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head calculations. Underground piping would be in trenches. Figure 6-88d is a conceptual representation of a pipeline trench. Extraction well discharge headers would connect each well to the groundwater extraction system and would discharge extracted groundwater to duplex pump stations. Extracted groundwater would flow to the pump stations via gravity drain. Force mains would transfer groundwater from force mains to the Cliffside WWTP via the pipe rack that crosses Suck Creek. Aboveground piping would be insulated and heated seasonally to prevent freezing.

Wastewater Discharge Piping To Basement Basin (Holding Cell) (STEP 6b)

(CAP Content Section 6.E.b.i)

Extracted groundwater would be conveyed through existing storm water piping. According to Cliffside plant personnel, the storm water piping tracks to the northwest and along the road to the Basement Basin (Holding Cell) where it is comingled with process water before being treated and discharged.

Treatment of Extracted Groundwater (STEP 7)

(CAP Content Section 6.E.b.i)

Extracted groundwater would be directed to storm sewer piping located between Cooling Towers A and B. Extracted groundwater would be discharged to a new manhole (**Figure 6-88a**) that would be tied into existing piping that is routed the Basement Basin. There it would mix with process water and would be transferred to the Cliffside WWTP, which is a physical/chemical treatment system consisting of pH adjustment, coagulation and flocculation. Solids are removed from the wastewater using high-rate clarifiers and polishing filters, if necessary. Wastewater is discharged to the Broad River through NPDES Outfall 005. There is no indication that any permit parameters would be exceeded (**Table 6-35**).

Electrical and Instrumentation Design

(CAP Content Section 6.E.b.i)

The design package would provide the necessary plans and specifications for procurement of materials and construction purposes. This would include Site layout drawings, plans and profiles, well enclosure details, trench and discharge piping outlet details, well construction schematics, piping and instrumentation diagrams/drawings and complete equipment, materials and construction specifications.

Existing power near the system might not be adequate for the anticipated number of wells. Additional power might need to be a component of the design. Control panels might also be necessary for each distinct area of the well systems. The control systems would be equipped with system shutdown notification.

Design Documents

(CAP Content Section 6.E.b.i)

The design package would provide the necessary plans and specifications for procurement of materials and construction purposes. This would include Site layout drawings, plans and profiles, well enclosure details, trench and discharge piping outlet details, well construction schematics, piping and instrumentation diagrams/drawings and complete equipment, materials and construction specifications.

System Operation and Maintenance

(CAP Content Section 6.E.b.i)

Groundwater extraction well and source control trench performance would be monitored and tracked to determine if there is a loss in pumping efficiency due to mineral and/or biological fouling. If well performance monitoring indicates a decrease in flow rate, the well would be inspected for fouling and the screens would be cleaned as appropriate.

In addition to well performance monitoring and maintenance, other system elements, such as pumps controls, would receive routine maintenance in accordance with the manufacturer's recommendations. Groundwater samples would be collected from the following monitoring wells to evaluate treatment effectiveness:

- GWA-36S
- GWA-36D
- GWA-37S
- GWA-4D
- MW-38S
- MW-38D
- MW-38BR

6.26.2.2 Design Assumptions, Calculations, and Specifications

(CAP Content Section 6.E.b.ii)

Design calculations are presented in **Appendix N.**

6.26.2.3 Permits

(CAP Content Section 6.E.b.iii)

Discharge of extracted groundwater extracted under Alternative 3 would require modification of NPDES Permit NC0005088 to include discharge of groundwater. When modified, NPDES Permit NC0005088 would allow for the discharge of groundwater at Outfall 005.

6.26.2.4 Construction Schedule and Cost of Implementation

(CAP Content Section 6.E.e.i)

The time to construct Groundwater Alternative 3 is estimated to be 2 months. Duke Energy would provide construction reports monthly from the beginning of construction until construction is complete.

Reporting would include:

- Health and Safety/Man Hours.
- Tasks completed for the month prior.
- Problems affecting schedule (*e.g.,* inclement weather).
- Measures taken to achieve construction milestones (*e.g.,* increase number of drilling crews).
- Contingencies.
- Tasks to be completed by next reporting period.
- Provide updated schedule/Gantt chart.

Progress reports would be prepared and submitted to NCDEQ monthly.

The cost estimate for this alternative is based on capital costs for design and implementation. Implementation includes pumping tests, installation of extraction wells, submersible pumps, instrumentation, piping, and telemetry system. Long term O&M costs include groundwater monitoring costs, analytical costs, reporting costs, periodic redevelopment and replacement of monitoring wells, and periodic replacement of submersible pumps

A detailed cost estimate for this Alternative is provided in **Appendix K**. The cost estimate is based on capital costs for design and implementation, and the operations, maintenance (O&M) and monitoring costs. The design costs

include work plans, design documents and reports necessary for implementation of the alternative. Implementation costs include procurement and construction. O&M costs are based on annual routine labor, materials and equipment to effectively conduct monitoring, routine annual and 5-year reporting, and routine and non-routine maintenance costs.

6.26.2.5 Measure to Ensure Health and Safety

(CAP Content Section 6.E.b.v)

There is no measurable difference between evaluated Site risks and risks indicated by background concentrations; therefore, no material increases in risks to human health related to the ash basin have been identified. The groundwater corrective action is being planned to address regulatory requirements. The risk assessment (**Appendix E**) identified no current human health or ecological risk associated with groundwater downgradient of the U5 AB. Water supply wells are located upgradient of the ash basin and municipal water connections have been provided to those who selected this option. Surface water quality standards downgradient of the COI-affected plume are also met. Based on the absence of receptors, it is anticipated that groundwater extraction would create conditions that continue to be protective of human health and the environment because the COI concentrations will diminish with time.

6.26.2.6 Description of All Other Activities and Notifications Being Conducted to Ensure Compliance with 02L, CAMA, and Other Relevant Laws and Regulations

(CAP Content Section 6.E.b.vi)

The CAP provides a description of activities related to compliance with 02L, CAMA, in regard to the U5 AB.

6.26.3 Requirements for 02L .0106(l) – MNA

(CAP Content Section 6.E.c)

The requirements for implementing corrective action by MNA, under 02L .0106(l), are provided in **Section 6.23.1** and **Appendix I**. MNA is not applicable at this time for Cliffside as described in **Section 6.23.1**.

6.26.4 Requirements for 02L .0106(k) – Alternate Standards

(CAP Content Section 6.E.d)

Regulation 02L .0106(k), states that a request may be made for approval of a corrective action plan that uses standards other than the 02L groundwater quality standards. G.S. Section 130A, Article 9, Part 8 allows risk-based remediation as a clean-up option where the use of remedial actions and land use controls can manage properties safely for intended use. Risk-based corrective action is where constituent concentrations are remediated to an alternative standard based on the actual posed risks rather than applicable background-levels or regulatory standards. The requirements for implementing corrective action by remediating to alternate standards, under 02L .0106(k), are as follows:

- *Sources are removed or controlled;*
- *Time and direction of contaminant travel can be predicted with reasonable certainty;*
- *COIs have and will not migrate onto adjacent properties unless specific conditions are met (i.e., alternative water sources, written property owner approval, etc.);*
- *Standards specified in Rule .0202 of this Subchapter will be met at a location no closer than one year time of travel upgradient of an existing or foreseeable receptor, based on travel time and the natural attenuation capacity of subsurface materials or on a physical barrier to groundwater migration that exists or will be installed by the person making the request;*
- *If contaminant plume is expected to intercept surface waters, the groundwater discharge will not possess contaminant concentrations that would result in violations of standards for surface waters contained in 15A NCAC 02B .0200;*
- *Public notice of the request has been provided in accordance with Rule .0114(b) of this Section; and*
- *Proposed corrective action plan would be consistent with all other environmental laws*

Because historical and ongoing assessment indicates that there is not the potential for off-Site groundwater flow, Cliffside meets the requirements for implementing corrective action under 02L .0106(k) at this time.

6.26.5 Sampling and Reporting

(CAP Content Section 6.E.e)

An EMP has been developed as part of this CAP consistent with 02L .0106(h)(4). The EMP is designed to monitor groundwater conditions at the CSS and document progress towards the remedial objectives over time. This plan is designed to be adaptive over the project life cycle and can be modified as the groundwater remediation system design is prepared, completed, or evaluated for termination.

Duke Energy implemented an IMP after the plan was that was submitted to NCDEQ on October 23, 2018. Additional modifications to the plan were approved by NCDEQ on April 4, 2019 (**Appendix A**). The IMP includes the locations of groundwater wells sampled quarterly and semiannually.

The EMP is required by G.S. Section 130A-309.211(b)(1)(e). The IMP will be replaced by the EMP upon NCDEQ approval of the CAP Update. Either submittal of the EMP, or the pilot test work plan and permit applications (as applicable), will fulfill G.S. Section 130A-309.209(b)(3).

The EMP, presented in **Appendix O**, is designed to be adaptable and target key areas where changes to groundwater conditions are most likely to occur due to corrective action and ash basin closure activities. The EMP will be used to evaluate progress towards remediation. EMP key areas for monitoring are based on the following considerations:

1. Include background locations
2. Include designated flow paths with area of groundwater remediation
3. Within areas of observed or anticipated changing Site conditions, and/or have increasing constituent concentration trends
4. Will effectively monitor COIs plume stability and model simulation verification

EMP elements including well systems, locations, frequency, parameters, schedule and reporting evaluation are summarized below and outlined on **Table 6-40.** Effectiveness monitoring well locations are illustrated on **Figure 6-91**. The EMP will be implemented 30 days after CAP approval, and will continue until there is a total of three years of data confirming COIs are below applicable standards at or beyond the compliance boundary, at which time a request for completion of active remediation will be filed with NCDEQ. If applicable

standards are not met, the EMP will continue and transition to post-closure monitoring, if necessary.

After ash basin closure and following ash basin closure certification, a post-closure groundwater monitoring plan (PCMP) will be implemented at the Site for a minimum of 30 years in accordance with G.S. Section 130A-309.214(a)(4)k.2. If groundwater monitoring results are below applicable standards at the compliance boundary for three years, Duke Energy may request completion of corrective action in accordance with G.S. Section 130A-309.214(a)(3)b. If groundwater monitoring results are above applicable standards, the PCMP will continue. An EMP work flow and optimization process is outlined on a flow chart on **Figure 6-92**.

