# FALLS LAKE ANNUAL REPORT
# 2021

## NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
## DIVISION OF WATER RESOURCES
## WATER SCIENCES SECTION

THIS REPORT HAS BEEN APPROVED FOR RELEASE

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Chris Johnson
Chief, Water Sciences Section

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# Study for the Ongoing Assessment of Water Quality in Falls of the Neuse Reservoir: 2021 Results.

## Purpose

The objective of this study is to evaluate progress in attainment of water quality standards and use support in Falls of the Neuse Reservoir (WS-IV,B;NSW,CA) as required by the Falls Lake water supply nutrient strategy (15A NCAC 02B.0275) (i.e. the "Falls Lake Rules"). Station LI01 was added in April of 2011. This report summarizes sample results collected in 2021.

## Methods

Study Plan for the Ongoing Assessment of Falls of the Neuse Reservoir. A total of 11 monitoring stations on Falls Lake were sampled monthly in 2021 (Figure 1), excluding the months of January and February due to restrictions related to Covid-19 All samples were collected in accordance with ISB's *Standard Operating Procedures Manual: Physical and Chemical Monitoring v2.1, Dec. 2014* and *Ambient Lakes Quality Assurance Project Plan v2.0, March 2014.* Chemical samples were collected as a composite from the photic zone, defined here as the range from the water surface to a depth equal to two times the secchi depth. Each composite sample was analyzed for total phosphorus (TP), total nitrogen (TN), ammonia ($NH_3$), nitrate + nitrite ($NO_3$+$NO_2$), total Kjeldahl nitrogen (TKN), turbidity, and chlorophyll α (Chl-α) (excluding site NEU013 due to high turbidity at this location). Duplicate samples were collected at one station per sampling event on a rotating schedule for quality control. Depth-stratified physical parameters were collected at the surface (0.15 m), then in one-meter (m) increments to a depth of 10 m, and every 5 m thereafter. Physical measurements of dissolved oxygen (DO), temperature, pH, and conductivity were collected with a multi-parameter sonde. Surface readings (0.15m) for physical parameters were used in data analysis. Additional parameters collected at select sites include: total residue, suspended residue, phytoplankton, and microcystin.

## Results

One-year summary results are presented by station for the two management areas: Lower Falls Lake (Figure 2) and Upper Falls Lake (Figure 3). The tables display annual mean, minimum, and maximum concentrations for TP (mg/L), TN (mg/L), Chl-α (µg/L), and turbidity (NTU) from the photic zone; DO (mg/L) and pH (s.u.) from surface readings. Data summaries are calculated from 10 sampling events (n) for all sites. All stations were not sampled in January and February due to restrictions related to Covid-19. Qualified data due to improper laboratory and/or field quality assurance protocols were excluded from this report. The removal of qualified data resulted in a sample size (n) of 8 for Chl-α and 10 for TP, TN, turbidity, and pH. Percent exceedance of state surface water quality standards (freshwater) is shown for each station. Exceedance is defined by Chl-α > 40 ug/L; turbidity ≥ 25 NTU; DO < 4 mg/L; pH ≥ 9 or ≤ 6 s.u. All nitrate + nitrite and ammonia data below analytical detection limit (≤ 0.02 mg/L) were quantified as 0.01 mg/L to calculate TN values. Results for additional parameters not provided in this report are available upon request. Please direct any question or comments to the Intensive Survey Branch Supervisor at 919-743-8496 or email: Sean.buczek@deq.nc.gov

