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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 Belews Creek Steam Station FGD Residue Landfill	3195 Pine Hall Road Belews Creek, NC	8505	.0500	November 25-26, 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*  
Signature

February 4, 2014

Affix NC Licensed Professional Geologist Seal

Signature

Date

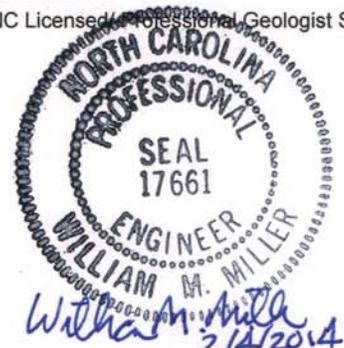
440 S. Church Street Suite 1000, Charlotte, NC 28202

Facility Representative Address

F-0116

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

Revised 6/2009



**SEMIANNUAL GROUNDWATER  
MONITORING REPORT**

**BELEWS CREEK STEAM STATION**

**FGD RESIDUE LANDFILL  
PERMIT NO. 8505**

**NOVEMBER 2013 SAMPLING EVENT**

**Prepared for:**  
**DUKE ENERGY CAROLINAS, LLC**  
**Belews Creek Steam Station**  
**3195 Pine Hall Road**  
**Belews Creek, NC 27042**

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

**February 4, 2014**



REPORT VERIFICATION

**PROJECT: SEMIANNUAL GROUNDWATER MONITORING REPORT  
BELEWS CREEK STEAM STATION  
FGD RESIDUE LANDFILL  
PERMIT NO. 8505**

**TITLE: NOVEMBER 2013 SAMPLING EVENT**

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

Prepared by: *[Signature]* Date: 2/4/2014  
Checked by: *William M. Miller* Date: 2/4/2014  
Approved by: *Ty Ziegler* Date: 2/4/2014

Project Manager: Ty Ziegler, PE

Professional Engineer Seal:



*William M. Miller 2/4/2014*

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  
BELEWS CREEK STEAM STATION  
FGD RESIDUE LANDFILL  
PERMIT NO. 8505**

**NOVEMBER 2013 SAMPLING EVENT**

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## Section 1

# Background

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The flue gas desulfurization (FGD) residue landfill is located at the Duke Energy Carolinas, LLC (Duke Energy) Belews Creek Steam Station, in Stokes County, North Carolina. The FGD residue landfill is permitted to receive FGD residue (gypsum) from Belews Creek Steam Station operations. The landfill is permitted under the North Carolina Department of Environment and Natural Resources (NCDENR) Solid Waste Permit No. 8505.

The FGD residue landfill is located south of the Belews Creek plant, on land between two arms of the Belews Lake. The West Belews Creek arm of the lake is located west of the landfill site and the East Belews Creek arm of the lake is located east of the site. Craig Road is located to the west of the landfill. The FGD residue landfill and nearby surrounding area are depicted on Figure 1.

The landfill consists of four cells contained in an area of approximately 24 acres. The adjacent stormwater basin occupies an area of approximately 2.4 acres. This stormwater basin is used to manage leachate and stormwater collected from the landfill. The landfill has an engineered liner system consisting of a leachate collection system, underlain by a high-density polyethylene (HDPE) geomembrane liner, underlain by a geo-synthetic clay liner.

The subsurface conditions in the landfill area consist of residual soils, saprolite, partially weathered rock, and bedrock, as described in the Water Quality Monitoring Plan.<sup>1</sup>

As is typical for groundwater systems located in the Piedmont region, groundwater at the landfill site occurs within the residuum, saprolite, partially weathered rock, and shallow fractured bedrock under unconfined aquifer conditions. The groundwater flow in the area of the landfill is generally from areas of higher topography, located to the east of the landfill, to the west and to the northwest of the landfill, towards Belews Lake.

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<sup>1</sup> *Water Quality Monitoring Plan FGD Scrubber Residue Landfill Belews Creek Steam Station*, December 07, 2007.

The monitoring system for the landfill consists of the following:

Monitoring Wells: BC-20  
BC-21  
BC-22  
BC-23A  
BC-25  
BC-26  
BC-27  
BC-28  
BC-29  
BC-30  
BC-31  
BC-32<sup>2</sup>

Observation Well: BC-7

Surface Water: SW-1

Leachate Sample: Leachate

The monitoring system for the landfill is shown on Figure 2. Monitoring wells BC-23A and BC-28 are considered to represent background groundwater quality, according to the Water Quality Monitoring Plan. The groundwater monitoring locations are sampled on a semi-annual basis and the results compared to groundwater quality standards found in 15A NCAC .02L .0202(g) (2L Standards).

Observation well BC-7 is used for water level measurements only. Monitoring wells are used to monitor groundwater quality and to measure groundwater levels.

SW-1 is a groundwater seep located to the east of well BC-28. When water is present, it emanates from the ground just above the sampling location. SW-1 analytical results are compared to 2L Standards. This surface water feature drains to Belews Lake.

The sampling was conducted by Duke Energy according to the North Carolina Solid Waste Management Guidelines. The parameters and constituents sampled and analyzed were selected

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<sup>2</sup> Monitoring well BC-32 was installed in August 2013, as part of a groundwater assessment being conducted at the landfill. The monitoring well is not included in the Water Quality Monitoring Plan, but the analytical results from the well are included in this landfill monitoring report.

by Duke Energy and the NCDENR Division of Solid Waste. The samples were analyzed by a North Carolina certified laboratory.

## Section 2

# Methods

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### 2.1 Sampling and Analysis Methods

Groundwater sampling and documentation of sampling activities were performed by Duke Energy personnel (Duke Energy Carolinas Field Certification #5193). The groundwater samples were analyzed by the Duke Energy Analytical Laboratory (North Carolina Laboratory Certification #248) and provided to HDR Engineering, Inc. (HDR) by Duke Energy.