Optimization of the plan to help determine the remedy's performance, appropriate number of sample locations, sampling frequency, and laboratory analytes, and statistical analysis to evaluate the plume stability conditions would be conducted during EMP review periods. The optimization process would be conducted using software designed to improve long-term groundwater monitoring programs such as Monitoring and Remediation Optimization System (MAROS).

6.26.5.1 Progress Reports and Schedule

(CAP Content Section 6.E.e.i)

The effectiveness monitoring plan for Source Area 3 will be consistent with the EMP presented in **Section 6.8.5.1** and provided in **Appendix O.**

6.26.5.2 Sampling and Reporting Plan During Active Remediation

(CAP Content Section 6.E.e.ii)

See **Section 6.8.6.2** regarding sampling and reporting during active remediation for Source Area 3.

6.26.6 Termination of Groundwater Remediation Alternative

(CAP Content Section 6.E.e.iii)

Termination of the proposed remedial alternative would be consistent with and implemented in accordance with NCDEQ 15A NCAC 02L .106 (m). A flow chart of the request and review timeline for termination is outlined on **Figure 6-93**. Completion of this phase might also provide stakeholders with an opportunity to evaluate terminating the system, as appropriate, near the well or wells where groundwater restoration completion is being evaluated.

Groundwater remediation effectiveness monitoring would transition to the attainment monitoring phase when NCDEQ determines that the remediation monitoring phase is complete at a particular well or area.

6.26.7 Interim Activities

(CAP Content Section 6.E.a.iv; 6.E.a.v; 6.E.f)

Bench Scale Testing

(CAP Content Section 6.E.f)

Bench scale testing would evaluate media that might have the potential to neutralize acidic surface water flowing west of the southernmost cooling tower. Media to be evaluated might include limestone, recycled concrete, or similar. The bench scale testing would also evaluate the minimum residence time versus media surface area to neutralize the acidic surface water. Bench scale testing results would be used to develop the final design of the infiltration trench.

6.26.8 Implementation Schedule

In accordance with requirements of G.S. Section 130A-309.211(b)(3), implementation of the proposed corrective action for Source Area 3 will begin within 30 days of NCDEQ approval of the CAP Update.

During pilot testing, extracted groundwater will be collected and analyzed for geochemical parameters consistent with the NPDES permit**.**

Additional interim activities to be conducted prior to implementation of the corrective action remedy include:

- Implementation of the EMP within 30 days of CAP approval
- Submittal of permit and registration applications to NCDEQ, as applicable.

6.26.9 Contingency Plan

(CAP Content Section 6.E.g)

The purpose of the Contingency Plan is to monitor changes in conditions and operations to effectively reach the remedial action objectives. The contingency plan addresses operations, groundwater conditions and performance.

The Contingency Plan will be defined in greater detail as design elements of the system are finalized. A groundwater monitoring program to measure and track the effectiveness of the proposed extraction and infiltration system for Source Area 3 is described in **Appendix O**. This plan is designed to be adaptive and can

be modified as the groundwater remediation system design is prepared, completed, or evaluated for termination. The contingency plan for Source Area 3 will be similar to the contingency plan proposed for Source Area 1 as described in **Section 6.8.9**.

6.27 SA3 Corrective Action Approach Summary

This CAP Update includes a proposed remedial alternative that would address COIs in groundwater beyond the U5 AB compliance boundary to the northeast. This CAP Update provides:

- A screening and ranking process of three potential groundwater corrective action alternatives.
- A selection and description of the proposed targeted corrective action: Groundwater Remedial Alternative 3, Groundwater Extraction and Source Control.
- Specific plans, including engineering details where applicable, for restoring groundwater quality.
- An EMP for evaluating the performance and effectiveness of the proposed targeted corrective action and its effect on the movement of the affected groundwater plume. The EMP uses an optimized groundwater monitoring system with multiple groundwater flow paths in the area of corrective action that would monitor geochemical and physical conditions.
- A schedule for the implementation and operation of the proposed groundwater corrective action strategy.
- Planned activities prior to full-scale implementation include pumping tests. A pumping test work plan would be submitted to NCDEQ within 30 days of CAP approval to fulfill G.S. Section 130A-309.211(b)(3).

6.28 Summary and Conclusions

This CAP Update meets the corrective action requirements under G.S. and Subchapter 02L.0106 and to addresses Subchapter 02L .0106(j). This CAP Update proposes a remedy for COIs in groundwater associated with the AAB, U1-4 AB, U5 AB, and ASA that are at or beyond the compliance boundaries. This CAP Update provides:

- Groundwater remediation approaches that can be implemented under either closure scenario (closure-in-place or closure-by-excavation).

- A screening process of multiple potential groundwater corrective action alternatives that would address areas requiring corrective action.
- A selection and description of the favored corrective action groundwater remedy for the AAB and ASA: **Alternative 2 – Groundwater Extraction Combined with Clean Water Infiltration and Treatment.**
- A selection and description of the favored corrective action groundwater remedy for the U1-4 AB: **Alternative 2 – Continued Monitoring with Phytoremediation and TreeWell™ Technology.**
- A selection and description of the favored corrective action groundwater remedy for the U5 AB: **Alternative 3 - Groundwater Extraction.**
- Specific plans, including engineering design details, for restoring groundwater quality.
- A schedule for the implementation and operation of the corrective action strategies.
- A monitoring plan for evaluating the performance and effectiveness of corrective action groundwater remedies, and their effect on the restoration of groundwater quality.

Planned activities prior to full-scale implementation include pilot testing in selected areas and water treatment testing. Pilot test work plan(s) will be submitted to NCDEQ within 30 days of CAP approval to fulfill G.S. Section 130A-309.211(b)(3).

7.0 PROFESSIONAL CERTIFICATIONS

(CAP Content Section 7)

Certification for the Submittal of a Corrective Action Plan

Responsible Party and/or Permittee: Duke Energy Progress, LLC

Contact Person: Paul Draovitch

Address: 526 South Church Street

City: Charlotte **State:** NC **Zip Code:** 28202

Site Name: Cliffside Steam Station

Address: 573 Duke Power Road

City: Mooresboro **State:** NC **Zip Code:** 28114-7754

Groundwater Incident Number (applicable): NA/Coal Ash Management Act CAP

We, Scott A. Spinner, **Professional Geologist** and James E. Clemmer, a **Professional Engineer** for SynTerra Corporation (firm or company of employment) do hereby certify that the information indicated below is enclosed as part of the required Corrective Action Plan (CAP) and that to the best of my knowledge the data, assessments, conclusions, recommendations and other associated materials are correct, complete and accurate.

(Affix Seal and Signature)

Scott A. Spinner, NC LG 2243
Project Manager

James E. Clemmer, NC PE 18675
Project Engineer

Sworn to and subscribed
before me this
27 day of December 2019

DARNELL B. DELLINGER
Notary Public, State of South Carolina
My Commission Expires 12/22/2025

8.0 REFERENCES

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TABLES

(CAP Content Section 9)

Table ES-1

Summary of CSS Assessment Documentation

Included in Executive Summary text

Table ES-2

Summary of CSS Assessment Activities

Included in Executive Summary text

Table ES-3

Components of Source Control, Active Remediation, and Monitoring

Included in Executive Summary text

TABLE 1-1
SUMMARY OF ONSITE INCIDENTS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Station Name	Station Location	DEQ Section	Incident Number	Occurrence Date	Status	Closure Date	Release Type	Latitude	Longitude	Proximity to Basins (ft)	Notes
Cliffside	Mooresboro	UST	3693	7/15/1988	Closed	6/23/1997	Petroleum	35.220833	-81.7575	400	
Cliffside	Mooresboro	UST	28482	10/9/2006	Closed	2/5/2007	Petroleum	35.218611	-81.759722	496	Incident Name: Duke Dozer Diesel
Cliffside	Mooresboro	UST	28594	12/17/2007	Closed	3/7/2008	Petroleum	35.208056	-81.770556	1,251	Incident Name: Duke Energy Parcel 6
Cliffside	Mooresboro	UST	28595	12/13/2007	Closed	3/7/2008	Petroleum	35.207778	-81.765556	548	Incident Name: Duke Energy Parcel 33
Cliffside	Mooresboro	UST	28596	12/21/2007	Closed	3/7/2008	Petroleum	35.208889	-81.77	1,019	Incident Name: Duke Energy Parcel 34
Cliffside	Mooresboro	UST	41322	11/5/2014	Open	NA	Petroleum	35.22	-81.76	560	Incident Name: #5 Fuel Oil Release

Prepared By: TJG Checked By: SAS

Notes:

Onsite incident records provided by Duke Energy

DEQ - Department of Environmental Quality

ft - feet

UST - Underground Storage Tank

NA - Not Available

TABLE 3-1
SUMMARY OF ONSITE FACILITIES
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Facility Name	Evaluated as Source Area in CAP Update	CSA Schedule	Operational Status	Source Material	Area or Capacity	Rationale for Evaluation
Active Ash Basin	Yes	NA	Inactive	Coal Ash/NPDES Permitted waste streams	86 acres	CAMA regulated unit
Ash Storage Area	Yes	NA	Inactive	Coal Ash	7 acres	Adjacent to and within same groundwater flow regime as AAB
Unit 5 Inactive Ash Basin	Yes	NA	Inactive	Coal Ash	46 acres	CAMA regulated unit
Former Units 1-4 Ash Basin	Yes	NA	Closed	Coal Ash	14 acres	CAMA regulated unit
Unit 6 Source Area	No	March 2020	Not Applicable	Unknown	Unknown	In separate groundwater flow regime from ash basins; select monitoring data included in CAP figures and modeling since certain CAMA wells monitor nearby groundwater. This area has been determined to be a separate source area from the AAB (groundwater is not underflowing Suck Creek at this location contributing to groundwater standard exceedances). Area will be assessed on a separate timeline.
CCP Landfill	No	NA	Operational	Coal Ash and operational waste	Phase 1 – 23.3 acres Phase 2 – 16.9 acres	Not hydrologically connected to the ash basins and with NCDEQ DWM regulatory oversight
Coal Pile	No	March 2020	Operational	Coal	22 acres	Upgradient of U1-4 AB
Gypsum Stack-out Area	No	March 2020	Operational	Gypsum	1 acre	Upgradient of U1-4 AB
Unit 5 Switchyard	No	March 2020	Not Applicable	Coal Ash	Unknown	Not hydrologically connected to the ash basins (north of Broad River)

