEU00C	8.3	18.6	6.4	62	0.7	89.8%	0.05	0.62	0.08	0.28	0.90	0.54	0.36	4.4	61	8.5	14.0	
	May 26, 2020	NEU00C1	7.9	19.5	6.6	64	0.5	86.6%	0.05	0.56	0.08	0.30	0.86	0.48	0.38	4.7	62	11.0	15.0	26.0
LAKE BEN JOHNSON	September 14, 2020	NEU00D	4.8	23.2	7.1	91	0.6	57.2%	0.04	0.52	0.04	0.32	0.84	0.48	0.36	5.6	78	<6.2	6.5	36.0
	August 24, 2020	NEU00D	6.8	24.9	7.6	74	0.7	82.9%	0.04	0.53	0.03	0.26	0.79	0.50	0.29	6.4	81	<12.0	11.0	
	July 27, 2020	NEU00D	8.6	29.0	7.5	84	0.9	113.3%	0.04	0.59	<0.02	0.28	0.87	0.58	0.29	25.0	73	<6.2	7.4	28.0
	June 16, 2020	NEU00D	8.3	18.5	7.2	72	0.5	89.0%	0.05	0.53	0.04	0.39	0.92	0.49	0.43	6.5		12.0	20.0	26.0
	May 19, 2020	NEU00D	7.5	18.8	7.0	75	0.8	81.8%	0.04	0.42	0.05	0.33	0.75	0.37	0.38	2.9	58	<12.0	9.4	27.0
LITTLE RIVER RESERVOIR	September 8, 2020	NEU006S	8.0	28.5	7.4	72	1.1	103.6%	0.04	0.57	<0.02	0.02	0.59	0.56	0.03	28.0	62	<6.2	3.5	
	September 8, 2020	NEU006T	5.8	28.0	7.0	71	1.1	74.5%	0.02	0.46	<0.02	<0.02	0.47	0.45	0.02	21.0	51	<6.2	2.5	
	September 8, 2020	NEU006U	6.9	28.5	7.2	71	1.1	89.1%	0.02	0.50	<0.02	<0.02	0.51	0.49	0.02	19.0	56	<6.2	2.4	24.0
	August 18, 2020	NEU006S	4.7	28.4	7.0	71	1.3	60.9%								32.0	64	<6.2	3.7	
	August 18, 2020	NEU006T	5.8	28.0	7.1	69	1.6	75.0%	0.03	0.58	<0.02	<0.02	0.59	0.57	0.02	24.0	63	<6.2	2.4	
	August 18, 2020	NEU006U	5.9	29.1	7.1	69	1.3	78.2%	0.02	0.50	<0.02	<0.02	0.51	0.49	0.02	13.0	64	<6.2	2.5	24.0
	July 27, 2020	NEU006S	9.1	30.8	8.4	74	1.2	122.7%	0.05	0.73	<0.02	<0.02	0.74	0.72	0.02	41.0	56	<12.0	3,6	
	July 27, 2020	NEU006T	8.5	30.9	8.2	72	1.4	115.4%	0.03	0.62	<0.02	<0.02	0.62	0.61	0.01	16.0	60	<6.2	2.7	
	July 27, 2020	NEU006U	8.3	30.5	7.6	70	1.1	111.8%	0.04	0.86	<0.02	<0.02	0.87	0.85	0.02	26.0	48	<6.2	3.8	22.0
	June 23, 2020	NEU006S	11.3	27.2	8.8	63	1.0	143.8%	0.06	0.82	<0.02	0.08	0.90	0.81	0.09	71.0	67	6.8	5.1	
	June 23, 2020	NEU006T	10.0	26.7	8.3	61	1.1	126.8%	0.04	0.78	<0.02	0.02	0.80	0.77	0.03	43.0	59	<6.2	4.2	
	June 23, 2020	NEU006U	9.3	24.5	7.4	61	1.1	112.4%	0.04	0.77	0.05	0.09	0.86	0.72	0.14	38.0	60	<6.2	4.3	21.0
	May 27, 2020	NEU006S	11.0	23.4	7.5	60	0.7	129.8%	0.06	0.77	<0.02	0.11	0.88	0.76	0.12	45.0	77	8.3	12.0	
	May 27, 2020	NEU006T	11.8	22.9	8.0	59	0.6	137.7%	0.08	0.82	<0.02	0.02	0.84	0.81	0.03	70.0	70	<7.0	9.5	
	May 27, 2020	NEU006U	11.7	23.0	7.9	61	0.7	137.2%	0.06	0.91	<0.02	0.02	0.93	0.90	0.03	160.0	63	<15.0	7.8	22.0
LAKE MICHIE	September 28, 2020	NEU0061G	10.4	21.4	7.7	70	0.9	118.8%	0.07	0.74	<0.02	<0.02	0.75	0.73	0.02	47.0	63	7.0	7.3	
	September 28, 2020	NEU0061J	10.0	21.2	7.6	70	1.1	114.0%	0.05	0.62	<0.02	0.03	0.65	0.61	0.04	42.0	74	<6.2	4.7	
	September 28, 2020	NEU0061L	9.6	21.2	7.3	69	0.9	108.8%	0.04	0.63	<0.02	0.04	0.67	0.62	0.05	55.0	57	<6.2	5.1	23.0
	August 25, 2020	NEU0061G	9.2	28.8	7.8	79	0.8	120.2%	0.05	0.65	<0.02	<0.02	0.66	0.64	0.02	20.0	74	<6.2	7.0	
	August 25, 2020	NEU0061J	8.5	28.4	8.1	76	1.4	109.9%	0.04	0.51	<0.02	<0.02	0.52	0.50	0.02	23.0	67	<12.0	2.4	
	August 25, 2020	NEU0061L	8.1	28.4	7.9	76	1.6	105.1%	0.03	0.50	<0.02	<0.02	0.51	0.49	0.02	19.0	58	<6.2	2.3	24.0
	July 21, 2020	NEU0061G	7.7	31.5	7.8	81	0.8	105.0%	0.05	0.64	<0.02	<0.02	0.65	0.63	0.02	25.0	68	7.5	6.9	
	July 21, 2020	NEU0061J	7.2	30.4	8.7	5	1.7	97.1%	0.04	0.53	<0.02	<0.02	0.54	0.52	0.02	22.0	65	<6.2	2.8	