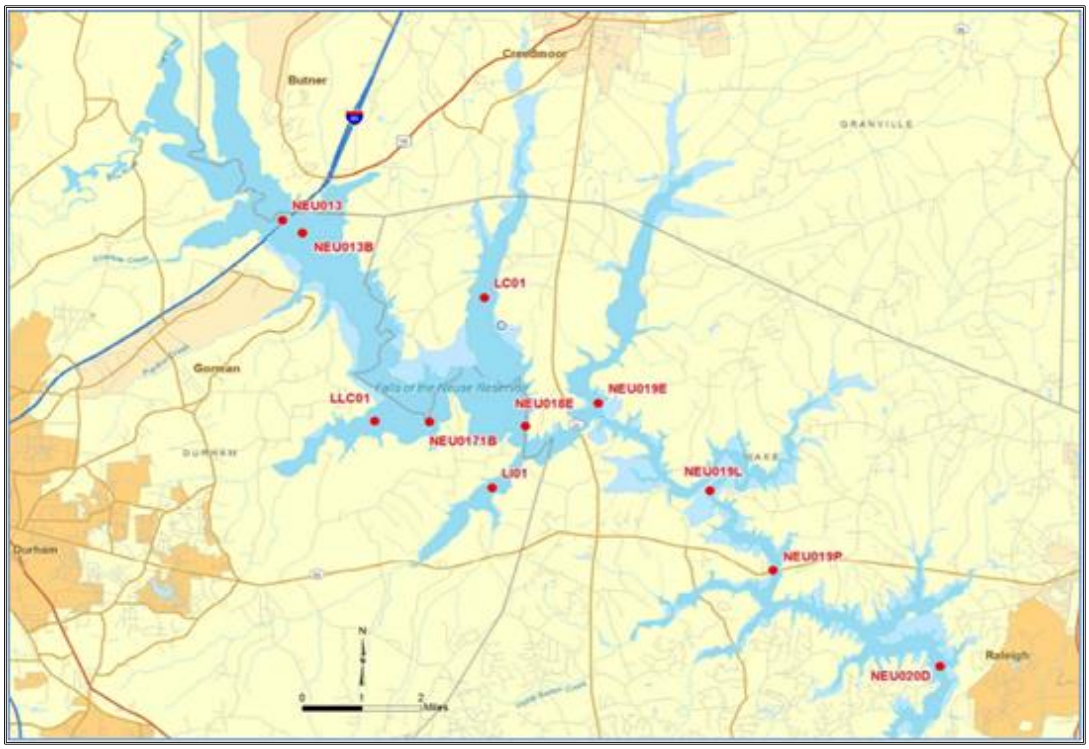


***Figure 1: Falls Lake Monitoring Stations***

| NEU019E | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.04 | 0.32 | 32.5 | 6.43 | 9.31 | 7.68 |
| Min | 0.02 | 0.01 | 18.0 | 3.30 | 6.90 | 7.20 |
| Max | 0.07 | 0.84 | 49.0 | 18.0 | 12.10 | 8.40 |
| *n>Standard* | | | 2 | *0* | *0* | *0* |
| *% Exceedance* | | | 25.0% | *0.0%* | *0.0%* | *0.0%* |
| *% Confidence* | | | 81.3% | *N/A* | *N/A* | *N/A* |

| NEU019L | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.03 | 0.31 | 24.3 | 5.85 | 8.75 | 7.54 |
| Min | 0.02 | 0.01 | 14.0 | 3.10 | 6.40 | 7.00 |
| Max | 0.06 | 0.74 | 36.0 | 20.00 | 10.80 | 8.10 |
| *n>Standard* | | | *0* | *0* | *0* | *0* |
| *% Exceedance* | | | *0.0%* | *0.0%* | *0.0%* | *0.0%* |
| *% Confidence* | | | *N/A* | *N/A* | *N/A* | *N/A* |