Prepared by: SAS Checked by: TJG

Notes:
CSA Schedule - applicable only for units identified in the letter "Final Comprehensive Site Assessment and Corrective Action Plans Approvals for Duke Energy Coal Ash Facilities" (April 5, 2019)
CAMA – North Carolina Coal Ash Management Act of 2014
CAP – Corrective Action Plan
DWM – Division of Waste Management
NA – not applicable
NCDEQ – North Carolina Department of Environmental Quality

TABLE 4-1
BACKGROUND SOIL SAMPLE SUMMARY
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Soil Boring	Depth Range (ft bgs)	Number of Sampled Intervals
BG-1D	(3.5-10)	2
BG-2D	(3.5-30)	4
MW-30D	(3.5-30)	4
MW-32D	(3.5-20)	3
MW-32S	(22.5-24)	1
MW-42D	(28.5-30)	1
GWA-25D	(8.5-10)	1
BGSB-BG-01	(6-20)	3
BGSB-BG-02	(2-7)	2
BGSB-GWA-25	(6-15)	2
BGSB-MW-30	(6-25)	3
BGSB-MW-32	(2-15)	2

Prepared by: TJG Checked by: SAS

Note:
ft bgs – feet below ground surface

TABLE 4-2
BACKGROUND VALUES FOR SOIL
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituent	Reporting Unit	PSRG Protection of Groundwater	2018 Background Threshold Value[1]	2019 Updated Background Threshold Value[2]	Piedmont Background Threshold Value Range[3]
pH*	S.U.	NE	4.0 - 6.8	4.0 - 6.8	2.3 - 9.8
Aluminum	mg/kg	110,000	61,758	81,619	25,978 - 61,758
Antimony	mg/kg	0.9	0.64	0.64	0.177 - 0.9
Arsenic	mg/kg	5.8	7.8	10.26	1.2 - 43.13
Barium	mg/kg	580	198.2	304	122.2 - 1,063
Beryllium	mg/kg	63	1.8	1.769	1.2 - 4.52
Boron	mg/kg	45	31	30	14.4 - 56.3
Cadmium	mg/kg	3	0.03	0.49	0.03 - 1
Calcium	mg/kg	NE	282	1,300	282 - 8,769
Chloride	mg/kg	NE	17	400	12 - 423
Chromium	mg/kg	3.8	142.4	142	20 - 440
Cobalt	mg/kg	0.9	48	47.53	27 - 81.68
Copper	mg/kg	700	40	40	17.4 - 216
Iron	mg/kg	150	74,362	74,362	24,500 - 85,345
Lead	mg/kg	270	44	44.37	7.5 - 95.23
Magnesium	mg/kg	NE	8,225	17,119	760 - 51,829
Manganese	mg/kg	65	672	1,078	370 - 3,388
Mercury	mg/kg	1	0.1	0.10	0.04 - 0.113
Molybdenum	mg/kg	7.1	7.7	4.1	1.83 - 12
Nickel	mg/kg	130	72	72	9.2 - 237
Nitrate (as N)	mg/kg	NE	0.26	0.26	0.25 - 31.2
Nitrate	mg/kg	NE	---	49	40.3 - 43.7
Potassium	mg/kg	NE	13,697	13,697	427 - 35,600
Selenium	mg/kg	2.1	3.8	6.857	1.58 - 5.348
Sodium	mg/kg	NE	198	1,200	198 - 1,500
Strontium	mg/kg	1,500	9.9	9.9	7.1 - 200
Sulfate	mg/kg	1,438^	13	400	12 - 437
Thallium	mg/kg	0.28	1.1	1	0.166 - 2.132
Total Organic Carbon	mg/kg	NE	---	4,960	742 - 4,070
Vanadium	mg/kg	350	161	163.3	42 - 230.9
Zinc	mg/kg	1,200	140	160	60.5 - 325.5

Prepared by: TJG Checked by: VJH

Notes:

2018 Background threshold values were approved by North Carolina Department of Environmental Quality (NCDEQ) on May 14, 2018.

^ - PSRG Protection of Groundwater value was calculated using the equation shown in **Section 6**

* - Upper and lower threshold values calculated for parameter

[1] - Background threshold values were calculated using data from background unsaturated soil samples collected February 2015 to May 2015.

[2] - Updated background threshold values were calculated using data from background unsaturated soil samples collected February 2015 to August 2017. The background threshold value updates retained extreme outlier concentrations in background unsaturated soil datasets (SynTerra, 2019).

[3] - Piedmont background threshold value ranges include the Duke Energy calculated 2017[4] and 2019[5] background threshold values from 10 Duke Energy facilities located in the Piedmont physiographic region (Allen Steam Station[5], Belews Creek Steam Station[5], Buck Steam Station[4], Cape Fear Steam Electric Plant[4], Cliffside Steam Station[5], Dan River Steam Station[4], Marshall Steam Station[5], Mayo Steam Electric Plant[5], Riverbend Steam Station[4], and Roxboro Steam Electric Plant[5]).

--- - 2018 background threshold value was not calculated for constituent.

mg/kg - milligrams per kilogram

NE - not established

S.U. - standard unit

PSRG - preliminary soil remediation goals

TABLE 4-3
BACKGROUND VALUES FOR GROUNDWATER
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituent	Reporting Unit	15A NCAC 02L Standard	2017 Background Threshold Values[1]			2019 Updated Background Threshold Values[2]			Piedmont Background Threshold Values Range[3]
			Shallow Flow Zone	Deep Flow Zone	Bedrock Flow Zone	Shallow Flow Zone	Deep Flow Zone	Bedrock Flow Zone	
pH	S.U.	6.5 - 8.5	4.4 - 6.1	4.8 - 6.1	5.4 - 7.4	4.0 - 6.0	4.9 - 7.2	4.5 - 7.5	3.6 - 9
Alkalinity	mg-$CaCO_3$/L	NE	14	20	53	19	54	56	19 - 379
Aluminum	µg/L	NE	253	290	208	820	483	309	100 - 1,238
Antimony	µg/L	1*	1	1	1	0.5	0.5	1	0.5 - 2.9
Arsenic	µg/L	10	1	1	1	0.2	2	1	0.2 - 6.35
Barium	µg/L	700		23	19	94	44	19	10.52 - 840
Beryllium	µg/L	4*	0.2	0.2	1	0.2	0.2	0.2	0.0625 - 1
Bicarbonate	mg-$CaCO_3$/L	NE	14	18	69	19	58	59	19 - 388
Boron	µg/L	700	50	50	50	50	50	50	50 - 176.8
Cadmium	µg/L	2	1	1	1	0.09	1	1	0.08 - 1
Calcium	mg/L	NE	3	11	16	4	13	17	4 - 111
Carbonate	mg-$CaCO_3$/L	NE	5	5	5	5	5	5	5 - 10
Chloride	mg/L	250	8	5	9	8	8	8	3.34 - 250
Chromium	µg/L	10	4	2	4	26	2	3	43,491
Chromium (VI)	µg/L	NE	0.5	0.2	0.1	4	0.6	0.7	0.03 - 12
Cobalt	µg/L	1*	11	5	1	21	5	2	0.088 - 88.85
Copper	µg/L	1,000	7	10	5	9	8	5	0.5 - 17.15
Fluoride	mg/L	2	---	---	---	0.1	0.1	0.1	0.1 - 1.8
Iron	µg/L	300	684	515	6,220	1,700	1,840	7,680	56.3 - 37,500
Lead	µg/L	15	1	1	1	1	0.3	1	0 - 2
Lithium	µg/L	NE	---	---	---	3	12	11	2 - 95.39
Magnesium	mg/L	NE	2	2	2	2	2	2	1 - 45
Manganese	µg/L	50	169	78	89	969	260	113	2,655,496
Mercury	µg/L	1	0.2	0.2	0.2	0.2	0.2	0.2	0.05 - 0.5
Methane	µg/L	NE	10	3	10	10	10	10	1 - 2,505
Molybdenum	µg/L	NE	1	1	2	0.6	4	2	0.5 - 26.2
Nickel	µg/L	100	6	13	5	12	13	7	0.87 - 48
Nitrate + Nitrite	mg-N/L	NE	9	3	1	4	3	1	0.02 - 6.3
Potassium	mg/L	NE	5	5	5	5	6	5	1.609 - 18.8
Selenium	µg/L	20	1	1	1	0.5	1	1	0.5 - 2.4
Sodium	mg/L	NE	6	4	7	6	9	8	6 - 190
Strontium	µg/L	NE	37	56	107	34	69	93	27 - 2,120
Sulfate	mg/L	250	1	10	15	4	15	17	1.2 - 510
Sulfide	mg/L	NE	0.1	0.1	0.1	0.1	0.1	0.1	0.1 - 2
TDS	mg/L	500	75	71	120	57	107	120	50 - 1,200
Thallium	µg/L	0.2*	0.1	0.1	0.2	0.2	0.2	0.2	0.1 - 0.2
TOC	mg/L	NE	1	1	1	1	2	1	1 - 12.3
Total Radium	pCi/L	NE	3	2	3	2	2	3	0.494 - 35
Total Uranium	µg/mL	NE	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002 - 0.864
Vanadium	µg/L	0.3*	1	1	0.4	1	11	1	0.33 - 25.8
Zinc	µg/L	1,000	15	15	10	26	14	15	5 - 140

Prepared by: HES Checked by: JHG

Notes:

2017 background threshold values (BTVs) approved by North Carolina Department of Environmental Quality (NCDEQ) on September 1, 2017.

Background threshold values (BTVs) have been rounded to similar levels of precision as 15A North Carolina Administrative Code (NCAC) 02L Standard or Interim Maximum Allowable Concentration (IMAC).

--- - BTV was not calculated for constituent.

* - IMAC of the 15A NCAC 02L Standard, Appendix 1, April 1, 2013.