	July 21, 2020	NEU0061L	7.5	32.8	8.9	72	1.6	104.5%	0.03	0.56	<0.02	<0.02	0.57	0.55	0.02	18.0	52	<6.2	3.1	31.0
	June 23, 2020	NEU0061G	10.6	26.4	8.8	65	0.5	132.9%	0.09	0.92	<0.02	0.19	1.11	0.91	0.20	40.0	75	12.0	19.0	
	June 23, 2020	NEU0061J	11.8	26.2	9.2	68	0.6	148.5%	0.06	0.85	<0.02	0.04	0.89	0.84	0.05	40.0		8.0	12.0	
	June 23, 2020	NEU0061L	12.8	26.0	9.4	71	0.7	159.8%	0.05	0.82	<0.02	0.04	0.86	0.81	0.05	44.0	72	7.5	8.7	22.0
	May 27, 2020	NEU0061G	10.0	23.8	7.3	55	0.5	118.5%	0.06	0.81	<0.02	0.28	1.09	0.80	0.29	28.0	81	10.0	17.0	
	May 27, 2020	NEU0061J	10.2	23.2	7.4	48	0.6	119.9%	0.07	0.67	<0.02	0.17	0.84	0.66	0.18	44.0	84	10.0	16.0	
	May 27, 2020	NEU0061L	9.5	21.8	7.0	47	0.6	108.3%	0.07	0.70	<0.02	0.18	0.88	0.69	0.19	35.0	70	8.0	17.0	10.0
LAKE BUTNER	September 28, 2020	NEU007	8.5	21.8	6.8	43	1.5	97.7%	0.03	0.54	<0.02	0.02	0.56	0.53	0.03	15.0	52	<6.2	3.9	
	September 28, 2020	NEU007B	7.6	20.8	7.4	44	0.9	86.4%	0.04	0.61	<0.02	<0.02	0.62	0.60	0.02	62.0	53	<6.2	3.6	16.0
	August 25, 2020	NEU007	8.2	28.8	7.6	47	1.8	107.3%	0.02	0.50	<0.02	<0.02	0.51	0.49	0.02	12.0	50	<6.2	2.4	
	August 25, 2020	NEU007B	7.1	28.5	7.1		1.8	91.6%	0.02	0.44	<0.02	<0.02	0.45	0.43	0.02	8.6	52	<6.2	2.1	16.0
	July 21, 2020	NEU007	7.5	31.8	7.3	50	1.5	103.4%	0.02	0.55	<0.02	<0.02	0.56	0.54	0.02	16.0	61	<6.2	2.8	
	July 21, 2020	NEU007B	7.6	30.8	7.4	48	1.7	103.0%	0.02	0.54	<0.02	<0.02	0.55	0.53	0.02	14.0	64	<12.0	2.6	16.0
	June 23, 2020	NEU007	8.6	28.5	7.7	45	1.2	112.5%	0.04	0.52	<0.02	0.03	0.55	0.51	0.04	11.0	55	<6.2	5.0	
	June 23, 2020	NEU007B	8.6	26.8	7.3	45	1.0	108.6%	0.04	0.62	<0.02	<0.02	0.63	0.61	0.02	24.0	65	<6.2	5.3	16.0
	May 27, 2020	NEU007	9.4	23.9	6.2	37	0.7	111.7%	0.04	0.54	<0.02	0.03	0.57	0.53	0.04	17.0	73	7.2	10.0	
	May 27, 2020	NEU007B	9.6	24.8	7.5	40	0.9	117.1%	0.04	0.58	<0.02	<0.02	0.59	0.57	0.02	20.0	61	<6.2	7.2	15.0

Appendix A - Neuse River Basin Lakes Data
October 1, 2015 through September 31, 2020

Lake	Date	Sampling Station	SURFACE PHYSICAL DATA DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	PHOTIC ZONE DATA 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 Hardnes mg/L
LAKE ROGERS	September 8, 2020	NEU017A	5.6	26.8	7.1	67	0.4	70.4%	0.15	2.00	<0.02	0.03	2.03	1.99	0.04	96.0	90	17.0	21.0	26.0
	August 18, 2020	NEU017A	10.3	30.2	9.1	64	0.3	138.7%	0.12	1.70	<0.02	0.02	1.72	1.69	0.03	99.0	100	17.0	17.0	22.0
	July 23, 2020	NEU017A	5.6	31.0	7.1	63	0.4	75.7%	0.11	1.50	<0.02	<0.02	1.51	1.49	0.02		71	15.0	18.0	11.0
	June 23, 2020	NEU017A	7.4	27.9	6.9	56	0.5	95.1%	0.08	1.20	<0.02	<0.02	1.21	1.19	0.02	48.0	80	9.2	12.0	23.0
	May 27, 2020	NEU017A	7.1	24.1	6.5	52	0.5	84.6%	0.06	0.81	<0.02	<0.02	0.82	0.80	0.02	32.0	81	7.3	14.0	20.0
BEAVERDAM LALKE	September 15, 2020	NEU019C	6.9	24.8	6.0	69	0.6	83.1%	0.04	0.77	<0.02	<0.02	0.78	0.76	0.02	39.0	82	9.2	6.0	
	August 18, 2020	NEU019C	6.4	29.0	6.3	61	0.7	83.8%	0.04	0.92	<0.02	<0.02	0.93	0.91	0.02	36.0	68	<6.2	5.6	
	July 21, 2020	NEU019C	8.0	31.5	8.5	64	0.9	109.4%	0.04	0.74	<0.02	<0.02	0.75	0.73	0.02	34.0	66	<6.2	4.8	
	June 23, 2020	NEU019C	8.9	27.8	8.5	62	0.8	115.1%	0.05	0.86	<0.02	<0.02	0.87	0.85	0.02	38.0	60	<12.0	6.6	
	June 1, 2020	NEU019C	8.7	24.0	7.2	58	0.9	103.5%	0.04	0.49	<0.02	<0.02	0.50	0.48	0.02	25.0	90	<12.0	4.6	
