Belews Creek Steam Station Ash Basin

Plan for Identification of New Discharges

NPDES Permit NC0024406

September 30, 2014

Report Verification

PROJECT: **GROUNDWATER MONITORING PROGRAM**
BELEWS CREEK STEAM STATION
ASH BASIN
NPDES PERMIT NC0024406

TITLE: **PLAN FOR IDENTIFICATION OF NEW DISCHARGES**

This document has been reviewed for accuracy and quality commensurate with the intended application.

Prepared by:_____ Date:_____

Checked by:_____ Date:_____

Approved by:_____ Date:_____

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Charlotte, NC 28202
North Carolina Engineering Firm Number F-0116

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Section 1 - Introduction

The purpose of this document is to address the requirements of North Carolina General Statute (GS)130A-309.210 (d) *Identification and assessment of discharges; correction of unpermitted discharges*, as modified by North Carolina Senate Bill 729, for the Belews Creek Steam Station (BCSS) ash basin operated under National Pollutant Discharge Elimination System (NPDES) Permit NC0024406.

The following requirements are contained in General statue 130A-309.210:

d) Identification of New Discharges. – No later than October 1, 2014, the owner of a coal combustion residuals surface impoundment shall submit a proposed Plan for the Identification of New Discharges to the Department for its review and approval as provided in this subsection.

> *(1) The proposed Plan for the Identification of New Discharges shall include, at a minimum, all of the following:*
>
> > *a. A procedure for routine inspection of the coal combustion residuals surface impoundment to identify indicators of potential new discharges, including toe drain outfalls, seeps, and weeps.*
> >
> > *b. A procedure for determining whether a new discharge is actually present.*
> >
> > *c. A procedure for notifying the Department when a new discharge is confirmed.*
> >
> > *d. Any other information related to the identification of new discharges required by the Department.*
>
> *(2) The Department shall approve the Plan for the Identification of New Discharges 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 Plan for the Identification of New Discharges, the owner shall begin implementation of the Plan in accordance with the Plan.*

The North Carolina Senate Bill 729 establishes the submittal date of this Plan for Identification of New Discharges no later than October 1, 2014.

This bill also modified GS 130A to establish the following submittals that are related to this Plan. GS130A-309.210(a) was modified to require:

(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 inspection procedures presented in this plan, developed to satisfy the requirements of GS130A-309.210(d), will be used as the basis for developing the topographic map required by GS130A-309.210(a)(2).

Section 2 - Site Description

2.1 Plant Description

BCSS is a coal-fired electricity-generating facility with a capacity of 2,240 megawatts located on Belews Lake in Stokes County, North Carolina. BCSS is a two-unit station which began commercial operation in 1974. Belews Creek, a tributary of the Dan River, was impounded by Duke Energy (formerly Duke Power at the time of initial impoundment) to form Belews Lake. Belews Lake is approximately 3,800 acres in area and provides cooling water for the station.

2.2 Ash Basin Description

The ash basin system consists of a single cell impounded by an earthen dike located on the north end of the ash basin. The ash basin system was constructed from 1970-1972 and it is located approximately 3,200 feet northwest of the power plant. The waste boundary for the ash basin encompasses approximately 342 acres.

The full pond elevation for the BCSS ash basin is approximately 750 feet. The normal pond elevation of Belews Lake is approximately 725 feet.

Due to the nature of BCSS operations, inflows to the ash basin are highly variable. The inflows from the station to the ash basin are discharged to the southeast portion of the ash basin. The ash basin pond elevation is controlled by the use of concrete stop logs. The discharge from the ash basin is through a concrete discharge tower located in the northwest portion of the ash basin. The concrete discharge tower drains through a 24-inch-diameter SDR 17 HDPE conduit for approximately 1,600 feet and then discharges into a concrete flume box. The discharge is to an un-named tributary that flows northward to the Dan River.

Section 3 - Site Geology and Hydrogeology

3.1 Site Geologic/Soil Framework

BCSS and its associated ash basin system are located in the Milton Belt of the Piedmont physiographic province (Piedmont), one of several northeast-trending geologic belts of the southern crystalline Appalachians. The rocks of the Milton belt were formed during the Precambrian era and metamorphosed during the early to late Paleozoic era (Butler and Secor 1991). The Milton belt bedrock is characterized by strongly foliated gneiss and schist, commonly with distinct compositional layering and having felsic composition – quartzite, calc-silicate gneiss, and marble are minor units (Carpenter 1982).

