

**Yadkin Project (FERC No. 2197)**  
**Flow and Reservoir Elevation Monitoring Plan**

**Cube Yadkin Generation, LLC**

**June 2017**

**Table of Contents**

1.0 Introduction..... 1  
    1.1 Project Description..... 1  
    1.2 Background ..... 1  
    1.3 Purpose of the Flow and Reservoir Elevation Monitoring Plan..... 1  
    1.4 Plan Development ..... 2  
2.0 Flow Monitoring ..... 4  
    2.1 High Rock Flow Monitoring..... 4  
    2.2 Falls Flow Monitoring..... 5  
3.0 Reservoir Elevation Monitoring ..... 7  
4.0 Flow and Reservoir Elevation Monitoring Records ..... 7  
5.0 Schedule ..... 7  
Appendix A: Consultation Record..... 8

**List of Figures**

Figure 1 Yadkin Project Regional Locus..... 3  
Figure 2 Approximate Location of High Rock Flow Monitoring Device Transect ..... 5  
Figure 3 Approximate Location of Falls Flow Monitoring Device Transect ..... 6

## Acronyms

APGI	Alcoa Power Generating Inc. (Previous owner of the Yadkin Project)
Cube	Cube Yadkin Generation, LLC, Licensee of Yadkin Hydroelectric Project
Duke	Duke Energy, Licensee of the Yadkin-Pee Dee Project (FERC No. 2206)
FERC	Federal Energy Regulatory Commission
Licensee	Cube Yadkin Generation, LLC (Cube)
NCDEQ	North Carolina Department of Environmental Quality
NCDWR	North Carolina Division of Water Resources
NCWRC	North Carolina Wildlife Resources Commission
Plan	Flow and Reservoir Elevation Monitoring Plan
Project	Yadkin Project or Yadkin Hydroelectric Project (FERC No. 2197)
SCDNR	South Carolina Department of Natural Resources
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Yadkin	Yadkin Division of Cube Hydro Carolinas, LLC
Yadkin Project	Yadkin Hydroelectric Project (FERC No. 2197)

## 1.0 Introduction

### 1.1 Project Description

The Yadkin Hydroelectric Project (Yadkin Project or Project) is owned by Cube Hydro Carolinas, LLC (Cube), an affiliate of Cube Hydro Partners, LLC. Cube Yadkin Generation LLC is responsible for the operation of the Project. The Yadkin Project includes four hydroelectric developments, the High Rock, Tuckertown, Narrows, and Falls developments, which are located on a 38 mile stretch of the Yadkin River (see Figure 1). High Rock, the most upstream development, is located at mile 253 on the Yadkin River and serves as the principal reservoir facility for the entire Yadkin-Pee Dee River. The Tuckertown, Narrows, and Falls developments are located approximately 8.7 miles, 16.5 miles, and 19.0 miles downstream, respectively, of the High Rock Development.

The Yadkin Project is located approximately 60 miles northeast of Charlotte on the Yadkin River in Davidson, Davie, Montgomery, Rowan, and Stanly counties in central North Carolina. The Yadkin River and its tributaries are part of the Yadkin-Pee Dee Basin, which extends from the eastern slopes of the Blue Ridge Mountains to the Atlantic coast near Georgetown, South Carolina. The Yadkin River's name changes to the Pee Dee River at its confluence with the Uwharrie River. The Pee Dee River continues its southeastern flow to Winyah Bay, where it meets the Atlantic Ocean.

### 1.2 Background

On October 23, 2015, the North Carolina Department of Environmental Quality (NCDEQ) issued a Water Quality Certification for the Project under Section 401 of the Clean Water Act. On September 22, 2016, the Federal Energy Regulatory Commission (FERC) issued a new license for the Yadkin Project. On February 3, 2017, the 401 Water Quality Certification was reissued to Cube. In accordance with the conditions of the FERC License (Article PO-3) and the 401 Water Quality Certification, Cube is required to prepare a Project Flow and Reservoir Elevation Monitoring Plan (Plan) and to monitor flows and reservoir elevations in accordance with the Plan.

