Cliffside Steam Station Ash Basin

Topographic Map and Discharge Assessment Plan

NPDES Permit NC0005088

December 30, 2014

DUKE ENERGY®

HDR

Contents

Figures and Tables

Section 1 - Introduction

The purpose of this document is to address the requirements of North Carolina General Statute (GS)130A-309.210(a) *topographic map* and (b) *Assessment of Discharges from Coal Combustion Residuals Surface Impoundments to the Surface Waters of the State*, as modified by North Carolina Senate Bill 729, for the Cliffside Steam Station (CSS) ash basin operated under National Pollutant Discharge Elimination System (NPDES) Permit NC0005088.

The following requirements are contained in General Statute (GS) 130A-309.210(a):

(1) The owner of a coal combustion residuals surface impoundment shall identify all discharges from the impoundment as provided in this subsection. The requirements for identifying all discharges from an impoundment set out in this subsection are in addition to any other requirements for identifying discharges applicable to the owners of coal combustion residuals surface impoundments.

(2) No later than December 31, 2014, the owner of a coal combustion residuals surface impoundment shall submit a topographic map that identifies the location of all (i) outfalls from engineered channels designed or improved for the purpose of collecting water from the toe of the impoundment and (ii) seeps and weeps discharging from the impoundment that are not captured by engineered channels designed or improved for the purpose of collecting water from the toe of the impoundment to the Department. The topographic map shall comply with all of the following:

a. Be at a scale as required by the Department.

b. Specify the latitude and longitude of each toe drain outfall, seep, and weep.

c. Specify whether the discharge from each toe drain outfall, seep, and weep is continuous or intermittent.

d. Provide an average flow measurement of the discharge from each toe drain outfall, seep, and weep including a description of the method used to measure average flow.

e. Specify whether the discharge from each toe drain outfall, seep, and weep identified reaches the surface waters of the State. If the discharge from a toe drain outfall, seep, or weep reaches the surface waters of the State, the map shall specify the latitude and longitude of where the discharge reaches the surface waters of the State.

f. Include any other information related to the topographic map required by the Department.

The following requirements are contained in General Statute (GS) 130A-309.210(b):

b) Assessment of Discharges from Coal Combustion Residuals Surface Impoundments to the Surface Waters of the State. The owner of a coal combustion residuals surface impoundment shall conduct an assessment of discharges from the coal combustion *residuals surface impoundment to the surface waters of the State as provided in this subsection. The requirements for assessment of discharges from the coal combustion residuals surface impoundment to the surface waters of the State set out in this subsection are in addition to any other requirements for the assessment of discharges from coal combustion residuals surface impoundments to surface waters of the State applicable to the owners of coal combustion residuals surface impoundments.*

(1) No later than December 31, 2014, the owner of a coal combustion residuals surface impoundment shall submit a proposed Discharge Assessment Plan to the Department. The Discharge Assessment Plan shall include information sufficient to allow the Department to determine whether any discharge, including a discharge from a toe drain outfall, seep, or weep, has reached the surface waters of the State and has caused a violation of surface water quality standards. The Discharge Assessment Plan shall include, at a minimum, all of the following:

a. Upstream and downstream sampling locations within all channels that could potentially carry a discharge.

b. A description of the surface water quality analyses that will be performed.

c. A sampling schedule, including frequency and duration of sampling activities.

d. Reporting requirements.

e. Any other information related to the identification of new discharges required by the Department.

(2) The Department shall approve the Discharge Assessment Plan if it determines that the Plan complies with the requirements of this subsection and will be sufficient to protect public health, safety, and welfare; the environment; and natural resources.

(3) No later than 30 days from the approval of the Discharge Assessment Plan, the owner shall begin implementation of the Plan in accordance with the Plan's schedule.

The North Carolina Senate Bill 729 establishes the submittal date of this topographic map and Discharge Assessment Plan no later than December 31, 2014.

The topographic map, developed to satisfy the requirements of GS130A-309.210(a), was utilized as the basis for developing the assessment procedures presented in this plan, required by GS130A-309.210(b).

Section 2 - Site Background

2.1 Plant Description

CSS is a coal-fired, electricity-generating facility located along the south bank of the Broad River in Rutherford and Cleveland Counties at 573 Duke Power Road, Cliffside, North Carolina (Figure 1). CSS currently operates Units 5 and 6 only. The original Units 1–4 were retired in October 2011. The surrounding area generally consists of residential properties, undeveloped land, and the Broad River.

2.2 Ash Basin Description

The station has one active ash basin and two inactive ash basins, the Units 1–4 inactive ash basin, and the Unit 5 inactive ash basin as shown on Figure 1. The active ash basin and the Units 1–4 inactive ash basin are located in Cleveland County to the east and southeast of the CSS. The Unit 5 inactive ash basin is located in Rutherford County west of the CSS.

The active ash basin is located approximately 1,700 feet to the east-southeast of CSS adjacent to the Broad River as shown on Figure 2. The active ash basin is impounded by earthen dikes located between the west portion of the basin and Suck Creek and between the northeast portion of the basin and the Broad River. The waste boundary associated with the active ash basin is approximately 117 acres in area. The approximate maximum pond elevation of the active ash basin is 770 feet. The main section of the pond is operated below 765 feet to have extra storage capacity during a heavy flood event.

