B. Everett Jordan Reservoir (Jordan Lake)
2014-2016 Triennial Report.

Cape Fear River Basin
HUC: 0303000206
WS-IV,B;NSW,CA

North Carolina Department of Environmental Quality
Water Sciences Section
Intensive Survey Unit
May 2018

NC Division of Water Resources
Water Sciences Section

May 21, 2018

Memorandum

To: Environmental Review Commission

CC: Joint Legislative Oversight Committee
Fiscal Research Division

From: Taryn Davis

Through: Eric Morris

Subject: B. Everett Jordan Reservoir (Jordan Lake) 2014-2016 Triennial Report

Purpose: The objective of this review is to evaluate progress in reducing nutrient and nutrient-related pollution in B. Everett Jordan Reservoir (WS-IV,B;NSW,CA), as required by the Jordan Water Supply Nutrient Strategy (15A NCAC 02B.0262) (i.e. the "Jordan Lake Rules"). Pursuant to SL 2009-216 Sec. 3(c), this report summarizes results of samples collected from January 2014 through December 2016.

Division of Water Resources

B. Everett Jordan Reservoir Triennial Report 2014-2016

Cape Fear River Basin

HUC: 0303000206

Background:

B. Everett Jordan Reservoir (Jordan Lake) is a multipurpose reservoir constructed in Chatham County and filled in the late 1981. Major tributaries to the lake include the Haw River, New Hope Creek, and Morgan Creek. Constructed by U.S. Army Corps of Engineers for flood control, this lake is used extensively for primary and secondary recreational activities and as a water supply for several municipalities. Ninety percent of the annual inflow to the lake comes from the Haw River. This arm of the lake has an average hydraulic retention time of five days[1]. The average hydraulic retention time of the New Hope Creek arm is 418 days[1]. Land uses in the watershed include the municipalities of Cary, Apex, Durham and Chapel Hill. Other land uses in the watershed include forest and agricultural areas. Most of the shoreline is undeveloped and forested. Numerous NPDES permitted facilities discharge into the watershed. Nutrient enrichment, algal blooms, and eutrophic conditions have been present in the lake since impoundment.

Methods:

A total of nine monitoring stations represent the three lake management areas (Upper New Hope, Lower New Hope, and Haw River). All stations were sampled at minimum once per month throughout the year for a sum of 48 visits per site (432 total sampling events). Chemical samples were collected as a composite from the photic zone, a depth equal to twice the Secchi depth, and 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 (Chl *a*). Duplicate samples were collected at one station per sampling event on a rotating schedule for quality control. Physical measurements of dissolved oxygen (DO), temperature, and pH were collected at surface (0.15 m) then through the water column in one-meter (m) increments with a multiparameter hydrosonde. Surface readings for physical parameters were used in data analysis. All water quality samples were analyzed by the DWR Chemistry Laboratory. Additional study details can be found in the Jordan Lake Study Plan[2].

Results:

Three-year summary results are presented by station for the three management areas: Upper New Hope (Figure 1), Lower New Hope (Figure 2), and Haw River Arm (Figure 3). The tables display annual mean, minimum, and maximum concentrations for TP (mg/L), TN (mg/L), Chl *a* (µg/L), turbidity (NTU), DO (mg/L), and pH (s.u.). Data summaries are calculated from 48 sampling events (n). Percent exceedance of state fresh surface water quality standards is shown for each station. Exceedance is defined as Chl *a* >40 µg/L; turbidity >25 NTU; DO < 4.0 mg/L, pH >9 or <6 units. Nitrate + Nitrate values below analytical detection limit (<0.02 mg/L) were quantified as 0.01 mg/L to calculate TN values.

Summary:

Jordan Lake was placed on the 303(d) List of Impaired Waters in 2008 for turbidity values greater than the state water quality standard of 25 NTU and for pH values greater than the state standard of 9.0 s.u.[3] Out of 432 sampling events (n) over the course of three years (January 2014 through December 2016), Jordan Lake exceeded Chl *a* standards 159 times; turbidity standards 51 times; DO standards once; and pH 41 times.