FALLS OF THE NEUSE RESERVOIR	September 16, 2020	LC01	6.8	26.5	7.3	90	0.5	84.0%	0.05	0.87	0.07	<0.02	0.88	0.80	0.08	38.0	84	11.0	11.0	
	September 16, 2020	LI01	7.9	26.3	7.5	86	0.4	97.7%	0.06	0.86	<0.02	0.02	0.88	0.85	0.03	49.0	73	13.0	13.0	
	September 16, 2020	LLC01	9.2	26.3	8.2	95	0.4	114.2%	0.07	0.98	<0.02	<0.02	0.99	0.97	0.02	62.0	54	17.0	15.0	
	September 16, 2020	NEU013	9.9	25.5	8.5	144	0.3	120.8%	0.10	1.00	<0.02	<0.02	1.01	0.99	0.02		122	24.0	24.0	
	September 16, 2020	NEU013B	9.5	25.6	8.4	124	0.3	115.9%	0.08	0.88	<0.02	<0.02	0.89	0.87	0.02	37.0	106	26.0	22.0	
	September 16, 2020	NEU0171B	8.4	26.2	7.7	95	0.4	103.7%	0.06	0.84	<0.02	0.02	0.86	0.83	0.03	50.0	118	16.0	14.0	
	September 16, 2020	NEU018E	9.6	26.5	8.4	89	0.5	119.2%	0.06	0.97	<0.02	<0.02	0.98	0.96	0.02	71.0	100	13.0	10.0	
	September 16, 2020	NEU019E	4.7	26.0	7.1	85	0.6	57.8%	0.04	0.86	0.10	0.02	0.88	0.76	0.12	32.0	68	8.0	7.7	
	September 16, 2020	NEU019L	3.1	26.7	6.8	85	0.7	38.0%	0.03	0.81	0.15	0.02	0.83	0.66	0.17	23.0	64	<6.2	5.3	
	September 16, 2020	NEU019P	4.9	26.8	6.9	78	0.6	61.1%	0.03	0.63	<0.02	<0.02	0.64	0.62	0.02	22.0		<6.2	4.4	
	September 16, 2020	NEU020D	5.1	26.6	6.9	75		63.3%	0.02	0.55	<0.02	0.03	0.58	0.54	0.04	17.0	44	<6.2	4.0	23.0
	August 27, 2020	LC01					0.7		0.04	0.70	<0.02	<0.02	0.71	0.69	0.02	23.0	62	<6.2	4.0	
	August 27, 2020	LI01	8.9	29.7	8.6	81	0.7	117.6%	0.04	0.75	<0.02	<0.02	0.76	0.74	0.02	32.0	63	<6.2	5.1	
	August 27, 2020	LLC01	7.9	29.3	7.8	96	0.5	103.6%	0.06	0.82	<0.02	<0.02	0.83	0.81	0.02	37.0	86	8.0	7.3	
	August 27, 2020	NEU013	8.9	29.6	8.5	123	0.3	116.8%	0.10	1.00	<0.02	<0.02	1.01	0.99	0.02		105	18.0	18.0	
	August 27, 2020	NEU013B	8.8	29.8	8.5	123	0.5	115.9%	0.07	0.78	<0.02	0.02	0.80	0.77	0.03	36.0	104	12.0	11.0	
	August 27, 2020	NEU0171B	8.6	29.4	8.5	98	0.6	113.7%	0.05	0.80	<0.02	<0.02	0.81	0.79	0.02	35.0	76	7.0	7.0	
	August 27, 2020	NEU018E	9.1	29.9	8.7	83	0.8	120.2%	0.04	0.74	<0.02	<0.02	0.75	0.73	0.02	19.0	69	<6.2	3.5	
	August 27, 2020	NEU019E	8.6	29.5	8.5	77	0.9	113.3%	0.04	0.75	<0.02	<0.02	0.76	0.74	0.02	28.0	73	<12.0	3.7	
	August 27, 2020	NEU019L	9.4	30.7	8.6	78	1.1	126.5%	0.03	0.64	<0.02	<0.02	0.65	0.63	0.02	23.0	72	<6.2	3.4	
	August 27, 2020	NEU019P	8.8	31.2	8.3	76	1.0	119.5%	0.03	0.60	<0.02	<0.02	0.61	0.59	0.02	28.0	64	<6.2	4.2	
	August 27, 2020	NEU020D	8.8	31.1	8.4	72	1.5	118.7%	0.02	0.55	<0.02	<0.02	0.56	0.54	0.02	23.0	63	<6.2	3.6	22.0
	July 22, 2020	LC01	7.1	32.0	7.7	78	0.6	97.9%	0.05	0.63	<0.02	<0.02	0.64	0.62	0.02	25.0	71	8.0	7.5	
	July 22, 2020	LI01	5.1	30.6	7.1	81	0.8	68.6%	0.04	0.61	<0.02	0.02	0.63	0.60	0.03	23.0	63	<6.2	4.8	
	July 22, 2020	LLC01	5.4	31.0	7.3	82	0.7	72.4%	0.05	0.68	<0.02	<0.02	0.69	0.67	0.02	40.0	69	<12.0	7.2	
	July 22, 2020	NEU013	6.8	31.3	7.7	157	0.3	91.6%	0.12	1.00	<0.02	<0.02	1.01	0.99	0.02		138	29.0	29.0	
	July 22, 2020	NEU013B	6.3	31.2	7.5	112	0.3	85.1%	0.09	0.79	<0.02	<0.02	0.80	0.78	0.02	49.0	99	22.0	22.0	
	July 22, 2020	NEU0171B	6.4	31.1	7.5	81	0.7	86.4%	0.04	0.64	<0.02	<0.02	0.65	0.63	0.02	26.0	52	9.8	7.9	
	July 22, 2020	NEU018E	6.8	31.3	7.7	81	0.9	92.8%	0.04	0.64	<0.02	<0.02	0.65	0.63	0.02	28.0	39	<6.2	4.2	
	July 22, 2020	NEU019E	6.9	31.6	7.6	78	0.9	94.5%	0.03	0.56	<0.02	<0.02	0.57	0.55	0.02	20.0	56	<6.2	3.3	