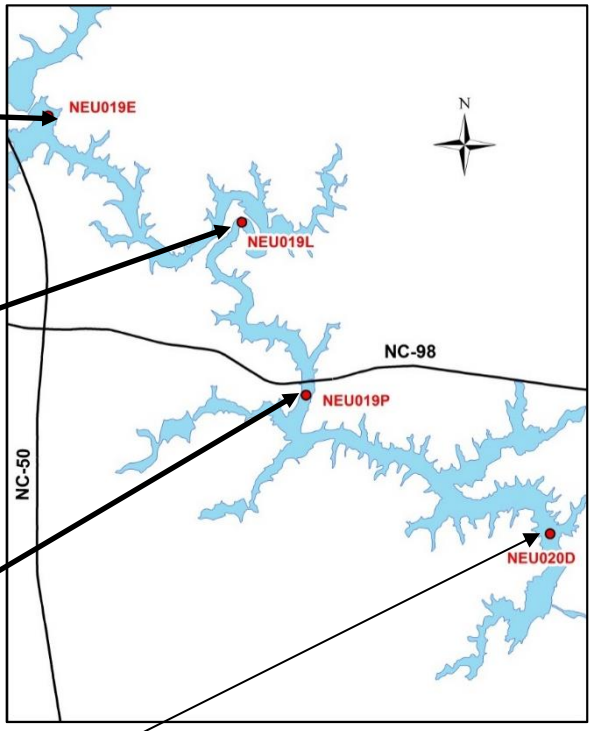


***Figure 2. Lower Falls Lake***

| NEU019P | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.03 | 0.32 | 22.40 | 5.81 | 8.71 | 7.55 |
| Min | 0.02 | 0.01 | 17 | 3.10 | 5.40 | 7.00 |
| Max | 0.06 | 0.77 | 35 | 20.0 | 11.1 | 8.40 |
| *n>Standard* | | | *0* | *0* | *0* | *0* |
| *% Exceedance* | | | *0.0%* | *0.0 %* | *0.0%* | *0.0%* |
| *% Confidence* | | | *N/A* | *N/A* | *N/A* | *N/A* |

| NEU020D | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.03 | 0.27 | 20.1 | 5.37 | 8.67 | 7.72 |
| Min | 0.02 | 0.01 | 11.0 | 3.00 | 3.60 | 7.10 |
| Max | 0.06 | 0.69 | 35.0 | 18.00 | 11.70 | 8.30 |
| *n>Standard* | | | *0* | *0* | *1* | *0* |
| *% Exceedance* | | | *0.0%* | *0.0%* | *10.0%* | *0.0%* |
| *% Confidence* | | | *N/A* | *N/A* | *34.9%* | *N/A* |

| NEU013 | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 0 | 10 | 10 | 10 |
| Mean | 0.09 | 0.46 | N/A | 22.80 | 9.52 | 7.61 |
| Min | 0.06 | 0.01 | N/A | 17.00 | 6.70 | 7.10 |
| Max | 0.13 | 1.11 | N/A | 32.00 | 12.80 | 8.50 |
| *n>Standard* | | | *0* | *3* | *0* | *0* |
| *% Exceedance* | | | *0.0%* | *30.0%* | *0%* | *0.0%* |
| *% Confidence* | | | *N/A* | *91.0%* | *N/A* | *N/A* |

| NEU013B | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.07 | 0.39 | 29.6 | 15.93 | 9.47 | 7.68 |
| Min | 0.05 | 0.01 | 21.0 | 9.30 | 6.90 | 7.20 |
| Max | 0.08 | 0.89 | 40.0 | 21.00 | 12.70 | 8.20 |
| *n>Standard* | | | *0* | *0* | *0* | *0* |
| *% Exceedance* | | | *0.0%* | *0.0%* | *0.0%* | *0.0%* |
| *% Confidence* | | | *N/A* | *N/A* | *N/A* | *N/A* |