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

- Barium, boron, chromium, copper, iron, manganese, nickel, silver, and zinc using Environmental Protection Agency (EPA) Method 200.7
- Arsenic, cadmium, lead, and selenium by EPA Method 200.8
- Chloride, fluoride, nitrate as nitrogen, and sulfate using EPA Method 300.0
- Mercury using EPA Method 245.1
- Total Dissolved Solids using Standard Method (SM) 2540C

### 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 BC-20, BC-21, BC-22, BC-23A, BC-25, BC-26, BC-27, BC-28, BC-29, BC-30, BC-31, BC-32, surface water sampling location SW-1, and the leachate sampling location. The samples were collected on November 25 and 26, 2013 and HDR received the data on December 16, 2013.
- Reviewed the laboratory analytical results for the samples noted above. The Electronic Data Deliverable (EDD), provided by Duke Energy, was adapted to conform to the format requirements of the 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 Limit (SWSL).<sup>3</sup> 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.

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<sup>3</sup> Solid Waste Section Limits (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.

## Section 3

# Results

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### 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 at the wells on the date of sampling.

Based on the groundwater elevations measured at 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 east of the landfill, to the west and to the northwest of the landfill, towards Belews Lake.

### 3.2 Analytical Results

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

The field and analytical results of groundwater and surface water sampling are summarized in Table 2.

The field and analytical results of leachate sampling are summarized in Table 3.

A summary of 2L Standard exceedances and a preliminary analysis of the cause and significance of the exceedances are presented in Table 4.

Concentrations with values that attain or exceed the SWSLs are noted on Tables 2 and 3 by gray cells.

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 amount, are reported in the EDD.

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

HDR previously prepared and submitted an assessment to NCDENR for exceedances of 2L Standards at this landfill (*Groundwater Assessment Belews Creek Steam Station FGD Residue Landfill, Permit No. 8505. October 5, 2012*).

The report also assessed the exceedances of the 2L Standards at wells BC-20, BC-21, BC-23A, BC-26, BC-27, BC-29, and BC-31 and at surface water sampling location SW-1. The assessment report concluded:

- the source of iron exceedances reported in BC-20, BC-21, BC-23A, BC-26, BC-27, BC-29, and BC-31 appear to be related to turbidity introduced from naturally occurring sources,
- the source of manganese exceedances reported in BC-27 appear to be related to turbidity introduced from naturally occurring sources,
- the manganese results at BC-21 do not appear to be related to turbidity, and
- the iron and manganese exceedances at surface water sampling location SW-1 are from naturally occurring sources and are not related to impacts from the landfill.

The report assessed 2L Standard exceedances for iron, sulfate, and total dissolved solids (TDS) at monitoring well BC-25. HDR recommended installing an additional monitoring well at the review boundary between BC-25 and the landfill to further delineate the sulfate and TDS concentrations in this area and improve the understanding of groundwater flow and quality near BC-25. HDR further recommended that BC-20 and BC-21 be re-sampled when the new monitoring well is sampled.

In a letter dated November 28, 2012<sup>4</sup> to Mr. Ed Sullivan, P.E., of Duke Energy, the NCDENR Solid Waste Section approved the recommendations presented in the groundwater assessment report dated October 5, 2012.

Monitoring well BC-32 was installed in August 2013. A supplemental assessment is currently being conducted considering the results from BC-32 and monitoring wells BC-20, BC-21, BC-25, and BC-26, and will be submitted to NCDENR.

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<sup>4</sup> North Carolina Department of Environment and Natural Resources, Division of Waste Management. November 28, 2012, Groundwater Assessment Report Response. Duke Energy – Belews Creek FGD Landfill, DOC ID 17761.

## **FIGURES**



**NOTES:**

1. SOURCE: USGS TOPOGRAPHIC MAP - BELEWS LAKE QUADRANGLE. CREATED 1971. REVISED 2010.
2. TOPOGRAPHIC MAP DOES NOT REFLECT REALIGNMENT OF CRAIG ROAD.

SCALE (FEET)