[1] - BTVs were calculated using data from background groundwater samples collected June 2015 to September 2017

[2] - Updated BTVs were calculated using data from background groundwater samples collected February 2010 to December 2018

[3] - Piedmont background threshold value ranges include the Duke Energy calculated 2017[1] and 2019[2] background threshold values from 10 Duke Energy facilities located in the Piedmont physiographic region (Allen Steam Station[2], Belews Creek Steam Station[2], Buck Steam Station[1], Cape Fear Steam Electric Plant[1], Cliffside Steam Station[2], Dan River Steam Station[1], Marshall Steam Station[2], Mayo Steam Electric Plant[2], Riverbend Steam Station[1], and Roxboro Steam Electric Plant[2]).

µg/L - micrograms per liter

µg/mL - micrograms per milliliter

mg/L - milligrams per liter

mg-$CaCO_3$/L - milligrams calcium carbonate per liter

mg-N/L - milligrams nitrogen per liter

NE - not established

pCi/L - picocuries per liter

S.U. - standard units

TDS - total dissolved solids

TOC - total organic carbon

TABLE 4-4
BACKGROUND DATASET RANGES FOR SURFACE WATER
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituent	Reporting Unit	Comparison Criteria	Background Range
Constituents with 15A NCAC 02B (Class Water Supply: WS-IV) Standards			
pH	S.U.	6.0-9.0	6.0 - 8.7
Dissolved Oxygen	mg/L	≥ 4	4.3 - 12.4
Temperature	deg C	≤ 32	5.5 -30.0
Turbidity	NTU	≤ 50	2.5 - 114.0
Arsenic	µg/L	10	0.0002 j - <10
Arsenic (Dissolved)	µg/L	acute: 340, chronic: 150	0.077 j - <1
Barium	µg/L	1000	<5 - 39
Beryllium (Dissolved)	µg/L	acute: 65, chronic: 6.5	<0.01 - <0.2
Cadmium (Dissolved)[1]	µg/L	acute: 0.82, chronic: 0.15	<0.05 - <1
Chloride	mg/L	250	0.0043 j - 20.4
Chromium (III) (Dissolved)[1,2]	µg/L	acute: 180, chronic: 24	NA
Chromium (VI) (Dissolved)	µg/L	acute: 16, chronic: 11	NA
Copper (Dissolved)[1]	µg/L	acute: 3.6, chronic: 2.7	<0.11 - 8.2
Fluoride	mg/L	1.8	0.000064 j - <0.5
Lead (Dissolved)[1]	µg/L	acute: 14, chronic: 0.54	0.044 j - <1
Mercury	µg/L	chronic: 0.012	0.000532 B - <0.2
Nickel	µg/L	25	0.2 j - <10
Nickel (Dissolved)[1]	µg/L	acute:140, chronic: 16	0.16 j - 2.7
Nitrate + Nitrite	mg-N/L	10	<0.02 - 1
Selenium	µg/L	chronic: 5	0.133 j - <10
Silver (Dissolved)[1]	µg/L	acute: 0.3, chronic: 0.06	<0.07 - <1
Sulfate	mg/L	250	0.62 j - 75
Thallium	µg/L	2	<0.015 - <10
Total Dissolved Solids	mg/L	500	<25 - 10,000
Total Hardness	mg/L	100	10.7 - 18.8
Zinc (Dissolved)[1]	µg/L	acute: 36, chronic: 36	<2.5 - 18 j+
Constituents with USEPA National Recommended Water Quality Criteria			
Alkalinity	mg/L	chronic: 20	5.2 - 64.2
Aluminum	µg/L	acute: 620, chronic: 300	69.2 j - 1,760 M1
Antimony	µg/L	5.6	<0.1 - <5
Iron	µg/L	1000	225 - 3,630
Manganese	µg/L	50	17.8 - 160
Constituents without 02B or USEPA Criteria			
Bicarbonate	mg-$CaCO_3$/L	NE	8.3 - 64.2
Boron	µg/L	NE	3.39 j - <50
Cadmium	µg/L	NE	0.035 j - <1
Calcium	mg/L	NE	2.12 - 44.3
Carbonate Alkalinity	mg-$CaCO_3$/L	NE	<1 - 11
Chromium	µg/L	NE	0.0008 j - <10
Chromium (VI)	µg/L	NE	0.021 j - <0.6
Cobalt	µg/L	NE	0.0013 j - 2.1
Copper	µg/L	NE	<0.11 - 2.71 j
Lead	µg/L	NE	0.083 j - <10
Lithium	µg/L	NE	0.45 j - 0.61
Magnesium	mg/L	NE	1.06 - 5.67

TABLE 4-4
BACKGROUND DATASET RANGES FOR SURFACE WATER
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituent	Reporting Unit	Comparison Criteria	Background Range
Constituents without 02B or USEPA Criteria (Continued)			
Methane	µg/L	NE	2.2 j - 344
Molybdenum	µg/L	NE	<0.11 - 1.7
Potassium	mg/L	NE	1.56 - 11.2
Sodium	mg/L	NE	1.57 - 10
Strontium	µg/L	NE	16.3 - 59.3
Sulfide	mg/L	NE	<0.1
Total Organic Carbon	mg/L	NE	0.51 j - 7.7
Total Radium	pCi/L	NE	NA
Total Uranium	µg/mL	NE	NA
Vanadium	µg/L	NE	<0.3 - 5.5
Zinc	µg/L	NE	1.71 j - 47.2 B

Prepared by: LWD Checked by: GRK

Notes:

Background locations were approved by North Carolina Department of Environmental Quality (NCDEQ).

All samples are subject to Class C water quality standards.

[1] Standard value dependent on hardness. Calculated hardness dependent metal standards represent most conservative value. Standards are calculated using 25 mg/L hardness, regardless if actual instream hardness values are greater than 25 mg/L.

[2] Chromium speciation is not performed for trivalent chromium (Cr(III)). Trivalent values are derived by subtracting hexavalent chromium values from dissolved chromium values. Where a dissolved chromium value is less than the detection limit ("<"), it is considered a whole number for purposes of deriving a trivalent chromium value.

acute - "Compliance with acute instream metals standards shall only be evaluated using an average of two or more samples collected within one hour." Reference 15A NCAC 02B .0211

chronic - "Compliance with chronic instream metals standards shall only be evaluated using averages of a minimum of four samples taken on consecutive days, or as a 96-hour average" Reference 15A NCAC 02B .0211.

< - concentration not detected at or above the adjusted reporting limit.

B - Target analyte detected in method blank at or above the reporting limit. Target analyte concentration in sample is less than 10X the concentration in the method blank. Analyte concentration in sample could be due to blank contamination.

j - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

j+ - Estimated concentration, biased high.

M1 - Matrix spike recovery was high: the associated Laboratory Control Spike (LCS) was acceptable.

Deg C - Degrees Celsius

mg/L - milligrams per liter

µg/L - micrograms per liter

µg/mL - micrograms per milliliter

mg-$CaCO_3$/L - milligrams calcium carbonate per liter

mg-N/L - milligram nitrogen per liter

NA - not available

NE - not established

NTU - Nephelometric Turbidity Unit

pCi/L - picocuries per liter

S.U. - standard unit

TABLE 4-5
BACKGROUND DATASET RANGES FOR SEDIMENT
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituent	Reporting Unit	Background Range
pH	S.U.	6.2 - 6.7
Aluminum	mg/kg	12,000 - 18,000
Antimony	mg/kg	<0.68 - <0.9
Arsenic	mg/kg	1.4 - 1.5
Barium	mg/kg	47 - 110
Beryllium	mg/kg	0.48 - 1.1
Boron	mg/kg	<3.7 - <4.3
Cadmium	mg/kg	0.052 j - 0.25
Calcium	mg/kg	590 - 1,100
Chloride	mg/kg	9.8 j - <19
Chromium	mg/kg	16 - 26
Chromium (III)	mg/kg	NA
Cobalt	mg/kg	3.6 - 10
Copper	mg/kg	5.2 - 13
Iron	mg/kg	8,300 - 18,000
Lead	mg/kg	7.4 - 12
Magnesium	mg/kg	1,700 - 3,400
Manganese	mg/kg	41 - 350
Mercury	mg/kg	<0.13 - <0.16
Molybdenum	mg/kg	<3 - <3.4
Nickel	mg/kg	5.9 - 10
Nitrate (as N)	mg/kg	<0.35 - <0.41 M
Nitrate	mg/kg	NA
Potassium	mg/kg	1,400 - 2,800
Selenium	mg/kg	<1.8 - <2.3
Silver	mg/kg	<0.74 - <0.86
Sodium	mg/kg	<370 - <430
Strontium	mg/kg	3.5 - 6.9
Sulfate	mg/kg	<18 - <20
Sulfide	mg/kg	<39.8 - <42.9
Thallium	mg/kg	0.22 j - 0.33
Total Organic Carbon	mg/kg	10,300 - 26,900
Vanadium	mg/kg	28 - 51
Zinc	mg/kg	23 - 48

Prepared by: LWD Checked by: GRK

Notes:

Background locations were approved by North Carolina Department of Environmental Quality (NCDEQ).

< - concentration not detected at or above the adjusted reporting limit.

j - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

mg/kg - milligrams per kilogram

M - Matrix spike / matrix spike dup failure.

