



**PLAN FOR IDENTIFICATION  
OF NEW DISCHARGES  
FOR  
MAYO STEAM ELECTRIC PLANT  
10600 BOSTON ROAD  
ROXBORO, NORTH CAROLINA 27574  
NPDES PERMIT #NC0038377**

**PREPARED FOR**

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410 S. WILMINGTON STREET/NC14  
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**Submitted: September 2014**

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## 1.0 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 Mayo Steam Electric Plant (Mayo) ash basin operated under National Pollution Discharge Elimination System (NPDES) Permit NC0038377.

The following requirements are contained in General statute 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).

## **2.0 SITE DESCRIPTION**

### **2.1 Plant Description**

Duke Energy Progress, Inc. (Duke Energy) owns and operates the Mayo Plant, a coal-fired electricity-generating facility located in Person County, North Carolina, near the city of Roxboro. The location of the plant is shown on **Figure 1**. The Mayo Plant became fully operational in June 1983. The plant is located on Boston Road (US Highway 501) north of Roxboro. The northern plant property line extends to the North Carolina/Virginia state line. The overall topography of the Plant generally slopes toward the east (Mayo Reservoir) and northeast (Crutchfield Branch).

### **2.2 Ash Basin Description**

The Mayo Plant ash basin is approximately 153 acres in size with an earthen dike. Ash generated from the plant's coal combustion is contained in the ash basin. The Mayo Plant NPDES permit (NC0038377) authorizes two discharges to Mayo Lake. Outfall 001 discharges cooling tower water and circulating water system discharge water. Outfall 002 is comprised of a number of streams including internal outfall 008 (cooling tower blowdown), internal outfall 009 (FGD blowdown), ash transport water, coal pile runoff, and other sources including water from wastewater treatment processes. Stormwater outfalls are also authorized for the Mayo Plant.

### **3.0 SITE GEOLOGY AND HYDROGEOLOGY**

#### **3.1 Site Geologic/Soil Framework**

The Mayo Plant is situated in the eastern Piedmont Region of north-central North Carolina. The Piedmont is characterized by well-rounded hills and rolling ridges cut by small streams and drainages. Elevations in the area of the Mayo Plant range between 570 feet above mean sea level (msl) near the Plant entrance along Boston Road to 360 feet msl in the Crutchfield Branch stream area on the north side of the Plant.

Geologically, the Plant is located at the contact between two regional zones of metamorphosed intrusive rocks: the Carolina Slate Belt (now referred to as Carolina Terrane) on the east and the Charlotte Belt (or Charlotte Terrane) to the west. The majority of the Mayo Plant, including the largest portion of the ash basin and Mayo Lake are situated in the Carolina Terrane (Dicken, et. al., 2007). The characteristics and genesis of the rocks within these regional metamorphic belts have been the subject of intense study to describe the geology in tectonic, structural, and/or litho-stratigraphic terms (Hibbard, et. al., 2002).

Rocks of Charlotte Terrane are characterized by strongly foliated felsic mica gneiss and schist and metamorphosed intrusive rocks. Carolina Terrane rocks in the vicinity of the Plant are typically felsic meta-volcanics and meta-argillites. These general observations are consistent with site-specific observations from well logs for the Mayo Plant, which document the bedrock of the northwestern portion of the compliance boundary as intermediate meta-volcanic rock and the bedrock of the remainder of the site as felsic meta-volcanics or meta-argillites.

Rocks of the region are covered with unconsolidated material formed from the in-situ chemical and physical breakdown of the bedrock. This unconsolidated material is referred to as saprolite or residuum. Direct observations at the Mayo Plant confirm the presence of residuum, developed above the bedrock, which is generally 10 to 30 feet thick. The residuum extends from the ground surface (soil zones) downward, transitioning through a zone comprised of unconsolidated silt and sand, downward through a transition zone of partially weathered rock in a silt/sand matrix, down to the contact with competent bedrock.