	July 22, 2020	NEU019L	8.3	32.8	8.4	78	1.1	115.1%	0.02	0.52	<0.02	<0.02	0.53	0.51	0.02	24.0	90	<6.2	3.3	
	July 22, 2020	NEU019P	7.9	32.9	8.0	79	0.9	109.4%	0.02	0.5	<0.02	<0.02	0.51	0.49	0.02	14.0	74	<6.2	3.3	
	July 22, 2020	NEU020D	8.2	33.4	8.5	81	1.3	114.8%	<0.02	0.49	<0.02	0.02	0.51	0.48	0.03	13.0	<25.0	<6.2	3.1	25.0
	June 24, 2020	LC01	8.4	28.9	8.4	74	0.6	110.5%	0.05	0.93	<0.02	0.02	0.95	0.92	0.03	36.0	64	9.8	8.6	
	June 24, 2020	LI01	7.9	27.1	7.7	76	0.7	100.3%	0.04	0.74	<0.02	0.02	0.76	0.73	0.03	35.0	72	7.8	8.2	
	June 24, 2020	LLC01	8.4	27.0	7.9	74	0.6	106.7%	0.05	0.79	<0.02	<0.02	0.80	0.78	0.02	59.0	72	11.0	9.8	
	June 24, 2020	NEU013	8.3	28.3	7.9	76	0.4	107.3%	0.09	1.10	<0.02	<0.02	1.11	1.09	0.02		106	25.0	20.0	
	June 24, 2020	NEU013B	8.3	28.3	7.9	76	0.4	107.3%	0.07	0.75	<0.02	<0.02	0.76	0.74	0.02	40.0	95	16.0	14.0	
	June 24, 2020	NEU0171B	7.9	26.8	7.7	74	0.5	99.6%	0.06	0.83	<0.02	<0.02	0.84	0.82	0.02	54.0	72	10.0	9.5	
	June 24, 2020	NEU018E	8.3	26.9	8.4	74	0.7	105.3%	0.05	0.73	<0.02	<0.02	0.74	0.72	0.02	44.0	69	6.5	5.4	
	June 24, 2020	NEU019E	8.9	28.2	8.8	74	0.8	115.2%	0.04	0.62	<0.02	<0.02	0.63	0.61	0.02	42.0	57	<6.2	5.2	
	June 24, 2020	NEU019L	9.6	29.1	8.9	75	0.9	126.3%	0.04	0.72	<0.02	<0.02	0.73	0.71	0.02	39.0	72	<6.2	4.8	
	June 24, 2020	NEU019P	9.5	28.7	8.9	75	0.9	124.5%	0.04	0.66	<0.02	<0.02	0.67	0.65	0.02	38.0	104	<6.2	4.8	
	June 24, 2020	NEU020D	9.8	29.9	9.1	76	0.9	130.9%	0.03	0.68	<0.02	<0.02	0.69	0.67	0.02	33.0	58	<6.2	5.0	25.0
	June 1, 2020	LC01	8.4	23	7.2	69	0.8	97.4%	0.04	0.65	<0.02	<0.02	0.66	0.64	0.02	30.0	74	<12.0	5.4	
	June 1, 2020	LI01	10.0	25.3	8.3	72	0.8	80.0%	0.05	0.68	<0.02	<0.02	0.69	0.67	0.02	36.0	80	6.8	6.0	
	June 1, 2020	LLC01	8.8	23.6	7.1	64	0.7	103.9%	0.05	0.65	<0.02	<0.02	0.66	0.64	0.02	44.0	85	6.8	7.1	
	June 1, 2020	NEU013	8.6	23.5	7.0	71	0.4	100.8%	0.06	0.62	<0.02	0.11	0.73	0.61	0.12		80	14.0	14.0	
	June 1, 2020	NEU013B	8.5	24.2	7.2	69	0.6	101.0%	0.06	0.73	<0.02	0.04	0.77	0.72	0.05	54.0	92	11.0	9.9	
	June 1, 2020	NEU0171B	9.1	23.5	7.1	64	0.8	106.9%	0.05	0.58	<0.02	<0.02	0.59	0.57	0.02	49.0	70	<6.2	5.3	
	June 1, 2020	NEU018E	9.2	24.2	7.6	65	0.9	109.3%	0.04	0.64	<0.02	<0.02	0.65	0.63	0.02	33.0	100	<6.2	4.7	
	June 1, 2020	NEU019E	9.6	23.8	8.0	66	0.9	113.2%	0.04	0.65	<0.02	<0.02	0.66	0.64	0.02	37.0	90	<6.2	4.5	
	June 1, 2020	NEU019L	8.6	23.7	7.2	69	0.9	101.0%	0.03	0.73	<0.02	0.02	0.75	0.72	0.03	28.0	88	<6.2	5.3	
	June 1, 2020	NEU019P	8.9	23.9	7.3	70	0.9	105.0%	0.06	0.59	<0.02	0.03	0.62	0.58	0.04	28.0	116	<6.2	5.6	
	June 1, 2020	NEU020D	9.7	25.0	8.2	77	1.0	117.2%	0.04	0.54	<0.02	<0.02	0.55	0.53	0.02	27.0	86	<6.2	4.2	25.0
WAKE FOREST RESERVOIR	September 30, 2020	NEUWFR010	8.8	22.9	7.0	67	0.8	103.0%	0.06	0.57	<0.02	0.04	0.61	0.56	0.05	21.0	105	7.2	10.0	
	September 30, 2020	NEUWFR020	9.5	22.3	7.7	67	1.6	109.7%	0.04	0.64	<0.02	<0.02	0.65	0.63	0.02	42.0	66	<12.0	5.2	
	August 27, 2020	NEUWFR020	8.7	29.4	7.5	67	1.3	114.5%	0.03	0.46	<0.02	<0.02	0.47	0.45	0.02	21.0	35	<6.2	4.9	
LAKE CRABTREE	September 9, 2020	NEUCL1	6.8	26.6	7.4	76	0.4	85.5%	0.12	0.96	<0.02	<0.02	0.97	0.95	0.02	39.0	90	38.0	37.0	
	September 9, 2020	NEUCL2	3.8	26.1	6.9	84	0.4	47.5%	0.09	0.68	<0.02	0.03	0.71	0.67	0.04	18.0	92	18.0	21.0	