NA - not available

S.U. - standard unit

TABLE 5-1
APRIL 2019 WATER LEVEL MEASUREMENTS AND ELEVATIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Top of Casing Elevation (ft. NAVD 88)	Top of Screen Elevation (ft. NAVD 88)	Bottom of Screen Elevation (ft. NAVD 88)	April 2019 Measured Water Level (ft. BOTC)	April 2019 Water Elevation (ft. NAVD 88)	Screened Interval (Ft-BGS)		Monitoring Zone Flow
AB-1BROR	773.58	647.39	597.89	61.10	712.48	–	–	Bedrock
AB-1D	773.44	652.30	647.23	61.60	711.84	121.5	126.5	Deep
AB-1S	773.19	719.80	704.80	39.65	733.54	54.0	69.0	Shallow
AB-2BRO	773.47	694.53	624.53	30.66	742.81	–	–	Bedrock
AB-2D	773.00	700.97	695.97	38.13	734.87	72.5	77.5	Deep
AB-2S	772.92	729.53	724.53	30.62	742.30	44.0	49.0	Shallow
AB-3-LA15	796.86	726.08	721.08	–	–	67.5	72.5	Ash Pore Water
AB-3-MA15	796.78	737.52	732.52	35.31	761.47	56.2	61.2	Ash Pore Water
AB-3BR	796.55	617.91	607.91	36.86	759.69	175.5	185.5	Bedrock
AB-3BRA	796.18	--	646.35	74.86	721.32	-	147.5	Bedrock
AB-3BRUA	796.02	668.26	663.26	83.92	712.10	125.0	130.0	Deep
AB-3I	795.97	701.62	691.62	34.32	761.65	92.0	102.0	Shallow
AB-3S	795.64	771.66	756.66	Below Pump	–	22.0	37.0	Ash Pore Water
AB-3SL	796.02	732.36	722.36	34.49	761.53	62.2	72.2	Ash Pore Water
AB-3SLA	796.90	733.75	723.75	–	–	60.0	70.0	Ash Pore Water
AB-4LA15	771.10	735.68	730.68	10.53	760.57	32.4	37.4	Ash Pore Water
AB-4UA15	771.62	753.32	748.32	11.38	760.24	14.9	19.9	Ash Pore Water
AB-4BR	770.66	664.06	659.06	14.48	756.18	104.5	109.5	Bedrock
AB-4D	770.59	713.54	708.54	9.67	760.92	55.0	60.0	Deep
AB-4S	770.59	763.51	748.51	10.14	760.45	5.0	20.0	Ash Pore Water
AB-4SL	770.61	739.71	729.71	9.98	760.63	28.7	38.7	Ash Pore Water
AB-5BR	772.13	677.90	673.00	9.45	762.68	91.2	96.1	Bedrock
AB-5BRU	771.81	709.31	704.31	7.32	764.49	60.5	65.5	Deep
AB-5S	771.74	763.88	748.88	8.10	763.64	5.0	20.0	Ash Pore Water
AB-6BR	770.61	672.76	667.76	10.61	760.00	96.0	101.0	Bedrock
AB-6D	770.68	702.89	697.89	5.59	765.09	65.8	70.8	Deep
AB-6S	770.56	763.38	748.38	6.20	764.36	5.0	20.0	Ash Pore Water
AB-7BR	795.19	607.18	597.18	35.46	759.73	185.5	195.5	Bedrock
AB-7BRU	795.90	646.15	636.15	48.00	747.90	147.0	157.0	Deep
AB-7S	795.80	746.15	736.15	34.84	760.96	47.0	57.0	Ash Pore Water
AB-8BR	774.93	655.11	650.11	13.41	761.52	117.0	122.0	Bedrock
AB-8BRU	775.13	685.18	675.18	13.68	761.45	87.0	97.0	Deep
AB-8I	774.99	715.21	705.21	13.31	761.68	57.0	67.0	Shallow
AB-8S	774.91	759.69	749.69	13.01	761.90	12.5	22.5	Ash Pore Water
AB-9BR	771.15	659.30	649.30	11.50	759.65	109.0	119.0	Bedrock
AB-9D	771.04	710.71	700.71	10.87	760.17	57.5	67.5	Deep
AB-9S	770.81	754.12	744.12	10.52	760.29	14.0	24.0	Ash Pore Water
AS-1D	809.41	701.52	696.52	77.20	732.21	106.0	111.0	Deep
AS-1SB	809.20	723.83	708.83	75.81	733.39	83.0	98.0	Shallow
AS-2BR	698.74	604.44	599.44	38.61	660.13	92.0	97.0	Bedrock
AS-2D	697.26	640.43	635.43	28.92	668.34	55.0	60.0	Deep
AS-2S	697.84	680.23	665.23	22.45	675.39	15.5	30.5	Shallow
AS-3BRU	754.16	704.11	699.11	49.08	705.08	48.5	53.5	Deep
AS-4D	837.71	740.59	735.59	90.29	747.42	95.0	100.0	Deep
AS-4S	837.49	751.30	741.30	91.72	745.77	84.4	94.4	Shallow
AS-5BR	739.77	664.80	659.80	34.16	705.61	75.1	80.1	Bedrock
AS-5BRU	740.45	685.59	680.59	37.68	702.77	55.0	60.0	Deep
AS-5S	739.72	710.70	695.70	34.82	704.90	29.3	44.3	Shallow
AS-6BRA	822.29	665.36	660.36	97.25	725.04	153.5	158.5	Bedrock
AS-6D	818.30	694.17	689.17	93.56	724.74	123.0	128.0	Deep
AS-6S	817.74	729.13	714.13	92.70	725.04	86.0	101.0	Shallow
AS-7BR	742.70	618.29	613.29	35.15	707.55	122.0	127.0	Bedrock
AS-7BRA	737.25	614.37	604.37	46.55	690.70	120.0	130.0	Bedrock
AS-7BRB	746.11	632.21	622.21	52.83	693.28	111.0	121.0	Bedrock
AS-7BRL	733.79	--	--	32.77	701.02	-	-	Bedrock
AS-7D	742.90	658.27	653.27	34.06	708.84	82.5	87.5	Deep
AS-7I	735.66	675.89	670.89	30.43	705.23	57.0	62.0	Shallow
AS-7S	742.06	711.33	696.33	27.56	714.50	28.5	43.5	Ash Pore Water
AS-8BR	725.18	635.51	625.51	94.86	630.32	90.0	100.0	Bedrock
AS-8D	724.95	662.14	657.14	31.12	693.83	62.9	67.9	Deep
AS-8S	724.79	702.09	687.09	20.14	704.65	23.0	38.0	Shallow
AS-9BR	727.49	648.76	638.76	68.90	658.59	79.4	89.4	Bedrock
AS-9D	727.07	693.77	683.77	22.75	704.32	34.0	44.0	Deep

TABLE 5-1
APRIL 2019 WATER LEVEL MEASUREMENTS AND ELEVATIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Top of Casing Elevation (ft. NAVD 88)	Top of Screen Elevation (ft. NAVD 88)	Bottom of Screen Elevation (ft. NAVD 88)	April 2019 Measured Water Level (ft. BOTC)	April 2019 Water Elevation (ft. NAVD 88)	Screened Interval (Ft-BGS)		Monitoring Zone Flow
BG-1BRA	806.00	709.84	704.84	24.16	781.84	93.0	98.0	Bedrock
BG-1D	802.63	734.40	729.40	21.02	781.61	66.5	71.5	Deep
BG-1S	802.67	780.71	765.71	20.74	781.93	20.0	35.0	Shallow
BG-2D	846.51	795.65	790.65	42.56	803.95	49.0	54.0	Deep
CCPMW-1D	875.89	824.19	819.19	30.56	845.33	49.0	54.0	Bedrock
CCPMW-1S	875.58	843.34	833.34	30.01	845.57	30.0	40.0	Shallow
CCPMW-2D	842.38	774.91	769.91	35.33	807.05	65.0	70.0	Deep
CCPMW-2S	842.24	808.17	798.17	34.29	807.95	32.0	42.0	Shallow
CCPMW-3D	811.74	786.74	781.74	11.01	800.73	26.0	31.0	Deep
CCPMW-3S	811.56	801.54	796.54	9.65	801.91	9.0	14.0	Shallow
CCPMW-4	845.95	792.62	777.62	22.14	823.81	50.0	65.0	Bedrock
CCPMW-5	858.63	793.23	783.23	38.40	820.23	62.5	72.5	Bedrock
CCPMW-6D	854.35	801.27	791.27	31.86	822.49	50.0	60.0	Bedrock
CCPMW-6S	854.38	817.65	807.65	31.88	822.50	33.5	43.5	Shallow
CCPTW-1D	838.53	775.30	770.30	23.72	814.81	61.0	66.0	Deep
CCPTW-1S	838.92	812.14	802.14	22.21	816.71	25.0	35.0	Shallow
CCPTW-2	842.18	804.55	794.55	38.05	804.13	35.0	45.0	Shallow
CCR-7S	790.54	753.30	738.30	38.90	751.64	34.5	49.5	Shallow
CCR-7D	790.40	701.22	696.22	37.33	753.07	86.0	91.0	Deep
CCR-11D	736.83	709.40	704.40	5.62	731.21	24.5	29.5	Deep
CCR-11S	737.07	729.27	714.27	6.56	730.51	4.5	20.0	Shallow
CCR-12S	770.82	734.57	719.57	31.90	738.92	33.0	48.0	Shallow
CCR-12D	770.10	707.61	702.61	31.25	738.85	59.0	64.0	Deep
CCR-12BR	770.85	668.00	663.00	34.64	736.21	100.0	105.0	Bedrock
CCR-13D	787.75	757.37	752.37	25.21	762.54	27.0	32.0	Deep
CCR-14D	805.14	754.70	749.70	45.83	759.31	47.0	52.0	Deep
CCR-15D	780.40	763.56	758.56	15.69	764.71	15.0	20.0	Deep
CCR-16D	780.13	716.90	711.90	13.82	766.31	63.0	68.0	Deep
CCR-16S	780.00	762.48	747.48	13.48	766.52	18.0	33.0	Shallow
CCR-17BR	789.52	716.88	711.88	42.72	746.80	75.2	77.0	Bedrock
CCR-3BR	763.00	620.69	615.69	39.19	723.81	51.5	56.5	Bedrock
CCR-4D	781.43	761.12	756.12	23.98	757.45	17.5	22.5	Deep
CCR-5D	784.10	753.75	748.75	25.14	758.96	29.5	34.5	Deep
CCR-6D	793.86	732.21	727.21	34.90	758.96	58.5	63.5	Deep
CCR-6S	793.69	765.34	750.34	34.40	759.29	29.0	44.0	Shallow
CCR-8BR	801.98	718.87	713.87	41.62	760.36	80.4	85.4	Bedrock
CCR-8D	798.99	751.13	746.13	38.34	760.65	44.5	49.5	Deep
CCR-9D	752.89	727.19	722.19	17.10	735.79	22.5	27.5	Deep
CCR-CCP-10DA	853.09	783.12	778.12	30.06	823.03	66.7	71.7	Bedrock
CCR-CCP-10S	853.67	820.17	805.17	30.58	823.09	30.2	45.2	Shallow
CCR-CCP-11BR	862.61	793.01	788.01	40.38	822.23	71.0	76.0	Bedrock
CCR-CCP-12D	859.70	791.42	786.42	38.33	821.37	68.0	73.0	Deep
CCR-CCP-12S	859.59	822.57	807.57	37.45	822.14	37.0	52.0	Shallow
CCR-CCP-13D	857.00	820.53	815.53	30.45	826.55	33.0	38.0	Deep
CCR-CCP-14D	859.86	816.18	811.18	36.74	823.12	39.0	44.0	Deep
CCR-CCP-15D	880.12	815.00	810.00	47.22	832.90	66.1	71.1	Bedrock
CCR-CCP-15S	880.10	838.41	828.41	44.60	835.50	44.0	54.0	Shallow
CCR-CCP-16BR	814.21	699.35	689.35	34.38	779.83	112.1	122.1	Bedrock
CCR-CCP-16S	913.90	771.16	761.16	28.19	885.71	40.0	50.0	Shallow
CCR-CCP-1D	878.84	820.59	815.59	45.79	833.05	55.0	60.0	Bedrock
CCR-CCP-2D	870.51	815.20	810.20	44.11	826.40	51.0	56.0	Deep
CCR-CCP-3DA	858.41	791.03	786.03	49.71	808.70	64.6	69.6	Bedrock
CCR-CCP-3S	862.17	810.01	795.01	50.24	811.93	50.0	65.0	Shallow
CCR-CCP-4D	855.36	798.88	793.88	47.58	807.78	53.0	58.0	Deep
CCR-CCP-5D	847.09	773.51	768.51	41.64	805.45	70.0	75.0	Deep
CCR-CCP-5S	847.46	794.88	779.88	42.40	805.06	49.0	64.0	Shallow
CCR-CCP-6D	834.50	744.09	739.09	24.31	810.19	90.0	95.0	Deep
CCR-CCP-6S	834.19	788.68	773.68	18.90	815.29	45.0	60.0	Shallow
CCR-CCP-7D	841.56	818.53	808.53	22.81	818.75	23.0	33.0	Deep
CCR-CCP-8D	845.48	829.08	819.08	24.20	821.28	17.0	27.0	Deep
CCR-CCP-9D	842.30	777.37	772.37	21.78	820.52	61.8	66.8	Bedrock
CCR-CCP-9S	841.97	805.88	790.88	23.02	818.95	30.3	45.3	Shallow
CCR-IB-1S	668.91	663.22	653.22	7.81	661.10	6.0	16.0	Shallow
CCR-IB-1D	668.76	648.62	643.62	7.37	661.39	20.0	25.0	Deep