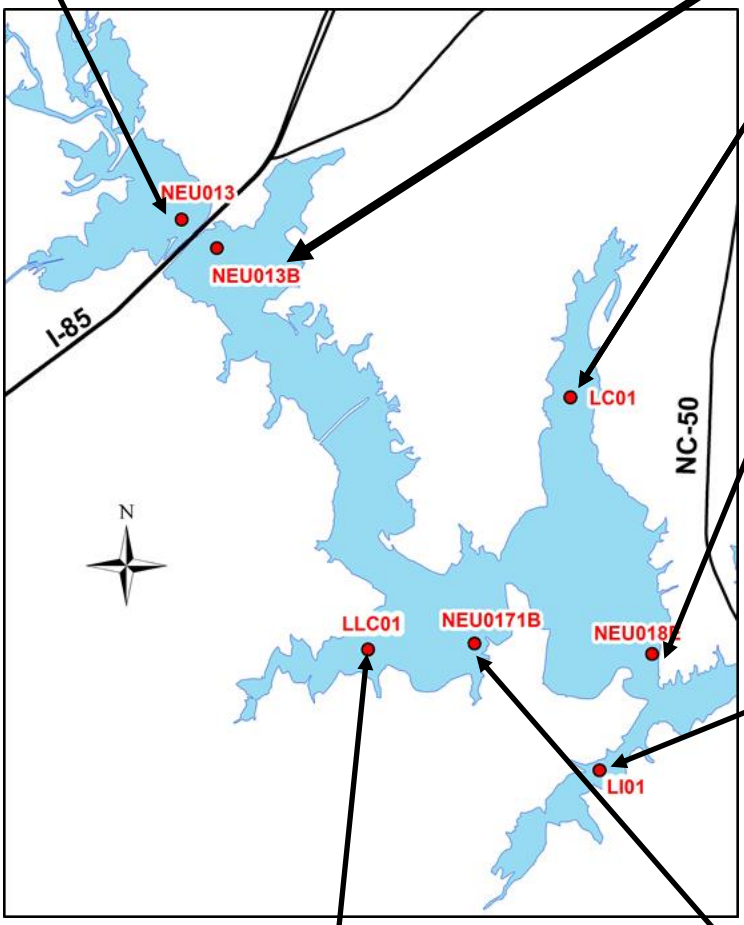


*Figure 3. Upper Falls Lake*

| LC01 | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.04 | 0.32 | 25.3 | 7.08 | 8.95 | 7.59 |
| Min | 0.03 | 0.01 | 18.0 | 3.40 | 6.60 | 7.20 |
| Max | 0.05 | 0.75 | 35.0 | 16.00 | 11.80 | 8.50 |
| *n>Standard* | | | 0 | 0 | 0 | 0 |
| *% Exceedance* | | | 0.0% | 0.0% | 0.0% | 0.0% |
| *% Confidence* | | | N/A | N/A | N/A | N/A |

| NEU018E | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.04 | 0.32 | 29.0 | 7.50 | 9.25 | 7.69 |
| Min | 0.03 | 0.01 | 19.0 | 3.60 | 6.30 | 7.20 |
| Max | 0.05 | 0.72 | 39.0 | 17.00 | 12.30 | 8.40 |
| *n>Standard* | | | *0* | *0* | *0* | *0* |
| *% Exceedance* | | | *0.0%* | *0%* | *0%* | *0%* |
| *% Confidence* | | | *N/A* | *N/A* | *N/A* | *N/A* |

| LI01 | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.05 | 0.33 | 31.3 | 9.77 | 9.35 | 7.75 |
| Min | 0.03 | 0.01 | 18.0 | 4.50 | 7.50 | 7.10 |
| Max | 0.08 | 0.82 | 42.0 | 28.00 | 12.10 | 8.60 |
| *n>Standard* | | | 1 | *1* | *0* | *0* |
| *% Exceedance* | | | 12.5% | *10.0%* | *0%* | *0.0%* |
| *% Confidence* | | | 43.0% | *34.9%* | *N/A* | *N/A* |

| LLCO1 | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.05 | 0.35 | 31.37 | 9.21 | 9.32 | 7.63 |
| | | | 5 | | | |
| Min | 0.04 | 0.01 | 19 | 5.80 | 7.50 | 7.00 |
| Max | 0.06 | 0.84 | 47 | 19.00 | 13.00 | 8.60 |
| *n>Standard* | | | 1 | *0* | *0* | *0* |
| *% Exceedance* | | | 13% | *0.0%* | *0.0%* | *0.0%* |
| *% Confidence* | | | 43.0% | *N/A* | *N/A* | *N/A* |

| NEU0171B | | | | | | |
|---|---|---|---|---|---|---|
| | TP | TN | Chl*a* | Turbidity | DO | pH |
| n | 10 | 10 | 8 | 10 | 10 | 10 |
| Mean | 0.05 | 0.33 | 31.0 | 9.14 | 9.20 | 7.64 |
| Min | 0.03 | 0.01 | 21.0 | 4.60 | 6.80 | 7.20 |
| Max | 0.06 | 0.79 | 41.0 | 19.00 | 13.20 | 8.50 |
| *n>Standard* | | | 1 | *0* | *0* | *0* |
| *% Exceedance* | | | 12.5% | *0.0%* | *0.0%* | *0.0%* |
| *% Confidence* | | | 43.0% | *N/A* | *N/A* | *N/A* |

Key for data tables:
n: number of sampling events
n>standard: number of times sample exceeds water quality standards chla >40 ug/L; turbidity ≥25 NTU; DO <4 mg/L; pH ≥9 or ≤6 s.u
% exceedance: percentage of samples that were in exceedance of water quality standards
% confidence: states the percent statistical confidence that the actual percentage of exceedances is greater than 10%. Low % confidence values are a result of a small sample size or exceedance values less than or equal to 10%.