

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- Prepare one form for each individually monitored unit.
- Please type or print legibly.
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.)
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i)).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

HDR Engineering, Inc. of the Carolinas (Consultant)

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: William M. Miller Phone: 828-891-6296

E-mail: bill.miller@hdrinc.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Duke Energy Carolinas, LLC Marshall Steam Station FGD Residue Landfill Phase 1, Cell 1	8320 East NC Highway 150 Terrell, NC 28682	1809	.0500	March 18-19, 2013

Environmental Status: (Check all that apply)

- Initial/Background Monitoring Detection Monitoring Assessment Monitoring Corrective Action

Type of data submitted: (Check all that apply)

- Groundwater monitoring data from monitoring wells Methane gas monitoring data
 Groundwater monitoring data from private water supply wells Corrective action data (specify) _____
 Leachate monitoring data Other(specify) _____
 Surface water monitoring data

Notification attached?

- No. No groundwater or surface water standards were exceeded.
 Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
 Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

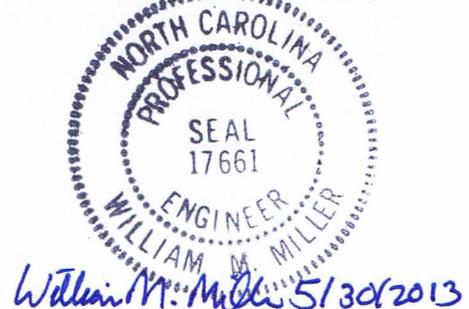
William M. Miller Senior Engineer (828) 891-6296
 Facility Representative Name (Print) Title (Area Code) Telephone Number
William M. Miller May 30, 2013 Affix NC Licensed/Professional Geologist Seal
 Signature Date

440 S. Church Street Suite 1000, Charlotte, NC 28202

Facility Representative Address

F-0116

NC PE Firm License Number (if applicable effective May 1, 2009)



**SEMIANNUAL GROUNDWATER
MONITORING REPORT**

MARSHALL STEAM STATION

**FGD RESIDUE LANDFILL, PHASE 1, CELL 1
PERMIT NO. 1809**

MARCH 2013 SAMPLING EVENT

**Prepared for:
DUKE ENERGY CAROLINAS, LLC
8320 East NC Highway 150
Terrell, NC 28682**

**Prepared by:
HDR ENGINEERING, INC. OF THE CAROLINAS
Charlotte, North Carolina**

May 30, 2013



REPORT VERIFICATION

PROJECT: SEMIANNUAL GROUNDWATER MONITORING REPORT
MARSHALL STEAM STATION
FGD RESIDUE LANDFILL, PHASE 1, CELL 1
PERMIT NO. 1809

TITLE: MARCH 2013 SAMPLING EVENT

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

Prepared by: *[Signature]*

Date: May 30, 2013

Checked by: *William M. Miller*

Date: May 30, 2013

Approved by: *Ty Ziegler*

Date: MAY 30, 2013

Project Manager: Ty Ziegler, PE

Professional Engineer Seal:



William M. Miller 5/30/2013

HDR Engineering, Inc. of the Carolinas
440 South Church St., Suite 1000
Charlotte, NC 28202

North Carolina Engineering Firm Number F-0116

**SEMIANNUAL GROUNDWATER MONITORING REPORT
MARSHALL STEAM STATION
FGD RESIDUE LANDFILL, PHASE 1, CELL 1
PERMIT NO. 1809**

MARCH 2013 SAMPLING EVENT

TABLE OF CONTENTS

Section	Title	Page No.
1.	BACKGROUND.....	1
2.	METHODS.....	3
2.1	Sampling and Analysis Methods	3
2.2	Statement of Work.....	3
3.	RESULTS	5
3.1	Site Groundwater Flow.....	5
3.2	Analytical Results.....	5

FIGURES

1. Site Location Map
2. Sample Locations
3. Generalized Groundwater Surface Contours

TABLES

1. Field Data Parameters
2. Field and Analytical Results
3. Leachate Analytical Results
4. Field and Analytical Results that Equal or Exceed NCAC 2L Groundwater Quality Standards

APPENDICES

- A. Chain-of-Custody Forms

Section 1

Background

Marshall Steam Station (Marshall) is owned and operated by Duke Energy Carolinas, LLC (Duke Energy). The Marshall plant has a generating capacity of 2090 megawatts (MW) of electric power by the combustion of coal. The plant is located in Catawba County, North Carolina, on Lake Norman, and is in the Piedmont physiographic region.

The flue gas desulfurization (FGD) landfill is located northwest of the power plant and west of the Marshall ash basin as shown on Figure 1. In general, the topography of the landfill site slopes from the west-northwest to the east-southeast towards the Marshall ash basin.

The landfill is permitted to receive FGD residue (gypsum), clarifier sludge, fly ash, bottom ash, asbestos waste, C&D waste, and mill rejects (pyrites). The clarifier sludge is generated from the FGD wastewater treatment system. Only Cell 1 of the landfill is in operation and is approximately 18 acres in area. The landfill is constructed with an engineered liner system. Contact stormwater and leachate are collected in the lined Cell 1, and then piped to the ash basin. The landfill began receiving waste in 2007.

The subsurface conditions at the site consist of residual soils and partially weathered rock, which have been formed by the in-place weathering of the parent rock. These materials are underlain by bedrock. The site hydrogeological description and information on the monitoring wells can be found in the *Groundwater Sampling and Analysis Plan*.¹

The monitoring system for the Marshall FGD Landfill, Phase 1, Cell 1 consists the following:

Monitoring Wells: MS-8
MS-9
MS-10
MS-11
MS-12
MS-13

¹ Marshall Steam Station Flue Gas Desulfurization (FGD) Residue Landfill Phase 1, Cell 1 Permit No. 1809 *Groundwater Sampling and Analysis Plan*. Dated August 19, 2011.