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CORRECTIVE ACTION PLAN UPDATE
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DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Top of Casing Elevation (ft. NAVD 88)	Top of Screen Elevation (ft. NAVD 88)	Bottom of Screen Elevation (ft. NAVD 88)	April 2019 Measured Water Level (ft. BOTC)	April 2019 Water Elevation (ft. NAVD 88)	Screened Interval (Ft-BGS)		Monitoring Zone Flow
CCR-IB-3S	678.74	666.63	651.63	16.68	662.06	12.0	27.0	Shallow
CCR-IB-3D	678.92	640.67	635.67	17.85	661.07	38.0	43.0	Deep
CCR-U5-3S	695.90	686.91	676.91	6.21	689.69	7.0	17.0	Shallow
CCR-U5-3D	694.88	670.63	665.63	10.54	684.34	22.0	27.0	Deep
CCR-IB-3BR	682.56	609.34	604.34	20.91	661.65	69.9	74.9	Bedrock
CCR-U5-10D	785.63	745.25	740.25	22.54	763.09	36.0	41.0	Deep
CCR-U5-10S	784.93	763.83	753.83	21.79	763.14	18.0	28.0	Shallow
CCR-U5-1D	782.01	737.58	732.58	36.68	745.33	41.0	46.0	Deep
CCR-U5-2D	775.22	710.40	705.40	63.37	711.85	60.5	65.5	Deep
CCR-U5-4BR	696.27	616.98	611.98	8.48	687.79	79.8	84.8	Bedrock
CCR-U5-4D	699.62	664.07	659.07	18.17	681.45	31.0	36.0	Deep
CCR-U5-4S	698.27	684.92	669.92	16.85	681.42	10.0	25.0	Shallow
CCR-U5-5D	768.89	698.49	693.49	57.76	711.13	66.0	71.0	Deep
CCR-U5-6DA	719.04	697.59	692.59	8.97	710.07	21.5	26.5	Deep
CCR-U5-6S	717.69	708.29	698.29	7.80	709.89	6.0	16.0	Shallow
CCR-U5-8D	759.63	700.73	695.73	6.00	753.63	58.5	62.5	Deep
CCR-U5-8S	760.48	745.96	730.96	7.10	753.38	11.0	26.0	Shallow
CCR-U5-9S	763.11	754.08	739.08	6.45	756.66	6.0	21.0	Shallow
CLMW-1	789.08	738.28	728.28	36.84	752.24	47.5	57.5	Shallow
CLMW-2	728.92	683.84	673.84	36.85	692.07	43.0	53.0	Shallow
CLMW-3D	774.92	679.47	669.47	44.70	730.22	93.0	103.0	Deep
CLMW-3S	775.07	723.62	713.62	44.80	730.27	49.0	59.0	Shallow
CLMW-5D	775.39	681.39	671.39	–	–	94.0	104.0	Deep
CLMW-5S	773.78	723.97	713.97	35.88	737.90	50.0	60.0	Shallow
CLMW-6	770.86	747.77	737.77	3.50	767.36	20.0	30.0	Shallow
CLP-1	730.78	700.90	690.90	24.00	706.78	25.0	35.0	Shallow
CLP-2	672.66	662.39	652.39	15.38	657.28	8.0	18.0	Shallow
CLP-3	789.33	753.91	743.91	ABD	–	30.0	40.0	Shallow
CLP-4	794.45	758.81	718.81	36.50	757.95	33.0	73.0	Shallow
GWA-10D	679.74	632.44	627.44	18.12	661.62	47.6	52.6	Deep
GWA-10S	679.55	667.85	652.85	18.32	661.23	12.0	27.0	Shallow
GWA-11BR	679.48	607.02	602.02	18.96	660.52	69.1	74.1	Bedrock
GWA-11BRL	678.87	504.90	494.90	14.52	664.35	171.0	181.0	Bedrock
GWA-11BRU	674.99	638.20	633.20	13.95	661.04	37.0	42.0	Deep
GWA-11S	674.98	663.24	648.24	13.78	661.20	12.0	27.0	Shallow
GWA-12BRU	719.66	669.95	664.95	35.74	683.92	48.0	53.0	Deep
GWA-12S	719.40	698.59	683.59	26.64	692.76	19.0	34.0	Shallow
GWA-13BR	724.12	643.88	638.88	22.26	701.86	80.5	85.5	Bedrock
GWA-14BR	712.55	593.73	583.73	30.23	682.32	118.5	128.5	Bedrock
GWA-14D	712.52	664.85	659.85	29.86	682.66	48.0	53.0	Deep
GWA-14S	712.41	691.41	676.41	DRY	–	21.3	36.3	Shallow
GWA-1BRU	781.29	756.51	751.51	12.25	769.04	22.8	27.8	Deep
GWA-20BR	736.61	679.26	675.26	7.09	729.52	54.0	59.0	Bedrock
GWA-20D	736.24	709.31	704.31	12.21	724.03	25.0	30.0	Deep
GWA-20S	736.13	729.68	714.68	8.30	727.83	4.5	19.5	Shallow
GWA-21BR	672.98	609.66	604.66	0.00	672.98	60.6	65.6	Bedrock
GWA-21BRL	673.22	546.50	536.50	0.00	673.22	125.0	135.0	Bedrock
GWA-21BRU	672.91	650.72	645.72	10.99	661.92	20.0	25.0	Deep
GWA-21S	673.32	665.87	655.87	10.50	662.82	5.5	15.5	Shallow
GWA-22BRU	665.19	646.26	641.26	9.52	655.67	17.0	22.0	Deep
GWA-22S	665.19	660.64	650.64	7.40	657.79	2.6	12.6	Shallow
GWA-23D	786.80	761.34	756.34	27.07	759.73	23.5	28.5	Deep
GWA-24BR	798.92	730.95	725.95	13.12	785.80	65.0	70.0	Bedrock
GWA-24D	794.94	765.02	760.02	14.52	780.42	28.0	33.0	Deep
GWA-24S	794.47	778.52	768.52	15.68	778.79	14.0	24.0	Shallow
GWA-25D	792.01	753.49	748.49	21.35	770.66	36.5	41.5	Deep
GWA-25S	791.81	779.64	764.64	21.18	770.63	10.0	25.0	Shallow
GWA-26D	782.98	712.58	707.38	14.62	768.36	68.6	73.8	Deep
GWA-26S	783.36	771.23	756.23	15.35	768.01	10.2	25.2	Shallow
GWA-27BR	805.50	699.21	694.21	48.65	756.85	103.9	108.9	Bedrock
GWA-27DA	805.48	751.95	746.95	49.70	755.78	51.0	56.0	Deep
GWA-28BR	757.90	670.91	665.91	44.05	713.85	85.0	90.0	Bedrock
GWA-28BRU	758.35	702.39	697.39	38.80	719.55	53.9	58.9	Deep
GWA-28S	757.74	733.48	718.48	31.28	726.46	22.5	37.5	Shallow

