

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	September 22 and 24, 2014

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

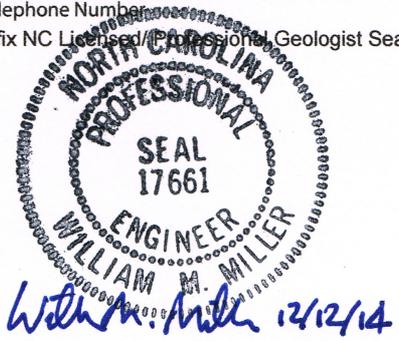
William M. Miller Dec. 12, 2014 Affix NC Licensed Professional Geologist Seal

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)



**FGD Residue Landfill, Phase 1, Cell 1
Permit No. 1809**

Semiannual Groundwater Monitoring Report

September 2014 Sampling Event

Marshall Steam Station

December 12, 2014



REPORT VERIFICATION

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

TITLE: SEPTEMBER 2014 SAMPLING EVENT

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

Prepared by: *Scott A. Smith* Date: 12/12/14

Checked by: *Wm Miller* Date: 12/12/14

Approved by: *Brooke Ahrens* Date: 12/12/14

Project Manager: Brooke Ahrens, PE

Professional Engineer Seal:



HDR Engineering, Inc. of the Carolinas
440 South Church St., Suite 1000
Charlotte, NC 28202
North Carolina Engineering Firm Number F-0116



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Appendix 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 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, construction and demolition (C&D) waste, asbestos waste, mill rejects (pyrites), waste limestone material, land clearing and inert debris, boiler slag, ball mill rejects, sand blast material, and coal waste. The clarifier sludge is generated from the FGD wastewater treatment system. Only Cell 1 of the landfill has been constructed and is in operation. Cell 1 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
	MS-14
	MS-15
	MS-16
Surface water sample:	SW-1
Leachate sample:	C1

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.



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. Due to landfill operations, the historical leachate collection area is no longer accessible as of the September 2014 sampling event. A new collection point for leachate sample C-1 has been established northwest of the landfill at the outlet of the leachate discharge pipe. 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 samples were analyzed for the following constituents and/or parameters:

- Barium, boron, copper, iron, manganese, nickel, silver, and zinc using U.S. Environmental Protection Agency (EPA) Method 200.7
- Arsenic, cadmium, chromium, lead, and selenium using EPA Method 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

Selected samples were diluted as is normal laboratory practice to bring samples to the calibrated range of the analytical method. Additional information regarding the samples that were diluted, including the dilution factor, are reported in the Electronic Data Deliverable (EDD).

The chain-of-custody forms are located in Appendix A.

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, and MS-16, and leachate sampling location C1. There was insufficient flow at SW-1 to collect a surface water sample. The samples were collected on September 22 and 24, 2014, and HDR received the data on October 22, 2014.
- Reviewed the laboratory analytical results for samples. The 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 concentration that is equal to or 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.

³ The Solid Waste Section Limit (SWSL) is defined by NCDENR 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.



- Prepared and submitted this Semiannual Groundwater Monitoring Report to Duke Energy.

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 the date of sampling.

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 to be toward surface water sample location SW-1.

