Study for the Ongoing Assessment of Water Quality in Falls of the Neuse Reservoir: 2019 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 L101 was added in April of 2011. This report summarizes sample results collected in 2019.

Methods

A detailed Falls Lake study plan can be found by following the URL at the end of this document. A total of 12 monitoring stations on Falls Lake were sampled monthly in 2019 (Figure 1). 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 *a* (chla) (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 mulitparameter 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 microcystins.

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), chla (µg/L), and turbidity (NTU) from the photic zone; DO (mg/L) and pH (s.u.) from surface readings. Data summaries are calculated from 12 sampling events (n) for most sites. Chemical samples were not analyzed for total Kjeldahl nitrogen (TKN) and nitrate + nitrite (NO_3+NO_2) at any sites during the months of June and July due to an ammonia contamination with the TKN digestion at the processing lab. Sampling was not conducted at sites NUE019E, NEU019L, and NEU019P in August due to site inaccessibility from a police investigation. All sites in Lower Falls Lake do not have pH values for the month of May due to a failed out-calibration of the multi-parameter sonde. Percent exceedance of state fresh surface water quality standards is shown for each station. Exceedance is defined by chla >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. Phytoplankton results showed cyanobacteria as the dominant algal group at sites NEU013B, NEU018E, and NEU019P. Cyanobacteria, or blue-green algae are common indicators of nutrient enrichment and are characterized by discoloration, surface films, flecks, mats, and foul odors. 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.

Figure 1: Falls Lake Monitoring Stations

NEU019E						
	TP	TN	Chla	Turbidity	DO	pH
n	12	10	12	12	12	11
Mean	0.04	0.78	28.7	8.7	8.8	7.4
Min	0.08	0.62	17.0	4.4	5.8	7.0
Max	0.15	1.32	40.0	17.0	11.4	8.5
n>Standard			*0*	*0*	*0*	*0*
% Exceedance			*0.0%*	*0.0%*	*0.0%*	*0.0%*
% Confidence			*N/A*	*N/A*	*N/A*	*N/A*

NEU019L						
	TP	TN	Chla	Turbidity	DO	pH
n	11	9	11	11	11	10
Mean	0.04	0.75	22.6	8.4	8.7	7.3
Min	0.03	0.59	14.0	3.6	7.7	6.8
Max	0.05	0.96	31.0	16.0	11.4	7.9
n>Standard			*0*	*0*	*0*	*0*
% Exceedance			*0.0%*	*0.0%*	*0.0%*	*0.0%*
% Confidence			*N/A*	*N/A*	*N/A*	*N/A*

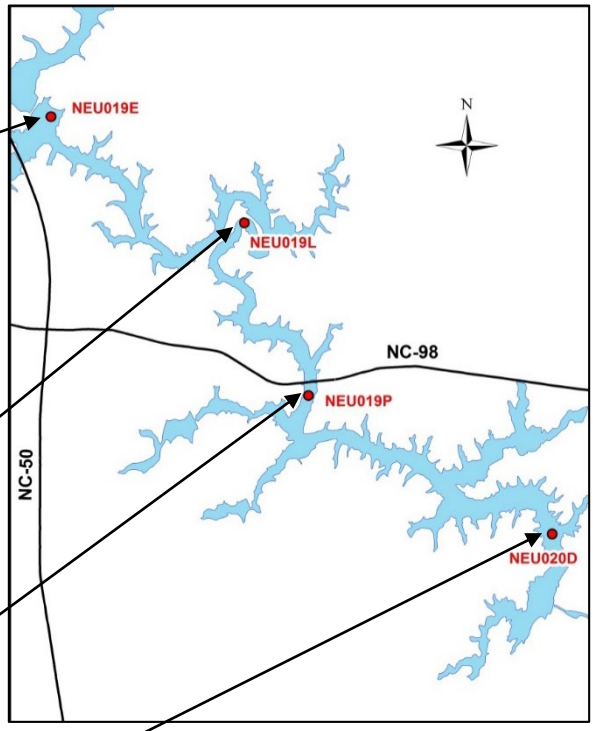

Figure 2. Lower Falls Lake

NEU019P						
	TP	TN	Chla	Turbidity	DO	pH
n	11	9	11	11	11	10
Mean	0.03	0.76	22.2	8.0	8.5	7.2
Min	0.02	0.62	14.0	3.6	6.0	6.9
Max	0.05	0.97	31.0	15.0	11.6	7.8
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	Chla	Turbidity	DO	pH
n	11	9	11	11	11	10
Mean	0.03	0.72	22.5	6.6	8.5	7.3
Min	0.02	0.56	11.0	3.2	6.6	6.9
Max	0.05	0.93	56.0	14.0	11.5	6.8
n>Standard			*1*	*0*	*0*	*0*
% Exceedance			*8.3%*	*0.0%*	*0.0%*	*0.0%*
% Confidence			*31.4%*	*N/A*	*N/A*	*N/A*

NEU013	TP	TN	Chla	Turbidity	DO	pH
n	12	10	0	12	12	12
Mean	0.10	0.96	N/A	33.1	9.5	7.5
Min	0.08	0.75	N/A	23.0	5.9	6.4
Max	0.15	1.32	N/A	45.0	13.2	8.5
n>Standard			*0*	*10*	*0*	*0*
% Exceedance			*0.0%*	*83.3%*	*0%*	*0.0%*
% Confidence			*N/A*	*100.0%*	*N/A*	*N/A*