MS-14

MS-15

MS-16

Surface water sample: SW-1

Leachate sample: C1

The locations of the wells, surface water sample location, and the leachate sampling location are shown on Figure 2. The leachate sampling requirement was added in the revised Permit to Operate for the Marshall FGD Landfill² in September 2011. Well MS-8 is located north of the landfill and, according to the *Groundwater Sampling and Analysis Plan*, is the background monitoring well for the site. Surface water sample location SW-1 is a groundwater seep and the analytical results are compared to Title 15A, North Carolina Administrative Code (NCAC), Subchapter 2L Standards (2L Standards) for Class GA groundwater.

² Attachment 3 – Conditions of Operating Permit, Part I: General Facility Conditions, Monitoring and Reporting Requirements, #13.

Section 2

Methods

2.1 Sampling and Analysis Methods

Groundwater sampling, surface water sampling, and documentation of sampling activities were performed by Duke Energy personnel. The groundwater and surface water samples were analyzed by the Duke Energy Analytical Laboratory (North Carolina Laboratory Certification #248).

The groundwater samples were analyzed for the following constituents and/or parameters:

- Select metals using U.S. Environmental Protection Agency (EPA) Methods 200.7 and 200.8
- Mercury using EPA Method 245.1
- Total dissolved solids using Standard Method (SM) 2540C
- Chloride, fluoride, nitrate as nitrogen, and sulfate using EPA Method 300.0

2.2 Statement of Work

HDR completed the following tasks:

- Received field sampling information provided by Duke Energy (performed by Duke Energy personnel) for monitoring wells MS-8, MS-9, MS-10, MS-11, MS-12, MS-13, MS-14, MS-15, MS-16, surface water sampling location SW-1, and leachate sampling location C1. The samples were collected on March 18-19, 2013 and HDR received the data on April 5, 2013.
- Reviewed the laboratory analytical results for samples. The Electronic Data Deliverable (EDD), provided by Duke Energy, was adapted to conform to the format requirements of the North Carolina Department of Environment and Natural Resources (NCDENR) EDD template. HDR added an italicized J data qualifier (*J*) to indicate a detected concentration that attains or is greater than the laboratory's method reporting limit

(MRL), but less than the Solid Waste Section Limit³ (SWSL). A copy of the original EDD is retained in HDR's files.

- Developed a generalized groundwater surface contour map using map data and groundwater elevation data supplied by Duke Energy.
- Prepared and submitted this Semiannual Groundwater Monitoring Report to Duke Energy.

Selected samples were diluted as is normal laboratory practice to bring samples to the calibrated range of the analysis. Specifics regarding the samples that were diluted, including the dilution factor, are reported in the EDD.

³ Solid Waste Section Limits (SWSL) is defined by DENR as the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy. The SWSL is the concentration below which reported results must be qualified as estimated. NCDENR Division of Waste Management Memorandum dated February 23, 2007.

Section 3

Results

3.1 Site Groundwater Flow

Generalized groundwater surface contours for the site are shown on Figure 3. These contours were developed using groundwater elevations measured in the wells on March 18-19, 2013.

Groundwater flow in the area of the landfill is generally from areas of higher topography, located to the north and west of the landfill, toward the Marshall ash basin, located to the east of the landfill. To a lesser extent, some component of groundwater flow is expected toward surface water sample location SW-1.

3.2 Analytical Results

A summary of the field data is presented in Table 1.

The results of the field and laboratory analyses are summarized in Tables 2 and 3.

A summary of the analytical results that attain or exceed the Title 15A NCAC 02L .0202 (g) Standards (2L Standards) are presented in Table 4.

Concentrations for constituents at sampling locations listed in Table 4 were measured in excess of their respective SWSLs with the following exceptions:

- pH – There is no SWSL for pH

Concentrations that attain or exceed their respective SWSLs but did not exceed the 2L Standards were measured at the following locations:

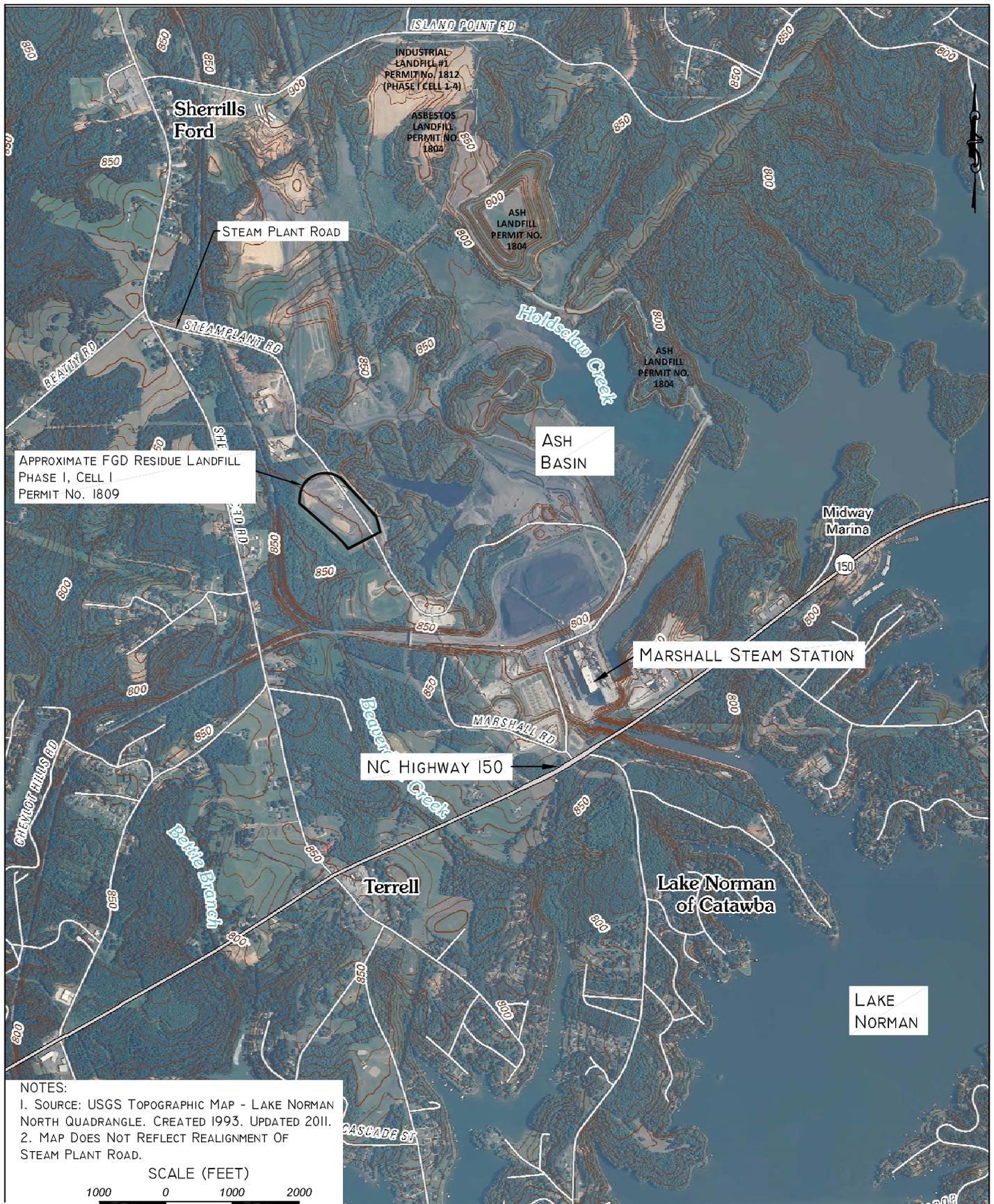
- Barium in MS-10

HDR prepared and submitted an assessment to NCDENR on historical exceedances of 2L Standards at this landfill (*Groundwater Assessment Marshall Steam Station FGD Landfill, Phase 1, Cell 1, July 12, 2012*). The report assessed 2L Standard exceedances for iron and chromium at MW-8, chromium at MS-15, iron at MS-16, and iron and manganese at SW-1. The assessment report concluded that the historical exceedances of the 2L Standards at the site were naturally occurring and are not related to impacts from the landfill.

The 2L Standard exceedances measured during the March 2013 sampling event for chromium at MS-15, iron at MW-8 and SW-1, and manganese at SW-1 are within the historical ranges evaluated during the landfill assessment.

The chain-of-custody forms can be found in Appendix A.

FIGURES



APPROXIMATE FGD RESIDUE LANDFILL
PHASE I, CELL I
PERMIT NO. 1809

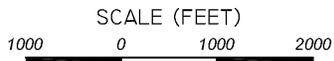
ASH
BASIN

MARSHALL STEAM STATION

NC HIGHWAY 150

LAKE
NORMAN

NOTES:
1. SOURCE: USGS TOPOGRAPHIC MAP - LAKE NORMAN
NORTH QUADRANGLE. CREATED 1993. UPDATED 2011.
2. MAP DOES NOT REFLECT REALIGNMENT OF
STEAM PLANT ROAD.



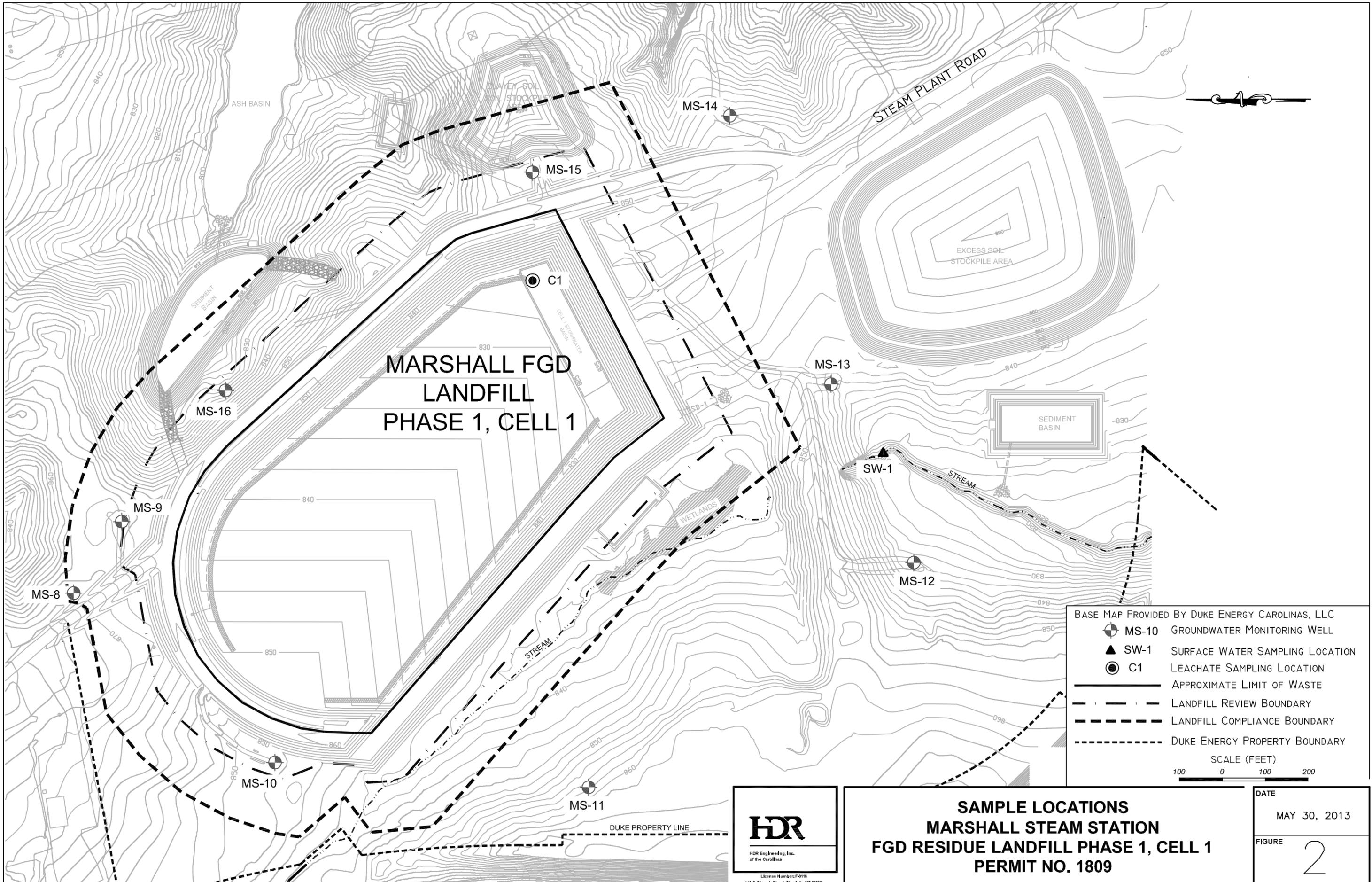
C:\pwworking\tpa\0448416\Site Location Map.dwg