The two ash storage areas are located adjacent to the active ash basin. The ash located in these storage areas was removed from the active ash basin. The Units 1–4 inactive ash basin is located approximately 400 feet to the southeast of the retired Units 1–4 and approximately 1,300 feet to the northeast of Unit 6, adjacent to the Broad River (Figure 2). The Units 1–4 inactive ash basin is impounded by an earthen dike located along the north and northeast side of the basin. The waste boundary associated with the Units 1–4 inactive ash basin is approximately 14.5 acres in area.

The Unit 5 inactive ash basin is located approximately 1,000 feet to the southwest of Unit 5 and approximately 1,000 feet west of Unit 6, south of the Broad River (Figure 2). The Unit 5 inactive ash basin is impounded by two earthen dikes located along the north and northeast sides of the basin. The waste boundary associated with the Unit 5 inactive ash basin is approximately 58 acres in area. The ash basin system has been an integral part of the station's wastewater treatment system which has received inflows from the ash removal system, station yard drain sump, stormwater flows, and station wastewater. Currently, the inflows from the ash removal system and the station yard drainage basin are discharged through High Density Polyethylene Pipe (HDPE) sluice lines into the active ash basin. The inflows are variable based on Unit 5 and Unit 6 operations.

Effluent from the ash basin system is discharged from the active basin to the Broad River through a concrete discharge tower located in the northeast portion of the basin. The concrete discharge tower drains through a 42-inch reinforced concrete pipe (RCP) into a riprap-lined channel that discharges to the Broad River. The ash basin pond elevation is controlled by the use of concrete stoplogs.

2.3 Site Geologic/Soil Framework

CSS is located within the Piedmont zone, one of several northeast-trending geologic belts of the southern crystalline Appalachians. The zone lies between the Charlotte Terrane of the Carolina zone to the east and the Blue Ridge Terrane to the west. Rocks in the Piedmont zone have undergone intense metamorphism, folding, faulting, and igneous intrusion.

The Piedmont zone is a fault-bounded composite stack of thrust sheets containing a variety of gneisses, schists, amphibolites, sparse ultramafic bodies, and intrusive granitoids (Horton and McConnell, 1991; Nelson and others, 1998). The general structure within the zone is characterized by irregular foliation of low dip and folds transverse to the northeast regional trend. The stratified rocks consist of thinly layered mica schist and biotite gneiss that are interlayered with lesser amounts of amphibolite, calc-silicate rocks, hornblende gneiss, and quartzite. Protoliths of these rocks were largely sedimentary and in part volcanic. Large and small masses of granite and granodiorite are present throughout the belt and form concordant to semi-concordant bodies in the country rock. Some of these granitoid bodies are gneissic and are probably older than the poorly foliated to non-foliated facies. Small, ultramafic masses are present along the eastern and western edges of the belt. The rocks of the central core of the Western Piedmont zone are in the sillimanite zone of amphibolite metamorphism with the flanks primarily in the staurolite-kyanite zone (Butler, 1991).

In the Piedmont zone, a variable thickness and degree of soil, saprolite, and weathered rock, referred to as regolith, typically overlie crystalline bedrock. The degree of weathering typically decreases with depth with a thoroughly weathered and structureless material at the surface termed residuum. The residuum grades into a relatively coarse-grained material that retains the structure of the parent bedrock and is termed saprolite (can extend to greater than 150 feet in depth below the ground surface). Beneath the saprolite, partially weathered bedrock occurs with depth until sound bedrock is encountered.

A transition zone may occur at the base of the regolith between the soil-saprolite and the unweathered bedrock. This transition zone of partially weathered rock is a zone of relatively high permeability compared to the overlying soil-saprolite and the underlying bedrock (LeGrand 2004).

Groundwater flow paths in the Piedmont are almost invariably restricted to the zone underlying the topographic slope extending from a topographic divide to an adjacent stream. LeGrand describes this as the local slope aquifer system. Under natural conditions, the general direction of groundwater flow can be approximated from the surface topography (LeGrand 2004).

Groundwater recharge in the Piedmont is derived entirely from infiltration of local precipitation. Groundwater recharge occurs in areas of higher topography (i.e., hilltops) and groundwater discharge occurs in lowland areas bordering surface water bodies, marshes, and floodplains (LeGrand 2004).

The CSS site is located on the southern bank of the Broad River and lies in both Cleveland and Rutherford Counties. McCraw Road runs from northwest to southeast in the vicinity of the site and appears to generally be located along a surface water divide. The geology/groundwater conditions at the site are expected to be generally consistent with the characteristics of the conceptual groundwater model developed by LeGrand for the Piedmont region.

2.4 Topographic Map and Identification of Discharges

A topographic map is presented in Figure 2 to meet the requirements of GS 130A-309.210(a) in the identification of outfalls from engineered channels, as well as seeps and weeps.

Seepage is the movement of wastewater from the ash basin through the ash basin embankment, the embankment foundation, the embankment abutments, basin rim, through residual material in areas adjacent to the ash basin. A seep is defined in this document as an expression of seepage at the ground surface. A weep is understood to have the same meaning as a seep.