3.2 Analytical Results

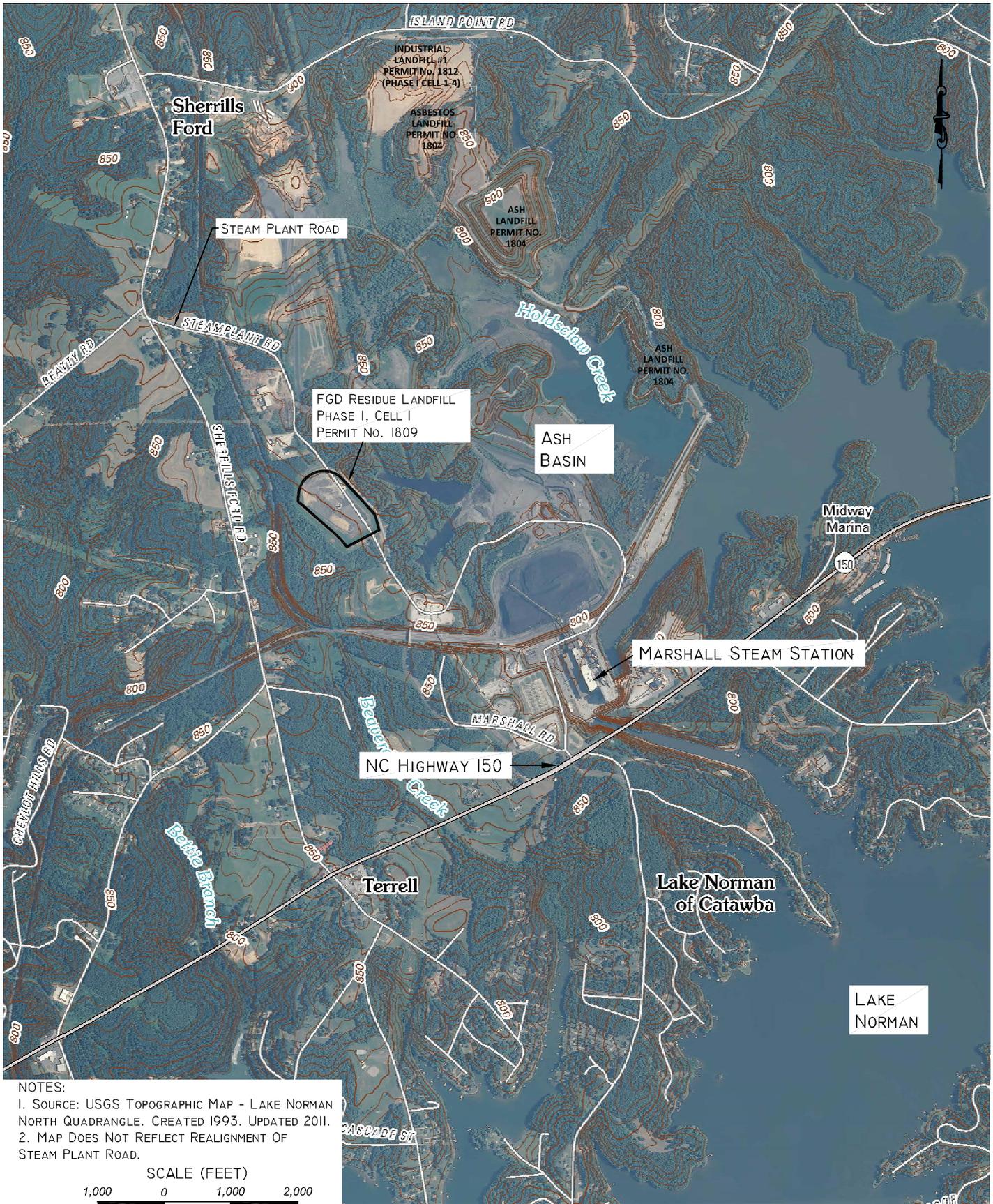
A summary of the field data is presented in Table 1.

The field and analytical results of the groundwater samples collected at the monitoring wells are summarized in Table 2. The analysis results for these locations are compared to the 2L Standards. Concentrations with values that attain or exceed the 2L Standards are noted on Table 2 by bold font. A summary of the analytical results that attain or exceed the 2L Standards is presented in Table 3. The field and analytical results for the leachate sampling are summarized in Table 4.