HDR Engineering, Inc.
of the Carolinas

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

**SITE LOCATION MAP
MARSHALL STEAM STATION
FGD RESIDUE LANDFILL PHASE 1, CELL 1
PERMIT NO. 1809**

DATE	MAY 30, 2013
FIGURE	1



**MARSHALL FGD
LANDFILL
PHASE 1, CELL 1**

BASE MAP PROVIDED BY DUKE ENERGY CAROLINAS, LLC

- MS-10 GROUNDWATER MONITORING WELL
- SW-1 SURFACE WATER SAMPLING LOCATION
- C1 LEACHATE SAMPLING LOCATION
- APPROXIMATE LIMIT OF WASTE
- LANDFILL REVIEW BOUNDARY
- LANDFILL COMPLIANCE BOUNDARY
- DUKE ENERGY PROPERTY BOUNDARY

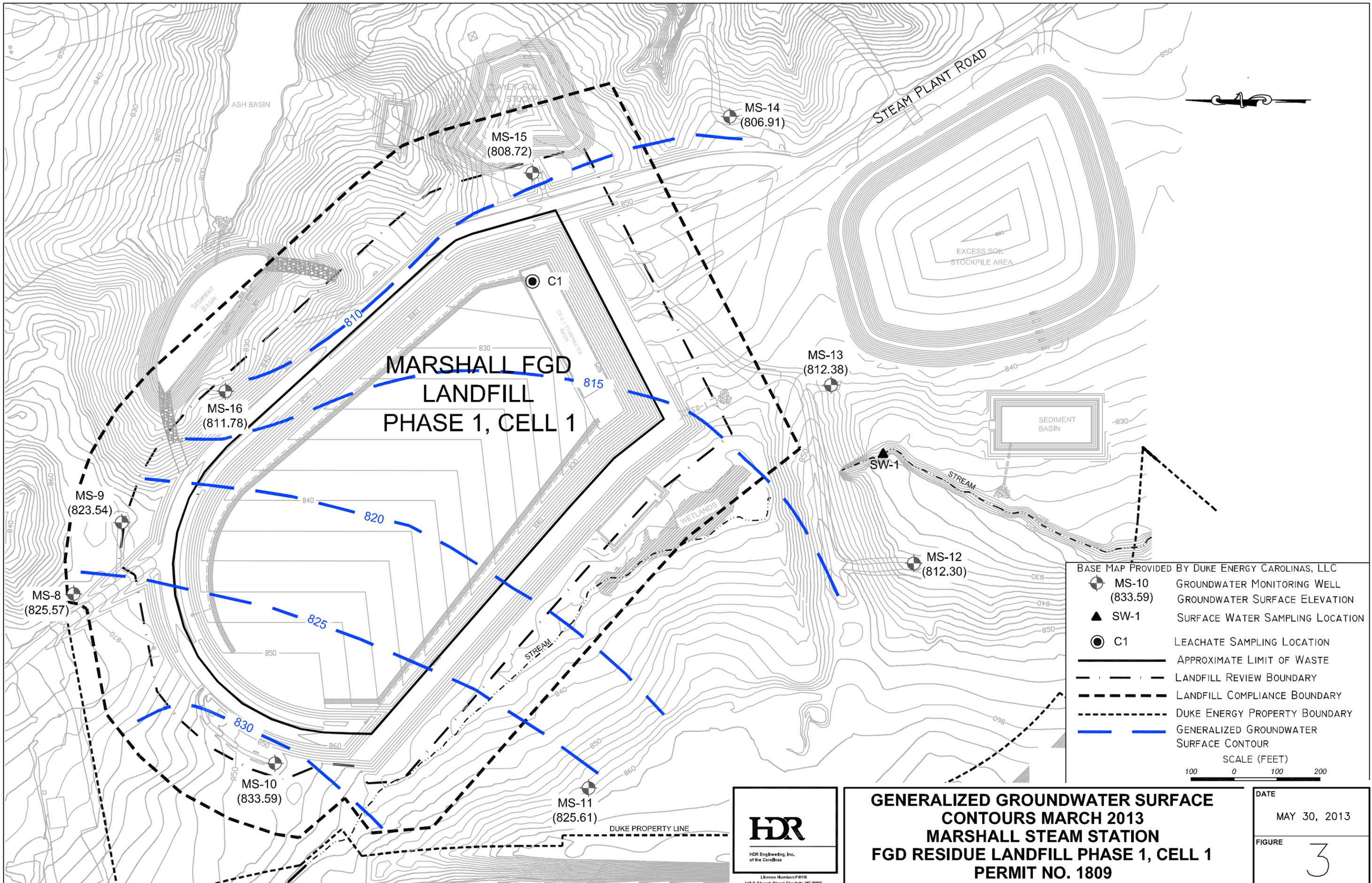
SCALE (FEET)
100 0 100 200

HDR
HDR Engineering, Inc.
of the Carolinas
License Number: F-0116
440 S Church Street Charlotte, NC 28202

