

NC Division of Water Resources
Water Science Section

August 18th, 2017

**Study Plan for the Assessment of In-Situ Phosphorus Locking and Algaecide
Application on Water Quality in Jordan Lake**

Purpose

The objective of this study is to provide assessment information for the Jordan Lake In Situ chemical Pilot Project administered by SePRO Corp. Specifically, this includes sampling, testing, and analyzing water, sediment, and biota in areas of Jordan Lake prior to, during, and after proposed application of phosphorus-locking (Phoslock) and algaecide (Pak27) technologies as detailed in Section 14.13.(e) of S.L. 2017-57.

Water Sciences Section staff will conduct this monitoring in cooperation with the contractor established under contract to perform applications. This is to include information sharing as it pertains to Jordan Lake specific hydrologic or morphologic conditions, physical/chemical analytical data as well as technical assistance to facilitate access and notification for various agencies and partners during product application phase activities.

Study Plan

In addition to the current monitoring study in place on Jordan Lake required by section 3.(c) of S.L. 2009- 216, four supplementary monitoring stations will be discretely sampled as part of this study (Figure 1, Table 1). These stations will be sampled at least once per month during the pre-application baseline phase and as much as 4 times per month during and after treatment applications (Table 2, 3). Additionally, periods of continuous data will be collected using autonomous monitoring stations during pre-application and treatment phases at select sites. Monitoring activities began in August 2017 and are currently ongoing.

Sites will be located to provide water quality data in the proposed chemical treatment area of the Morgan Creek arm, outside of the proposed treatment area in the New Hope Creek arm, as well as downstream of the confluence of Morgan and New Hope Creeks (Table 1, Figure 1). Sites will be located to provide water quality data in the immediate vicinity of the treatment area as well as in background or control areas outside of the designated treatment area. This will allow for comparison of water quality data independent of meteorological and hydrological variability. The sampling program will last the duration of the initial pre-application phase and treatment phase of algaecide/phosphorous-locking product application.