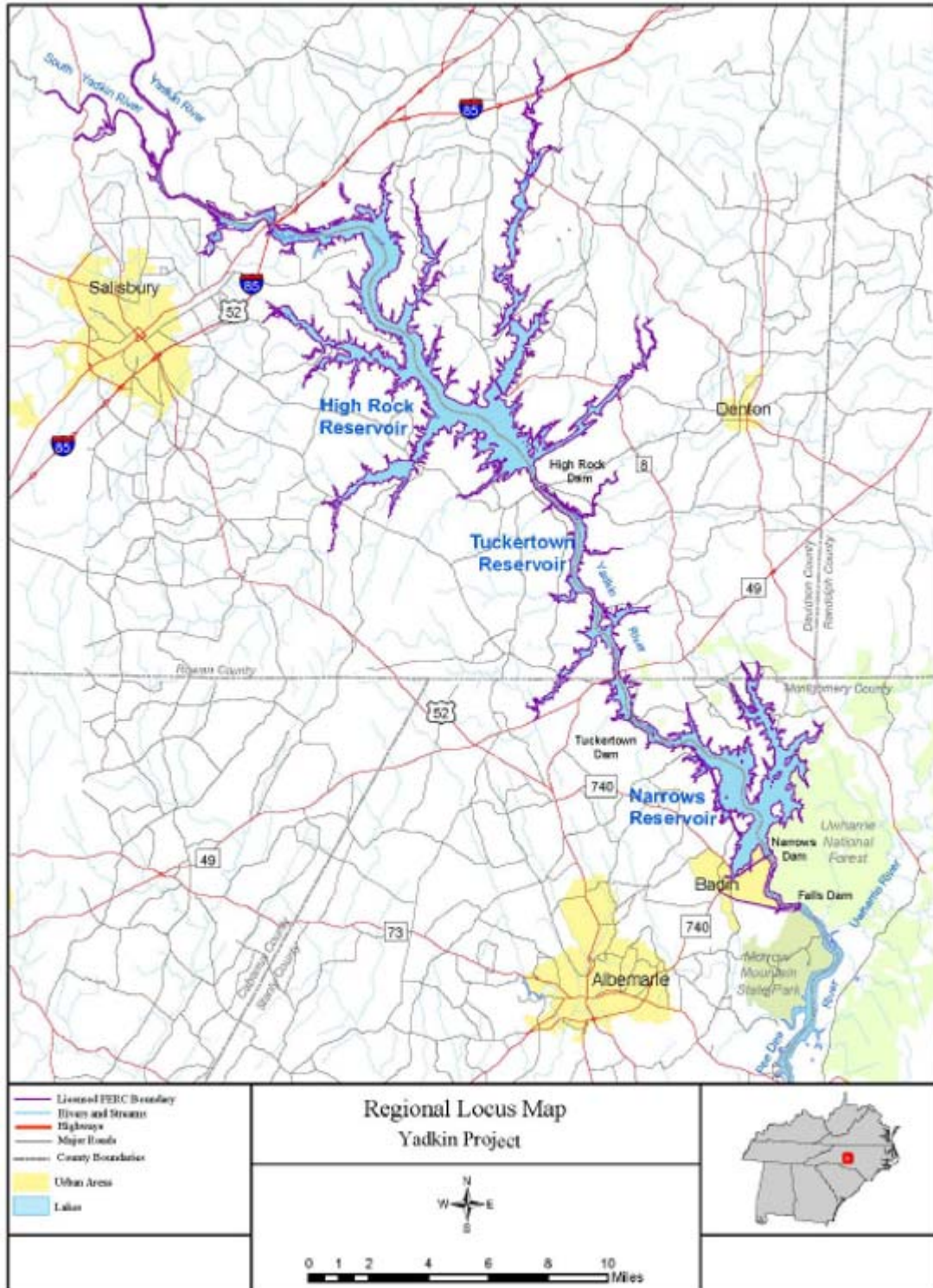
### 1.3 Purpose of the Flow and Reservoir Elevation Monitoring Plan

The purpose of the Yadkin Project Flow and Reservoir Elevation Monitoring Plan is to ensure through appropriate monitoring that Project operations comply with applicable requirements of the FERC license and 401 Water Quality Certification.

## 1.4 Plan Development

On April 17, 2017, a Draft Flow and Reservoir Elevation Monitoring Plan was distributed to the North Carolina Division of Water Resources (NCDWR), the South Carolina Department of Natural Resources (SCDNR), Duke Energy the Licensee of the downstream Yadkin-Pee Dee Project (FERC No. 2206) (Duke), and the U.S. Geological Survey (USGS) for review and comment. Comments were requested by May 17, 2017. Comments were received from Duke, NCDWR, and SCDNR. Appendix A includes a summary of all comments received on the draft plan, and Cube's response to each comment. Appendix A also includes copies of all comments received.