NEU013B	TP	TN	Chla	Turbidity	DO	pH
n	12	10	12	12	12	12
Mean	0.09	0.93	42.2	27.1	9.6	7.6
Min	0.07	0.75	3.6	19.0	6.4	6.2
Max	0.10	1.12	71.0	40.0	12.9	8.7
n>Standard			*7*	*6*	*0*	*0*
% Exceedance			*58.3%*	*50.0%*	*0.0%*	*0.0%*
% Confidence			*99.9%*	*99.5%*	*N/A*	*N/A*

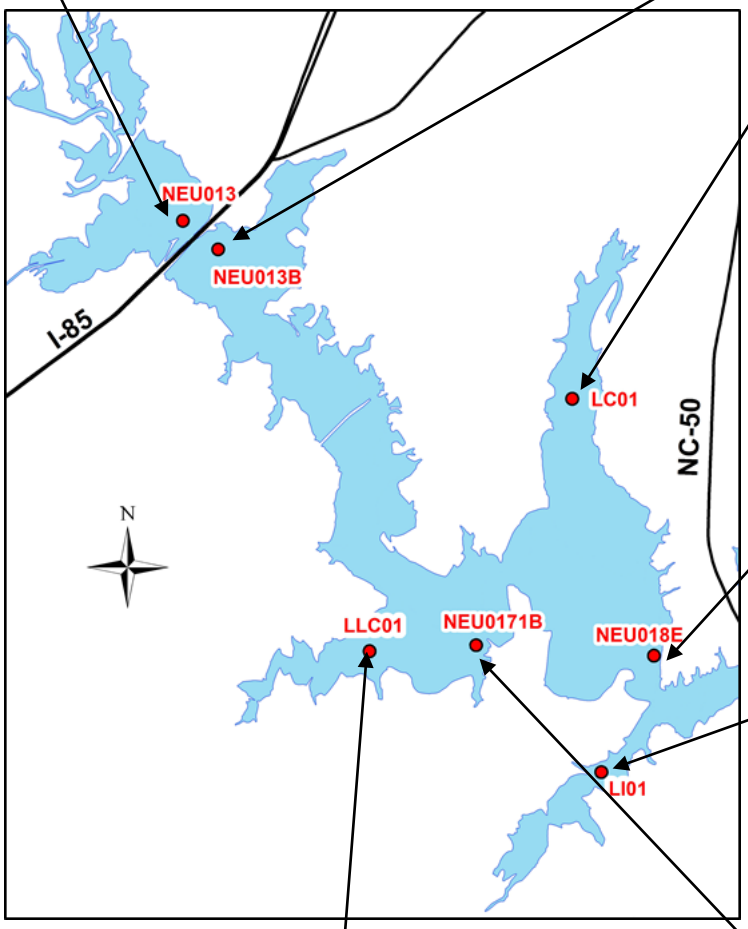

Figure 3. Upper Falls Lake

LC01	TP	TN	Chla	Turbidity	DO	pH
n	12	10	12	12	12	12
Mean	0.05	0.77	27.6	10.9	9.2	7.4
Min	0.04	0.61	16.0	4.8	6.3	6.6
Max	0.06	0.89	40.0	19.0	12.6	9.0
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	Chla	Turbidity	DO	pH
n	12	10	12	12	12	11
Mean	0.05	0.80	30.9	10.6	9.3	7.5
Min	0.04	0.90	15.0	5.5	7.0	7.2
Max	0.07	0.94	45.0	21.0	11.8	8.4
n>Standard			*1*	*0*	*0*	*0*
% Exceedance			*8.3%*	*0%*	*0%*	*0%*
% Confidence			*28.2%*	*N/A*	*N/A*	*N/A*

LI01	TP	TN	Chla	Turbidity	DO	pH
n	12	10	12	12	12	11
Mean	0.05	0.77	29.8	15.1	9.0	7.5
Min	0.04	0.66	16.0	5.9	5.8	6.9
Max	0.07	0.89	39.0	35	11.7	8.9
n>Standard			*0*	*3*	*0*	*0*
% Exceedance			*0.0%*	*25.0%*	*0%*	*0.0%*
% Confidence			*N/A*	*88.9%*	*N/A*	*N/A*

LLCO1	TP	TN	Chla	Turbidity	DO	pH
n	12	10	12	12	12	12
Mean	0.06	0.86	32.3	15.8	9.1	7.5
Min	0.04	0.73	12.0	7.2	5.9	6.8
Max	0.08	1.02	52.0	28.0	11.7	8.9
n>Standard			*4*	*2*	*0*	*0*
% Exceedance			*33.3%*	*16.7%*	*0.0%*	*0.0%*
% Confidence			*97.4%*	*65.9%*	*N/A*	*N/A*

NEU0171B	TP	TN	Chla	Turbidity	DO	pH
n	12	10	12	12	11	11
Mean	0.06	0.83	31.2	15.3	8.8	7.5
Min	0.04	0.70	12.0	6.8	5.1	6.9
Max	0.08	0.96	50.0	31.0	11.9	8.4
n>Standard			*2*	*1*	*0*	*0*
% Exceedance			*16.7%*	*8.3%*	*0.0%*	*0.0%*
% Confidence			*65.9%*	*28.2%*	*N/A*	*N/A*

https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/intensive-survey-branch/falls-jordan-lakes-monitoring

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%.