Indicators of seepage include areas where water is observed on the ground surface and/or where vegetation suggests the presence of seepage. Seepage can emerge anywhere on the downstream face, beyond the toe, or on the downstream abutments at elevations below normal pool. Seepage may vary in appearance from a "soft," wet area to a flowing "spring." Seepage may show up first as only an area where the vegetation is lusher and darker green than surrounding vegetation. Cattails, reeds, mosses, and other marsh vegetation often become established in a seepage area. However, in many instances, indicators of seeps do not necessarily indicate the presence of seeps. Areas of apparent iron staining and/or excess iron bacteria may also indicate the presence of a seep.

Locations of seepage at the ground surface adjacent to the ash basin have been identified and are shown in Figure 2. These areas include the earthen embankments which impound the ash basin as well as adjacent areas where water from the ash basin may have infiltrated into the underlying residual materials and expressed as seepage.

2.4.1 Engineered Drainage System for Earthen Dam

Earth dams are subject to seepage through the embankment, foundation, and abutments. Seepage control is necessary to prevent excessive uplift pressures, instability of the downstream slope, piping through the embankment and/or foundation, and erosion of material by migration into open joints in the foundation and abutments. The control of seepage is performed by the use of engineered drains such as blanket drains, trench drains, and/or toe drains. In certain cases, horizontal pipes may be installed into the embankment to collect and control seepage. It is standard engineering practice to collect the seepage and convey seepage away from the dam.

The Cliffside active ash basin downstream dam and upstream dam were constructed with a zoned trench drain, a zoned blanket drain, and a zoned toe drain. The engineered drainage system features, or outfalls, associated with the ash basin dam are shown as required by GS 130A-309.210(a)(2)(i) on Figure 2.

2.4.2 Non-Engineered Seep Identification

Topographic maps of the site were reviewed to identify regions of the site where there was a potential for ash-basin-related seepage to be present. These regions were determined by comparing ash basin full pond elevations to adjacent topography with ground surface elevations lower than the ash basin full pond elevation. HDR staff performed site observations within these identified areas as part of NPDES inspections during the reapplication process during June, July, September, and November 2014 and documented locations where seepage was apparent at the time of the site visit. These seeps are identified as required by GS 130A-309.210(a)(2)(ii) on Figure 2.

Section 3 - Discharge Assessment Plan

3.1 Purpose of Assessment

The purpose of the assessment is to determine whether existing, known discharges from toe drain outfalls, seeps, and weeps associated with the coal combustion residuals surface impoundment (ash basin) have reached the surface waters of the State and have caused a violation of surface water quality standards as required by North Carolina General Statute 130A-309.210(b).

Figure 2 and Table 1 present the background and downstream sampling locations to be considered as part of this Discharge Assessment Plan (DAP). These locations may be assessed by comparing surface water sampling analytical results of the associated background location with the corresponding downstream location. For discharges located at the toe of a dam, an upstream location within the channel may not have been possible to isolate for comparison given the proximity to the ash basin, which would have the same chemical composition as the discharge itself. As such, the upstream location was established upstream of the ash basin and is considered "background." For discharges located a distance from the ash basin, an identified upstream or "background" location for sampling may be compared to the downstream portion of the discharge channel. The background and downstream sampling locations are shown on Figure 2 with "B" and "D" identifiers, respectively, and the corresponding seep locations associated with the sampling locations are indicated on Table 1.

3.2 Assessment Procedure

The assessment procedure associated with the Cliffside ash basin is provided within this section. In addition to the specific requirements for the assessment, Section 3.2 also provides the general requirements, the frequency of assessment, documentation requirements, and a description of the surface water quality analyses that will be performed.

3.2.1 General Assessment Requirements

Assessments are to be performed in three phases as follows:

- Observation and Sampling (assessment site visit)
- Evaluation
- Assessment Reporting

The assessment site visit shall be performed when the background and downstream locations are accessible and not influenced by weather events. Locations on or adjacent to the ash basin embankments should be performed within two months after mowing, if possible. In addition, the assessment site visit should not be performed if the following precipitation amounts have occurred in the respective time period preceding the planned assessment site visit:

- Precipitation of 0.1 inches or greater within 72 hours or
- Precipitation of 0.5 inches or greater within 96 hours.

The assessments shall be performed under the direction of a qualified Professional Engineer or Professional Geologist on a semi-annual basis within two nonadjacent quarters. The date of the initial assessment site visit shall be selected no later than 30 days from the approval of the Discharge Assessment Plan and should fall within one of the semi-annual timeframes. Additional seep locations that may have been identified and documented in an Identification of New Discharge report(s) shall be reviewed prior to performing an assessment site visit, if available.

3.2.2 Observation and Sampling

The initial assessment site visit should be performed to document baseline conditions of the discharge channel, including location, extent (i.e., dimensions of affected area), and flow of each discharge. Discharge channel background and downstream locations should be verified using a Global Positioning System (GPS) device. Photographs should be taken from vantage points that can be replicated during subsequent semi-annual assessments.