The soils that overlie the bedrock in the area have generally formed from the in-place weathering of the parent bedrock. The fractured bedrock is overlain by a mantle of unconsolidated material known as regolith. The regolith, where present, includes the soil zone; a zone of weathered, decomposed bedrock known as saprolite; and alluvium. Saprolite, the product of chemical and mechanical weathering of the underlying bedrock, is typically composed of silt and coarser granular material up to boulder size and may reflect the texture of the rock from which it was formed. The weathering products of felsic rocks may be sandy-textured and rich in quartz content while mafic rocks form a more clayey saprolite (LeGrand 2004).

3.2 Site Hydrogeologic Framework

Piedmont topography is characterized by gently rounded sloped hills and valleys. Recharge typically occurs on upland areas and slopes while groundwater discharge is concentrated in surface water bodies and lowland areas. LeGrand's (1988, 2004) conceptual model of the groundwater setting in the Piedmont incorporates the above two medium systems into an entity that is useful for the description of groundwater conditions. That entity is the surface drainage basin that contains a perennial stream or river (LeGrand 1988). Each basin is similar to adjacent basins and the conditions are generally repetitive from basin to basin. Within a basin, movement of groundwater is generally restricted to the area extending from the drainage divides to a perennial stream or river (Slope-Aquifer System; LeGrand 1988, 2004). Rarely does groundwater move beneath a perennial stream or river to another more distant stream (LeGrand 2004).

Therefore, in most cases in the Piedmont, the groundwater system is a two-medium system (LeGrand 1988) restricted to the local drainage basin. The groundwater occurs in a system composed of two interconnected layers: residuum/saprolite and weathered rock overlying fractured crystalline rock separated by the transition zone. Typically, the residuum/saprolite is partly saturated and the water table fluctuates within it. Water movement is generally through the fractured bedrock. The near-surface fractured crystalline rocks can form extensive aquifers. The character of such aquifers results from the combined effects of the rock type, fracture system, topography, and weathering. Topography exerts an influence on both weathering and the opening of fractures while the weathering of the crystalline rock modifies both transmissive and storage characteristics.

The aquifer system in the Piedmont typically exists in an unconfined or semi-confined condition in the bedrock zone. Under natural conditions, the general direction of groundwater flow can be approximated from the surface topography. Groundwater moves both vertically down through the regolith and parallel to the bedrock surface to areas where groundwater discharges as seepage into streams, lakes, or other surface water bodies.

The BCSS ash basin is generally bounded to the north by the earthen dike and a natural ridge (Figure 2). Pine Hall Road runs along the east and south sides of the ash basin and appears to generally be located along a surface water divide. Belews Lake is located to the east and south of Pine Hall Road. Middleton Loop road is located on the west side of the ash basin 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.

Section 4 - Identification of New Discharges

4.1 Purpose of Inspection

The purpose of the inspection is to identify new discharges and indicators of potential new discharges, including toe drain outfalls, seeps, and weeps associated with the coal combustion residuals surface impoundment (ash basin).

4.2 Seepage

Seepage is considered to be the movement of wastewater from the ash basin through the ash basin embankment, the embankment foundation, the embankment abutments, or 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.[1] 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.

4.3 Area To Be Inspected for New Discharges

The areas to be inspected are the areas of the site adjacent to the ash basin where water contained in the ash basin might express itself (beyond the ash basin) at the ground surface. This would include the earthen embankment(s) which impound the ash basin and certain adjacent areas where water could infiltrate into the underlying residual materials and be expressed as seepage.

The extent of the area to be inspected was determined based on the generalized LeGrand conceptual model, the concept of the slope-aquifer system of this model, and the site characteristics/topography relative to the system/model. In this generalization, flow of water from the ash basin would be expected to be located (1) within those slope-aquifer compartment(s) below and/or adjacent to the basin(s) and (2) below the full-water basin elevation(s) of the ash basin(s). The area to be inspected is shown on Figure 2.