Concentrations with values that are equal to or greater than the SWSLs are noted on Tables 2 and 4 by gray cells.

HDR previously 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 for the period of analytical results reviewed, that the exceedances of the 2L Standards at the site were naturally occurring and are not related to impacts from the landfill.

FIGURES



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



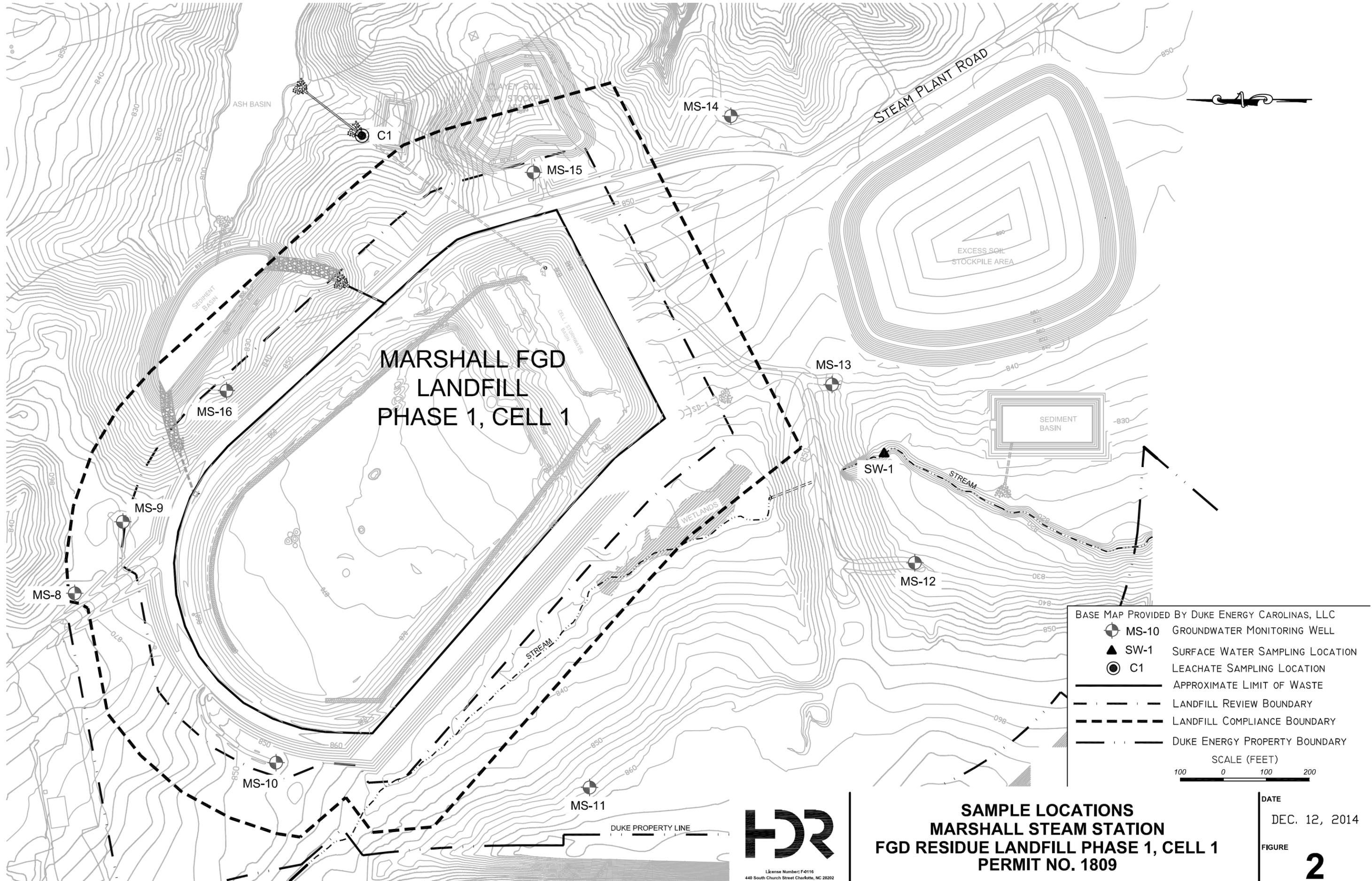
**SITE LOCATION MAP
 MARSHALL STEAM STATION
 FGD RESIDUE LANDFILL PHASE 1, CELL 1
 PERMIT NO. 1809**