Initial and subsequent assessment site visits shall document a minimum of the following to respond to the requirements in 130A-309.210.1(b):

- Record the most recent ash basin water surface elevation and compare to the seep and outfall and associated discharge location surface water elevations.
- For each discharge channel, the observer shall note the following as applicable on the day of the assessment site visit:
    - Is the discharge channel flowing at the time of the assessment site visit?
    - Does the discharge channel visibly flow into a Water of the U.S. at the time of the assessment site visit?
    - How far away is the nearest Water of the U.S.?
    - Document evidence that flow has or could reach a Water of the U.S. (e.g., description of flow, including extent and/or direction) and describe the observed condition. Evidence that flow could or has reached a Water of the U.S. may be indicated by an inspection of the adjacent and downstream topographic drainage features.
    - Observe and document the condition of the discharge channel and outfall of the engineered channel or seep location with photographs. Photographs are to be taken from similar direction and scale as photographs taken during the initial assessment site visit.
- Record flow rate within the discharge channel, if measureable, using the following methods:
    - Timed-volumetric method: Collect a volume of water from the discharge of the PVC pipe directly into an appropriately sized container. Measure volumes (in mL) in the field utilizing a graduated container. Record the amount of time (in seconds) needed to collect the volume of water and calculate the flows (in MGD) for the timed volume.

  - A V-notch weir apparatus will be installed, if necessary, during the initial assessment site visit to impound seepage at locations with a defined channel. Once the impounded seep reaches equilibrium discharge, flows will be measured using the timed-volumetric method described above.

  - Area-velocity method: Measure point velocities and water depth at a minimum of 20 stations along a transect setup perpendicular to the direction of flow using a Swoffer® 3000 flow meter mounted to a standard United States Geologic Survey (USGS) top-set wading rod. Utilize the average velocity and cross-sectional area of the wetted channel to calculate flows in MGD.

- Collect water quality samples using the following methods:

  - Collect background and downstream samples during a period with minimal preceding rainfall to minimize potential effects of stormwater runoff. Collect samples from the discharge channel at the flow measurement devices or directly from the discharge into sample bottles while minimizing disturbance and entrainment of soil/sediment. After collection, samples will be preserved and stored according to parameter-specific methods and delivered to the laboratory under proper Chain-of-Custody (COC) procedures.

  - Analytical parameters for analysis include: Fluoride, Arsenic, Cadmium, Copper, Chromium, Nickel, Lead, Selenium, and Mercury. This list includes all parameters previously identified for seep sampling at Duke Energy power plants for which relevant stream water quality standards are in place. (This list is responsive to the statutory requirement for the discharge assessment to allow determination whether discharges from toe drain outfalls, seeps, or weeps have reached surface waters and caused a violation of surface water quality standards.) Analyses shall be conducted by Duke Energy's Huntersville Analytical Laboratory (NC Wastewater Certification #248) and Pace Analytical Laboratories (NC Wastewater Certification # 12). Laboratory analytical methods used for each constituent are provided in Table 2.

  - Seep in-situ measurements: In-situ field parameters (temperature and pH) shall be measured utilizing calibrated field meters either at the discharge of the seep directly, at the discharge of the flow measurement devices, or in the water pool created behind the device, if sufficient water depth did not exist at the device discharge.

  - Broad River and Ash Basin Sample Collection Method: Water quality samples and in-situ measurements from the Broad River shall be collected at a location upstream and downstream of the ash basin. Additionally, water samples and in-situ measurements shall be collected from an in-process ash basin location. The grab samples shall be collected from the river and basin's surface (0.3 m) directly into appropriate sample bottles.

3.2.3 Evaluation

Evaluation of the data from the initial assessment site visit will establish baseline conditions and will serve as the basis for comparison for subsequent assessment site visit results. Evaluation of observations and sampling results shall include location, extent (i.e., dimensions of affected area), and flow of each discharge. The analytical results of the upstream and downstream locations shall be compared to the 15A NCAC 2B standards for surface water quality upon receipt to identify potential exceedances.

3.2.4 Assessment Reporting

Each assessment site visit shall be documented by the individual performing the assessment, as described in Section 3.2.2 to meet the requirements in 130A-309.210.1(b). The report should contain site background, observation and sampling methodology, and a summary of the observations and descriptions of the discharge channels observed, changes in observations compared to previous assessment events, estimates of flows quantities, and photographs of discharges and outfalls of engineered channels designed or improved for collecting water from the impoundment. Photographs are to be numbered and captioned. The flow and analytical results shall be recorded and presented in tables similar to the examples provided as Tables 1 and 3. The analytical results shall be compared to the 15A NCAC 2B standards for surface water quality and exceedances highlighted. This information shall be compiled, reviewed, and submitted to NCDENR within 90 days from the Observation and Sampling event.

Section 4 - References

Butler, J. R. and Secor, D. T. 1991. The Central Piedmont, p. 59-78, in Horton, J. W., Jr., and Zullo, V. A., eds., The Geology of the Carolinas: The University of Tennessee Press, Knoxville, Tennessee, 406p.

Horton, J. W., Jr. and McConnell, K. I. 1991. The western Piedmont, p. 36-58, in Horton, J. W., Jr. and Zullo, V. A., eds., The Geology of the Carolinas: The University of Tennessee Press, Knoxville, TN, 406p.