4.4 Inspection Procedure

The inspection procedure for identification of new discharges and indicators of potential new discharges associated with the Belews Creek ash basin is provided in Appendix A. In addition to the specific requirements for the inspection, Appendix A also provides the general

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

requirements, the frequency of inspections, documentation requirements, and provides a decision flow chart for determining if the potential new discharge is associated with the ash basin.

Section 5 - 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.

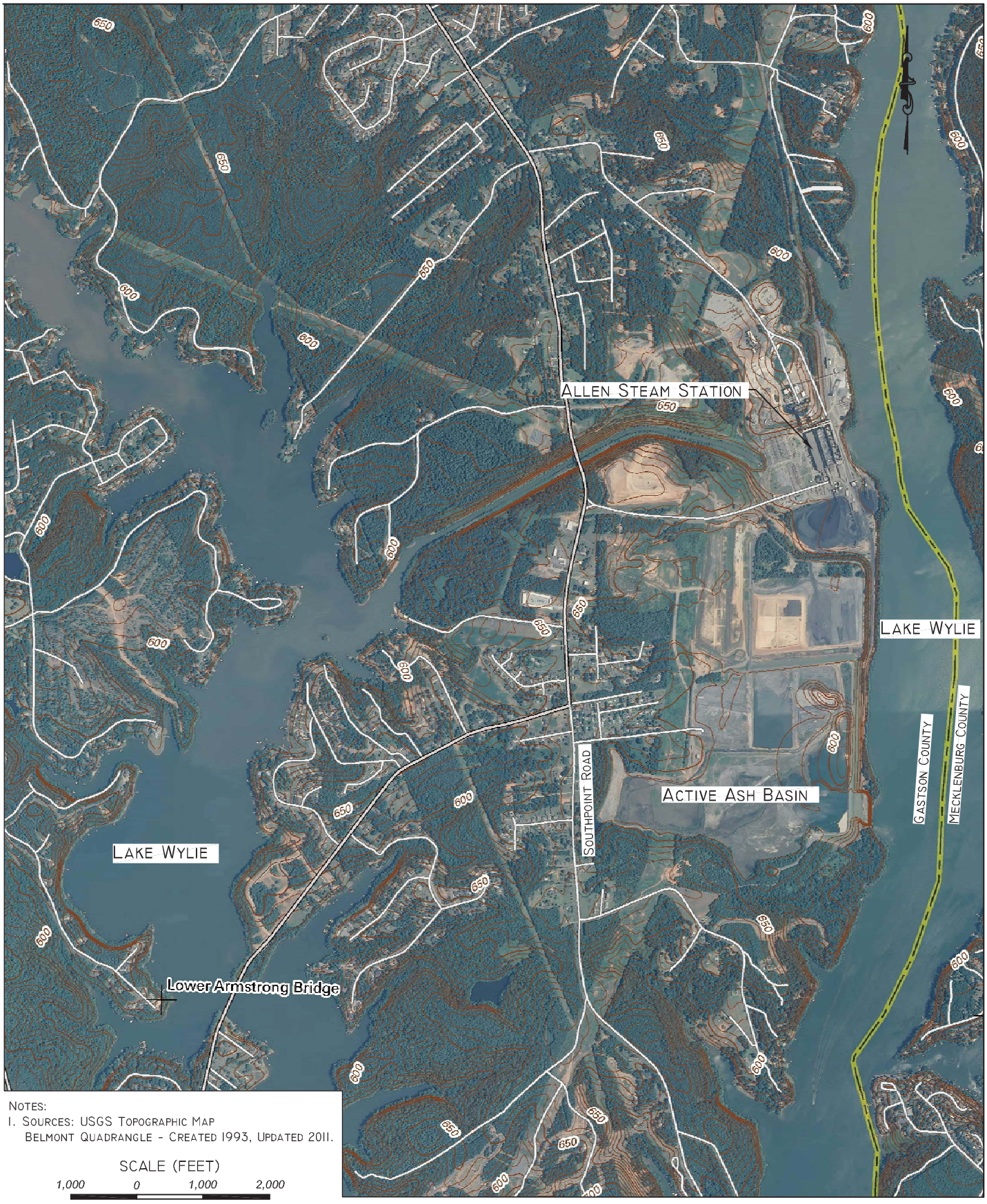
Carpenter, P. A., III. 1982. Geologic map of Region G, North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section, Regional Geology Series 2, Scale 1:125,000.