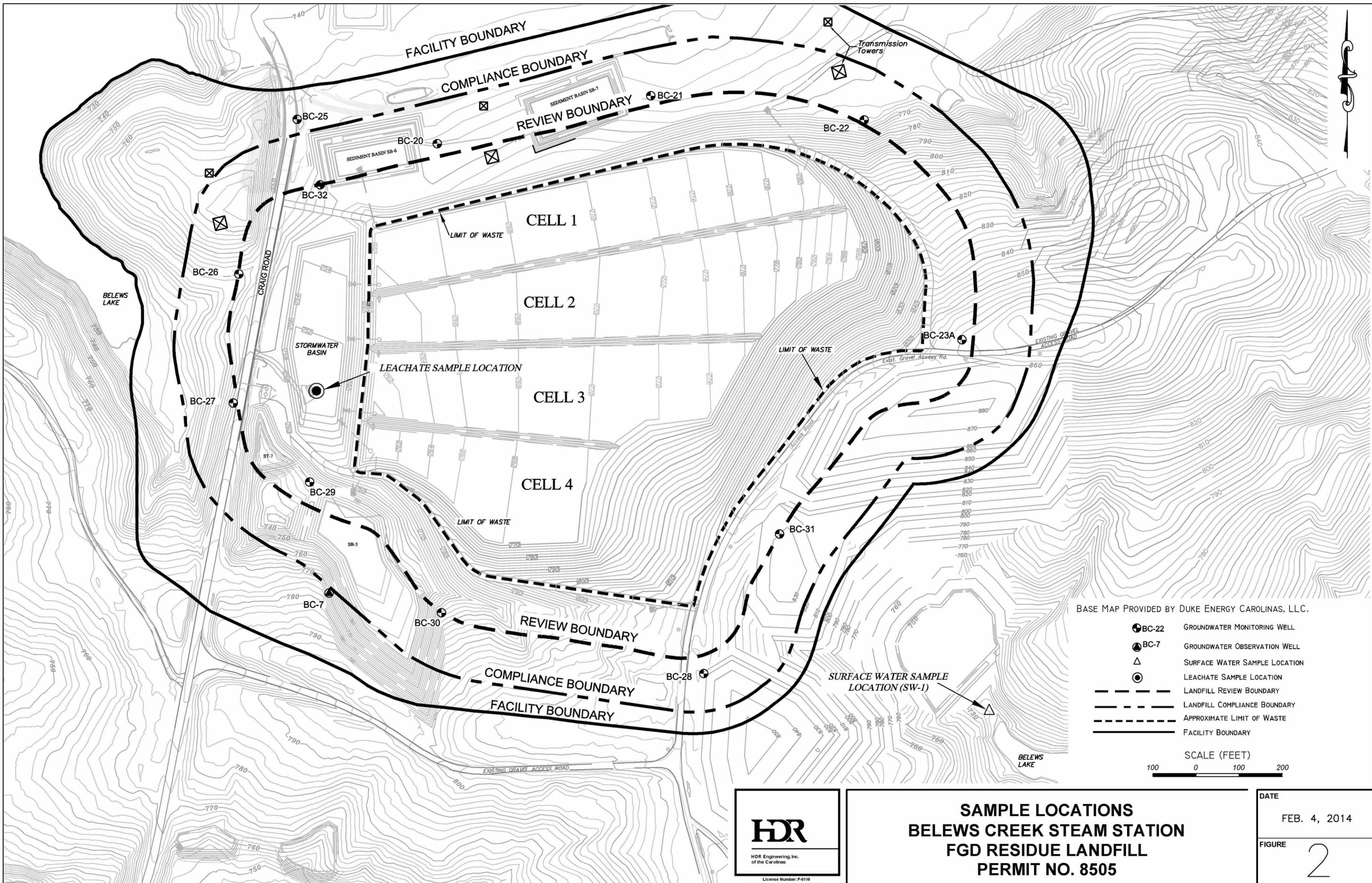
1000 0 1000 2000

C:\pwworking\hpa\d0387247\Figure 1 - Site Location Map.dwg



**SITE LOCATION MAP  
BELEWS CREEK STEAM STATION  
FGD RESIDUE LANDFILL  
PERMIT NO. 8505**

DATE	FEB. 4, 2014
FIGURE	1

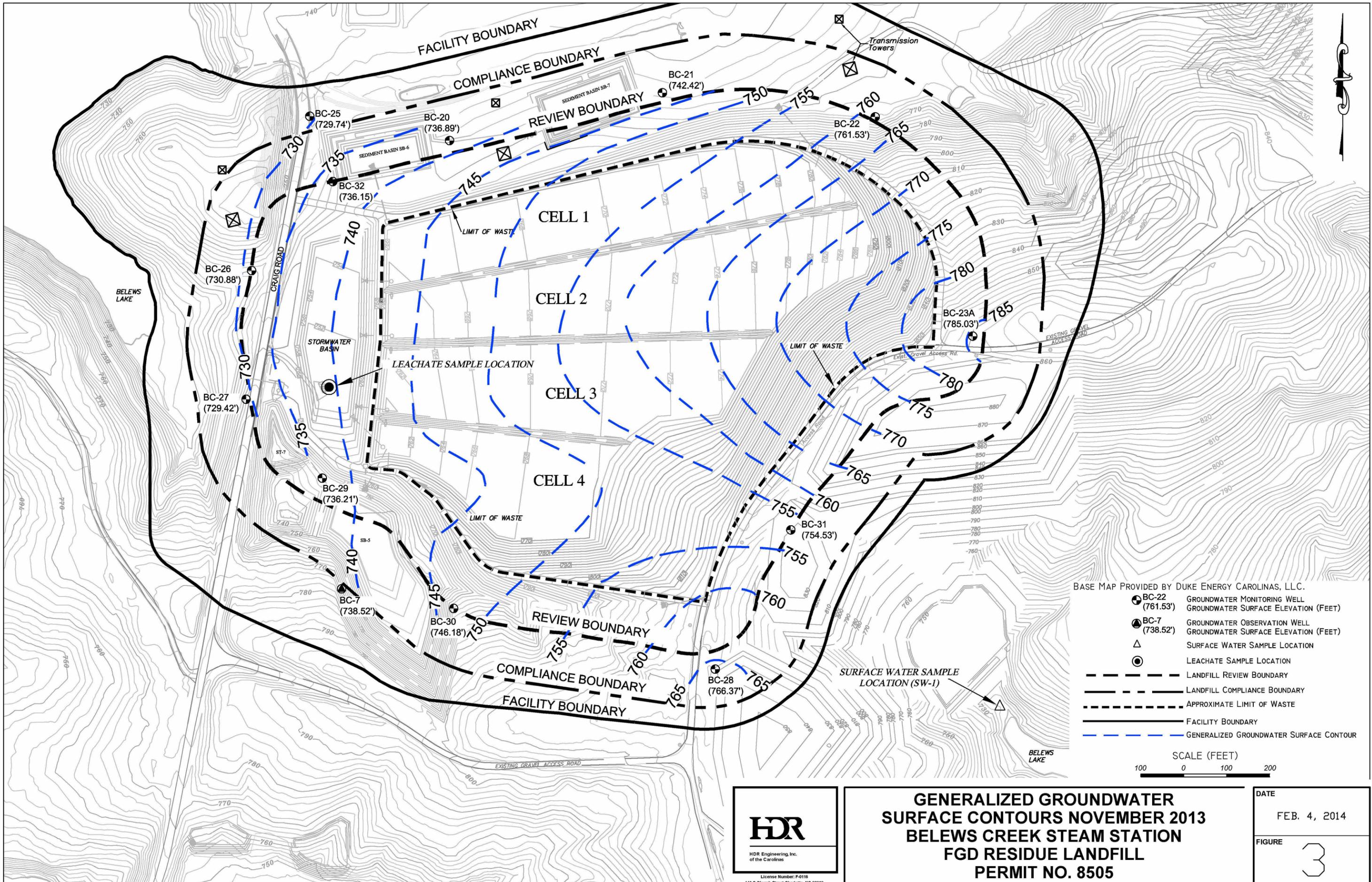


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**SAMPLE LOCATIONS  
BELEWS CREEK STEAM STATION  
FGD RESIDUE LANDFILL  
PERMIT NO. 8505**