#### **3.2 Site Hydrogeologic Framework**

An accepted conceptual model of groundwater flow in the Piedmont has been articulated by LeGrand (1988; 2004). In the Piedmont, the groundwater system is effectively a two-medium system restricted to the local drainage basin and comprised 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. The residuum acts as a reservoir for water supply to the fractures and joints in the underlying bedrock. Relatively shallow fractured crystalline rocks can form extensive aquifers, and the character of such aquifers results from the combined effects of the rock type, fracture system geometry, 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.

Shallow groundwater generally flows from local recharge zones in topographically high areas, such as ridges, toward groundwater discharge zones, such as stream valleys. Groundwater flow patterns in recharge areas tend to develop a somewhat radial pattern from the center of the recharge area outward toward the discharge areas and mimic surface topography. Within each of these small, localized drainage basins, the 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). Each basin is similar to adjacent basins and the conditions are generally repetitive from basin to basin. Within a basin, rarely does groundwater move beneath a perennial stream or river to another more distant stream (LeGrand 2004).

The closest surface water discharge for the plant is to the north-northeast at Crutchfield Branch and, for the eastern portions of the property, to the east and Mayo Lake. Routine water level measurements and corresponding elevations from the compliance monitoring well network indicate that groundwater flows from upland areas (southwestern portion of the property) towards the northeast and Crutchfield Branch. The approximate groundwater gradient for July 2014 data was 135 feet (vertical change) over 5,500 feet (horizontal distance) or 24.5 feet/1,000 feet as measured from upgradient background well BG-2 to downgradient well CW-2.

## 4.0 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 lush and darker green than surrounding vegetation. Cattails, reeds, mosses, and other marsh vegetation often become established in a seepage area (NCDENR, 1985). However, in many instances, indicators of seeps do not necessarily indicate the presence of seeps.

### 4.3 Area to be Inspected for New Discharges

The areas to be inspected are the areas of the site where water contained in the ash basin might infiltrate into the underlying residual material and be expressed as seepage. The extent of the areas to be inspected for new discharges was determined based on site topography and surface water drainage features around the ash basin. At the Mayo Plant, flow of water from the ash basin is from higher to lower elevations. The primary direction of flow from the ash basin is to the northeast and Crutchfield Branch. 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 Mayo Plant ash basin is provided in **Appendix A**. In addition to the specific requirements for the inspection, **Appendix A** also provides the general 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.