LaGrand, H.E. 1988. Region 21, Piedmont and Blue Ridge, p.201-208, in Black, W., Rosenhein, J.S., and Seaber, P.R., eds., Hydrogeology: Geological Society of America, The Geology of North America, v. O-2, Boulder, Colorado, 524p.

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.

Pippin, Charles G., Chapman, Melinda J., Huffman, Brad A., Heller, Matthew J., and Schelgel, Melissa E. 2008. Hydrogeologic Setting, Ground-Water Flow, and Ground-Water Quality at the Langtree Peninsula Research Station, Iredell County, North Carolina, 2000-2005, United States Geological Survey, Prepared in cooperation with the North Carolina Department of Environment and Natural Resources, Division of Water Quality.

Figures



NOTES:
1. SOURCES: USGS TOPOGRAPHIC MAP
BELMONT QUADRANGLE - CREATED 1993, UPDATED 2011.

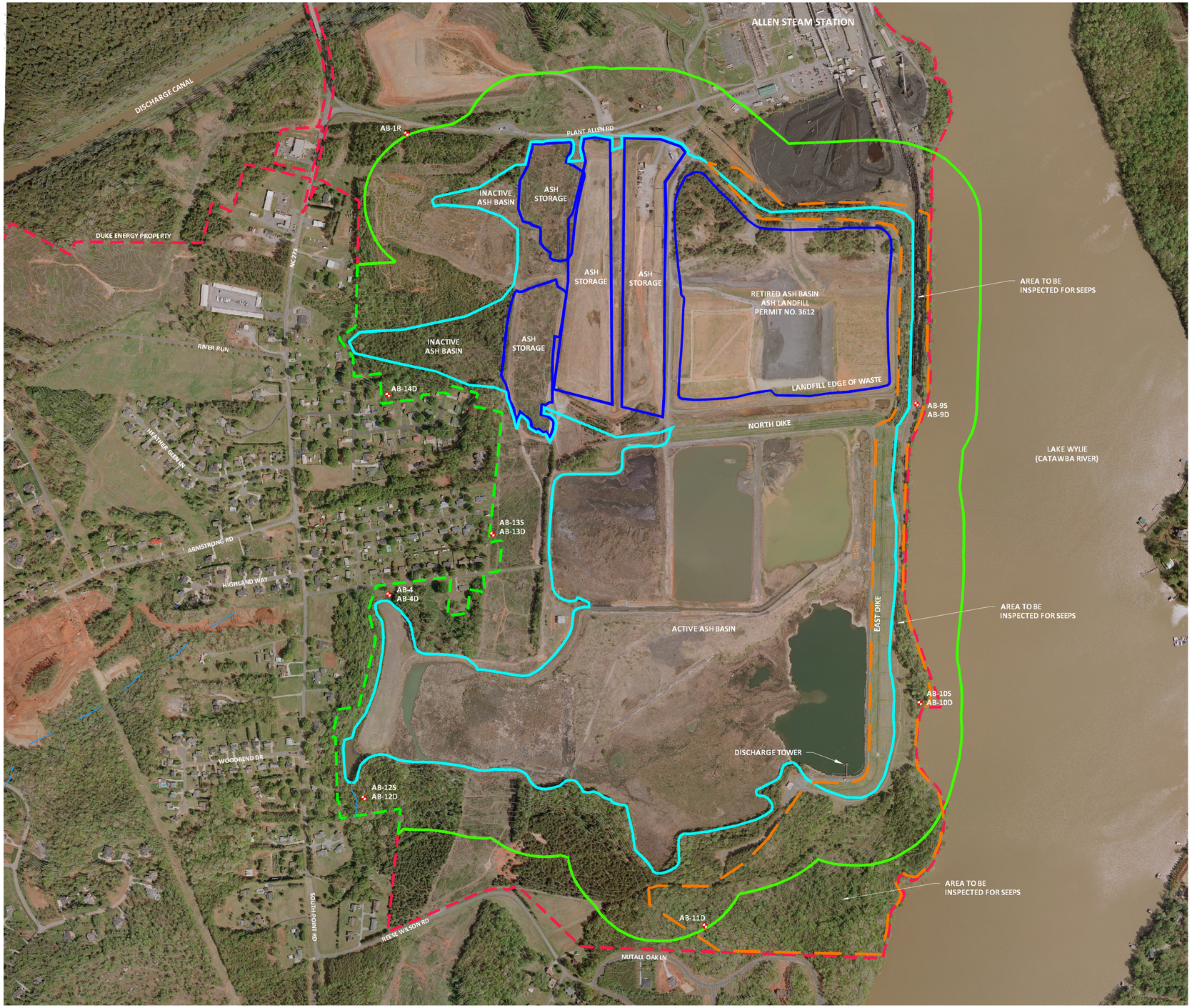
SCALE (FEET)
1,000 0 1,000 2,000

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

SITE LOCATION MAP
ALLEN STEAM STATION
DUKE ENERGY CAROLINAS, LLC
GASTON COUNTY, NORTH CAROLINA

September 30, 2014

FIGURE
1



LEGEND:

- DUKE ENERGY PROPERTY BOUNDARY
- ASH BASIN WASTE BOUNDARY
- ASH STORAGE AREA BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY COINCIDENT WITH DUKE PROPERTY BOUNDARY
- STREAM
- TOPOGRAPHIC CONTOUR (4-FT INTERVAL)*
- AREA TO BE INSPECTED FOR SEEPS
- ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELL

NOTES:
1. PARCEL DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY REAL ESTATE AND IS APPROXIMATE.
2. WASTE BOUNDARY IS APPROXIMATE.
3. AS-BUILT MONITORING WELL LOCATIONS PROVIDED BY DUKE ENERGY.
4. COMPLIANCE SHALLOW MONITORING WELLS (S) ARE SCREENED ACROSS THE SURFICIAL WATER TABLE.
5. COMPLIANCE DEEP MONITORING WELLS (D) ARE SCREENED IN THE TRANSITION ZONE BETWEEN COMPETENT BEDROCK AND THE REGOLITH.
6. TOPOGRAPHY DATA FOR THE SITE WAS OBTAINED FROM NC DOT GEOGRAPHIC INFORMATION SYSTEM (GIS) WEB SITE (DATED 2007).
7. AERIAL PHOTOGRAPHY WAS OBTAINED FROM WSP DATED APRIL 2014.
8. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).

SCALE (FEET)