	September 9, 2020	NEUCL3	4.9	25.8	7.4	76	0.4	60.0%	0.09	0.84	<0.02	<0.02	0.85	0.83	0.02	39.0	86	17.0	24.0	
	August 7, 2020	NEUCL1	7.6	27.7	7.0	76	0.3	96.9%	0.12	0.78	<0.02	0.03	0.81	0.77	0.04	32.0	96	34.0	40.0	
	August 7, 2020	NEUCL2	4.4	27.7	6.9	92	0.4	56.8%	0.08	0.66	0.04	0.06	0.72	0.62	0.10	15.0	89	18.0	24.0	
	August 7, 2020	NEUCL3	6.5	27.9	7.2	81	0.4	83.0%	0.10	0.91	0.01	0.02	0.93	0.90	0.03	44.0	90	17.0	23.0	
	July 10, 2020	NEUCL1	7.7	29.6	8.0	111	0.2	101.7%	0.14	1.20	<0.02	<0.02	1.21	1.19	0.02	81.0	127	50.0	43.0	
	July 10, 2020	NEUCL2	2.4	27.8	6.9	124	0.5	30.4%	0.08	0.64	<0.02	<0.02	0.65	0.63	0.02	9.7	100	11.0	13.0	
	July 10, 2020	NEUCL3	8.2	30.0	8.2	105	0.2	109.6%	0.11	1.10	<0.02	<0.02	1.11	1.09	0.02	89.0	97	25.0	27.0	
	June 4, 2020	NEUCL1	7.0	26.7	6.9	94	0.2	88.7%	0.12	0.98	<0.02	<0.02	0.99	0.97	0.02	32.0	116	30.0	40.0	
	June 4, 2020	NEUCL2	4.2	28.3	6.8	123	0.3	54.4%	0.09	0.91	0.07	0.04	0.95	0.84	0.11	8.6	125	17.0	28.0	
	June 4, 2020	NEUCL3	7.4	26.5	6.5	93	0.4	92.3%	0.10	1.00	<0.02	<0.02	1.01	0.99	0.02	43.0	105	20.0	23.0	
	May 19, 2020	NEUCL1	7.4	20.3	7.4	136	0.2	89.4%	0.20	1.70	0.06	<0.02	1.71	1.64	0.07	68.0	192	97.0	74.0	
	May 19, 2020	NEUCL2	6.5	20.5	7.2	153	0.3	72.7%	0.12	0.78	<0.02	<0.02	0.79	0.77	0.02	29.0		44.0	30.0	
	May 19, 2020	NEUCL3	5.0	22.2	7.0	141	0.3	57.4%	0.12	1.30	0.19	<0.02	1.31	1.11	0.20	34.0		32.0	40.0	
REEDY CREEK	September 8, 2020	NEU035A7	9.1	26.6	7.5	68	0.7	113.5%	0.07	0.80	<0.02	0.03	0.83	0.79	0.04	43.0	63	<12.0	9.4	

Appendix A - Neuse River Basin Lakes Data
October 1, 2015 through September 31, 2020

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 Hardnes mg/L
			SURFACE PHYSICAL DATA						PHOTIC ZONE DATA											
LAKE	August 5, 2020	NEU035A7	9.1	28.2	7.3	66	0.4	117.6%	0.09	0.77	<0.02	0.07	0.84	0.76	0.08	26.0	72	18.0	23.0	
	July 7, 2020	NEU035A7	9.2	30.2	7.9	95	0.6	123.2%	0.07	0.73	<0.02	<0.02	0.74	0.72	0.02	32.0	62	<12.0	10.0	
	June 3, 2020	NEU035A7	11.7	26.3		61	0.4	146.9%	0.10	1.20	<0.02	<0.02	1.21	1.19	0.02	77.0	92	17.0	24.0	
	May 7, 2020	NEU035A7	10.7	21.7	8.5	96	0.5	122.8%	0.06	0.71	<0.02	<0.02	0.72	0.70	0.02	31.0	82	<12.0	16.0	
BIG LAKE	September 8, 2020	NEU035H	9.5	25.8	8.1	82	0.5	117.7%	0.06	0.97	<0.02	0.02	0.99	0.96	0.03	43.0	67	7.0	14.0	
	August 5, 2020	NEU035H	7.1	27.3	7.1	76	0.4	90.7%	0.08	0.76	0.02	0.17	0.93	0.74	0.19	23.0	89	13.0	27.0	
	July 7, 2020	NEU035H	8.5	28.6	7.8	113	0.8	110.9%	0.04	0.61	<0.02	0.04	0.65	0.60	0.05	24.0	67	6.2	8.7	
	June 3, 2020	NEU035H	9.8	25.1	8.1	90	0.7	120.5%	0.07	1.00	<0.02	0.02	1.02	0.99	0.03	43.0	104	<6.2	14.0	
	May 7, 2020	NEU035H	7.8	19.7	7.2	110	0.8	86.3%	0.06	0.76	0.08	0.09	0.85	0.68	0.17	23.0	87	7.4	12.0	
SYCAMORE LAKE	September 8, 2020	NEU035J	6.7	25.8	7.3	74	0.7	82.8%	0.06	0.93	0.08	0.03	0.96	0.85	0.11	46.0	70	6.8	8.8	
	August 5, 2020	NEU035J	6.3	26.6	6.8	69	0.3	79.5%	0.08	0.79	0.06	0.12	0.91	0.73	0.18	26.0	81	14.0	29.0	
	July 7, 2020	NEU035J	8.4	28.8	8.1	110	0.8	110.1%	0.06	0.87	<0.02	<0.02	0.88	0.86	0.02	82.0	69	9.5	9.1	
	June 3, 2020	NEU035J	10.1	26.7		80	0.7	127.3%	0.05	0.80	<0.02	<0.02	0.81	0.79	0.02	27.0	96	6.2	13.0	
	May 7, 2020	NEU035J	9.3	20.9	7.7	125	1.0	105.0%	0.04	0.72	<0.02	0.04	0.76	0.71	0.05	17.0	104	6.5	7.7	