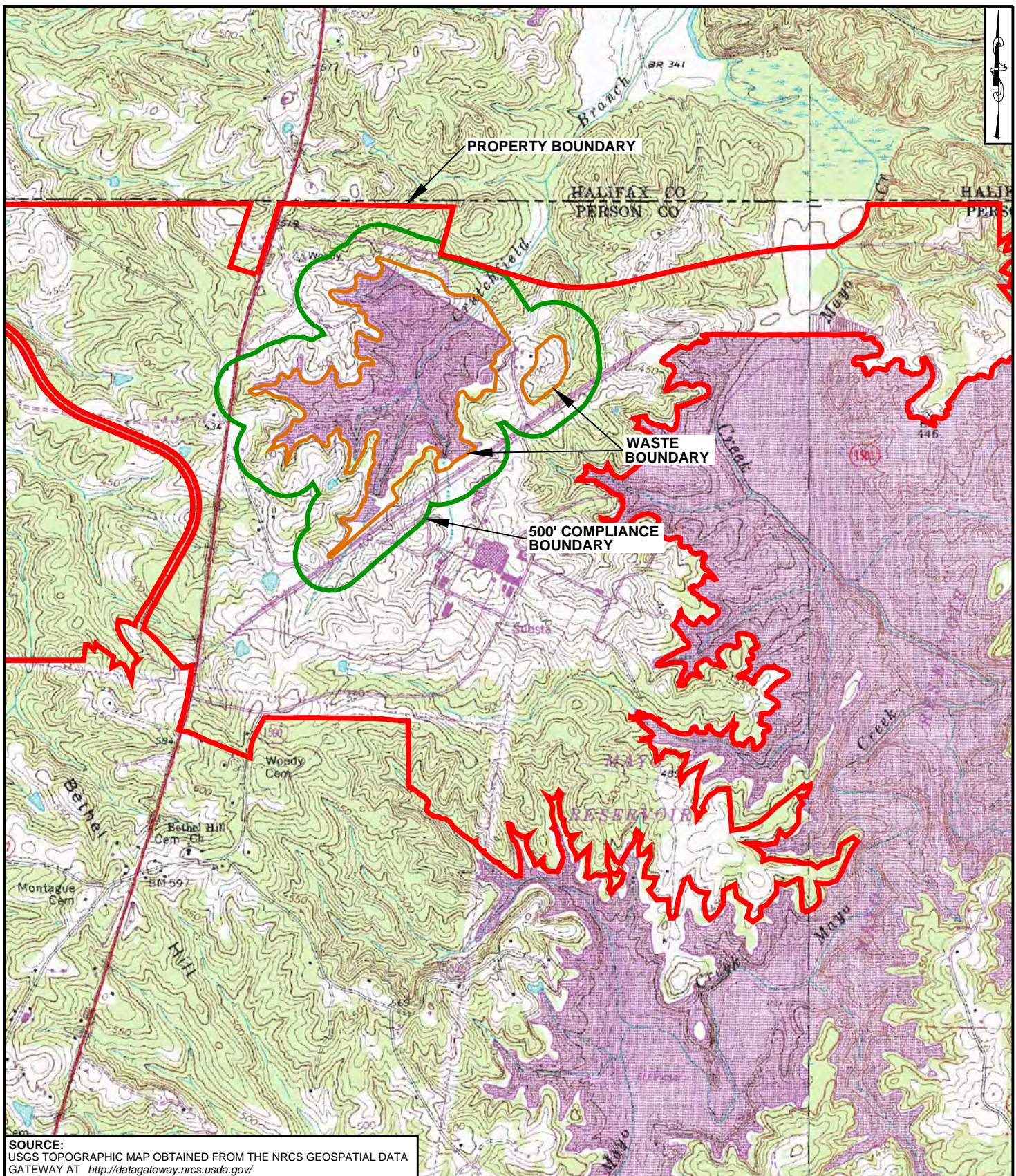


## 5.0 REFERENCES

- Dicken, Connie L., Suzanne W. Nicholson, John D. Horton, Michael P. Foose, and Julia A.L. Mueller, December 2007, *Preliminary integrated geologic map databases for the United States – Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina, Version 1.1*: United States Geological Survey, USGS Open File Report 2005-1323, <<http://pubs.usgs.gov/of/2005/1323>>.
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- LeGrand, 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, 524 p.
- LeGrand, H.E., 2004, *A Master Conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina: A Guidance Manual*, North Carolina Department of Environment and Natural Resources, Division of Water Quality – Groundwater Section.
- NCDENR, “Dam Operation, Maintenance, and Inspection Manual”, 1985 (Revised 2007).

## **FIGURES**

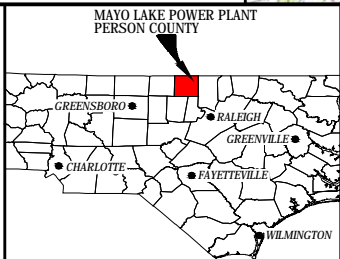




SOURCE:  
 USGS TOPOGRAPHIC MAP OBTAINED FROM THE NRCS GEOSPATIAL DATA  
 GATEWAY AT <http://datagateway.nrcs.usda.gov/>



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MAYO LAKE POWER PLANT  
 PERSON COUNTY

**FIGURE 1**  
**SITE LOCATION MAP**  
**MAYO STEAM ELECTRIC PLANT**  
**10600 BOSTON RD**  
**ROXBORO, NORTH CAROLINA**  
**CLUSTER SPRINGS, VA QUADRANGLE**

DRAWN BY: S. ARLEDGE  
 PROJECT MANAGER: KATHY WEBB  
 LAYOUT: FIG 1 (USGS SITE LOCATION)