**SAMPLE LOCATIONS
MARSHALL STEAM STATION
FGD RESIDUE LANDFILL PHASE 1, CELL 1
PERMIT NO. 1809**

DATE	MAY 30, 2013
FIGURE	2

C:\pwworking\paul0447087\MSS FGD LF.dwg



BASE MAP PROVIDED BY DUKE ENERGY CAROLINAS, LLC

- MS-10 (833.59) GROUNDWATER MONITORING WELL
- GROUNDWATER SURFACE ELEVATION
- SW-1 SURFACE WATER SAMPLING LOCATION
- C1 LEACHATE SAMPLING LOCATION
- APPROXIMATE LIMIT OF WASTE
- LANDFILL REVIEW BOUNDARY
- LANDFILL COMPLIANCE BOUNDARY
- DUKE ENERGY PROPERTY BOUNDARY
- GENERALIZED GROUNDWATER SURFACE CONTOUR

SCALE (FEET)

100 0 100 200

HDR
 HDR Engineering, Inc.
 of the Carolinas
 License Numbers F4118
 440 S Church Street Charlotte, NC 28202

GENERALIZED GROUNDWATER SURFACE CONTOURS MARCH 2013
MARSHALL STEAM STATION FGD RESIDUE LANDFILL PHASE 1, CELL 1
PERMIT NO. 1809

DATE
 MAY 30, 2013

FIGURE
 3

C:\pwworking\paul0447087\MSS FGD LF.dwg

TABLES

Table 1–Field Data Parameters
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1–Permit No. 1809

DATE	WELL No.	WELL DEPTH (feet)	DEPTH TO WATER (feet)	WATER ELEV. (feet)	APPEARANCE	ODOR	PURGE METHOD	PUMP RATE (mL/min)	WELL VOLUME (gal)	EVAC VOLUME (gal)	EVAC (yes/no)	TEMP (deg C)	SPECIFIC CONDUCTANCE (umho/cm)	pH (SU)	TURBIDITY (NTU)	ORP (mV-NHE)	DO (mg/L)
3/19/2013	MS-8	51.58	46.77	825.57	Colloidal	None	CP	N/A	0.78	1.50	YES	13.02	42	5.8	15.3	388	7.31
3/19/2013	MS-9	53.00	44.50	823.54	Normal	None	CP	N/A	1.39	7.50	NO	15.49	87	6.2	2.7	359	7.97
3/19/2013	MS-10	23.34	17.70	833.59	Normal	None	CP	N/A	0.92	3.00	NO	15.52	21	4.8	6.2	435	6.06
3/19/2013	MS-11	42.72	34.17	825.61	Normal	None	CP	N/A	1.39	4.50	NO	14.61	38	5.2	4.5	382	7.23
3/18/2013	MS-12	31.09	23.36	812.30	Normal	None	CP	N/A	1.26	4.50	NO	13.94	24	4.9	3.0	442	7.95
3/18/2013	MS-13	41.52	29.52	812.38	Normal	None	CP	N/A	1.96	6.00	NO	13.98	95	5.2	2.0	411	3.98
3/19/2013	MS-14	44.38	37.16	806.91	Normal	None	CP	N/A	1.18	3.75	NO	14.20	52	5.6	4.0	392	7.46
3/18/2013	MS-15	63.08	52.75	808.72	Normal	None	CP	N/A	1.68	8.75	NO	15.29	131	6.5	2.9	322	6.93
3/18/2013	MS-16	37.46	25.20	811.78	Colloidal	None	CP	N/A	2.00	7.00	YES	14.76	100	6.0	8.7	355	8.74
3/18/2013	SW-1	N/A	N/A	N/A	Normal	None	N/A	N/A	N/A	N/A	N/A	11.24	34	5.0	18.1	380	6.39
3/18/2013	C1-LEACHATE	N/A	N/A	N/A	Normal	None	N/A	N/A	N/A	N/A	N/A	14.25	4326	4.6	35.4	404	5.69

Notes:

1. Purge Methods; LF=Low Flow, CP=Conventional Purge (3-5 well volumes), NP=No Purge (HydraSleeve), LO= Level Only.
2. Field sampling performed by Duke Energy Carolinas, LLC personnel.
3. umho/cm indicates micromhos per centimeter.
4. SU indicates Standard Units.
5. NTU indicates Nephelometric Turbidity Units.
6. mV-NHE indicates millivolts-Normal Hydrogen Electrode.
7. Information provided by Tim Hunsucker of Duke Energy Carolinas, LLC on April 5, 2013.
8. N/A indicates not applicable.