CPF086C						
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.09	1.03	59.2	20.08	9.46	8.14
Min	48	0.05	0.64	12.0	7.90	4.94	5.30
Max	48	0.14	1.51	116.0	40.00	13.00	9.52
n > Standard				*38*	*11*	*0*	*7*
% Exceedance				*79.2%*	*22.9%*	*0.0%*	*14.6%*
% Confidence				*100.0%*	*99.3%*	*N/A*	*80.0%*

CPF081A1C						
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.09	0.95	58.9	23.35	9.58	8.04
Min	48	0.06	0.63	10.0	10.00	4.75	5.20
Max	48	0.18	1.41	120.0	60.00	13.00	9.31
n > Standard				*39*	*13*	*0*	*4*
% Exceedance				*81.3%*	*27.1%*	*0.0%*	*8.3%*
% Confidence				*100.0%*	*99.9%*	*N/A*	*28.0%*

CPF086F						
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.07	0.93	50.7	15.90	8.84	7.82
Min	48	0.04	0.50	14.0	7.60	5.50	5.10
Max	48	0.13	1.31	91.0	35.00	12.20	9.10
n > Standard				*31*	*3*	*0*	*2*
% Exceedance				*64.6%*	*6.3%*	*0.0%*	*4.2%*
% Confidence				*100.0%*	*12.9%*	*N/A*	*4.0%*