200' 0 200' 400'
1" = 400'

AREAS TO BE INSEPCTED FOR SEEPS
DUKE ENERGY CAROLINAS, LLC
ALLEN STEAM STATION ASH BASIN
NPDES PERMIT NO. NC0004979

GASTON COUNTY, NORTH CAROLINA

DATE
9/30/2014

FIGURE
2

A

BELEWS CREEK STEAM STATION ASH BASIN INSPECTION FOR IDENTIFICATION OF NEW DISCHARGES

Belews Creek Steam Station Ash Basin
INSPECTION FOR IDENTIFICATION OF NEW DISCHARGES

1. Purpose of Inspection

The purpose of the inspection is to identify new discharges and indicators of potential new discharges, including toe drain outfalls, seeps, and weeps that arise after the initial submittal of maps required by North Carolina General Statute 130A-309.210(a)(2)(ii). Seepage is considered to be the movement of wastewater from the ash basin through the ash basin embankment, the embankment foundation, the embankment abutments, or through residual material in areas adjacent to the ash basin. Therefore, 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. If new discharges or indicators of potential new discharges are identified, the decision flow chart (see Figure A-1) will be used to determine if the potential new discharge is from the ash basin and if notification to the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Resources (DWR) is required.

2. General Inspection Requirements

2.1. Inspections are to be performed on areas that are below the ash basin full pond elevation and within the area shown on Figure A-2. The purpose of the inspection is to identify new discharges and indicators of potential new discharges, including toe drain outfalls, seeps, and weeps associated with the coal combustion residuals surface impoundment (ash basin).

2.2. If required, a larger scale figure showing the locations of outfalls from engineered channels will be developed. If a separate figure showing outfalls from engineered channels is not developed, Figure A-2 will be revised to show these features.

2.3. Inspections of areas on or adjacent to the ash basin embankments should be performed within two months after mowing, if possible.