DATE
 DEC. 12, 2014

FIGURE
1



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**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

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

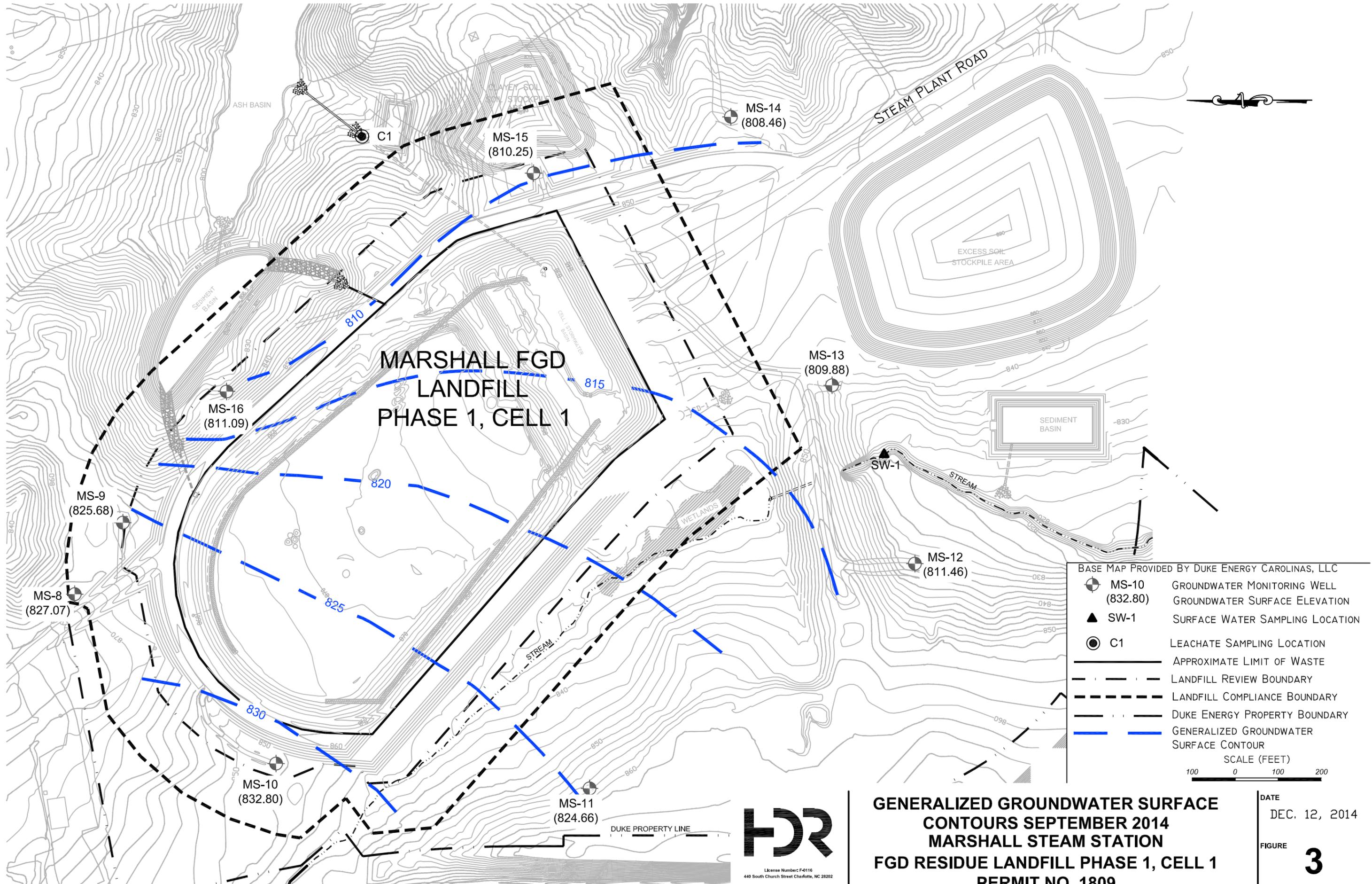
DATE
DEC. 12, 2014

FIGURE
2



DUKE PROPERTY LINE

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BASE MAP PROVIDED BY DUKE ENERGY CAROLINAS, LLC

	MS-10 (832.80)	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



**GENERALIZED GROUNDWATER SURFACE
CONTOURS SEPTEMBER 2014
MARSHALL STEAM STATION
FGD RESIDUE LANDFILL PHASE 1, CELL 1
PERMIT NO. 1809**

DATE
DEC. 12, 2014

FIGURE
3

TABLES

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

DATE	SAMPLE ID	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)
9/22/2014	MS-8	51.58	45.27	827.07	Normal	None	CP	N/A	1.03	3.00	YES	16.26	41	5.9	21.6	353	6.46
9/22/2014	MS-9	53.00	42.36	825.68	Normal	None	LF	380	1.74	2.30	N/A	16.16	94	6.6	2.7	324	7.56
9/22/2014	MS-10	23.34	18.49	832.80	Normal	None	LF	200	0.79	0.80	N/A	16.27	22	4.9	3.6	403	5.22
9/22/2014	MS-11	42.72	35.12	824.66	Normal	None	LF	200	1.24	1.60	N/A	14.83	39	5.1	3.0	337	6.98
9/22/2014	MS-12	31.09	24.20	811.46	Normal	None	CP	N/A	1.12	3.75	NO	14.26	25	4.6	5.8	384	7.24
9/22/2014	MS-13	41.52	32.02	809.88	Normal	None	CP	N/A	1.55	7.00	NO	13.92	74	5.1	3.1	368	3.33
9/22/2014	MS-14	44.38	35.61	808.46	Normal	None	CP	N/A	1.43	7.50	NO	15.14	52	5.8	28.7	347	7.15
9/22/2014	MS-15	63.08	51.22	810.25	Normal	None	CP	N/A	1.93	10.00	NO	16.26	145	6.3	3.5	322	7.26
9/22/2014	MS-16	37.46	25.89	811.09	Colloidal	None	CP	N/A	1.89	3.25	YES	15.89	100	5.8	130	302	6.31
9/22/2014	SW-1	N/A	N/A	N/A	Normal	None	N/A	N/A	N/A	N/A	N/A	NS	NS	NS	NS	NS	NS
9/24/2014	C1-LEACHATE	N/A	N/A	N/A	Normal	None	N/A	N/A	N/A	N/A	N/A	16.20	4,901	3.2	30.5	567	8.72

Notes:

- Purge Methods; LF=Low Flow, CP=Conventional Purge (3-5 well volumes), NP=No Purge (HydraSleeve), LO= Level Only. Average pump rate applicable to LF purging only.
- Field sampling performed by Duke Energy Carolinas, LLC personnel.
- EVAC indicates whether the water level in the well was drawn down to the level of the pump during purging.
- umho/cm indicates micromhos per centimeter.
- SU indicates Standard Units.
- NTU indicates Nephelometric Turbidity Units.
- mV-NHE indicates millivolts-Normal Hydrogen Electrode.
- mg/L indicates milligrams per liter.
- N/A indicates not applicable.
- NS indicates no sample collected. There was insufficient flow at SW-1 to collect a surface water sample.
- Information provided by Tim Hunsucker of Duke Energy Carolinas, LLC on October 22, 2014.