Figure 1. Monitoring Locations on Jordan Lake

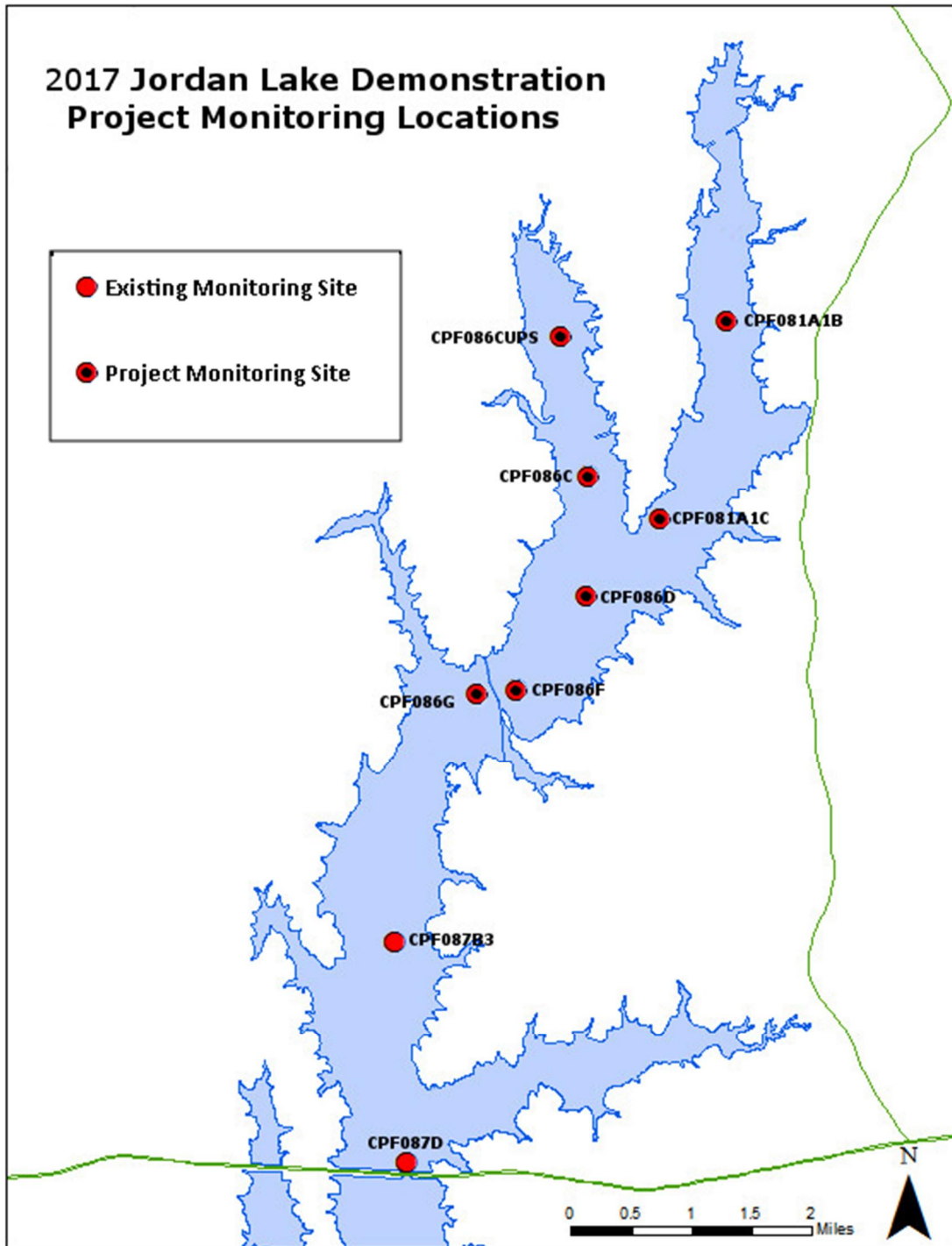


Table 1. Proposed sampling sites and location information

Station	Station Description	Latitude	Longitude
CPF086CUPS	Jordan Lake in upstream Morgan Creek Arm	35.83709	-79.0008
CPF086C	Jordan Lake at mouth of Morgan Creek near Farrington	35.82151	-78.99738
CPF081A1B	Jordan Lake downstream of Crooked Creek in New Hope Creek Arm	35.83646	-78.9763
CPF081A1C	Jordan lake at mouth of New Hope Creek	35.81622	-78.98683
CPF086D	Jordan Lake Upstream of Farrington Rd Bridge	35.80424	-79.00065
CPF086F	Jordan Lake near Farrington NC	35.79494	-79.00758
CPF086G	Jordan Lake downstream of Farrington Road Bridge	35.79307	-78.01396

Parameters

Sample collection will focus on nutrient related physical, chemical and biological water quality parameters. Chemical water quality samples will be collected from the photic zone and discreet depths throughout the water column. The photic zone is defined as an area from the water surface to a depth equal to two times the secchi depth, and represents the region of the water column which is most reflective of nutrient enrichment impacts. Depth stratified physical parameters will be collected at the surface (0.15 m), 1 m increments to a depth of 10 m, and every 5 m thereafter. Water quality sample collections and field operations will follow ISU Standard Operating Procedures: Physical and Chemical Monitoring Version 2.1 (December 2013) and Ambient Lakes Quality Assurance Project Plan Version 2.0 (March 2014). Quality control documents can be found on the Division of Water Resources' Intensive Survey Branch website at: <http://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/intensive-survey-branch> . Sampling began in August 2017 and will continue through 2018 allowing for sufficient data to be collected to evaluate the demonstration project.

Table 2. Proposed sampling types per site, denoted by 'X'

Site Name	Physical		Transport	Chemical		Sedimentation	Biological
	Discrete	Continuous	Discrete	Discrete	Continuous	Discrete	Discrete
CPF086CUPS	X	X	X	X		X	X
CPF086C	X	X	X	X		X	X
CPF081A1B	X		X	X		X	X
CPF081A1C	X	X	X	X		X	X
CPF086D	X	X	X	X		X	X
CPF086F	X			X		X	
CPF086G	X			X		X	

Table 3. Study parameters to be collected

Sample Type	Parameter	Frequency (minimum)
Physical Water	Temperature(°C) pH (s.u.) Dissolved Oxygen (mg/L) Conductivity (µs/cm) Secchi (m) Light Attenuation (m)	1-4 discrete site visits/month 4 continuous sessions during pre-treatment and treatment phase
	Flow	Velocity (m/s) & Direction 4 discrete site visits, treatment phase
Chemical Water	NH3 (mg/L) NO2+NO3 (mg/L) TKN & Dissolved TKN (mg/L) TP & Dissolved TP (mg/L) TOC (mg/L) COD (mg/L)	1-4 discrete site visits/month
	Chl <i>a</i> (µg/L) Turbidity (NTU) Algal Toxins	4 three-week continuous sessions pre-treatment and treatment phase 1-4 discrete site visits/month
	Metals (µg/L)	1 visit per month growing seasons
Sediment	Total Suspended Solids (mg/L) Settleable Solids (mg/L)	1 visit per month growing seasons
	Thickness Metals (mg/L)	1 baseline site visit 1 visit per month treatment
Biological	Phytoplankton	1-4 discrete site visits/month
	Aquatic Toxicology	1-2 discrete site visit/month, growing seasons only
	Algal Growth Potential	1 baseline visit 1 treatment visit, growing season only

	Benthic Macroinvertebrate <i>Fish Community (WRC may conduct)</i>	1 baseline visit 1 post study visit
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Assessment

Evaluation of water quality data collected during this study will focus on nutrient related problems including excessive chlorophyll *a*, high pH, and turbidity in the Morgan Creek Arm of Jordan Lake. According to 2016 assessment data, Jordan Lake remains impaired for chlorophyll *a*, pH, and turbidity. Success of the demonstration project will be measured by comparing concentrations of chlorophyll *a*, pH, and turbidity to water quality standards using the current assessment methodology for impairment (less than 10% exceedance with at least 90% confidence), as well as comparative pre and post application measurement of biological conditions inside and outside the study area.

If additional data are required or changes to the study area are required, this study plan will be re-evaluated and updated accordingly.