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Well ID	Top of Casing Elevation (ft. NAVD 88)	Top of Screen Elevation (ft. NAVD 88)	Bottom of Screen Elevation (ft. NAVD 88)	April 2019 Measured Water Level (ft. BOTC)	April 2019 Water Elevation (ft. NAVD 88)	Screened Interval (Ft-BGS)		Monitoring Zone Flow
GWA-29BRA	679.76	638.04	633.04	15.68	664.08	48.4	58.4	Bedrock
GWA-29D	679.56	628.54	618.54	20.63	658.93	20.5	25.5	Deep
GWA-2BR	685.43	619.22	614.22	12.43	673.00	63.0	68.0	Bedrock
GWA-2BRA	685.64	625.54	615.54	12.80	672.84	58.0	68.0	Bedrock
GWA-2BRU	685.35	650.86	645.86	12.37	672.98	32.4	37.4	Deep
GWA-2S	685.56	677.34	662.34	10.55	675.01	6.0	21.0	Shallow
GWA-30BR	806.90	740.01	735.01	34.46	772.44	65.0	70.0	Bedrock
GWA-30BRU	806.72	766.88	761.88	25.47	781.25	38.0	43.0	Deep
GWA-30S	806.89	787.49	777.49	21.77	785.12	17.5	27.5	Shallow
GWA-31BRA	757.13	637.16	627.16	45.62	711.51	116.5	126.5	Bedrock
GWA-31D	754.89	742.54	737.54	16.46	738.43	10.4	15.4	Deep
GWA-32BR	698.56	636.58	631.58	27.07	671.49	60.0	65.0	Bedrock
GWA-32D	698.53	661.67	656.67	27.20	671.33	35.0	40.0	Deep
GWA-33BR	722.94	636.10	631.10	20.83	702.11	85.0	90.0	Bedrock
GWA-33D	722.88	695.11	690.11	4.18	718.70	26.0	31.0	Deep
GWA-33S	722.71	715.81	705.81	3.12	719.59	5.0	15.0	Shallow
GWA-34S	715.88	698.25	683.25	4.50	711.38	14.3	29.3	Shallow
GWA-34BR	715.38	661.48	651.48	0.00	715.38	51.0	61.0	Bedrock
GWA-35D	697.74	633.25	628.25	23.69	674.05	62.0	67.0	Deep
GWA-35S	698.04	675.69	660.69	23.31	674.73	20.0	35.0	Shallow
GWA-36D	710.53	624.52	619.52	6.33	704.20	83.0	88.0	Deep
GWA-36S	710.53	700.80	685.80	7.40	703.13	7.0	22.0	Shallow
GWA-37D	710.47	612.67	607.67	35.99	674.48	95.0	100.0	Deep
GWA-37S	710.56	667.59	652.59	40.02	670.54	40.0	55.0	Shallow
GWA-38D	760.01	704.28	699.28	52.99	707.02	53.0	58.0	Deep
GWA-38S	760.01	721.85	706.85	53.44	706.57	35.0	50.0	Shallow
GWA-39S	723.41	717.17	715.17	3.08	720.33	3.0	5.0	Shallow
GWA-3D	757.53	694.08	689.08	56.51	701.02	62.0	67.0	Deep
GWA-40S	723.09	716.07	713.07	6.53	716.56	4.0	7.0	Shallow
GWA-42S	724.65	717.94	712.94	8.76	715.89	4.0	9.0	Shallow
GWA-43D	725.10	679.85	674.85	15.64	709.46	42.5	47.5	Deep
GWA-43S	725.19	716.05	701.05	7.08	718.11	6.0	21.0	Shallow
GWA-44BR	769.03	671.86	666.86	30.82	738.21	94.1	99.1	Bedrock
GWA-44D	769.07	696.02	691.02	39.62	729.45	70.0	75.0	Deep
GWA-44S	768.88	729.71	714.71	41.45	727.43	36.0	51.0	Shallow
GWA-45D	816.59	730.11	725.11	62.12	754.47	84.0	89.0	Deep
GWA-45S	816.55	769.93	759.93	53.02	763.53	45.5	55.5	Shallow
GWA-46D	788.60	767.55	762.55	25.01	763.59	18.0	23.0	Deep
GWA-47D	805.18	752.53	747.53	43.81	761.37	50.0	55.0	Deep
GWA-48BR	808.89	723.53	718.53	19.41	789.48	82.0	87.0	Bedrock
GWA-4D	711.64	677.84	672.84	4.06	707.58	32.0	37.0	Deep
GWA-4S	711.61	704.83	689.83	2.58	709.03	5.0	20.0	Shallow
GWA-51D	792.99	734.79	729.79	52.74	740.25	55.5	60.5	Deep
GWA-54D	765.03	655.31	650.31	41.51	723.52	107.0	112.0	Deep
GWA-54-BRO	764.65	640.01	576.51	41.57	723.08	112.0	175.0	Bedrock
GWA-54S	763.76	723.81	708.81	42.19	721.57	37.0	52.0	Shallow
GWA-56D	708.70	641.99	636.99	29.78	678.92	67.0	72.0	Deep
GWA-56S	708.58	683.82	668.82	27.05	681.53	25.0	40.0	Shallow
GWA-57BR	730.26	651.42	641.42	32.27	697.99	76.0	86.0	Bedrock
GWA-57BRU	729.66	691.09	681.09	25.60	704.06	36.0	46.0	Deep
GWA-57S	729.43	713.28	708.28	11.24	718.19	14.0	19.0	Shallow
GWA-58BR	732.56	654.03	644.03	27.30	705.26	76.0	86.0	Bedrock
GWA-58BRU	731.83	698.60	693.60	16.46	715.37	31.0	36.0	Deep
GWA-58S	731.74	724.20	714.20	14.39	717.35	4.8	14.8	Shallow
GWA-59BR	756.06	679.82	674.82	27.98	728.08	73.9	78.9	Bedrock
GWA-59D	756.53	717.42	707.42	28.65	727.88	36.2	46.2	Deep
GWA-5BRU	776.73	734.69	729.69	21.38	755.35	40.0	45.0	Deep
GWA-5S	777.01	760.93	745.93	20.81	756.20	14.0	29.0	Shallow
GWA-60BR	763.87	706.40	696.40	23.75	740.12	55.5	65.5	Bedrock
GWA-60BRU	763.99	739.67	729.67	18.17	745.82	22.0	32.0	Deep
GWA-61BR	763.74	672.84	667.84	33.04	730.70	88.4	93.4	Bedrock
GWA-61BRU	764.08	715.35	705.35	37.62	726.46	46.4	56.4	Deep
GWA-62BR	735.10	679.30	669.30	62.56	672.54	56.0	66.0	Bedrock

TABLE 5-1
APRIL 2019 WATER LEVEL MEASUREMENTS AND ELEVATIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Top of Casing Elevation (ft. NAVD 88)	Top of Screen Elevation (ft. NAVD 88)	Bottom of Screen Elevation (ft. NAVD 88)	April 2019 Measured Water Level (ft. BOTC)	April 2019 Water Elevation (ft. NAVD 88)	Screened Interval (Ft-BGS)		Monitoring Zone Flow
GWA-62BRU	734.65	713.08	708.08	7.89	726.76	22.0	27.0	Deep
GWA-63BRU	815.37	746.86	736.86	51.80	763.57	66.0	76.0	Deep
GWA-63S	815.08	767.29	762.29	50.29	764.79	46.0	51.0	Shallow
GWA-64BRL	762.45	534.46	524.46	44.91	717.54	225.0	235.0	Bedrock
GWA-65BR	754.33	685.12	675.12	23.73	730.60	66.1	76.1	Bedrock
GWA-65BRL	754.07	401.23	391.23	15.22	738.85	350.0	360.0	Bedrock
GWA-66BRL	771.11	513.29	493.29	22.93	748.18	254.0	274.0	Bedrock
GWA-67BR	696.23	586.70	571.70	1.92	694.31	106.5	121.5	Bedrock
GWA-67BRL	692.88	521.06	511.06	0.00	692.88	169.6	179.6	Bedrock
GWA-68BRL	699.30	346.25	336.25	4.97	694.33	350.0	360.0	Bedrock
GWA-6D	809.97	766.30	761.30	30.33	779.64	42.0	47.0	Deep
GWA-6S	810.00	777.33	767.33	29.03	780.97	31.0	41.0	Shallow
IB-6D	675.76	621.41	616.41	17.06	658.70	51.2	56.2	Deep
IB-6S	676.14	652.55	642.55	17.43	658.71	20.5	30.5	Shallow
IB-7S	681.44	658.79	648.79	18.72	662.72	39.8	44.8	Shallow
IB-7D	681.43	638.73	633.73	19.03	662.40	19.6	29.6	Deep
MW-10D	785.50	750.06	745.06	27.41	758.09	32.8	37.8	Deep
MW-10S	785.81	763.70	748.70	27.63	758.18	19.7	34.7	Shallow
MW-11BRL	767.462	469.05	459.05	60.79	706.67	295.2	305.2	Bedrock
MW-11BRO	764.96	709.05	589.05	12.36	752.60	–	–	Bedrock
MW-11D	763.67	723.45	718.45	–	–	37.9	42.9	Deep
MW-11DA	765.02	717.43	712.43	30.76	734.26	45.0	50.0	Deep
MW-11S	764.51	747.10	732.10	28.45	736.06	15.0	30.0	Shallow
MW-20D	665.20	656.13	641.13	6.25	658.95	6.5	21.5	Deep
MW-20DR	665.38	650.26	600.26	0.00	665.38	12.5	62.5	Bedrock
MW-21BR	777.56	694.40	689.40	14.35	763.21	81.1	86.1	Bedrock
MW-21D	777.51	768.83	754.23	3.80	773.71	6.6	21.2	Deep
MW-22BR	821.11	732.66	727.66	25.24	795.87	86.0	91.0	Bedrock
MW-22DR	821.81	778.19	728.39	25.65	796.16	40.4	90.2	Bedrock
MW-23D	734.08	695.09	685.09	16.61	717.47	36.0	46.0	Deep
MW-23DR	733.80	685.69	635.69	15.63	718.17	45.0	95.0	Bedrock
MW-23S	733.62	720.94	705.94	15.51	718.11	10.0	25.0	Shallow
MW-24D	816.36	779.93	760.13	12.90	803.46	33.2	53.0	Deep
MW-24DR	816.28	753.01	708.21	8.80	807.48	60.3	105.1	Bedrock
MW-25DR	667.05	627.23	577.53	9.18	657.87	37.3	87.0	Bedrock
MW-2DA	730.62	656.45	651.45	34.08	696.54	71.0	76.0	Bedrock
MW-30D	833.26	745.02	740.02	40.05	793.21	86.1	91.1	Deep
MW-30DA	835.05	741.64	736.64	43.57	791.48	87.0	92.0	Deep
MW-30S	833.73	798.79	783.79	39.46	794.27	32.7	47.7	Shallow
MW-32BR	839.40	769.42	764.42	24.30	815.10	62.5	72.5	Bedrock
MW-32D	839.28	788.65	783.65	25.01	814.27	48.5	53.5	Deep
MW-32S	839.71	817.64	802.64	26.46	813.25	20.0	35.0	Shallow
MW-34BRU	751.66	705.94	700.94	28.40	723.26	43.7	48.7	Deep
MW-34S	751.87	735.49	720.49	25.08	726.79	14.4	29.4	Shallow
MW-36BRU	678.40	598.35	593.35	8.58	669.82	77.6	82.6	Deep
MW-36S	678.87	672.93	657.93	7.73	671.14	4.0	19.0	Shallow
MW-38BR	707.70	610.47	605.47	38.68	669.02	97.5	102.5	Bedrock
MW-38D	707.68	638.90	633.90	37.18	670.50	69.0	74.0	Deep
MW-38S	707.60	670.17	655.17	38.43	669.17	37.7	52.7	Shallow
MW-40BRU	709.56	679.69	674.69	4.09	705.47	30.4	35.4	Deep
MW-40S	709.38	704.64	689.64	5.29	704.09	5.0	20.0	Shallow
MW-42DA	812.02	759.44	754.44	34.26	777.76	49.3	54.3	Deep
MW-42S	811.47	781.47	771.47	32.73	778.74	28.0	38.0	Shallow
MW-8D	736.64	704.11	699.11	9.37	727.27	29.8	34.8	Deep
MW-8S	736.27	730.88	715.88	6.13	730.14	2.9	17.9	Shallow
MW-7D	807.35	771.09	766.09	40.74	766.61	33.5	38.5	Deep
U5-1D	802.94	746.00	741.00	41.11	761.83	55.0	60.0	Deep
U5-1S	802.71	761.82	746.82	40.26	762.45	39.0	54.0	Shallow
U5-2BR	795.06	700.06	695.06	59.44	735.62	100.3	105.3	Bedrock
U5-2D	793.73	719.99	714.99	56.34	737.39	72.0	77.0	Deep
U5-2S-SLA	795.42	742.39	727.39	50.97	744.45	50.0	65.0	Ash Pore Water
U5-2S-SLB	795.56	742.09	727.09	52.21	743.35	51.0	66.0	Ash Pore Water
U5-4BR	765.06	639.90	634.90	75.85	689.21	125.1	130.1	Bedrock