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: September 22, 2014				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	Sample Location					SWSL	15A NCAC 2L
				1809 MS-8	1809 MS-9	1809 MS-10	1809 MS-11	1809 MS-12		
Field pH	320	SU	5193	5.9	6.6	4.9	5.1	4.6	NE	6.5-8.5
Field Specific Conductance	323	umho/cm	5193	41	94	22	39	25	NE	NE
Temperature	325	°C	5193	16.26	16.16	16.27	14.83	14.26	NE	NE
Top of Casing	328	feet	-	872.34	868.04	851.29	859.78	835.66	NE	NE
Depth to Water	318	feet	-	45.27	42.36	18.49	35.12	24.20	NE	NE
Water Elevation	319	feet	-	827.07	825.68	832.80	824.66	811.46	NE	NE
Well Depth	411	feet	-	51.58	53.00	23.34	42.72	31.09	NE	NE
Arsenic	14	µg/L	248	0.14 J	0.115 J	0.078 U	0.078 U	0.078 U	10	10
Barium	15	µg/L	248	45.6 J'	36.6 J'	148	73.1 J	84.6 J'	100	700
Boron	428	µg/L	248	7.45 J	5.96 J	3.3 U	4.07 J	3.56 J	NE	700
Cadmium	34	µg/L	248	0.101 U	0.101 U	0.101 U	0.101 U	0.101 U	1	2
Chloride	301	µg/L	248	1,180	1,050	1,260	2,630	3,120	NE	250,000
Chromium	51	µg/L	248	6.19 J'	1.53 J'	0.715 J'	1.82 J'	0.564 J'	10	10
Copper	54	µg/L	248	1.79 J	1 U	1 U	1 U	1 U	10	1,000
Fluoride	312	µg/L	248	163 J'	158 J'	68.3 J	65.1 J	59.5 J	2,000	2,000
Iron	340	µg/L	248	1,210	58.7 J'	118 J'	118 J'	87.3 J'	300	300
Lead	131	µg/L	248	0.433 J	0.065 U	0.065 U	0.065 U	0.065 U	10	15
Manganese	342	µg/L	248	12.1 J'	7.08 J	27.2 J'	7.57 J'	17.3 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	5.15 J'	0.5 U	3.19 J	2.18 J	0.88 J	50	100
Nitrate as Nitrogen	303	µg/L	248	39.9 J'	188 J'	1,020 J'	6.19 J	120 J'	10,000	10,000
Selenium	183	µg/L	248	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	10	20
Silver	184	µg/L	248	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	10	20
Sulfate	315	µg/L	248	160 J'	405 J'	59.1 J	356 J'	113 J	250,000	250,000
Total Dissolved Solids	311	µg/L	248	66,000	76,000	26,000	38,000	29,000	NE	500,000
Zinc	213	µg/L	248	4.75 J'	2.6 U	6.93 J'	3.81 J'	4.19 J	10	1,000

Notes:

- Concentrations presented in micrograms per liter (µg/L).
- 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 refers to Class GA Standards as found in 15A NCAC 02L .0202 Groundwater Quality Standards, last amended on April 1, 2013.
- Grayed values indicate values that are equal to or greater than the SWSL.
- Bold values indicate values that attain or exceed the 15A NCAC 2L Standard.
- NE indicates not established. NA indicates not analyzed. Blank cells indicate that there is no information relevant to the respective row.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used to identify results not detected at concentrations greater than the laboratory's method detection limit (MDL). "J" is used to identify estimated concentrations which are equal to or greater than the MDL but are less than the laboratory's method reporting limit (MRL). An italicized J'-flag is a data qualifier, added by HDR to indicate concentrations which are equal to or greater than the laboratory's MRL but are 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 Standards listed are for the chloride with CAS number SW301 as specified on the Constituent Look-up webpage (last updated June 13, 2011).
- Analytical results obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on October 22, 2014.

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: September 22, 2014										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	Sample Location					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	5.1	5.8	6.3	5.8	NS	-	NE	6.5-8.5
Field Specific Conductance	323	umho/cm	5193	74	52	145	100	NS	-	NE	NE
Temperature	325	°C	5193	13.92	15.14	16.26	15.89	NS	-	NE	NE
Top of Casing	328	feet	-	841.90	844.07	861.47	836.98	-	-	NE	NE
Depth to Water	318	feet	-	32.02	35.61	51.22	25.89	-	-	NE	NE
Water Elevation	319	feet	-	809.88	808.46	810.25	811.09	-	-	NE	NE
Well Depth	411	feet	-	41.52	44.38	63.08	37.46	-	-	NE	NE
Arsenic	14	µg/L	248	0.078 U	0.281 J	0.078 U	0.538 J	NS	0.078 U	10	10
Barium	15	µg/L	248	103	59.6 J'	108	167	NS	1.12 J	100	700
Boron	428	µg/L	248	4.17 J	3.49 J	3.70 J	3.3 U	NS	3.3 U	NE	700
Cadmium	34	µg/L	248	0.101 U	0.101 U	0.101 U	0.101 U	NS	0.101 U	1	2
Chloride	301	µg/L	248	3,130	935	2,400	1,440	NS	31.7 J	NE	250,000
Chromium	51	µg/L	248	0.061 U	0.355 J	18.5	8.63 J'	NS	0.061 U	10	10
Copper	54	µg/L	248	1 U	1 U	1 U	4.16 J	NS	1 U	10	1,000
Fluoride	312	µg/L	248	130 J'	148 J'	133 J'	242 J'	NS	32.4 J	2,000	2,000
Iron	340	µg/L	248	88.9 J'	1,220	78.7 J'	6,650	NS	5.57 J	300	300
Lead	131	µg/L	248	0.065 U	0.408 J	0.065 U	2.51 J	NS	0.065 U	10	15
Manganese	342	µg/L	248	8.66 J'	15.4 J'	1.51 J	117	NS	0.2 U	50	50
Mercury	132	µg/L	248	0.006 U	0.006 U	0.006 U	0.006 U	NS	0.006 U	0.2	1
Nickel	152	µg/L	248	0.5 U	1.37 J	3.7 J	6.23 J	NS	0.5 U	50	100
Nitrate as Nitrogen	303	µg/L	248	1,970 J'	11.4 J	221 J'	366 J'	NS	5.85 J	10,000	10,000
Selenium	183	µg/L	248	0.092 U	0.092 U	0.092 U	0.092 U	NS	0.092 U	10	20
Silver	184	µg/L	248	0.7 U	0.7 U	0.7 U	0.7 U	NS	0.7 U	10	20
Sulfate	315	µg/L	248	254 J'	52.7 J	958 J'	279 J'	NS	18 U	250,000	250,000
Total Dissolved Solids	311	µg/L	248	62,000	75,000	106,000	118,000	NS	NA	NE	500,000
Zinc	213	µg/L	248	3.44 J	4.20 J	2.6 U	21.2	NS	2.6 U	10	1,000