DATE: 2014-09-26  
 CONTOUR INTERVAL: 10ft  
 MAP DATE: 1987







**LEGEND**

	DUKE ENERGY PROGRESS MAYO PLANT
	500 ft COMPLIANCE BOUNDARY
	WASTE BOUNDARY
	BOUNDARY OF AREA TO BE INSPECTED FOR SEEPS
	FLOW DIRECTION
	2007 LIDAR CONTOUR MAJOR
	NPDES OUTFALL 001 NPDES OUTFALL LOCATION
	CB-9 ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELL

- SOURCES:**
- 2010 AERIAL PHOTOGRAPH OF PERSON COUNTY, NORTH CAROLINA OBTAINED FROM THE NRCS GEOSPATIAL DATA GATEWAY AT <http://datagateway.nrcs.usda.gov/>
  - 2012 AERIAL PHOTOGRAPH OF HALIFAX COUNTY, VIRGINIA WAS OBTAINED FROM NRCS GEOSPATIAL DATA GATEWAY AT <http://datagateway.nrcs.usda.gov/>
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  - PARCEL BOUNDARIES WERE OBTAINED FROM PERSON COUNTY (NC) GIS DATA AT <http://gis.personcounty.net>
  - DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD 83).
  - 10ft CONTOUR INTERVALS FROM NCDOT LIDAR DATED 2007 [https://connect.ncdot.gov/resources/gis/pages/cont-elev\\_v2.aspx](https://connect.ncdot.gov/resources/gis/pages/cont-elev_v2.aspx)
  - VIRGINIA 10ft CONTOUR INTERVALS FROM USGS TOPOGRAPHIC MAP OBTAINED FROM THE NRCS GEOSPATIAL DATA GATEWAY AT <http://datagateway.nrcs.usda.gov/>
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DRAWN BY: S. ARLEDGE	DATE: 2014-09-26
CHECKED BY: J. WYLIE	DATE: 2014-09-26
PROJECT MANAGER: K. WEBB	
LAYOUT NAME: FIG 2 (SEEP INSPECTION AREA)	

MAYO STEAM ELECTRIC PLANT  
10600 BOSTON RD  
ROXBORO, NORTH CAROLINA

**FIGURE 2**  
**AREAS TO BE**  
**INSPECTED FOR SEEPS**



## **APPENDIX A**

### **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 or occurrence of potential wastewater 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 scope of the inspections includes identification of seeps from residual ground and outfalls from engineered channels.
- 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 most recent ash basin water surface elevation.
- 2.6. Review previous inspections for new discharges 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 first quarter of the year (January to March representative of seasonal high precipitation and while vegetation is dormant) and during the third quarter (July to September representative of seasonal low precipitation and vegetative growth).

### **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 Outfalls**

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 a similar direction and scale as the original 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.

## **8. Inspection For New Seeps Not Captured by Engineered Channels**

Inspect areas below the ash basin full pond elevation and within the boundary of the area to be inspected as 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. Requirements for documentation of the inspection are found in Section 5.

### 8.1. 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 original photograph documenting the seep. Describe the approximate dimensions and flow conditions of the seep.
- b) If measureable, record flow.
- c) Observe seep to determine if changes to location, extent, of flow are present. Document changes to location, extent, and/or flow amount or pattern.