Table 2–Field and Analytical Results
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1–Permit No. 1809

Sample Date: March 18-19, 2013				Laboratory Certificate Codes:							
Field Sampling performed by Duke Energy Carolinas, LLC				Duke Energy Carolinas Field #5193 Duke Energy Analytical Laboratory #248							
Parameter	SWS ID	Units	Certificate Code	Monitoring Wells					SWSL	15A NCAC 2L	
				1809 MS-8	1809 MS-9	1809 MS-10	1809 MS-11	1809 MS-12			
Field pH	320	SU	5193	5.8	6.2	4.8	5.2	4.9	-	6.5-8.5	
Field Specific Conductance	323	umho/cm	5193	42	87	21	38	24	-	-	
Temperature	325	°C	5193	13.02	15.49	15.52	14.61	13.94	-	-	
Top of Casing	328	feet	-	872.34	868.04	851.29	859.78	835.66	-	-	
Depth to Water	318	feet	-	46.77	44.50	17.70	34.17	23.36	-	-	
Water Elevation	319	feet	-	825.57	823.54	833.59	825.61	812.30	-	-	
Well Depth	411	feet	-	51.58	53.00	23.34	42.72	31.09	-	-	
Arsenic	14	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	10	10	
Barium	15	µg/L	248	37.8 J'	36 J'	134	62.7 J'	71.8 J'	100	700	
Boron	428	µg/L	248	33.4 U	33.4 U	33.4 U	33.4 U	33.4 U	NE	700	
Cadmium	34	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	1	2	
Chloride	301	µg/L	248	1,090	936	1,250	2,670	2,920	NE	250,000	
Chromium	51	µg/L	248	4.26 J'	2.2 J'	0.667 U	2.43 J'	0.667 U	10	10	
Copper	54	µg/L	248	3.34 U	3.34 U	3.34 U	3.59 J	3.34 U	10	1,000	
Fluoride	312	µg/L	248	172 J'	156 J'	75.6 J	74.6 J	75.8 J	2,000	2,000	
Iron	340	µg/L	248	432	36 J'	75.2 J'	217 J'	10.4 J'	300	300	
Lead	131	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	10	15	
Manganese	342	µg/L	248	10.8 J'	4.54 J	25.9 J'	7.98 J'	13.2 J'	50	50	
Mercury	132	µg/L	248	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.2	1	
Nickel	152	µg/L	248	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	50	100	
Nitrate as Nitrogen	303	µg/L	248	48.3 J'	197 J'	866 J'	5.82 J	52.2 J'	10,000	10,000	
Selenium	183	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	10	20	
Silver	184	µg/L	248	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	10	20	
Sulfate	315	µg/L	248	167 J'	400 J'	44.7 J	150 J'	85.8 J	250,000	250,000	
Total Dissolved Solids	311	µg/L	248	59,000	76,000	21,000	41,000	26,000	NE	500,000	
Zinc	213	µg/L	248	3.34 U	3.34 U	6.67 J'	3.34 U	3.34 U	10	1,000	

Notes:

- Concentrations presented in micrograms per liter (µg/L), except where noted.
- SWS ID is the Solid Waste Section Identification Number.
- SWSL is the Solid Waste Section Limit. This limit (identified by NCDENR) is the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy.
- 15A NCAC 2L Standard is from "North Carolina Administrative Code, Title 15A: Department of Environment and Natural Resources, Subchapter 2L - Groundwater Classifications and Standards," NCDENR (last amended on April 1, 2013), Appendix I revised July 16, 2012
- Grayed values indicate values that attain or exceed the SWSL Standard.
- Bold values indicate values that attain or exceed the 15A NCAC 2L Standard.
- NE indicates not established. Blank cells indicate that there is no information relevant to the respective row.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used for parameters not detected at concentrations above the method detection limit (MDL). "J" is used for parameters detected at estimated concentrations greater than the MDL but less than the laboratory's method reporting limit (MRL).
An italicized J'-flag is a data qualifier, added by HDR to indicate a detected concentration which attains or is greater than the laboratory's MRL but less than the SWSL.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL or 2L Standard for choride associated with CAS number 16887-00-6, which is the CAS reported by the laboratory for the analyses completed. Therefore, the SWSL and 2L listed are for the chloride with CAS number SW301 as specified on the Constituent Look-up webpage (last updated June 13, 2011).
- Data obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on April 5, 2013.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.

Table 2–Field and Analytical Results
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1–Permit No. 1809

Sample Date: March 18-19, 2013				Laboratory Certificate Codes:							
Field Sampling performed by Duke Energy Carolinas, LLC				Duke Energy Carolinas Field #5193							
				Duke Energy Analytical Laboratory #248							
Parameter	SWS ID	Units	Certificate Code	Monitoring Wells					1809 Field Blank	SWSL	15A NCAC 2L
				1809 MS-13	1809 MS-14	1809 MS-15	1809 MS-16	1809 SW-1			
Field pH	320	SU	5193	5.2	5.6	6.5	6.0	5.0	-	-	6.5-8.5
Field Specific Conductance	323	umho/cm	5193	95	52	131	100	34	-	-	-
Temperature	325	°C	5193	13.98	14.20	15.29	14.76	11.24	-	-	-
Top of Casing	328	feet	-	841.90	844.07	861.47	836.98	-	-	-	-
Depth to Water	318	feet	-	29.52	37.16	52.75	25.20	N/A	-	-	-
Water Elevation	319	feet	-	812.38	806.91	808.72	811.78	N/A	-	-	-
Well Depth	411	feet	-	41.52	44.38	63.08	37.46	N/A	-	-	-
Arsenic	14	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	10	10
Barium	15	µg/L	248	94.9 J'	39.8 J'	79.7 J'	88.1 J'	66.5 J'	3.34 U	100	700
Boron	428	µg/L	248	33.4 U	33.4 U	33.4 U	33.4 U	33.4 U	33.4 U	NE	700
Cadmium	34	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	1	2
Chloride	301	µg/L	248	3,390	869	2,240	1,370	3,110	76.4 J	NE	250,000
Chromium	51	µg/L	248	0.667 U	0.667 U	20.4	2.11 J'	0.667 U	0.667 U	10	10
Copper	54	µg/L	248	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	10	1,000
Fluoride	312	µg/L	248	139 J'	148 J'	127 J'	253 J'	66.5 J	28.7 J	2,000	2,000
Iron	340	µg/L	248	11.6 J'	46.2 J'	34.1 J'	294 J'	408	6.67 U	300	300
Lead	131	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	2.11 J'	0.667 U	10	15
Manganese	342	µg/L	248	9.07 J'	3.34 U	3.34 U	6.08 J'	73.9	3.34 U	50	50
Mercury	132	µg/L	248	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.2	1
Nickel	152	µg/L	248	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	50	100
Nitrate as Nitrogen	303	µg/L	248	2,450 J'	5.78 J	325 J'	327 J'	39 J'	5.4 U	10,000	10,000
Selenium	183	µg/L	248	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	0.667 U	10	20
Silver	184	µg/L	248	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	3.34 U	10	20
Sulfate	315	µg/L	248	621 J'	68.1 J	1,220 J'	636 J'	4,810 J'	18 U	250,000	250,000
Total Dissolved Solids	311	µg/L	248	77,000	75,000	111,000	103,000	42,000	-	NE	500,000
Zinc	213	µg/L	248	6.5 J'	3.34 U	3.34 U	3.34 U	6.51 J'	3.34 U	10	1,000