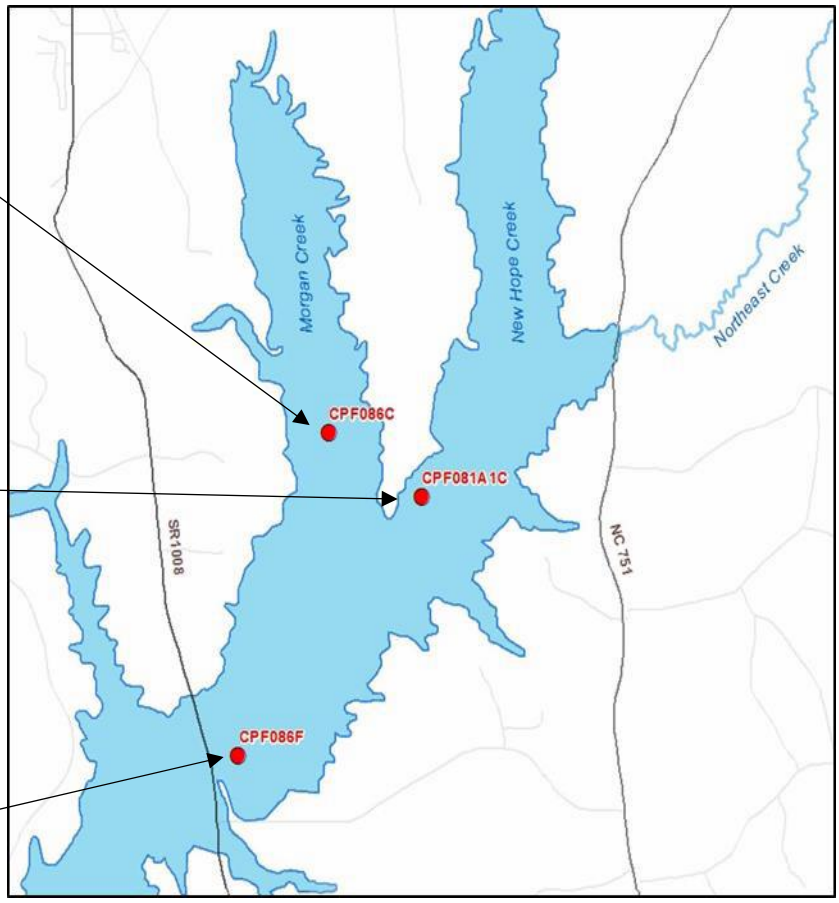

Figure 1. *Upper New Hope Section of Jordan Lake*

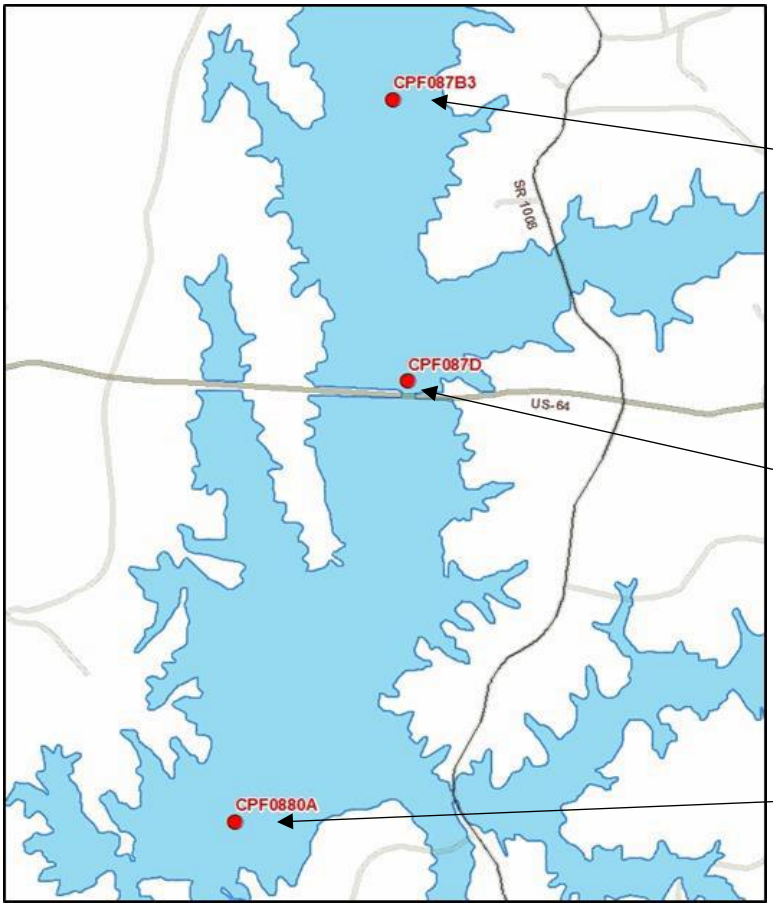

Figure 2. *Lower New Hope Section of Jordan Lake*

CPF087B3						
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.05	0.92	35.0	8.33	8.73	7.79
Min	48	0.02	0.57	8.5	4.30	4.10	5.30
Max	48	0.07	1.41	61.0	17.00	12.20	9.59
n > Standard				*16*	*0*	*0*	*2*
% Exceedance				*33.3%*	*0.0%*	*0.0%*	*4.2%*
% Confidence				*100.0%*	*N/A*	*N/A*	*4.0%*

CPF087D						
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.04	0.94	30.9	7.42	8.46	7.67
Min	48	0.02	0.63	7.5	3.60	4.90	5.50
Max	48	0.06	1.60	57.0	13.00	12.00	9.00
n > Standard				*11*	*0*	*0*	*1*
% Exceedance				*22.9%*	*0.0%*	*0.0%*	*2.1%*
% Confidence				*99.3%*	*N/A*	*N/A*	*0.6%*

CPF0880A						
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.04	0.93	25.7	7.69	8.51	7.79
Min	48	0.02	0.59	6.3	2.60	5.26	6.70
Max	48	0.10	1.62	44.0	29.00	12.81	9.19
n > Standard				*5*	*1*	*0*	*1*
% Exceedance				*10.4%*	*2.1%*	*0.0%*	*2.1%*
% Confidence				*46.8%*	*0.6%*	*N/A*	*0.6%*