Notes:

- Concentrations presented in micrograms per liter (µg/L).
- 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 refers to Class GA Standards as found in 15A NCAC 02L .0202 Groundwater Quality Standards, last amended on April 1, 2013.
- Grayed values indicate values that are equal to or greater than the SWSL.
- Bold values indicate values that attain or exceed the 15A NCAC 2L Standard.
- NE indicates not established. NA indicates not analyzed. Blank cells indicate that there is no information relevant to the respective row.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used to identify results not detected at concentrations greater than the laboratory's method detection limit (MDL). "J" is used to identify estimated concentrations which are equal to or greater than the MDL but are less than the laboratory's method reporting limit (MRL). An italicized J' flag is a data qualifier, added by HDR to indicate concentrations which are equal to or greater than the laboratory's MRL but are 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 Standards listed are for the chloride with CAS number SW301 as specified on the Constituent Look-up webpage (last updated June 13, 2011).
- Analytical results obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on October 22, 2014.

**Table 3--Field and Analytical Results that Equal or Exceed
15A NCAC 2L Groundwater Quality Standards
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1 - Permit No. 1809**

Sample Date: September 22, 2014						
Parameter	Well ID	Result	Units	15A NCAC 2L Standard	Historical Concentrations	Cause and Significance
pH	MS-8	5.9	SU	6.5 - 8.5	5.2 - 6.3	pH in MS-8 is consistent with historical readings at well.
	MS-10	4.9	SU		4.5 - 5.3	pH in MS-10 is consistent with historical readings at well.
	MS-11	5.1	SU		5.0 - 5.6	pH in MS-11 is consistent with historical readings at well.
	MS-12	4.6	SU		4.5 - 5.1	pH in MS-12 is consistent with historical readings at well.
	MS-13	5.1	SU		4.9 - 5.4	pH in MS-13 is consistent with historical readings at well.
	MS-14	5.8	SU		5.5 - 6.2	pH in MS-14 is consistent with historical readings at well.
	MS-15	6.3	SU		6.3 - 9.8	pH in MS-15 is the lowest reading measured over the period of monitoring.
	MS-16	5.8	SU		5.8 - 6.4	pH in MS-16 is consistent with the lowest historical reading at well.
Chromium	MS-15	18.5	µg/L	10	11.5 - 22.3	Chromium concentration in MS-15 is consistent with historical readings at well.
Iron	MS-8	1,210	µg/L	300	213 - 22,000	Iron concentration in MS-8 is consistent with historical readings at well. Turbidity measured at 21.6 NTUs.
	MS-14	1,220	µg/L		46.2 - 1,220	Iron in MS-14 is the highest concentration measured over the period of monitoring. Turbidity measured at 28.7 NTUs.
	MS-16	6,650	µg/L		294 - 57,572	Iron concentration in MS-16 is consistent with historical readings well. Turbidity measured at 130 NTUs.
Manganese	MS-16	117	µg/L	50	5.3 - 775	Manganese concentration in MS-16 is consistent with historical readings well. Turbidity measured at 130 NTUs.

Notes:

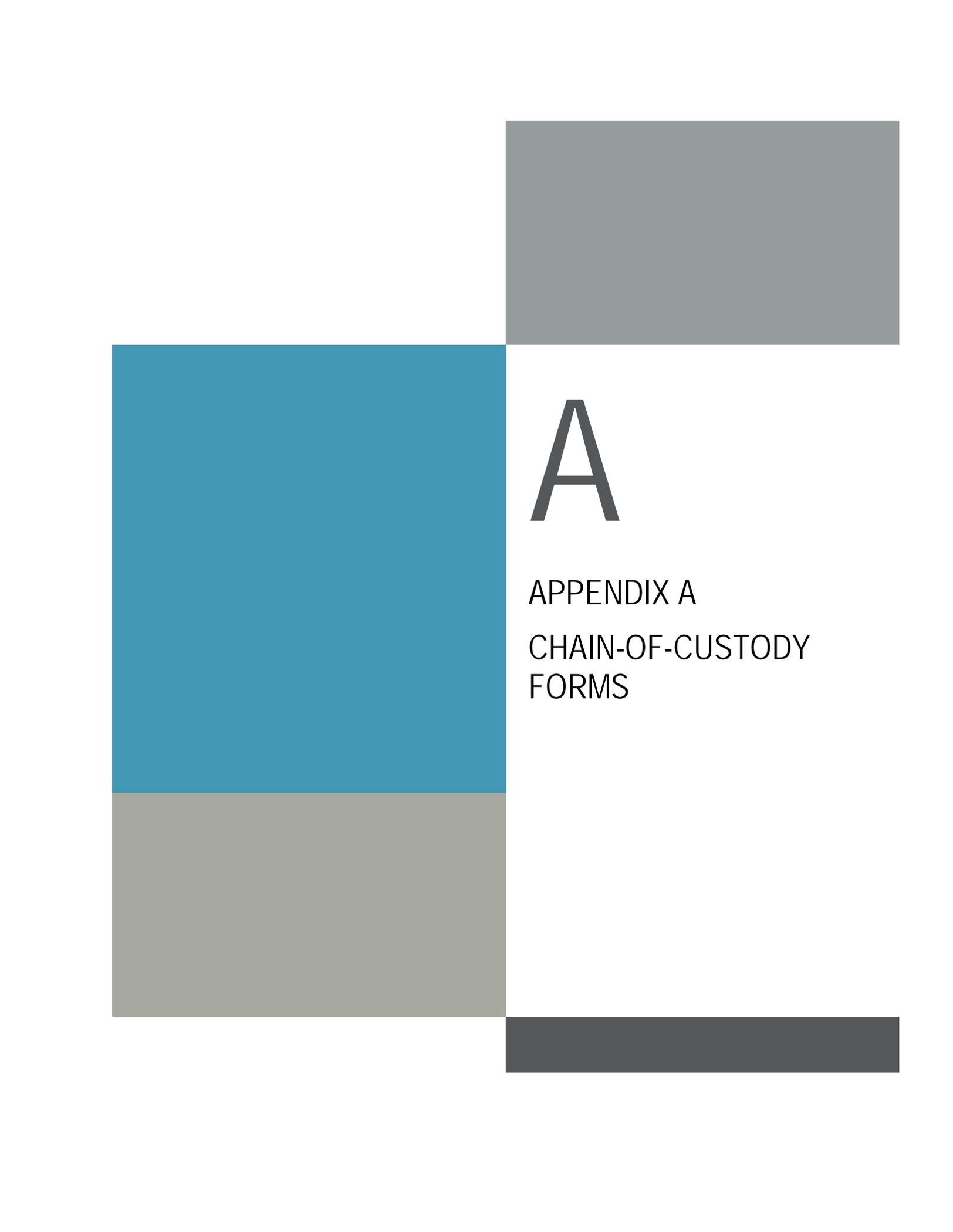
- 15A NCAC 2L Standard refers to Class GA Standards as found in 15A NCAC 02L .0202 Groundwater Quality Standards, last amended on April 1, 2013.
- µg/L indicates micrograms per liter.
- SU indicates Standard Units.
- NTU indicates Nephelometric Turbidity Units.
- Analytical results obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on October 22, 2014.
- Historical concentrations based on data in Duke Energy Carolinas, LLC (Duke Energy) analytical results database.

Table 4–Leachate Analytical Results
Duke Energy Carolinas, LLC/Marshall Steam Station
FGD Residue Landfill, Phase 1, Cell 1–Permit No. 1809

Sample Date: September 24, 2014								
Field Sampling performed by Duke Energy Carolinas, LLC								
Parameter	SWS ID	Units	Certificate Code	1809 Field Blank		1809 C1-LEACHATE		SWSL
Field pH	320	SU	5193	-		3.16		NE
Field Specific Conductance	323	umho/cm	5193	-		4,901		NE
Temperature	325	°C	5193	-		16.20		NE
Arsenic	14	µg/L	248	0.102	J	2.96	J	10
Barium	15	µg/L	248	0.228	J	22.8	J'	100
Boron	428	µg/L	248	3.65	J	22,000		NE
Cadmium	34	µg/L	248	0.101	U	1.01	U	1
Chloride	301	µg/L	248	22	U	526,000		NE
Chromium	51	µg/L	248	0.061	U	0.841	J	10
Copper	54	µg/L	248	1	U	1	U	10
Fluoride	312	µg/L	248	26.9	J	4,780		2,000
Iron	340	µg/L	248	5.79	J	331,000		300
Lead	131	µg/L	248	0.065	U	0.65	U	10
Manganese	342	µg/L	248	0.2	U	7,450		50
Mercury	132	µg/L	248	0.006	U	0.014	J	0.2
Nickel	152	µg/L	248	0.5	U	177		50
Nitrate as Nitrogen	303	µg/L	248	5.4	U	2,010	J'	10,000
Selenium	183	µg/L	248	0.092	U	210		10
Silver	184	µg/L	248	0.7	U	0.7	U	10
Sulfate	315	µg/L	248	18	U	2,900,000		250,000
Total Dissolved Solids	311	µg/L	248	NA		5,120,000		NE
Zinc	213	µg/L	248	2.6	U	379		10