2.4. Inspections should not be performed if the following precipitation amounts have occurred in the respective time period preceding the planned inspection:

2.4.1. Precipitation of 0.1 inches or greater within 72 hours or

2.4.2. Precipitation of 0.5 inches or greater within 96 hours

2.5. Record the most recent ash basin water surface elevation.

2.6. Review previous Inspection for Identification of New Discharge report(s) prior to performing inspection.

2.7. Review the most recent previous dam inspections.

2.8. Conduct an interview with the Site Environmental Coordinator prior to performing inspection to inquire about possible changes to site conditions, such as pond elevations, operations, additions or removal of wastewater discharges to the ash basin, changes to site surface water drainage, etc.

3. Frequency of Inspections

Inspections will be performed on a semi-annual basis during the following months: April to May and October to November.

4. Qualifications

The inspections shall be performed under the direction of a qualified Professional Engineer or Professional Geologist.

5. Documentation of Inspection

The inspection shall be documented by the individual performing the inspection. The report should contain observations and descriptions of the seeps observed, changes in observations compared to previous inspections, estimates of flows quantities, and photographs of seeps and outfalls of engineered channels designed or improved for collecting water from the impoundment. Photographs are to be numbered and captioned.

6. Initial Inspection

An initial inspection should be performed to identify features and document baseline conditions including location, extent (i.e., dimensions of affected area), and flow. Seep locations should be recorded using a Global Positioning System (GPS) device. Photographs should be taken from vantage points that can be replicated during subsequent semi-annual inspections.

7. Inspection For New Seeps at Outfalls From Engineered Channels

Inspect the outfalls from engineered channels designed and/or improved (such as through the placement of rip-rap) associated with the ash basin dikes to identify new seeps or indicators of new seeps.

7.1. Inspect all outfalls from engineered channels designed and/or improved (such as through the placement of rip-rap)

7.2. Document the condition of the outfall of the engineered channel with photographs. Photographs are to be taken from similar direction and scale as photographs taken during the initial inspection.

7.3. Observe outfall for seepage and for indicators of seeps.

7.4. Compare current seepage location, extent, and flow to seepage photographs and descriptions from previous inspections.

7.5. Record flow rate if measureable.

9. Inspection For New Seeps Not Captured by Engineered Channels

Inspect areas below the ash basin full pond elevation and within the slope-aquifer system shown on Figure A-2 to identify new seeps or indicators of new seeps. Inspect topographic drainage features that potentially could contain new seeps that potentially discharge from the ash basin.

9.1. Previously Identified Seeps

a) Inspect previously identified seep locations. Document the condition of the seeps with a photograph. Photographs are to be taken from similar direction and at a similar scale as the photograph documenting original photograph of seep. Describe the approximate dimensions and flow conditions of the seep.

b) If flow measurement device is installed at the outfall, record flow.

c) Observe seep to determine if changes to location, extent, or flows are present. Document changes to location, extent, and/or flow amount or pattern.

9.2. New Seep or Indicators of Seep

a) Mark the location of new seep or indicators of seep using a GPS device.

b) Document the condition of the seeps or indicators of seeps with a photograph.

c) Describe the approximate dimensions and flow conditions of the seep.

d) Map the location of new seep or indicator of seep using GPS coordinate points collected during the site visit.

e) If seep or indicator of seep was not caused by changes in surface water drainage and if the location is below the ash basin pond elevation, utilize the decision flow chart to determine if the seep represents a discharge from the ash basin and if notification to DWR is required.

10. Update Maps Identifying Seeps

If new seeps are identified during the inspection, Figure A-2 shall be updated to show the location of the new seeps. All seeps located below the ash basin full pond elevation and within the slope-aquifer system shown are to be shown on Figure A-2.