### 8.2. 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.

## 9. 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.

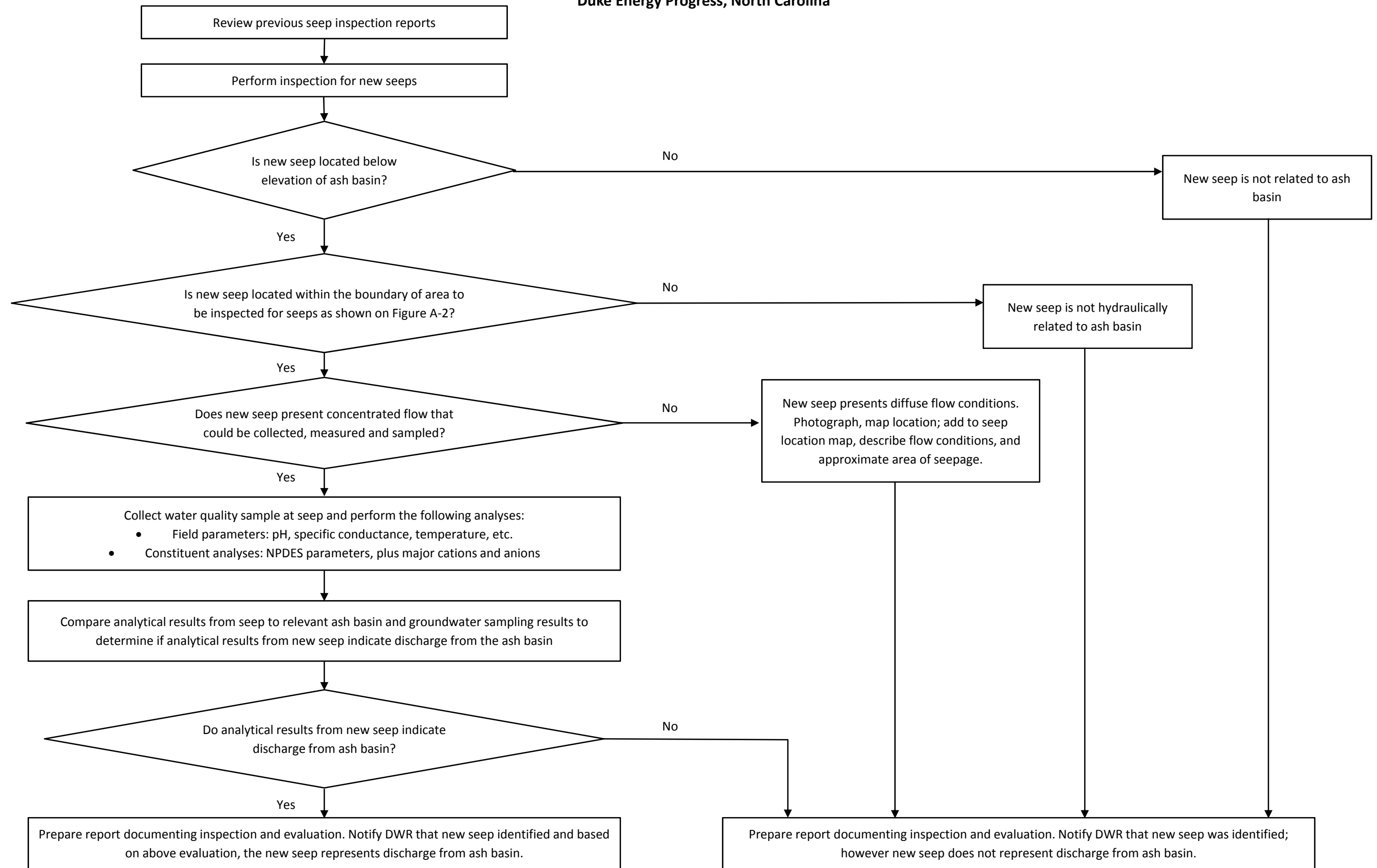
## 10. Decision Flow Chart

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

## 11. 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 Basin Locations  
Duke Energy Progress, North Carolina**



**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.





**LEGEND**

- DUKE ENERGY PROGRESS MAYO PLANT
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- WASTE BOUNDARY
- BOUNDARY OF AREA TO BE INSPECTED FOR SEEPS
- FLOW DIRECTION
- 420 — 2007 LIDAR CONTOUR MAJOR
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DRAWN BY: S. ARLEDGE	DATE: 2014-09-26
CHECKED BY: J. WYLIE	DATE: 2014-09-26
PROJECT MANAGER: K. WEBB	
LAYOUT NAME: FIG A-2 (SEEP INSPECTION AREA)	

MAYO STEAM ELECTRIC PLANT  
10600 BOSTON RD  
ROXBORO, NORTH CAROLINA

**FIGURE A-2  
AREAS TO BE  
INSPECTED FOR SEEPS**