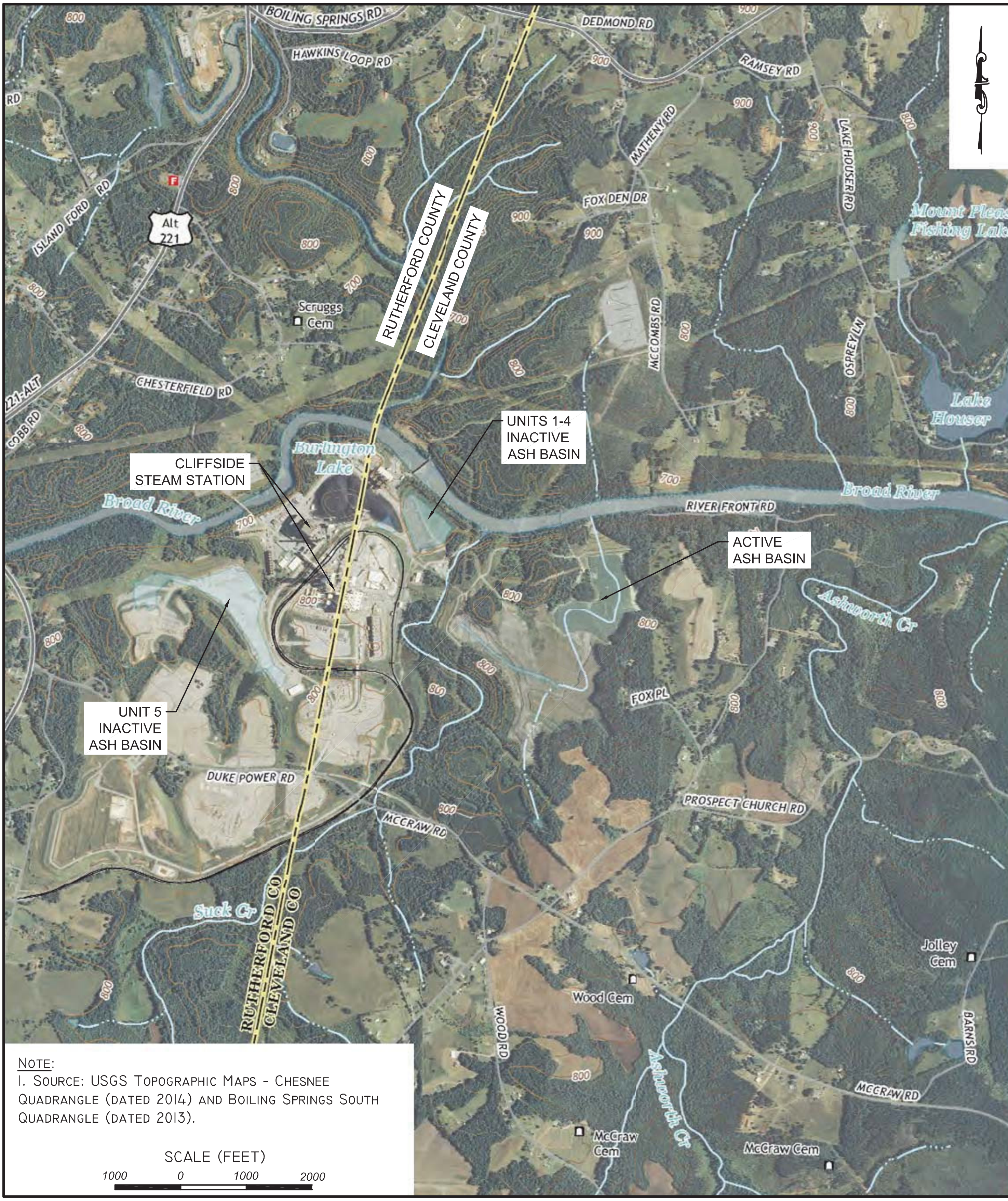
LeGrand, Harry, Sr. 2004. A Master Conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina, North Carolina Department of Environment and Natural Resources.

North Carolina Department of Environment and Natural Resources. 2007. *Dam Operation, Maintenance, and Inspection Manual*, North Carolina Department of Environment and Natural Resources, Division of Land Resources, Land Quality Division, 1985 (Revised 2007).