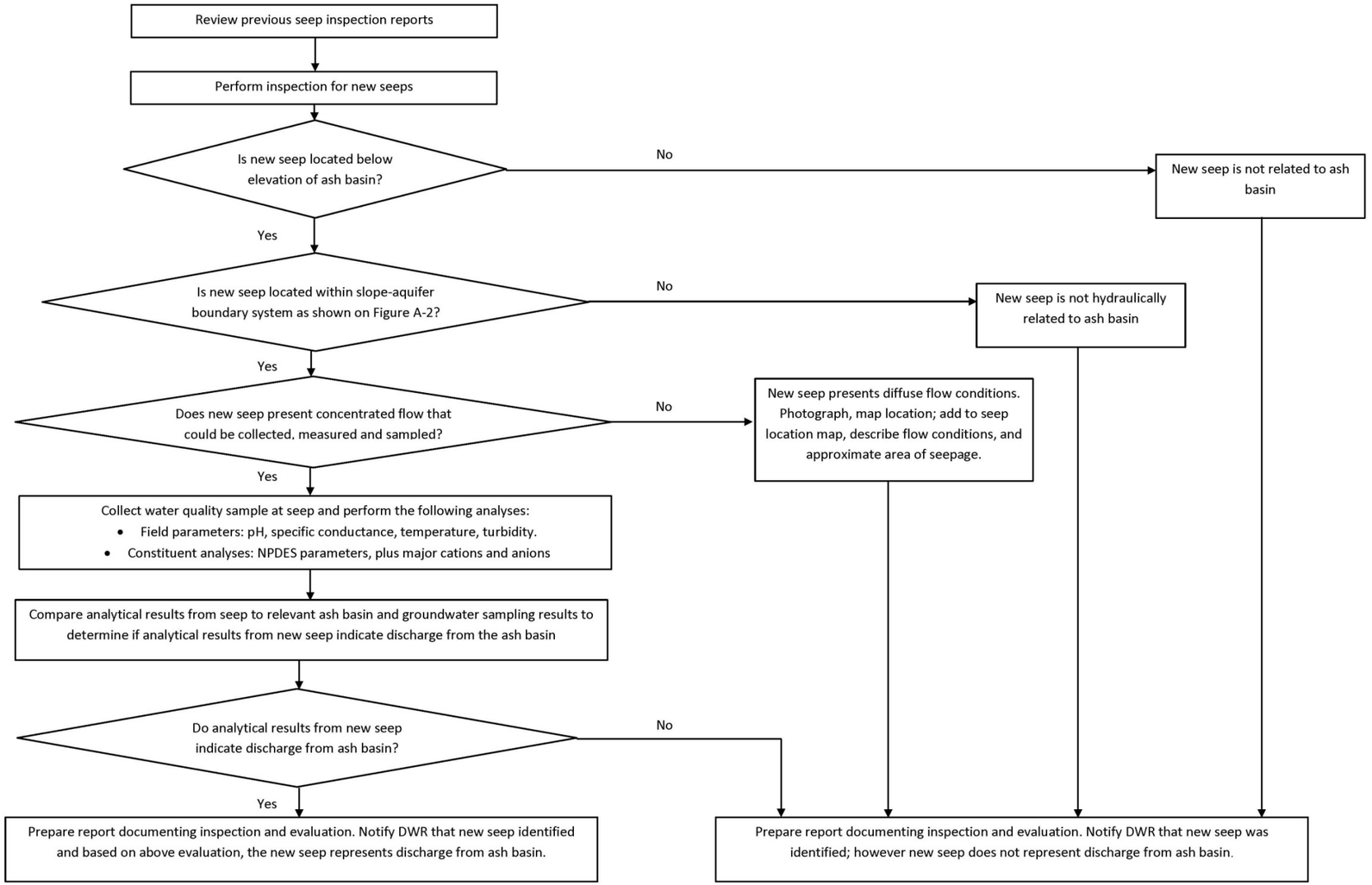
11. Decision Flow Chart

The decision flow chart developed to determine whether a new seep discharges from the ash basin is found on Figure A-1.