Figure 1 Yadkin Project Regional Locus



## 2.0 Flow Monitoring

In accordance with Article PO-3 of the Project license and the 401 Certification, Cube is required to monitor Project flows from the High Rock and Falls developments. The flow measurement and monitoring equipment to be used at both locations will be developed utilizing hydroelectric industry accepted practices.

### 2.1 High Rock Flow Monitoring

Alcoa Power Generating Inc. (APGI), previous owner of the Yadkin Project, worked with the United States Geological Survey (USGS) to identify and evaluate potential sites to install a permanent flow monitoring device below High Rock Dam. The first step in determining an appropriate monitoring location and gauging equipment to be used was an evaluation of the site conditions in the High Rock tailwater area by the USGS. In 2007, the USGS gathered field data utilizing a boat equipped with an Acoustic Doppler Current Profiler, GPS, and a depth finder. A visual survey was made of the area to locate transects where it appeared the flow of water was not significantly influenced by large rocks. Due to the rocky nature of the tailwater area, the potential gauging sites are limited. Velocity measurements and bottom profile data were gathered on transects upstream and downstream of the Bringle Ferry Road Bridge and near the Town of Denton water intake.

Based on this analysis, the USGS has recommended installing a permanent flow monitoring device near the Town of Denton water intake. Figure 2 shows the approximate location of the monitoring device transect. There is good water depth in this area and the rocks have limited influence on velocity. To calibrate the flow monitoring device, field measurements will be performed to develop the relationship between measured data and total stream flow. Cube will be responsible for maintenance to be performed annually, or as necessary.

15-minute increment flow data will be stored in a database maintained by Cube and will be available on the Project website at <http://cubecarolinas.com/>.

Figure 2 Approximate Location of High Rock Flow Monitoring Device Transect



## 2.2 Falls Flow Monitoring

APGI also worked with the USGS to identify and evaluate potential sites for the permanent flow monitoring device below Falls dam. A visual survey was performed by the USGS in the Falls tailwater to identify transects to collect velocity data. The initial survey of the area did not identify a suitable site, and a site above Falls Dam in Falls Reservoir was selected to measure flow from Narrows. Since Falls is operated essentially as run-of-river with only small variation in reservoir elevation, it was thought the this would be the best representation of Falls flow. The USGS later made an additional survey below Falls Dam and collected test data in an area downstream of the islands in the tailwater.

Based on this analysis, the USGS has recommended installing a permanent flow monitoring device at the site below Falls Dam. The approximate location of the Falls flow monitoring device transect is shown in Figure 3. There is good water depth in this area that will allow accurate measurement of water flow. The width of the river narrows in this area but remains relatively consistent for several hundred feet. To calibrate the flow monitoring device, field



measurements will be performed to develop the relationship between measured data and total stream flow. Cube will be responsible for maintenance to be performed annually, or as deemed necessary.

15-minute increment flow data will be stored in a database maintained by Cube and will be available on the Project website at <http://cubecarolinas.com/>.

Figure 3 Approximate Location of Falls Flow Monitoring Device Transect



### 3.0 Reservoir Elevation Monitoring

Cube will use existing equipment to monitor reservoir elevations. Each development has an elevation monitoring device, a Milltronics DPL Plus with ultrasonic transducer (or equivalent), on the upstream side of the dam. The data from these devices is transmitted hourly to the Cube Operating Center computers and logged in a database.

The accuracy of the elevation monitoring devices is +/- 0.10 foot compared to the staff gauge that is permanently installed at each dam. The calibration of the elevation monitoring devices versus the staff gauges is checked weekly by Cube. Cube performs all maintenance of the elevation monitoring devices.

### 4.0 Flow and Reservoir Elevation Monitoring Records

Cube will log and store in a database the 15-minute increment flow data for High Rock and Falls and the hourly reservoir elevation data for each of the four reservoirs. Cube will post the most recent flow data, the previous 24-hour flow data, the average of the 15-minute flow data for the previous day, and the average 15-minute flow data for the previous week on the Project website.

Cube will continue to post the recent reservoir elevation, the feet below full pond, and a fluctuation forecast for all four reservoirs on the Project website.

All flow data and reservoir data will be maintained electronically in the Cube database for the period of the Project license. The Cube database is backed up regularly. Data will be made available to NCDWR upon request.

### 5.0 Schedule

The elevation monitoring equipment is installed and operational. Cube plans to install the flow monitoring equipment within six (6) months of FERC's approval of the Plan, if hydrological conditions permit. If installation of the flow monitoring equipment is not possible within six (6) months, Cube will install the equipment no later than July 31, 2018.