DATE	FEB. 4, 2014
FIGURE	2



- BASE MAP PROVIDED BY DUKE ENERGY CAROLINAS, LLC.
- BC-22 (761.53') GROUNDWATER MONITORING WELL  
GROUNDWATER SURFACE ELEVATION (FEET)
  - BC-7 (738.52') GROUNDWATER OBSERVATION WELL  
GROUNDWATER SURFACE ELEVATION (FEET)
  - △ SURFACE WATER SAMPLE LOCATION
  - LEACHATE SAMPLE LOCATION
  - - - - LANDFILL REVIEW BOUNDARY
  - - - - LANDFILL COMPLIANCE BOUNDARY
  - - - - APPROXIMATE LIMIT OF WASTE
  - - - - FACILITY BOUNDARY
  - - - - GENERALIZED GROUNDWATER SURFACE CONTOUR



**GENERALIZED GROUNDWATER SURFACE CONTOURS NOVEMBER 2013**  
**BELEWS CREEK STEAM STATION**  
**FGD RESIDUE LANDFILL**  
**PERMIT NO. 8505**

DATE	FEB. 4, 2014
FIGURE	3

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## **TABLES**

**Table 1–Field Data Parameters  
Duke Energy Carolinas LLC/Belews Creek Steam Station  
FGD Residue Landfill, Permit No. 8505**

DATE	SAMPLE ID	WELL DEPTH (feet)	DEPTH TO WATER (feet)	WATER ELEV. (feet)	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)
11/25/2013	BC-7	52.30	39.28	738.52	N/A	LO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11/26/2013	BC-20	24.22	20.33	736.89	None	LF	210	0.63	1.35	N/A	12.54	404	5.1	11.0	408	8.42
11/26/2013	BC-21	16.77	14.27	742.42	None	LF	210	0.41	1.10	N/A	12.66	463	5.2	4.5	403	6.82
11/26/2013	BC-22	13.00	4.38	761.53	None	CP	N/A	1.41	4.50	NO	14.88	125	5.5	3.9	390	6.43
11/25/2013	BC-23A	101.21	78.76	785.03	None	CP	N/A	3.66	7.75	NO	14.93	42	5.6	25.8	554	8.05
11/26/2013	BC-25	23.15	16.22	729.74	None	LF	80	1.13	0.50	N/A	10.15	1226	5.1	95.5	379	4.36
11/25/2013	BC-26	23.26	18.44	730.88	None	CP	N/A	0.79	3.00	NO	13.76	135	4.7	7.7	362	4.19
11/25/2013	BC-27	34.95	32.46	729.42	None	LF	90	0.41	0.85	N/A	15.12	60	4.8	18.8	257	0.28
11/26/2013	BC-28	60.20	51.72	766.37	None	LF	150	1.38	0.65	N/A	12.48	61	5.6	2.5	277	7.67
11/25/2013	BC-29	22.30	16.97	736.21	None	CP	N/A	0.87	3.00	NO	14.58	50	4.8	8.9	525	2.34
11/25/2013	BC-30	34.10	29.54	746.18	None	CP	N/A	0.74	2.25	NO	12.79	76	5.3	11.5	507	7.24
11/26/2013	BC-31	83.30	61.87	754.53	None	LF	140	3.50	0.65	N/A	11.74	92	5.6	3.8	388	2.98
11/26/2013	BC-32	33.01	19.79	736.15	None	LF	240	2.16	1.40	N/A	14.68	1129	5.4	3.7	400	3.52
11/25/2013	BC-SW1	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A	N/A	7.16	123	5.9	19.8	391	8.44
11/25/2013	BC-LEACHATE	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A	N/A	15.27	2793	6.6	3.3	289	7.39

Notes:

1. Purge Methods; LF=Low Flow, CP=Conventional Purge (3-5 well volumes), NP=No Purge (HydraSleeve), LO=Level Only. Pump rate applicable to LF purging only.
2. Field sampling performed by Duke Energy Carolinas, LLC personnel.
3. EVAC indicates whether the water level in the well was drawn down to the level of the pump during purging.
4. umho/cm indicates microohms per centimeter.
5. SU indicates Standard Units.
6. NTU indicates Nephelometric Turbidity Units.
7. mV-NHE indicates millivolts-Normal Hydrogen Electrode.
8. mg/L indicates milligrams per liter.
9. N/A indicates not applicable.
10. Observation well BC-7 was gauged for depth to water only.
11. Information provided by Tim Hunsucker of Duke Energy Carolinas, LLC on December 16, 2013.

**Table 2–Field and Analytical Results**  
**Duke Energy Carolinas LLC/Belews Creek Steam Station**  
**FGD Residue Landfill, Permit No. 8505**

Sample Date: November 25-26, 2013 Laboratory Certificate Codes:  
Duke Energy Carolinas Field #5193  
Duke Energy Analytical Laboratory #248  
Field Sampling performed by Duke Energy Carolinas, LLC