Notes:

- Concentrations presented in micrograms per liter (µg/L), except where noted.
- SWS ID is the Solid Waste Section Identification Number.
- SWSL is the Solid Waste Section Limit. This limit (identified by NCDENR) is the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy.
- 15A NCAC 2L Standard is from "North Carolina Administrative Code, Title 15A: Department of Environment and Natural Resources, Subchapter 2L - Groundwater Classifications and Standards," NCDENR (last amended on April 1, 2013), Appendix I revised July 16, 2012
- Grayed values indicate values that attain or exceed the SWSL Standard.
- Bold values indicate values that attain or exceed the 15A NCAC 2L Standard.
- NE indicates not established. Blank cells indicate that there is no information relevant to the respective row.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used for parameters not detected at concentrations above the method detection limit (MDL). "J" is used for parameters detected at estimated concentrations greater than the MDL but less than the laboratory's method reporting limit (MRL).
An italicized J' flag is a data qualifier, added by HDR to indicate a detected concentration which attains or is greater than the laboratory's MRL but less than the SWSL.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL or 2L Standard for choride associated with CAS number 16887-00-6, which is the CAS reported by the laboratory for the analyses completed. Therefore, the SWSL and 2L listed are for the chloride with CAS number SW301 as specified on the Constituent Look-up webpage (last updated June 13, 2011).
- Data obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on April 5, 2013.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.

Table 3–Leachate Analytical Results
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1–Permit No. 1809

Sample Date: March 18-19, 2013					
Field Sampling performed by Duke Energy Carolinas, LLC					
Parameter	SWS ID	Units	Certificate Code	C1-LEACHATE	SWSL
Field pH	320	SU	5193	4.6	-
Field Specific Conductance	323	umho/cm	5193	4,326	-
Temperature	325	°C	5193	14.25	-
Arsenic	14	µg/L	248	6.67 U	10
Barium	15	µg/L	248	24 J'	100
Boron	428	µg/L	248	21,800	NE
Cadmium	34	µg/L	248	6.67 U	1
Chloride	301	µg/L	248	574,000	NE
Chromium	51	µg/L	248	6.67 U	10
Copper	54	µg/L	248	26.6	10
Fluoride	312	µg/L	248	5,300	2,000
Iron	340	µg/L	248	273,000	300
Lead	131	µg/L	248	19.1	10
Manganese	342	µg/L	248	5,880	50
Mercury	132	µg/L	248	0.006 U	0.2
Nickel	152	µg/L	248	156	50
Nitrate as Nitrogen	303	µg/L	248	4,480 J'	10,000
Selenium	183	µg/L	248	272	10
Silver	184	µg/L	248	3.34 U	10
Sulfate	315	µg/L	248	2,210,000	250,000
Total Dissolved Solids	311	µg/L	248	4,250,000	NE
Zinc	213	µg/L	248	278	10

Notes:

- Concentrations presented in micrograms per liter (µg/L), except where noted.
- SWS ID is the Solid Waste Section Identification Number.
- SWSL is the Solid Waste Section Limit. This limit (identified by NCDENR) is the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy.
- Grayed values indicate values that attain or exceed the SWSL Standard.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used for parameters not detected at concentrations above the method detection limit (MDL).
 "J" is used for parameters detected at estimated concentrations greater than the MDL but less than the laboratory's method reporting limit (MRL).
 An italicized J'-flag is a data qualifier, added by HDR to indicate a detected concentration which attains or is greater than the laboratory's MRL but less than the SWSL.
- NE indicates not established.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL Standard for choride associated with CAS number 16887-00-6, which is the CAS reported by the laboratory for the analyses completed. Therefore, the SWSL Standard listed is for the chloride with CAS number SW301 as specified on the Constituent Look-up webpage (last updated June 13, 2011).
- Data obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on April 5, 2013.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.

**Table 4—Field and Analytical Results that Equal or Exceed
NCAC 2L Groundwater Quality Standards
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1 - Permit No. 1809**