Notes:

- Concentrations presented in micrograms per liter (µg/L).
- 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 are equal to or greater than the SWSL.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.
- NE indicates not established. NA indicates not analyzed. 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 to identify results not detected at concentrations greater than the laboratory's method detection limit (MDL).
 "J" is used to identify estimated concentrations which are equal to or greater than the MDL but are less than the laboratory's method reporting limit (MRL).
 An italicized J'-flag is a data qualifier, added by HDR to indicate concentrations which are equal to or greater than the laboratory's MRL but are less than the SWSL.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL for chloride associated with CAS number 16887-00-6, which is the CAS reported by the laboratory for the analyses completed. Therefore, the SWSL listed is for the chloride with CAS number SW301 as specified on the Constituent Look-up webpage (last updated June 13, 2011).
- Analytical results obtained from Electronic Data Deliverable (EDD) provided by Tim Hunsucker of Duke Energy Carolinas, LLC on October 22, 2014.



A

APPENDIX A CHAIN-OF-CUSTODY FORMS



CHAIN OF CUSTODY RECORD 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

For Detailed Instructions, see:
<http://dewwww/essenv/coc/>

Analytical Laboratory Use Only			
LIMS #	J14090010	MATRIX: GW-RCRA	Samples Originating From NC <input checked="" type="checkbox"/> SC <input type="checkbox"/>
Logged By <i>DM</i>	Date & Time 9/22/14 1255	SAMPLE PROGRAM Ground Water <input checked="" type="checkbox"/> NPDES <input type="checkbox"/> Drinking Water <input type="checkbox"/> UST <input type="checkbox"/> RCRA Waste <input type="checkbox"/>	
VENDOR	Cooler Temp (C) 1.8	¹⁵ Preserv.: 1=HCL 2=H ₂ SO ₄ 3=HNO ₃ 4=Ice 5=None	
PO #			
MR #	¹⁶ Analyses Required NO ₃ -N, Cl, F, SO ₄ (IC), 4 and F_Aik (4-5)		
Customer to complete all appropriate NON-SHADED areas.			

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 DISTRIBUTION
 ORIGINAL to LAB,
 COPY to CLIENT

Revised 5/14/13

Customer must Complete

1) Project Name MARSHALL FGD LANDFILL Permit # 18-09	2) Phone No: 980-875-5257
3) Client LDC / TSH / Ed Sullivan	4) Fax No: 875-4349
5) Business Unit: 20035	6) Process: BENVWS
8) Project ID:	7) Resp. To: MS00
9) Activity ID:	10) Mail Code: MGO3A3

LAB USE ONLY
11) Lab ID
2014025792
2014025793
2014025794
2014025795
2014025796
2014025797
2014025798
2014025799
2014025800
2014025801
2014025802
2014025803

Customer to complete appropriate columns to right

13 Sample Description or ID	14 Collection Information			TESTS	18 Grab	NO ₃ -N, Cl, F, SO ₄ (IC), 4 and F_Aik (4-5)	Metals Prep - TRM (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						
MS-8	9/22/14	0750	WC	6	X	1	1	1	3
MS-9	9/22/14	0835	WC	6	X	1	1	1	3
MS-10	9/22/14	0915	WC	6	X	1	1	1	3
MS-11	9/22/14	0755	PSP	6	X	1	1	1	3
MS-12	9/22/14	0830	PSP	6	X	1	1	1	3
MS-13	9/22/14	0825	PSP	6	X	1	1	1	3
MS-14	9/22/14	1125	WC	6	X	1	1	1	3
MS-15	9/22/14	1025	WC	6	X	1	1	1	3
MS-16	9/22/14	1005	PSP	6	X	1	1	1	3
SW-1	9/22/14	DRY	PSP	6	X	1	1	1	3
C1-Leachate	9/22/14	DRY	PSP	6	X	1	1	1	3
FIELD BLANK	9/22/14	1135	PSP	5	X	1	1		2

Customer to sign & date below

21) Relinquished By <i>NO GEM</i>	Date/Time 9/22/14 1235	Accepted By: <i>[Signature]</i>	Date/Time 9/22/14 1235
Relinquished By	Date/Time	Accepted By:	Date/Time
Relinquished By	Date/Time	Accepted By:	Date/Time
23) Seal/Locked By	Date/Time	Sealed/Lock Opened By	Date/Time

Customer, important please indicate desired turnaround

22 Requested Turnaround

14 Days

*7 Days _____

• 48 Hr _____

*Other _____
 * Add. Cost Will Apply

24) Comments
 Regulatory Agency : NCDENR/DWM -SW Section - State EDD Format Required / Permit # 18-09 Use indicated or comparable analytical methods
 SW-1 - DRY NO Sample
 C1-Leachate - DRY NO Sample