Parameter	SWS ID	Units	Certificate Code	Monitoring Wells								SWSL	15A NCAC 2L
				8505 BC-20	8505 BC-21	8505 BC-22	8505 BC-23A	8505 BC-25	8505 BC-26	8505 BC-27			
Field pH	320	SU	5193	<b>5.1</b>	<b>5.2</b>	<b>5.5</b>	<b>5.6</b>	<b>5.1</b>	<b>4.7</b>	<b>4.8</b>	-	6.5-8.5	
Field Specific Conductance	323	umho/cm	5193	404	463	125	42	1,226	135	60	-	-	
Temperature	325	°C	5193	12.54	12.66	14.88	14.93	10.15	13.76	15.12	-	-	
Top of Casing	328	feet	-	757.22	756.69	765.91	863.79	745.96	749.32	761.88	-	-	
Depth to Water	318	feet	-	20.33	14.27	4.38	78.76	16.22	18.44	32.46	-	-	
Water Elevation	319	feet	-	736.89	742.42	761.53	785.03	729.74	730.88	729.42	-	-	
Well Depth	411	feet	-	24.22	16.77	13.00	101.21	23.15	23.26	34.95	-	-	
Arsenic	14	µg/L	248	0.078 U	0.329 J	0.078 U	0.078 U	0.186 J	0.078 U	0.457 J	10	10	
Barium	15	µg/L	248	156	25.1 J	96.7 J	36 J	64.5 J	267	30.1 J	100	700	
Boron	428	µg/L	248	12.3 J	3.3 U	4.67 J	3.3 U	11 J	3.3 U	3.3 U	NE	700	
Cadmium	34	µg/L	248	0.175 J	0.101 U	0.101 U	0.101 U	0.101 U	0.189 J	0.101 U	1	2	
Chloride	301	µg/L	248	5,440	16,500	4,420	2,200	20,300	9,730	3,420	NE	250,000	
Chromium	51	µg/L	248	0.512 J	0.5 U	0.5 U	2.15 J	5.26 J	0.949 J	1.26 J	10	10	
Copper	54	µg/L	248	1 U	1 U	1 U	1.09 J	5.18 J	1.24 J	1.24 J	10	1,000	
Fluoride	312	µg/L	248	118 J	114 J	34.1 J	78.3 J	113 J	59.5 J	62.5 J	2,000	2,000	
Iron	340	µg/L	248	<b>398</b>	46.7 J	78.1 J	<b>819</b>	<b>5,070</b>	<b>717</b>	<b>2,400</b>	300	300	
Lead	131	µg/L	248	0.065 U	0.065 U	0.065 U	0.241 J	0.992 J	0.209 J	0.585 J	10	15	
Manganese	342	µg/L	248	10.5 J	22.1 J	17 J	15.9 J	<b>51.4</b>	29.3 J	<b>150</b>	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	0.006 U	0.2	1	
Nickel	152	µg/L	248	5.76 J	0.568 J	0.5 U	0.767 J	39.5 J	7.27 J	0.926 J	50	100	
Nitrate (as Nitrogen)	303	µg/L	248	6,150 J	4,920 J	1,860 J	7.4 J	4,500 J	4,730 J	5.4 U	10,000	10,000	
Selenium	183	µg/L	248	1.78 J	2.69 J	0.546 J	0.201 J	7.98 J	0.35 J	0.547 J	10	20	
Silver	184	µg/L	248	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	10	20	
Sulfate	315	µg/L	248	168,000 J	173,000 J	26,500 J	237 J	<b>657,000</b>	15,900 J	547 J	250,000	250,000	
Total Dissolved Solids	311	µg/L	248	323,000	330,000	113,000	58,000	<b>1,030,000</b>	96,000	55,000	NE	500,000	
Zinc	213	µg/L	248	8.82 J	2.6 U	2.6 U	6.48 J	<b>33.1</b>	<b>50.8</b>	<b>15.5</b>	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. NCDENR defines the SWSL as 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.
- NE indicates not established. N/A indicates not applicable. Blank cells indicate that there is no information relevant to the respective row.
- Grayed values indicate values that attain or exceed the SWSL Standard.
- Bold values indicate values that attain or exceed the 15A NCAC 2L Standard.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used to identify results not detected at concentrations which attain the laboratory's method detection limit (MDL). "J" is used to identify estimated concentrations which attain or exceed 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 attain or exceed the laboratory's MRL but are less than the SWSL.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.
- NS indicates not sampled.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL or 2L Standard for chloride 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 December 16, 2013.

**Table 2–Field and Analytical Results**  
**Duke Energy Carolinas LLC/Belews Creek Steam Station**  
**FGD Residue Landfill, Permit No. 8505**

Sample Date: November 25-26, 2013 Laboratory Certificate Codes:  
Duke Energy Carolinas Field #5193  
Duke Energy Analytical Laboratory #248