Sample Date: March 18-19, 2013						
Parameter	Well ID	Result	Units	15A NCAC 2L Standard	Historical Concentrations	Cause and Significance
pH	MS-8	5.8	SU	6.5-8.5	5.2 - 6.3	pH consistent with historical readings at MS-8.
	MS-9	6.2	SU		6.2 - 10.3	pH is the lowest reading at MS-9 over the period of monitoring.
	MS-10	4.8	SU		4.5 - 5.3	pH consistent with historical readings at MS-10.
	MS-11	5.2	SU		5.1 - 5.6	pH consistent with historical readings at MS-11.
	MS-12	4.9	SU		4.5 - 5.1	pH consistent with historical readings at MS-12.
	MS-13	5.2	SU		4.9 - 5.4	pH consistent with historical readings at MS-13.
	MS-14	5.6	SU		5.5 - 6.2	pH consistent with historical readings at MS-14.
	MS-15	6.5	SU		6.5 - 9.8	pH equal to the lowest reading at MS-15 over the period of monitoring.
	MS-16	6.0	SU		5.8 - 6.4	pH consistent with historical readings at MS-16.
	SW-1	5.0	SU		5.0 - 6.1	pH is the lowest reading at SW-1 over the period of monitoring.
Chromium	MS-15	20.4	µg/L	10	11.5 - 21.5	Chromium concentration consistent with historical readings at MS-15.
Iron	MS-8	432	µg/L	300	213 - 22,000	Iron concentration consistent with historical readings at MS-8. Turbidity measured at 15.3 NTUs.
	SW-1	408	µg/L		334 - 3,816	Iron concentration consistent with historical readings at SW-1. Turbidity measured at 18.1 NTUs.
Manganese	SW-1	73.9	µg/L	50	22.1 - 447	Chromium concentration consistent with historical readings at SW-1. Turbidity measured at 18.1 NTUs.

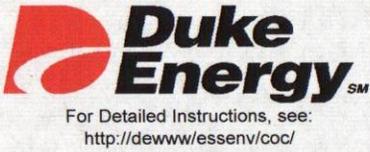
Notes:

- 15A NCAC 2L Standard is from "North Carolina Administrative Code, Title 15A: Department of Environment and Natural Resources, Subchapter 2L - Groundwater Classifications and Standards," NCDENR (last amended on April 1, 2013), Appendix I revised July 16, 2012
- Data obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas on April 5, 2013.
- µg/L indicates micrograms per liter.
- SU indicates Standard Units.
- NTU indicates Nephelometric Turbidity Units.
- Historical concentrations based on data in Duke Energy Carolinas, LLC (Duke Energy) analytical results database.

APPENDICES

APPENDIX A
CHAIN-OF-CUSTODY FORMS

CHAIN OF CUSTODY AND ANALYSIS REQUEST FORM



Duke Energy Analytical Lab Services
Mail Code MGO3A2 (Building 7405)
13339 Hagers Ferry Rd
Huntersville, N. C. 28078
(980) 875-5245
Fax: (980) 875-5038

Analytical Laboratory Use Only			
LIMS #	J13030175	MATRIX: GW-RCRA	Samples Originating From NC <input checked="" type="checkbox"/> SC <input type="checkbox"/>
Logged By	<i>Cpk</i>	Date & Time	3-19-13 1418
VENDOR		Cooler Temp (C)	2.1 (<6)
PO #		Preserv.: 1=HCL 2=H ₂ SO ₄ 3=HNO ₃ 4=Ice 5=None	4
MR #		Customer to complete all appropriate NON-SHADED areas.	16 Analyses Required NO ₃ -N, Cl, F, SO ₄ (IC), and F_Aik (4.5)

19 Page 1 of 1
DISTRIBUTION
ORIGINAL to LAB,
COPY to CLIENT

Revised 10/2/12

1) Project Name	MARSHALL FGD LANDFILL	2) Phone No:	980-875-5257
3) Client	LDC / TSH / Ed Sullivan	4) Fax No:	875-4349
5) Business Unit:	20035	6) Process:	BENVWS
7) Resp. To:	MS00	8) Project ID:	
9) Activity ID:		10) Mail Code:	MGO3A3

LAB USE ONLY
11 Lab ID

11 Lab ID	13 Sample Description or ID	14 Collection Information			TESTS	18 Grab	NO ₃ -N, Cl, F, SO ₄ (IC), and F_Aik (4.5)	Metals Prep - 3030C (ICP - EPA 200.7) Ag, B, Ba, Ca, Cu, Fe, K, Mg, Mn, Na, Ni, Zn (12) Hg (EPA 245.1) (1) (IMS - EPA 200.8) As, Cd, Cr, Pb, Se (5)	TDS	20 Total # of Containers
		Date	Time	Signature						
2013005536	MS-8	3/19/13	0850	DC	6	X	1	1	1	3
2013005537	MS-9	3/19/13	1030	DC	6	X	1	1	1	3
2013005538	MS-10	3/19/13	1130	DC	6	X	1	1	1	3
2013005539	MS-11	3/19/13	1230	DC	6	X	1	1	1	3
2013005540	MS-12	3/18/13	1005	DC	6	X	1	1	1	3
2013005541	MS-13	3/18/13	0835	DC	6	X	1	1	1	3
2013005542	MS-14	3/19/13	0750	DC	6	X	1	1	1	3
2013005543	MS-15	3/18/13	1405	DC	6	X	1	1	1	3
2013005544	MS-16	3/18/13	1245	DC	6	X	1	1	1	3
2013005545	SW-1	3/18/13	0855	DC	6	X	1	1	1	3
2013005546	C1-Leachate	3/18/13	1055	DC	6	X	1	1	1	3
2013005547	FIELD BLANK	3/19/13	1310	DC	5	X	1	1		2

Customer to sign & date below

21) Relinquished By	<i>LDC</i>	Date/Time	3/18/13 1510	Accepted By:	<i>[Signature]</i>	Date/Time	3-18-13 1510	22 Requested Turnaround 14 Days <input checked="" type="checkbox"/> *7 Days _____ *48 Hr _____ *Other _____ * Add. Cost Will Apply	
Relinquished By	<i>WCLU</i>	Date/Time	3/19/13 1410	Accepted By:	<i>Cindy Knorr</i>	Date/Time	3-19-13 1410		
Relinquished By		Date/Time		Accepted By:		Date/Time			
23) Seal/Locked By		Date/Time		Sealed/Lock Opened By		Date/Time			
24) Comments	Regulatory Agency : NCDENR/DWM -SW Section - State EDD Format Required / Permit # 18-09 Use indicated or comparable analytical methods								

Customer must Complete

Customer to complete appropriate columns to right

Customer, important please indicate desired turnaround