FIGURES

AND

TABLES



HDR

License Number: F-0116
440 South Church Street Charlotte, NC 28202

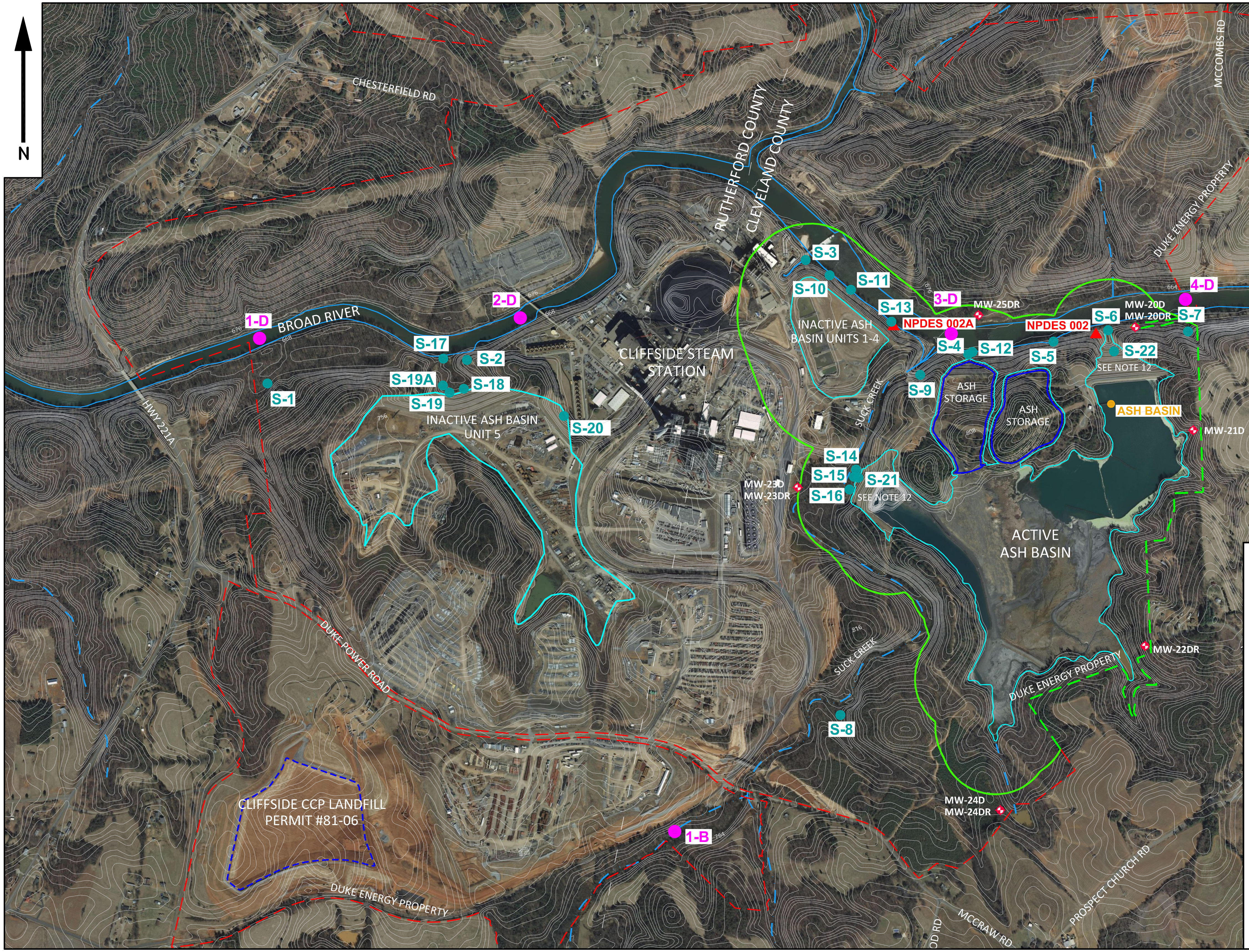
SITE LOCATION MAP
CLIFFSIDE STEAM STATION ASH BASIN
DUKE ENERGY CAROLINAS, LLC
CLEVELAND COUNTY, NORTH CAROLINA

DATE

SEPTEMBER 30, 2014

FIGURE

1



Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Background Location	Discharge Location and Discharge Sampling Location	Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude					Latitude	Longitude
S-1	35.216	-81.775	Continuous	0.0646 area-velocity	1-B	Northwest of the Inactive Unit 5 ash basin; tributary of Broad River 1-D	35.218	81.775
S-2	35.217	-81.768	Continuous	0.2004 area-velocity		Downriver from Inactive Unit 5 ash basin discharge canal 2-D	35.218	81.767
S-3	35.220	-81.758	Continuous	0.0582 area-velocity		At discharge canal for Units 1-4; tributary of Broad River 3-D	35.218	-81.753
S-4	35.218	-81.753	Continuous	0.0129 area-velocity		North of the ash storage area; below outfall of concrete ditch 4-D	35.219	-81.746
S-5	35.218	-81.750	Continuous	0.0014 timed-volumetric		North of the ash storage area; below outfall of concrete ditch 4-D		
S-6	35.218	-81.748	Continuous	0.0323 area-velocity		Downgradient of the active ash basin dike; tributary of Broad River 4-D		
S-7	35.218	-81.746	Continuous	0.0078 timed-volumetric		Northeast of the active ash basin; northeast corner of property 4-D		
S-8	35.208	-81.756	Continuous	<0.0129 timed-volumetric		Tributary to Suck Creek 3-D	35.218	-81.753
S-9	35.217	-81.754	Continuous	0.0013 timed-volumetric		East side of Suck Creek; downstream of bridge 3-D		
S-10	35.220	-81.757	Continuous	0.0004 timed-volumetric		Below inactive Units 1-4 south bank of Broad River 3-D		
S-11	35.219	-81.756	Continuous	0.0025 timed-volumetric		Below inactive Units 1-4 south bank of Broad River 3-D		
S-12	35.217	-81.752	Continuous	0.0003 timed-volumetric		Below ash storage basin; south bank of Broad River 4-D	35.219	-81.746
S-13	35.218	-81.75	No Flow	N/A		Along Units 1-4 dike 3-D	35.218	-81.753
S-14	35.214	-81.756	No Flow	N/A		Along active ash basin dike 3-D		
S-15	35.214	-81.756	No Flow	N/A		Along active ash basin dike 3-D		
S-16	35.214	-81.756	No Flow	N/A		Along active ash basin dike 3-D		
S-17	35.217	-81.769	Continuous	0.0017 timed-volumetric		Along active ash basin dike; seepage from Unit 5 2-D	35.218	-81.767
S-18	35.216	-81.768	Continuous	0.0046 timed-volumetric		Seepage from riprap at toe of Unit 5 2-D		
S-19	35.216	-81.768	Continuous	0.0009 timed-volumetric		Seepage from wooded area at toe of Unit 5 2-D		
S19a	35.216	-81.769	Continuous	0.0005 timed-volumetric		Seepage from wooded area at toe of Unit 5 2-D		
S-20	35.215	-81.765	No Flow	N/A		Seepage at toe of Unit 5 2-D		
S-21 CLEVE-050	35.214	-81.755	No Flow			Engineered drainage at Suck Creek dam at active ash basin 3-D	35.218	-81.753
S-22 CLEVE-049	35.217	-81.749	Continuous			Engineered drainage downstream dam at active ash basin 3-D		