LAKE JOHNSON	September 24, 2020	NEU042C	10.3	21.5	7.8	51	0.2	117.6%	0.04	0.55	<0.02	<0.02	0.56	0.54	0.02	42.0	61	7.0	8.2	
	September 24, 2020	NEU0431A	9.5	21.2	7.6	51	0.8	107.6%	0.03	0.49	<0.02	0.03	0.52	0.48	0.04	61.0	53	<6.2	6.2	
	August 11, 2020	NEU042C	6.6	29.7	6.9	58	0.4	87.3%	0.05	0.57	0.01	0.01	0.58	0.56	0.02	18.0	56	7.8	8.8	
	August 11, 2020	NEU0431A	9.1	29.3	8.6	55	1.0	119.3%	0.03	0.56	0.01	0.03	0.59	0.55	0.04	46.0	57	<6.2	4.3	
	July 14, 2020	NEU042C	6.6	30.5	7.0	66	0.4	89.1%	0.06	0.60	<0.02	0.020	0.62	0.59	0.03	23.0	62	10.0	8.7	
	July 14, 2020	NEU0431A	8.3	30.2	8.1	66	1.2	111.5%	0.03	0.50	<0.02	0.020	0.52	0.49	0.03	12.0	61	<6.2	3.1	
	June 17, 2020	NEU042C	5.4	21.4	6.9	67	0.5	61.1%	0.04	0.76	0.12	0.06	0.82	0.64	0.18	20.0	74	8.5	11.0	
	June 17, 2020	NEU0431A	6.3	22.4	7.1	64	0.8	73.5%	0.03	0.64	0.05	0.03	0.67	0.59	0.08		57	<6.2	5.7	
	May 13, 2020	NEU042C	9.3	18.5	7.3	77	0.3	99.1%	0.04	0.64	<0.02	<0.02	0.65	0.63	0.02	16.0	63	8.0	7.0	
	May 13, 2020	NEU0431A	9.4	18.7	7.2	65	1.1	100.7%	0.03	0.49	<0.02	<0.02	0.50	0.48	0.02	33.0	57	<6.2	4.0	
LAKE RALEIGH	September 14, 2020	NEU0433A	9.4	27.6	8.1	52	0.8	119.6%	0.03	0.48	<0.02	0.02	0.50	0.47	0.03	19.0	<50	<6.2	6.0	
	September 14, 2020	NEU043A	8.7	27.2	7.3	52	0.6	109.6%	0.04	0.56	<0.02	0.04	0.60	0.55	0.05	29.0	70	7.8	10.0	
	August 20, 2020	NEU0433A	8.0	27.7	7.5	61	1.1	101.6%	0.03	0.56	<0.02	<0.02	0.57	0.55	0.02	14.0	55	<6.2	4.5	
	August 20. 2020	NEU043A	7.3	27.6	7.1	61	0.8	93.3%	0.04	0.60	<0.02	<0.02	0.61	0.59	0.02	30.0	81	<6.2	7.0	
LAKE WHEELER	September 8, 2020	NEU055A01	8.2	28.3	7.3	59	0.5	106.2%	0.07	0.75	<0.02	0.01	0.76	0.74	0.02	39.0	58	10.0	10.0	
	September 8, 2020	NEU055A02	7.4	27.5	7.1	57	1.0	94.3%	0.04	0.60	<0.02	0.02	0.62	0.59	0.03	26.0	52	<6.2	4.8	20.0
	August 6, 2020	NEU055A01	9.3	30.9	8.2	69	0.7	126.3%	0.06	0.71	<0.02	0.03	0.74	0.70	0.04	38.0	58	9.0	10.0	
	August 6, 2020	NEU055A02	8.5	30.2	7.5	71	0.9	113.7%	0.04	0.68	<0.02	0.01	0.69	0.67	0.02	29.0	62	<6.2	7.1	23.0
	July 7, 2020	NEU055A01	9.3	30.5	9.1	84	0.6	124.5%	0.04	0.87	<0.02	<0.02	0.88	0.86	0.02	35.0	46	6.5	8.0	
	July 7, 2020	NEU055A02	10.1	30.1	9.4	84	0.7	134.0%	0.03	0.81	<0.02	0.02	0.83	0.80	0.03	38.0	47	<6.2	7.1	24.0
	June 18, 2020	NEU055A01	8.5	23.8	7.6	80	0.7	101.4%	0.04	0.81	<0.02	<0.02	0.82	0.80	0.02	38.0	79	9.5	9.5	
	June 18, 2020	NEU055A02	8.5	23.7	7.5	80	0.7	100.5%	0.03	0.73	<0.02	<0.02	0.74	0.72	0.02	44.0	63	8.0	7.0	23.0
	May 26, 2020	NEU055A01	9.8	25.1	8.6	78	0.7	119.3%	0.04	0.61	<0.02	<0.02	0.62	0.60	0.02	30.0	66	<12.0	13.0	
	May 26, 2020	NEU055A02	11.1	22.8	8.9	77	0.8	129.1%	0.04	0.76	<0.02	<0.02	0.77	0.75	0.02	49.0	56	6.8	13.0	22.0
APEX RESERVOIR	September 24, 2020	NEU055A	9.4	20.3	7.5	78	0.6	104.5%	0.05	0.61	<0.02	<0.02	0.62	0.60	0.02	35.0	80	8.8	8.1	
	August 11, 2020	NEU055A	10.1	29.8	8.8	79	0.6	134.6%	0.05	0.68	<0.02	0.02	0.70	0.67	0.03	36.0	82	9.2	8.1	
	July 14, 2020	NEU055A	7.7	32.4	7.7	97	1.0	107.7%	0.03	0.55	<0.02	0.02	0.57	0.54	0.03	13.0	70	<6.2	5.2	
	June 17, 2020	NEU055A	7.3	22.1	7.4	97	0.7	84.5%	0.04	0.74	0.23	<0.01	0.75	0.51	0.24	29.0	83	8.0	8.0	
	May 13, 2020	NEU055A	10.2	19.6	8.2	117	0.6	110.6%	0.05	0.89	<0.02	0.09	0.98	0.88	0.10	18.0	91	8.5	13.0	
LAKE BENSON	September 10, 2020	NEU055A3	6.8	27.3	6.8	62	0.7	85.5%	0.06	0.81	<0.02	<0.02	0.82	0.80	0.02	40.0	82	8.2	8.2	