Field Sampling performed by Duke Energy Carolinas, LLC

Parameter	SWS ID	Units	Certificate Code	Monitoring Wells					8505 SW-1	Field Blank	SWSL	15A NCAC 2L
				8505 BC-28	8505 BC-29	8505 BC-30	8505 BC-31	8505 BC-32				
Field pH	320	SU	5193	<b>5.6</b>	<b>4.8</b>	<b>5.3</b>	<b>5.6</b>	<b>5.4</b>	<b>5.9</b>	-	-	6.5-8.5
Field Specific Conductance	323	umho/cm	5193	61	50	76	92	1,129	123	-	-	-
Temperature	325	°C	5193	12.48	14.58	12.79	11.74	14.68	7.16	-	-	-
Top of Casing	328	feet	-	818.09	753.18	775.72	816.40	782.94	-	-	-	-
Depth to Water	318	feet	-	51.72	16.97	29.54	61.87	19.79	-	-	-	-
Water Elevation	319	feet	-	766.37	736.21	746.18	754.53	763.15	-	-	-	-
Well Depth	411	feet	-	60.20	22.30	34.10	83.30	33.01	-	-	-	-
Arsenic	14	µg/L	248	0.078 U	0.078 U	0.078 U	0.101 J	0.250 J	0.233 J	0.078 U	10	10
Barium	15	µg/L	248	30.9 J'	<b>118</b>	20.6 J'	10.7 J'	53.6 J'	33.3 J'	0.398 J	100	700
Boron	428	µg/L	248	3.3 U	3.3 U	3.3 U	3.3 U	6.05 J	3.3 U	3.3 U	NE	700
Cadmium	34	µg/L	248	0.101 U	0.101 U	0.101 U	0.101 U	0.532 J	0.101 U	0.101 U	1	2
Chloride	301	µg/L	248	1,680	5,170	4,350	1,490	3,200	4,150	22 U	NE	250,000
Chromium	51	µg/L	248	0.717 J	0.5 U	0.779 J	0.913 J	0.5 U	0.5 U	0.5 U	10	10
Copper	54	µg/L	248	1.8 J	1 U	1 U	1 U	1 U	1 U	1 U	10	1,000
Fluoride	312	µg/L	248	75.2 J	61 J	77.8 J	126 J'	138 J	87.2 J	20 J	2,000	2,000
Iron	340	µg/L	248	148 J'	245 J'	<b>369</b>	<b>1,320</b>	97.1 J'	<b>3,100</b>	17.3 J'	300	300
Lead	131	µg/L	248	0.150 J	0.065 U	0.189 J	0.105 J	0.340 J	0.226 J	0.065 U	10	15
Manganese	342	µg/L	248	6.97 J'	7.48 J'	7.48 J'	<b>106</b>	<b>222</b>	<b>259</b>	0.69 J	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	0.006 U	0.2	1
Nickel	152	µg/L	248	0.901 J	0.557 J	0.5 U	1.31 J	48 J'	0.988 J	0.5 U	50	100
Nitrate (as Nitrogen)	303	µg/L	248	1,200 J'	284 J'	530 J'	340 J'	1,700 J'	58.8 J'	5.4 U	10,000	10,000
Selenium	183	µg/L	248	0.092 U	0.151 J	0.171 J	0.274 J	5.72 J'	0.232 J	0.146 J	10	20
Silver	184	µg/L	248	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	10	20
Sulfate	315	µg/L	248	466 J'	620 J'	684 J'	1,750 J'	<b>517,000</b>	14,600 J'	18 U	250,000	250,000
Total Dissolved Solids	311	µg/L	248	70,000	46,000	78,000	95,000	<b>794,000</b>	90,000	N/A	NE	500,000
Zinc	213	µg/L	248	3.67 J	4.0 J	2.6 U	2.6 U	<b>35.2</b>	<b>13.7</b>	2.68 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. NCDENR defines the SWSL as 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.
- NE indicates not established. N/A indicates not applicable. Blank cells indicate that there is no information relevant to the respective row.
- Grayed values indicate values that attain or exceed the SWSL Standard.
- Bold values indicate values that attain or exceed the 15A NCAC 2L Standard.
- Qualifiers in non-italicized text are laboratory data qualifiers or "flags". "U" is used to identify results not detected at concentrations which attain the laboratory's method detection limit (MDL). "J" is used to identify estimated concentrations which attain or exceed 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 attain or exceed the laboratory's MRL but are less than the SWSL.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.
- NS indicates not sampled.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL or 2L Standard for chloride 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 December 16, 2013.

**Table 3–Leachate Field and Analytical Results  
Duke Energy Carolinas LLC/Belews Creek Steam Station  
FGD Residue Landfill, Permit No. 8505**

Sample Date: November 25-26, 2013 Laboratory Certificate Codes:  
Duke Energy Carolinas Field #5193  
Duke Energy Analytical Laboratory #248  
Field Sampling performed by Duke Energy Carolinas, LLC

Parameter	SWS ID	Units	Certificate Code	8505 Leachate		SWSL
Field pH	320	SU	5193	6.6		-
Field Specific Conductance	323	umho/cm	5193	2,793		-
Temperature	325	°C	5193	15.27		-
Arsenic	14	µg/L	248	1.55	J	10
Barium	15	µg/L	248	18.7	J'	100
Boron	428	µg/L	248	10,600		NE
Cadmium	34	µg/L	248	1.01	U	1
Chloride	301	µg/L	248	91,200		NE
Chromium	51	µg/L	248	0.5	U	10
Copper	54	µg/L	248	1.5	J	10
Fluoride	312	µg/L	248	1,140	J'	2,000
Iron	340	µg/L	248	11.8	J'	300
Lead	131	µg/L	248	0.65	U	10
Manganese	342	µg/L	248	9,680		50
Mercury	132	µg/L	248	0.006	U	0.2
Nickel	152	µg/L	248	8.29	J'	50
Nitrate (as Nitrogen)	303	µg/L	248	2,830	J'	10,000
Selenium	183	µg/L	248	1,160		10
Silver	184	µg/L	248	0.7	U	10
Sulfate	315	µg/L	248	1,420,000		250,000
Total Dissolved Solids	311	µg/L	248	2,670,000		NE
Zinc	213	µg/L	248	11.8		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. NCDENR defines the SWSL as the lowest amount of analyte in a sample that can be quantitatively determined with suitable precision and accuracy.
- NE indicates not established. Blank cells indicate that there is no information relevant to the respective row.
- 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 to identify results not detected at concentrations which attain the laboratory's method detection limit (MDL). "J" is used to identify estimated concentrations which attain or exceed 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 attain or exceed the laboratory's MRL but are less than the SWSL.
- SU indicates Standard Units.
- umho/cm indicates micromhos per centimeter.
- According to the Constituent Look-up webpage on the NCDENR Division of Waste Management webpage, there is no SWSL or 2L Standard for chloride 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 December 16, 2013.

