

**NC Division of Water Resources**  
**Water Science Section**

August 18<sup>th</sup>, 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.

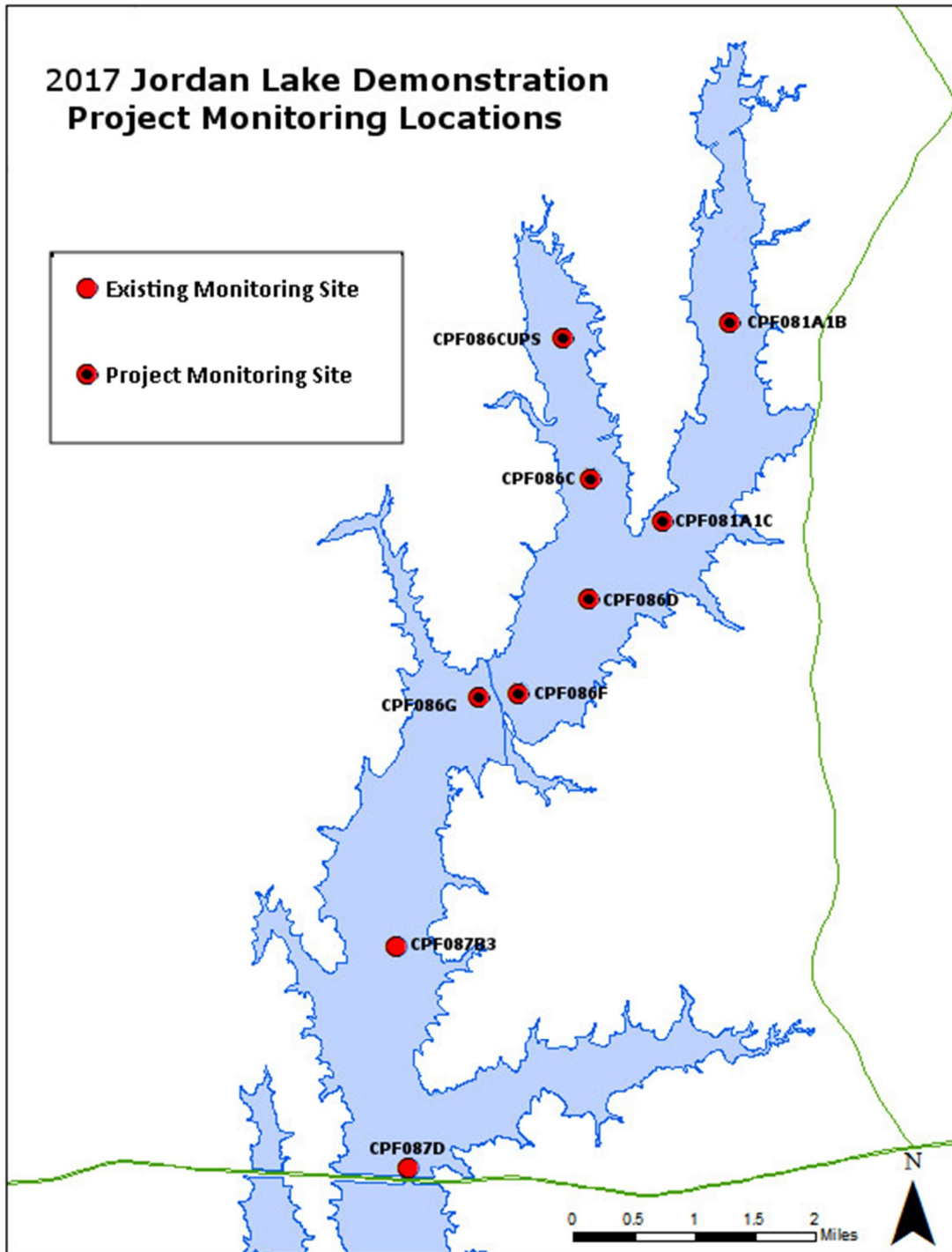
Water Sciences Section staff will conduct this monitoring in cooperation with the contractor established under contract to perform applications. This is to include information sharing as it pertains to Jordan Lake specific hydrologic or morphologic conditions, physical/chemical analytical data as well 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)<br>pH (s.u.)<br>Dissolved Oxygen (mg/L)<br>Conductivity (µs/cm)<br>Secchi (m)<br>Light Attenuation (m) | 1-4 discrete site visits/month<br>4 continuous sessions during pre-treatment and treatment phase     |
|                | Flow   | Velocity (m/s) & Direction<br>4 discrete site visits, treatment phase                                |
| Chemical Water | NH3 (mg/L)<br>NO2+NO3 (mg/L)<br>TKN & Dissolved TKN (mg/L)<br>TP & Dissolved TP (mg/L)<br>TOC (mg/L)<br>COD (mg/L)     | 1-4 discrete site visits/month   |
|                | Chl <i>a</i> (µg/L)<br>Turbidity (NTU)<br>Algal Toxins   | 4 three-week continuous sessions pre-treatment and treatment phase<br>1-4 discrete site visits/month |
|                | Metals (µg/L)  | 1 visit per month growing seasons  |
| Sediment       | Total Suspended Solids (mg/L)<br>Settleable Solids (mg/L)  | 1 visit per month growing seasons  |
|                | Thickness<br>Metals (mg/L)   | 1 baseline site visit<br>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<br>1 treatment visit, growing season only   |

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

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.