	September 10, 2020	NEU055A4	7.1	27.0	6.3	61	0.8	89.0%	0.05	0.77	<0.02	0.03	0.80	0.76	0.04	40.0	62	<6.2	6.2	23.0
	August 20, 2020	NEU055A3	8.7	28.1	7.6	65	0.6	112.3%	0.06	0.71	<0.02	<0.02	0.72	0.70	0.02	39.0	57	8.5	9.2	
	August 20, 2020	NEU055A4	8.5	27.8	7.1	64	0.6	108.4%	0.07	0.84	<0.02	<0.02	0.85	0.83	0.02	45.0	63	9.0	11.0	22.0
	July 9, 2020	NEU055A3	7.6	29.8	7.7	84	0.6	101.6%	0.05	0.79	<0.02	<0.02	0.80	0.78	0.02	41.0	63	7.5	9.4	
	July 9, 2020	NEU055A4	6.8	29.8	7.1	85	0.6	89.8%	0.05	0.77	<0.02	<0.02	0.78	0.76	0.02	42.0	81	6.5	8.4	26.0
	June 3, 2020	NEU055A3	9.0	26.2	7.7	78	0.6	111.9%	0.04	0.74	<0.02	<0.02	0.75	0.73	0.02	38.0	69	11.0	12.0	
	June 3, 2020	NEU055A4	9.5	26.9	8.3	78	0.6	120.2%	0.04	0.89	<0.02	<0.02	0.90	0.88	0.02	35.0	84	<12.0	11.0	24.0
	May 14, 2020	NEU055A3	11.3	21.8	8.7	79	0.6	128.1%	0.04	0.63	<0.02	<0.02	0.64	0.62	0.02	19.0	68	<12.0	7.6	
	May 14, 2020	NEU055A4	10.9	21.4	8.2	77	0.8	122.9%	0.04	0.64	<0.02	<0.02	0.65	0.63	0.02	21.0	66	<9.2	6.9	25.0
BASS LAKE	September 24, 2020	NEU057C	8.5	19.9	7.1	68	0.8	93.5%	0.05	0.62	0.05	0.13	0.75	0.57	0.18		83	<6.2	9.6	
	September 24, 2020	NEU057C1	8.1	20.0	7.3	67	0.9	89.8%	0.04	0.64	0.07	0.11	0.75	0.57	0.18		69	<6.2	7.7	
	August 11, 2020	NEU057C	9.0	29.9	7.3	67	0.6	119.8%	0.07	0.82	0.03	0.09	0.91	0.79	0.12	48.0	85	8.8	13.0	
	August 11, 2020	NEU057C1	9.2	29.9	7.4	64	0.8	122.1%	0.06	0.78	0.01	0.06	0.84	0.77	0.07	30.0	80	<6.2	11.0	
	July 14, 2020	NEU057C	9.4	31.9	8.7	74	0.9	129.1%	0.05	0.60	0.01	0.01	0.61	0.59	0.02	26.0	69	<6.2	7.6	
	July 14, 2020	NEU057C1	9.3	31.2	8.6	75	0.9	126.9%	0.05	0.60	0.01	0.01	0.61	0.59	0.02	32.0	66	<6.2	7.6	
	June 17, 2020	NEU057C	8.7	21.7	7.2	68	0.6	99.9%	0.04	0.78	0.01	0.05	0.83	0.77	0.06	39.0	79	10.0	14.0	
	June 17, 2020	NEU057C1	8.0	21.7	7.2	69	0.5	91.5%	0.04	0.75	0.03	0.04	0.79	0.72	0.07	37.0	70	9.5	14.0	
	May 13, 2020	NEU057C	9.0	19.3	7.0	69	0.8	97.7%	0.04	0.80	0.03	0.08	0.88	0.77	0.11	11.0	68	6.5	10.0	
	May 13, 2020	NEU057C1	9.6	19.3	7.2	69	0.8	103.9%	0.04	0.70	0.01	0.08	0.78	0.69	0.09	15.0	63	6.2	9.2	
HUC 03020202																				
CLIFFS OF THE NEUSE LAKE	June 17, 2020	NEU07113A	8.2	24.3	4.3	91	2.0	97.3%	<0.02	0.36	0.04	0.28	0.64	0.32	0.32	10.0	63	14.0	2.6	
	May 14, 2020	NEU07113A	9.4	20.6	4.1	92	2.3	102.9%	<0.02	0.21	<0.02	0.29	0.50	0.20	0.30	8.3	63	6.2	1.9	
HUC 03020203																				
BUCKHORN RESERVOIR	September 3, 2020	NEU084B	8.1	29.6	7.4	52	0.8	106.6%	0.04	0.76	<0.02	<0.02	0.77	0.75	0.02	29.0	44	<8.3	5,2	
	September 3, 2020	NEU084C	8.3	30.1	7.7	51	0.8	110.8%	0.04	0.84	<0.02	0.02	0.86	0.83	0.03	39.0	50	<8.3	4.1	16.0
	August 5, 2020	NEU084B	7.5	28.8	7.3	57	0.7	97.4%	0.04	0.90	<0.02	<0.02	0.91	0.89	0.02	35.0	56	6.8	8.2	
	August 5, 2020	NEU084C	6.4	28.7	6.9	58	0.7	82.3%	0.04	0.99	0.03	<0.02	1.00	0.96	0.04	37.0	60	<6.2	7.5	19.0
BUCKHORN RESERVOIR	July 16, 2020	NEU084B	7.4	31.2	7.3	56	0.6	98.8%	0.04	0.81	<0.02	<0.02	0.82	0.80	0.02	26.0	69	7.0	6.5	
	July 16, 2020	NEU084C	6.5	30.4	7.0	55	0.7	85.9%	0.04	0.85	<0.02	<0.02	0.86	0.84	0.02	30.0	67	6.5	5.9	16.0

Appendix A - Neuse River Basin Lakes Data
October 1, 2015 through September 31, 2020

Lake	SURFACE PHYSICAL DATA								PHOTIC ZONE DATA											