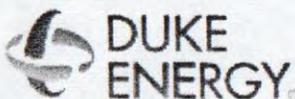
**Table 4—Analytical Results that Equal or Exceed  
NCAC 2L Groundwater Quality Standards  
Duke Energy Carolinas LLC/Belews Creek Steam Station  
FGD Residue Landfill, Permit No. 8505**

Sample Date: November 25-26, 2013						
Parameter	Sample ID	Result	Units	15A NCAC 2L Standard	Historical Concentrations	Cause and Significance
Field pH	BC-20	5.1	SU	6.5 - 8.5	5.1 - 5.9	pH in BC-20 is consistent with the lowest historical reading at well.
	BC-21	5.2	SU		4.7 - 5.8	pH in BC-21 is consistent with historical readings at well.
	BC-22	5.5	SU		5.5 - 5.9	pH in BC-22 is consistent with the lowest historical reading at well.
	BC-23A	5.6	SU		5.4 - 6.1	pH in BC-23A is consistent with historical readings at well.
	BC-25	5.1	SU		5.0 - 5.8	pH in BC-25 is consistent with historical readings at well.
	BC-26	4.7	SU		4.7 - 5.2	pH in BC-26 is the lowest reading over the period of monitoring.
	BC-27	4.8	SU		4.8 - 5.7	pH in BC-27 is the lowest reading over the period of monitoring.
	BC-28	5.6	SU		5.6 - 6.1	pH in BC-28 is consistent with the lowest historical reading at well.
	BC-29	4.8	SU		4.8 - 5.5	pH in BC-29 is the lowest reading over the period of monitoring.
	BC-30	5.3	SU		5.3 - 5.9	pH in BC-30 is the lowest reading over the period of monitoring.
	BC-31	5.6	SU		5.5 - 6.6	pH in BC-31 is consistent with historical readings at well.
	BC-32	5.4	SU		5.3 - 5.4	pH in BC-32 is the highest reading over the period of monitoring. This is the second sampling event at BC-32.
	SW-1	5.9	SU		5.9 - 7.2	pH at SW-1 is the lowest reading over the period of monitoring.
Iron	BC-20	398	µg/L	300	398 - 148,000	Iron concentration in BC-20 is the lowest concentration measured over the period of monitoring. Turbidity measured at 11 NTUs.
	BC-23A	819	µg/L		157 - 8,733	Iron concentration in BC-23A is consistent with historical readings at well. Turbidity measured at 25.8 NTUs.
	BC-25	5,070	µg/L		374 - 288,000	Iron concentration in BC-25 is consistent with historical readings at well. Turbidity measured at 95.5 NTUs.
	BC-26	717	µg/L		183 - 6,050	Iron concentration in BC-26 is consistent with historical readings at well.
	BC-27	2,400	µg/L		2,400 - 32,300	Iron concentration in BC-27 is the lowest concentration measured over the period of monitoring. Turbidity measured at 18.8 NTUs.
	BC-30	369	µg/L		228 - 11,800	Iron concentration in BC-30 is consistent with historical readings at well. Turbidity measured at 11.5 NTUs.
	BC-31	1,320	µg/L		513 - 22,300	Iron concentration in BC-31 is consistent with historical readings at well.
	SW-1	3,100	µg/L		1,010 - 7,625	Iron concentration at SW-1 is consistent with historical readings. Turbidity measured at 19.8 NTUs.
Manganese	BC-25	51.4	µg/L	50	5.6 - 942	Manganese concentration in BC-25 is consistent with historical readings at well. Turbidity measured at 95.5 NTUs.
	BC-27	150	µg/L		113 - 780	Manganese concentration in BC-27 is consistent with historical readings at well. Turbidity measured at 18.8 NTUs.
	BC-31	106	µg/L		17 - 810	Manganese concentration in BC-31 is consistent with historical readings at well.
	BC-32	222	µg/L		222 - 234	Manganese concentration in BC-32 is the lowest concentration measured over the period of monitoring. This is the second sampling event at monitoring well BC-32.
	SW-1	259	µg/L		259 - 1,779	Manganese concentration in SW-1 is the lowest concentration measured over the period of monitoring. Turbidity measured at 19.8 NTUs.
Sulfate	BC-25	657,000	µg/L	250,000	14,320 - 930,000	Sulfate concentration in BC-25 is consistent with historical readings at well.
	BC-32	517,000	µg/L		490,000 - 517,000	Sulfate concentration in BC-32 is the highest concentration measured over the period of monitoring. This is the second sampling event at monitoring well BC-32.
Total Dissolved Solids	BC-25	1,030,000	µg/L	500,000	74,000 - 1,480,000	TDS concentration in BC-25 is consistent with historical readings at well.
	BC-32	794,000	µg/L		789,000 - 794,000	TDS concentration in BC-32 is the highest concentration measured over the period of monitoring. This is the second sampling event at monitoring well BC-32.

- Notes:
- 15A NCAC 2L Standard refers to Class GA Standards as found in 15A NCAC 02L .0202 Groundwater Standards, last amended on April 1, 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 analytical results database.

## **APPENDICES**

**APPENDIX A**  
**CHAIN-OF-CUSTODY FORMS**



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

Duke Energy Analytical Lab Services

Mail Code MGO3A2 (Building 7405)  
13339 Hagers Ferry Rd  
Huntersville, N. C. 28078

(980) 875-5245

(980) 875-5038

Fax:

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM

Analytical Laboratory Use Only

LIMS #	J13100412	MATRIX: GW-RCRA	Samples Originating From	NC <input checked="" type="checkbox"/> SC <input type="checkbox"/>
Logged By	Date & Time		SAMPLE PROGRAM	
D. Baker	11/26/13 0648		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)			
	0.7°C			
PO #	15 Preserv.: 1=HCL 2=H <sub>2</sub> SO <sub>4</sub> 3=HNO <sub>3</sub> 4=Ice 5=None			
MR #				
Customer to complete all appropriate NON-SHADED areas.				