LEGEND:

- DUKE ENERGY PROPERTY BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY COINCIDENT WITH DUKE ENERGY PROPERTY BOUNDARY
- ASH BASIN WASTE BOUNDARY
- ASH STORAGE AREA BOUNDARY
- ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELL
- LANDFILL LIMIT OF WASTE
- STREAM
- TOPOGRAPHIC CONTOUR (4 FOOT)
- S-1 SEEP SAMPLE LOCATION
- NPDES 002 NPDES OUTFALL LOCATION
- ASH BASIN WATER QUALITY SAMPLE LOCATION
- 1-D DISCHARGE SAMPLING LOCATIONS
- 1-B BACKGROUND SAMPLING LOCATIONS

NOTES:

1. PARCEL DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY REAL ESTATE AND IS APPROXIMATE.
2. ASH BASIN WASTE BOUNDARY, CCP LANDFILL BOUNDARY, AND ASH STORAGE AREA BOUNDARIES ARE APPROXIMATE.
3. AS-BUILT MONITORING WELL LOCATIONS PROVIDED BY DUKE ENERGY.
4. ORTHOPHOTOGRAPHY WAS OBTAINED FROM NC ONEMAP GIS WEB SITE (DATED 2010).
5. TOPOGRAPHIC CONTOURS WERE OBTAINED FROM NCDOT WEB SITE (DATED 2010) AND ARE APPROXIMATE.
6. THE ASH BASIN COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).
7. HYDROGRAPHY WAS OBTAINED FROM THE USGS NATIONAL MAP VIEWER AND DOWNLOAD PLATFORM ON MARCH 26, 2014 (http://nationalmap.gov/viewer.html)
8. SEEP SAMPLING LOCATIONS ARE APPROXIMATE.
9. NPDES OUTFALL AND WATER QUALITY SAMPLE LOCATIONS PROVIDED BY DUKE ENERGY.
10. SEE REPORT "CLIFFSIDE STEAM STATION ASH BASIN SURFACE WATER AND SEEP MONITORING - OCTOBER 2014, APPENDIX C" FOR DESCRIPTION OF DAM DRAINAGE SYSTEM.

SCALE (FEET)

300' 0 300' 600'

1" = 600'

North Carolina Engineering Firm Number: F-0116
440 South Church Street Charlotte, NC 28202

TOPOGRAPHIC MAP WITH IDENTIFIED SEEPS AND OUTFALLS
DUKE ENERGY CAROLINAS, LLC
CLIFFSIDE STEAM STATION ASH BASIN
NPDES PERMIT #NC0005088
CLEVELAND COUNTY, NORTH CAROLINA

DATE
DECEMBER, 2014

FIGURE
2

Table 1 – Cliffside Steam Station Ash Basin – Seep and Associated Discharge Locations and Descriptions

Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Background Location	Discharge Location and Discharge Sampling Location	Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude					Latitude	Longitude
S-1	35.216	-81.775	Continuous	0.0646 area-velocity	1-B	Northwest of the Inactive Unit 5 ash basin; tributary of Broad River 1-D	35.218	81.775
S-2	35.217	-81.768	Continuous	0.2004 area-velocity		Downriver from Inactive Unit 5 ash basin discharge canal 2-D	35.218	81.767
S-3	35.220	-81.758	Continuous	0.0582 area-velocity		At discharge canal for Units 1-4; tributary of Broad River 3-D	35.218	-81.753
S-4	35.218	-81.753	Continuous	0.0129 area-velocity		North of the ash storage area; below outfall of concrete ditch 4-D	35.219	-81.746
S-5	35.218	-81.750	Continuous	0.0014 timed-volumetric		North of the ash storage area; below outfall of concrete ditch 4-D		
S-6	35.218	-81.748	Continuous	0.0323 area-velocity		Downgradient of the active ash basin dike; tributary of Broad River 4-D		
S-7	35.218	-81.746	Continuous	0.0078 timed-volumetric		Northeast of the active ash basin; northeast corner of property 4-D		
S-8	35.208	-81.756	Continuous	<0.0129 timed-volumetric		Tributary to Suck Creek 3-D	35.218	-81.753
S-9	35.217	-81.754	Continuous	0.0013 timed-volumetric		East side of Suck Creek; downstream of bridge 3-D		
S-10	35.220	-81.757	Continuous	0.0004 timed-volumetric		Below inactive Units 1-4 south bank of Broad River 3-D		
S-11	35.219	-81.756	Continuous	0.0025 timed-volumetric		Below inactive Units 1-4 south bank of Broad River 3-D		
S-12	35.217	-81.752	Continuous	0.0003 timed-volumetric		Below ash storage basin; south bank of Broad River 4-D	35.219	-81.746
S-13	35.218	-81.75	No Flow	N/A		Along Units 1-4 dike 3-D	35.218	-81.753
S-14	35.214	-81.756	No Flow	N/A		Along active ash basin dike 3-D		
S-15	35.214	-81.756	No Flow	N/A		Along active ash basin dike 3-D		

Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Background Location	Discharge Location and Discharge Sampling Location	Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude					Latitude	Longitude
S-16	35.214	-81.756	No Flow	N/A		Along active ash basin dike 3-D		
S-17	35.217	-81.769	Continuous	0.0017 timed-volumetric		Along active ash basin dike; seepage from Unit 5 2-D	35.218	-81.767
S-18	35.216	-81.768	Continuous	0.0046 timed-volumetric		Seepage from riprap at toe of Unit 5 2-D		
S-19	35.216	-81.768	Continuous	0.0009 timed-volumetric		Seepage from wooded area at toe of Unit 5 2-D		
S19a	35.216	-81.769	Continuous	0.0005 timed-volumetric		Seepage from wooded area at toe of Unit 5 2-D		
S-20	35.215	-81.765	No Flow	N/A		Seepage at toe of Unit 5 2-D		
S-21 CLEVE-050	35.214	-81.755	No Flow			Engineered drainage at Suck Creek dam at active ash basin 3-D	35.218	-81.753
S-22 CLEVE-049	35.217	-81.749	Continuous			Engineered drainage downstream dam at active ash basin 3-D		

Notes:

1. Flow description for each seep sample location is based on observation during site visits performed by HDR in June and July 2014
2. Flow measurements and analytical samples were collected on July 7, 9, and 22, 2014; and November 10, 2014
3. Location coordinates for seep sampling locations are approximate
4. Location coordinates (degrees) in NAD 83 datum

Table 2 – Laboratory Analytical Methods

Parameter	Method	Reporting Limit	Units	Laboratory
Fluoride (F)	EPA 300.0	1	mg/l	Duke Energy
Mercury (Hg)	EPA 245.1	0.05	µg/l	Duke Energy
Arsenic (As)	EPA 200.8	1	µg/l	Duke Energy
Cadmium (Cd)	EPA 200.8	1	µg/l	Duke Energy
Chromium (Cr)	EPA 200.8	1	µg/l	Duke Energy
Copper (Cu)	EPA 200.8	1	µg/l	Duke Energy
Lead (Pb)	EPA 200.8	1	µg/l	Duke Energy
Nickel (Ni)	EPA 200.8	1	µg/l	Duke Energy
Selenium (Se)	EPA 200.8	1	µg/l	Duke Energy

Table 3 – Cliffside Steam Station – Example of Surface Water/Seep Monitoring Flow and Analysis Results Table

Parameters	Units	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12	S-17
Fluoride	mg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Hg - Mercury (71900)	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
As - Arsenic (01002)	µg/l	< 1	< 1	5.51	28.6	< 1	< 1	< 1	< 1	< 1	334	104	< 1	< 1
Cd - Cadmium (01027)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cr - Chromium (01034)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cu - Copper (01042)	µg/l	< 1	< 1	1.24	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pb - Lead (01051)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni - Nickel (01067)	µg/l	< 1	9.01	59.3	< 1	< 1	1.82	< 1	< 1	1.45	< 1	10.4	< 1	< 1
Se - Selenium (01147)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	1.64
pH	s.u.	6.7	7	5.8	7	5.6	6.5	6.2	6.4	5.9	6.7	6.6	6.5	5.15
Temperature	°F	68.2	74	75.5	64.9	61.3	62.3	67.7	66.0	62.4	74.4	73.6	15.8	16.7
Flow	MGD	0.0646	0.2004	0.0582	0.0129	0.0014	0.0323	0.0078	< 0.0129	0.0013	0.0004	0.0025	0.0003	0.0017

Parameters	Units	S-18	S-19	S-19a	Ash Basin in Process	Broad River Upstream	Broad River Downstream
Fluoride	mg/l	< 1	< 1	< 0.1	< 1	< 1	< 1
Hg - Mercury (71900)	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
As - Arsenic (01002)	µg/l	< 1	< 1	< 1	< 51.9	< 1	< 1
Cd - Cadmium (01027)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1
Cr - Chromium (01034)	µg/l	< 1	< 1	< 1	< 15	< 1	< 1
Cu - Copper (01042)	µg/l	< 1	< 1	< 1	< 1.6	< 1	< 1
Pb - Lead (01051)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1
Ni - Nickel (01067)	µg/l	24.3	< 1	8.94	1.24	< 1	< 1
Se - Selenium (01147)	µg/l	< 1	< 1	< 1	< 32.5	< 1	< 1
pH	s.u.	6.3	6.4	6.8	10	7.3	7.9
Temperature	°F	17.7	13.3	15.8	87.1	79	79.7
Flow	MGD	0.0046	0.0009	0.0005		537	< 537

Notes:
1. Flow measurements and analytical samples for were collected on July 7, 9, and 22, 2014; October 22, 2014; November 10, 2014
2. Flow at locations upstream and downstream of CSS in the Broad River is from the USGS Broad River-Boiling Springs daily average flows for the date of river sampling