	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 Hardnes mg/L
	June 3, 2020	NEU084B	8.8	25.0	6.8	59	0.7	106.3%	0.06	1.00	<0.02	<0.02	1.01	0.99	0.02	35.0	74	7.8	9.1	
	June 3, 2020	NEU084C	8.8	24.9	6.7	60	0.8	106.2%	0.04	0.87	<0.02	<0.02	0.88	0.86	0.02	39.0	66	7.0	6.8	20.0
	May 13, 2020	NEU084B	8.9	18.8	7.7	61	0.7	95.0%	0.05	0.79	<0.02	<0.02	0.80	0.78	0.02	22.0	68	<6.2	7.2	
	May 13, 2020	NEU084C	9.4	19.4	7.4	62	0.7	101.2%	0.04	0.72	<0.02	<0.02	0.73	0.71	0.02	22.0	70	<6.2	5.4	18.0
WIGGINS MILL RESERVOIR	September 16. 2020	NEU084D	6.6	24.6	6.4	62	0.8	78.4%	0.14	1.10	0.04	0.17	1.27	1.06	0.21	15.0	82	19.0	15.0	
	September 16. 2020	NEU084F	7.0	24.9	6.6	61	0.8	84.5%	0.06	0.64	<0.02	0.18	0.82	0.63	0.19	15.0	<50	<6.2	8.0	22.0
	August 27, 2020	NEU084D	8.1	28.9	6.6	60	0.7	105.0%	0.07	0.83	<0.02	0.14	0.97	0.82	0.15	31.0	69	<6.2	5.6	
	August 27, 2020	NEU084F	7.7	28.8	6.4	60	0.7	99.1%	0.07	0.90	<0.02	0.15	1.05	0.89	0.16	38.0	66	<6.2	6.0	19.0
	July 30, 2020	NEU084D	6.3	28.7	6.1	60	0.4	81.6%	0.12	0.92	<0.02	0.20	1.12	0.91	0.21	37.0	54	13.0	20.0	
	July 30, 2020	NEU084F	4.4	28.8	6.3	61	0.4	57.4%	0.12	0.82	0.05	0.25	1.07	0.77	0.30	20.0	88	13.0	25.0	20.0
	June 25, 2020	NEU084D	6.6	27.6	6.5	66	0.6	83.2%	0.12	1.00	<0.02	0.16	1.16	0.99	0.17	26.0	88	22.0	13.0	
	June 25, 2020	NEU084F	5.5	27.4	6.4	66	0.6	70.0%	0.06	0.86	<0.02	0.20	1.06	0.85	0.21	27.0	73	6.5	7.6	22.0
	May 27, 2020	NEU084D	7.6	22.8	6.6	65	0.7	88.1%	0.05	0.84	<0.02	0.12	0.96	0.83	0.13	34.0	74	<6.4	6.0	
	May 27, 2020	NEU084F	7.8	22.6	6.5	65	0.7	89.4%	0.05	0.76	<0.02	0.09	0.85	0.75	0.10	31.0	70	<14.0	6.2	21.0
LAKE WILSON	September 3, 2020	NEU096B4	7.9	30.4	7.1	82	0.8	105.4%	0.10	0.95	<0.02	<0.02	0.96	0.94	0.02	36.0	91	<8.3	5.2	31.0
	August 5, 2020	NEU096B4	8.1	27.3	6.8	69	0.5	102.6%	0.13	1.00	0.08	0.20	1.20	0.92	0.28	53.0	85	13.0	17.0	25.0
	July 16, 2020	NEU096B4	9.2	32.6	8.0	91	0.6	126.8%	0.10	1.10	<0.02	<0.02	1.11	1.09	0.02	48.0	84	8.0	6.3	36.0
	June 3, 2020	NEU096B4	9.4	25.8	6.8	81	0.7	115.4%	0.08	0.98	<0.02	0.16	1.14	0.97	0.17	34.0	92	<6.2	5.5	32.0
	May 13, 2020	NEU096B4	10.0	19.7	7.5	77	0.7	107.9%	0.09	1.00	<0.02	0.24	1.24	0.99	0.25	84.0	84	6.5	8.0	25.0
TOISNOT RESERVOIR	September 16. 2020	NEU096C	6.4	22.0	5.9	43	0.7	72.7%	0.10	0.84	0.07	0.17	1.01	0.77	0.24	2.1	98	12.0	12.0	
	September 16. 2020	NEU096E	8.5	22.2	5.3	36	0.5	97.3%	0.11	0.85	<0.02	0.14	0.99	0.84	0.15	18.0	106	8.0	11.0	29.0
	August 25, 2020	NEU096C	6.1	26.5	6.3	80	0.6	75.6%	0.08	0.74	0.06	0.140	0.88	0.68	0.20	4.6	90	8.8	8.2	
	August 25, 2020	NEU096E	6.4	28.3	5.8	79	0.6	81.5%	0.09	0.79	0.08	0.12	0.91	0.71	0.20	8.1	92	6.5	8.4	30.0
	July 30, 2020	NEU096C	4.8	27.7	6.1	90	0.4	61.3%	0.10	0.70	0.06	0.18	0.88	0.64	0.24	2.8	68	<6.2	6.7	
	July 30, 2020	NEU096E	6.3	28.3	5.9	79	0.6	80.7%	0.15	1.00	<0.02	0.03	1.03	0.99	0.04	44.0	<50	9.2	10.0	28.0
	June 25, 2020	NEU096C	5.9	26.6	6.3	73	0.6	74.0%	0.06	0.84	0.07	0.34	1.18	0.77	0.41	25.0	81	9.0	8.9	
	June 25, 2020	NEU096E	5.8	26.4	5.8	75	0.5	72.3%	0.09	0.99	0.04	0.28	1.27	0.95	0.32	37.0	90	10.0	9.6	25.0
	May 27, 2020	NEU096C	5.6	21.7	6.3	99	0.7	63.8%	0.08	0.77	0.12	0.51	1.28	0.65	0.63	7.7	113	<7.8	10.0	
	May 27, 2020	NEU096E	5.6	22.0	6.4	97	0.6	63.7%	0.08	0.85	0.11	0.43	1.28	0.74	0.54	8.3	98	7.2	11.0	35.0