12. Procedure for Notifying NCDENR DWR If New Discharge Is Confirmed

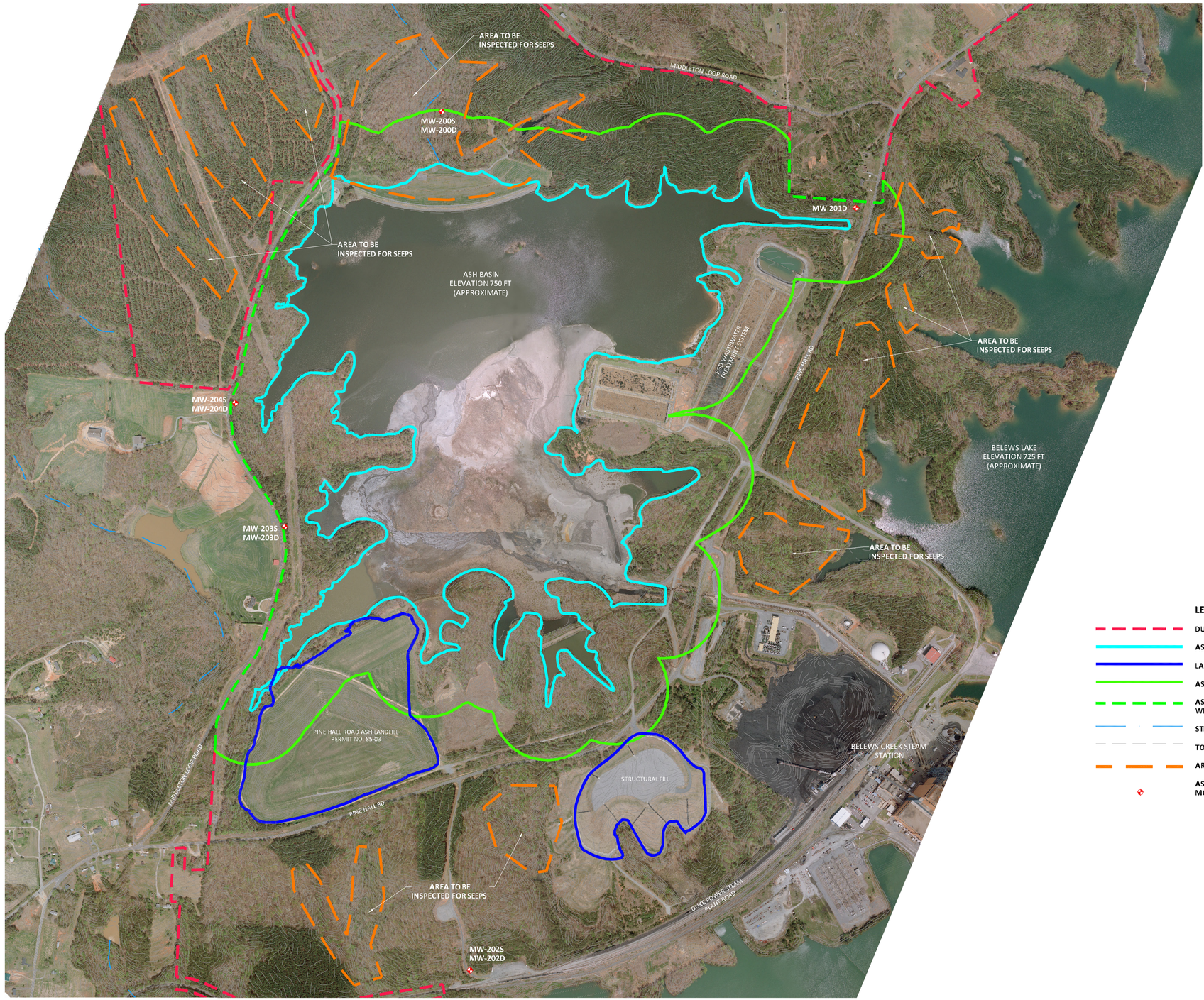
If it is determined that a newly identified seep is present, Duke Energy will notify the DWR Regional Office by mail within 14 days after the determination.

Figure A-1 - Decision Flow Chart for Determining If New Seep Represents Discharge From the Ash



Notes:

1. If no new seeps are identified, inspection will be documented however no notification to NCDENR DWR is required.
2. If new seeps are identified that do not represent discharge from the ash basin during the same inspection that identifies new seeps that do represent a discharge from the ash basin, a single report will be submitted to NCDENR DWR.



NOTES:
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SCALE (FEET)

250' 0 250' 500'

1" = 500'

AREAS TO BE INSEPCTED FOR SEEPS
DUKE ENERGY CAROLINAS, LLC
BELEWS CREEK STEAM STATION ASH BASIN
NPDES PERMIT NO. NC0022406

STOKES COUNTY, NORTH CAROLINA

DATE
9/30/2014

FIGURE
A-2