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DISTRIBUTION  
ORIGINAL to LAB,  
COPY to CLIENT

Revised 5/14/13

1) Project Name	BELEWS CREEK FGD LANDFILL #85-05	Permit	2) Phone No: 980-875-5257
3) Client	LDC / TSH / Ed Sullivan	4) Fax No: 875-4349	
5) Business Unit:	20003	6) Process:	BENVWS
7) Resp. To:	BC00	8) Project ID:	
9) Activity ID:		10) Mail Code:	MG03A3

LAB USE ONLY
11 Lab ID
2013026033
2013026034
2013026035
2013026036
2013026037
2013026038
2013026039
2013026040
2013026041
2013026042
2013026043
2013026193
2013026044
2013026045
2013026046

Customer to complete appropriate columns to right

11 Lab ID	13 Sample Description or ID	14 Collection Information			15 TESTS	16 Analytes Required	17 Grab	18 NO <sub>3</sub> -N, SO <sub>4</sub> , Cl, F, - (10) and F <sub>2</sub> Alk (4,5)	19	20 Total # of Containers
		Date	Time	Signature						
2013026033	BC-20				6	X	1		1	3
2013026034	BC-21				6	X	1		1	3
2013026035	BC-22				6	X	1		1	3
2013026036	BC-23A	11/25/13	1140	WC	6	X	1		1	3
2013026037	BC-25				6	X	1		1	3
2013026038	BC-26	11/25/13	1410	WC	6	X	1		1	3
2013026039	BC-27	11/25/13	1300	WC	6	X	1		1	3
2013026040	BC-28				6	X	1		1	3
2013026041	BC-29	11/25/13	0845	WC	6	X	1		1	3
2013026042	BC-30	11/25/13	1010	WC	6	X	1		1	3
2013026043	BC-31				6	X	1		1	3
2013026193	BC-32				6	X	1		1	3
2013026044	SW-1	11/25/13	1200	WC	6	X	1		1	3
2013026045	LEACHATE	11/25/13	1445	WC	6	X	1		1	3
2013026046	FIELD BLANK				5	X	1		1	2

Customer to sign & date below

21) Relinquished By	<i>TD Gell</i>	Date/Time	11/25/13 1745	Accepted By:	<i>Jamela S. Bdu</i>	Date/Time	11/26/13 0635
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 <input checked="" type="checkbox"/>
	*7 Days <input type="checkbox"/>
	- 48 Hr <input type="checkbox"/>
	*Other <input type="checkbox"/>
	* Add. Cost Will Apply

24) Comments	Regulatory Agency : NCDENR/DWM -SW Section - State EDD Format Required / Permit # 85-05	Use indicated or
	comparable analytical methods	



# 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/>

Customer must Complete

1) Project Name <b>BELEWS CREEK FGD LANDFILL #85-05</b>	2) Phone No: 980-875-5257
3) Client <b>LDC / TSH / Ed Sullivan</b>	4) Fax No: 875-4349
5) Business Unit: 20003	6) Process: <b>BENVWS</b>
7) Resp. To: <b>BC00</b>	8) Project ID:
9) Activity ID:	10) Mail Code: <b>MG03A3</b>

Analytical Laboratory Use Only			
LIMS # <b>J13100412</b>	MATRIX: <b>GW-RCRA</b>	Samples Originating From NC <input checked="" type="checkbox"/> SC <input type="checkbox"/>	
Logged By <b>BGeorge</b>	Date & Time <b>11/27/13</b>	Cooler Temp (C) <b>7:48</b>	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	PO #	15 Preserv.: 1=HCL 2=H2SO4 3=HNO3 4=Ice 5=None	4
MR #	Customer to complete all appropriate NON-SHADED areas.		3

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 DISTRIBUTION ORIGINAL to LAB, COPY to CLIENT

Revised 5/14/13

- LAB USE ONLY
- 11 Lab ID
  - 2013026033
  - 2013026034
  - 2013026035
  - 2013026036
  - 2013026037
  - 2013026038
  - 2013026039
  - 2013026040
  - 2013026041
  - 2013026042
  - 2013026043
  - 2013026193
  - 2013026044
  - 2013026045
  - 2013026046

Customer to complete appropriate columns to right

11 Lab ID	13 Sample Description or ID	14 Collection Information			15 TESTS	16 Grab	17 NO3-N, SO4, Cl, F, (f)C and F_Aik (4,5)	18	19	20 Total # of Containers
		Date	Time	Signature						
		15 Analyses Required	16 Grab	17 NO3-N, SO4, Cl, F, (f)C and F_Aik (4,5)						
2013026033	BC-20	11/26/13	0655	VC	6	X	1		1	3
2013026034	BC-21	11/26/13	0805	VC	6	X	1		1	3
2013026035	BC-22	11/26/13	0910	VC	6	X	1		1	3
2013026036	BC-23A	11/25/13	1140	VC	6	X	1		1	3
2013026037	BC-25	11/26/13	1305	VC	6	X	1		1	3
2013026038	BC-26	11/25/13	1410	VC	6	X	1		1	3
2013026039	BC-27	11/25/13	1300	VC	6	X	1		1	3
2013026040	BC-28	11/26/13	1210	VC	6	X	1		1	3
2013026041	BC-29	11/25/13	0845	VC	6	X	1		1	3
2013026042	BC-30	11/25/13	1010	VC	6	X	1		1	3
2013026043	BC-31	11/26/13	1125	VC	6	X	1		1	3
2013026193	BC-32	11/26/13	1005	VC	6	X	1		1	3
2013026044	SW-1	11/25/13	1200	VC	6	X	1		1	3
2013026045	LEACHATE	11/25/13	1445	VC	6	X	1		1	3
2013026046	FIELD BLANK	11/26/13	1345	VC	5	X	1		1	2

Metals Prep - TRM  
 (ICP- EPA-200.7) Ag, B, Ba, Ca, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Zn (13)  
 Hg (EPA 245.1) (1)  
 (IMS-EPA-200.8) As, Cd, Pb, Se (4)

21) Relinquished By <b>LD GEM</b>	Date/Time <b>11/25/13 1745</b>	Accepted By: <b>[Signature]</b>	Date/Time <b>11/27/13 7:35</b>
Relinquished By <b>LD GEM</b>	Date/Time <b>11/27/13 0735</b>	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 # 85-05  
 comparable analytical methods

Use indicated or