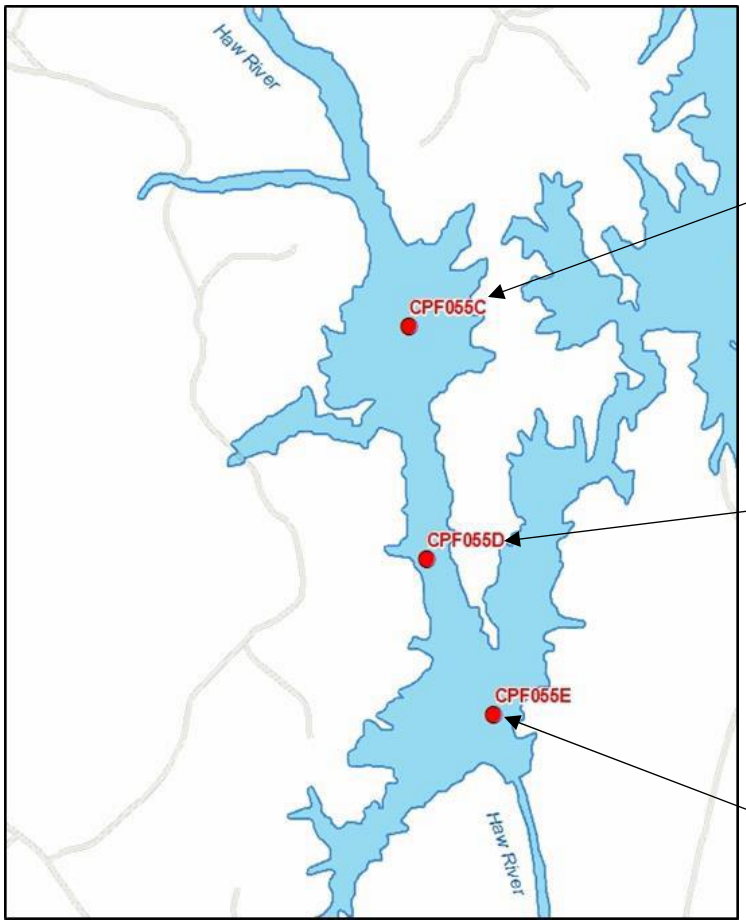

***Figure 3**. Haw River Arm of Jordan Lake*

CPF055C							
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.08	1.28	31.0	18.22	9.65	8.03
Min	48	0.05	0.65	3.2	4.40	4.20	6.90
Max	48	0.24	1.99	72.0	160.00	13.40	9.50
n > Standard				*13*	*9*	*0*	*12*
% Exceedance				*27.1%*	*18.8%*	*0.0%*	*25.0%*
% Confidence				*99.9%*	*95.4%*	*N/A*	*99.8%*

CPF055D							
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.07	1.12	27.2	15.75	9.11	7.91
Min	48	0.04	0.57	6.0	3.80	3.69	6.90
Max	48	0.24	1.96	65.0	150.00	14.24	9.27
n > Standard				*8*	*8*	*1*	*7*
% Exceedance				*16.7%*	*16.7%*	*2.1%*	*15.2%*
% Confidence				*89.8%*	*89.8%*	*0.6%*	*80.0%*

CPF055E							
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	48	0.06	1.04	25.5	11.53	8.80	7.91
Min	48	0.03	0.59	5.0	3.70	4.70	6.80
Max	48	0.14	1.77	50.0	65.00	13.21	9.20
n > Standard				*5*	*6*	*0*	*4*
% Exceedance				*10.4%*	*12.5%*	*0.0%*	*8.3%*
% Confidence				*46.8%*	*65.3%*	*N/A*	*28.0%*

Jordan Lake							
	n	TP	TN	Chl a	Turbidity	DO	pH
Mean	432	0.07	1.02	38.2	14.25	9.02	7.90
Min	432	0.02	0.50	3.2	2.60	3.69	5.10
Max	432	0.24	1.99	120.0	160.00	14.24	9.59
n > Standard				*166*	*51*	*1*	*40*
% Exceedance				*38.4%*	*11.8%*	*0.2%*	*9.3%*
% Confidence				*100.0%*	*87.8%*	*0.0%*	*28.1%*

References:

[1] Intensive Survey Unit. 2014. Lake & Reservoir Assessments Cape Fear River Basin. https://files.nc.gov/ncdeq/Water%20Quality/Environmental%20Sciences/Reports/CapeFearRLakesAssess2013.pdf

[2] Intensive Survey Unit. 2016. Study Plan for the Ongoing Assessment of Water Quality in Jordan Lake. https://deq.nc.gov/about/divisions/water-resources/water-resourcesdata/water-sciences-home-page/intensive-survey-branch/falls-jordan-lakes-monitoring

[3] NCDEQ. 2008. North Carolina Integrated Report Categories 4 and 5 (Impaired Waters List). https://files.nc.gov/ncdeq/Water%20Quality/Planning/TMDL/303d/final2008IRcat45%20%282%29%203.17.10.pdf