TABLE 5-1
APRIL 2019 WATER LEVEL MEASUREMENTS AND ELEVATIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Top of Casing Elevation (ft. NAVD 88)	Top of Screen Elevation (ft. NAVD 88)	Bottom of Screen Elevation (ft. NAVD 88)	April 2019 Measured Water Level (ft. BOTC)	April 2019 Water Elevation (ft. NAVD 88)	Screened Interval (Ft-BGS)		Monitoring Zone Flow
U5-4BRA	765.11	636.34	626.34	17.80	747.31	129.0	139.0	Bedrock
U5-4D	764.99	661.23	656.23	53.83	711.16	104.2	109.2	Deep
U5-4S	764.82	705.59	690.59	50.60	714.22	59.8	74.8	Shallow
U5-5BR	765.66	660.12	655.12	62.35	703.31	105.5	110.5	Bedrock
U5-5D	765.40	700.98	695.98	57.69	707.71	65.5	69.5	Deep
U5-6D	765.19	708.93	703.93	46.36	718.83	56.5	61.5	Deep
U5-6S	765.28	728.64	713.64	46.92	718.36	37.0	52.0	Shallow
U5-8BR	770.31	649.64	644.64	3.28	767.03	120.9	125.9	Bedrock
U5-8D	770.25	699.57	694.57	7.40	762.85	71.0	76.0	Deep
U5-8S	770.29	765.63	750.63	5.54	764.75	5.0	20.0	Shallow

Prepared by: AKM Checked by: VJH

Notes:
-- not measured or not available
BGS - below ground surface
Ft - Feet
NAVD 88 - North American Vertical Datum 1988

TABLE 5-2
GROUNDWATER BALANCE SUMMARY
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Modeling Scenario	Pre-Decanting		Closure-in-Place		Closure-by-Excavation	
Water Balance Components	Flow in (gpm)	Flow out (gpm)	Flow in (gpm)	Flow out (gpm)	Flow in (gpm)	Flow out (gpm)
Recharge from capped areas					10	
Flow removed by Unit 5		10		56		18
Leakage from AAB to GW	65					
Flow removed by streams or drains in AAB and ASA				114		54
Recharge from Suck Creek to groundwater system	4		17		9	
Flow removed by surface water and private wells		337		251		287
Recharge from watershed	562		567		511	
Flow removed by General Head Edge of model		24		24		26

Prepared by: SAS Checked by: TJG

Notes:
1) Drainage includes streams, seeps, ditch, channel, canal, etc. Drainage streams included are depending on the scenario, where the pre-decanting scenario includes streams present prior to closure and closure-by excavation includes streams that form within the excavated ash basin footprint after closure.
2) Other refers to groundwater flow in/out the watershed that are not accounted in the above categories

Flow in refers to recharge to the groundwater system
Flow out refers to discharge from the groundwater system
gpm - gallons per minute

TABLE 5-3
SURFACE WATER CLASSIFICATIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Adjacent Surface Water Body	Surface Water Classification (15A NCAC 02B .0300)
Broad River	Class WS-IV
Suck Creek	Class WS-IV
Unnamed Tributary west of U5 AB	Class WS-IV

Prepared by: SAS Checked by: TJG

Notes:

1. Class C waters are protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, and survival.
2. Class WS-IV waters are protected as water supplies that are generally in moderately to highly developed watersheds. WS-IV waters are also subject to Class C water quality standards.

Source Area 1
(Active Ash Basin and Ash Storage Area)

TABLE 6-1
BORON CONCENTRATIONS IN GROUNDWATER BELOW SOURCE AREA
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well Beneath Ash (Flow Zone)	Number of Sample Events	Time Period of Record	Boron Concentration Range in Groundwater (µg/L)	Boron Concentration Range in Overlying Pore Water (µg/L)
AB-3BRA (Bedrock)	3	11/2018 – 04/2019	<50[1]	<50 – 4,990 (~30' saturated ash)
AB-3BRU/BRUA (Deep)	17	06/2015 – 04/2019	<50 – 72.5	
AB-3I (Shallow)	16	06/2015 – 04/2019	<50 – 94.4	
AB-4BR (Bedrock)	15	06/2015 –04/2019	<50 – 70	449 – 3,000 (~25' saturated ash)
AB-4D (Deep)	16	06/2015 – 04/2019	<50[1]	
AB-5BR (Bedrock)	12	03/2016 – 01/2019	<50[1]	2,940 – 6,150 (~45' saturated ash)
AB-5BRU (Deep)	14	06/2015 – 01/2019	<50[1]	
AB-6BR (Bedrock)	15	06/2015 – 01/2019	<50[1]	1,960 – 11,300 (~35' saturated ash)
AB-6D (Deep)	15	06/2015 – 01/2019	<50 (one anomalous concentration of 114)	
AB-7BR (Bedrock)	2	04/2019 – 06/2019	90 - 93	1,630 – 1,890 (~25' saturated ash)
AB-7BRU (Deep)	3	04/2019 – 07/2019	89.7 - 100	
AB-8BR (Bedrock)	2	03/2019 – 06/2019	331 - 341	4,330 – 4,390 (~35' saturated ash)
AB-8BRU (Deep)	2	03/2019 – 06/2019	417 - 459	
AB-8I (Shallow)	2	03/2019 – 06/2019	807 – 811	
AB-9BR (Bedrock)	2	03/2019 – 06/2019	<50[1]	5,600 – 6,220 (~15' saturated ash)
AB-9D (Deep)	2	03/2019 – 06/2019	73 - 81	

Prepared by: TJG Checked by: SAS

Notes:

< – Concentration not detected at or above the adjusted reporting limit

[1] – Concentrations have not been detected at or above the adjusted reporting limit across all sampling events

TABLE 6-2
SOIL PSRG POG STANDARD EQUATION PARAMETERS AND VALUES
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

$$C_{soil} = C_{gw} [K_d + (\theta_w + \theta_a H')/P_b]df$$

Inorganic Parameters	Parameter Definition	Default Values	Units
C_{soil}	Calculated source concentrations for soil	NA	mg/kg
C_{gw}	Applicable groundwater target concentration: 15A NCAC 02L Standard	15A NCAC 02L Standard	mg/L
df	Dilution factor[1]	20	unitless
K_d	Soil -water partition coefficient for inorganics (range)	Constituent Specific[4]	L/kg
θ_w	Effective porosity - water filled soil porosity vadose soils[2]	0.3	L_{water}/L_{soil}
θ_a	Total porosity - Air filled soil porosity - vadose soils[3]	0.13	L_{air}/L_{soil}
P_b	dry bulk density[2]	1.6	kg/L
H'	Henry's law constant-dimensionless where: H' = Henry's law constant (atm - m3/mole) x conversion factor of 41	Constituent Specific[3,5]	unitless

Prepared by: SAS Checked by: TJG

Notes:

[1] - Default value from Soil Screening Guidance: Technical Background Document (USEPA, 1996)

[2] - Site specific value (Falta *et al*., 2019). Effective porosity represents unconsolidated material.

[3] - DEQ default value appropriate for North Carolina

[4] - Constituent Specific- Soil water partition coefficients (K_d) were obtained from the Groundwater Quality Signatures for Assessing Potential Impacts from Coal Combustion Product Leachate (EPRI, 2012). Sulfate K_d ranges from 0.1 to 2.1, based on sands/sediments and a pH range of 4.6 to 7.2

[5] – a value of 0 is used for sulfate

NA - Not applicable

NCAC – North Carolina Administrative Code

mg/kg – milligrams per kilogram

mg/L – milligrams per liter

L/kg – liters per kilogram

L_{water}/L_{soil} – volume of water filled spaces per volume of soil

L_{air}/L_{soil} – volume of air filled spaces per volume of soil

kg/L - kilogram per liter

TABLE 6-3
SUMMARY OF UNSATURATED SOIL ANALYTICAL RESULTS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameters		pH	Arsenic	Boron	Cobalt	Iron	Manganese	Strontium	Sulfate	Thallium	Vanadium
Reporting Units		S.U.	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PSRG Protection of Groundwater		NE	5.8	45	0.9	150	65	1,500	1,438	0.28	350
Background Threshold Values		4.0-6.8	7.8	31	48	74,362	672	9.9	13	1.1	161
Sample ID	**Sample Collection Date**	**Analytical Results**									
Background											
BGSB-BG-1 (6-7)	10/19/2017	5.0	1.2	<5.1	23	40,000 B	260	1.5	13	0.64	84
BGSB-BG-1 (13-14)	10/19/2017	4.8	0.49	<5.2	6	16,000 B	130	1 j	<11	0.4	42
BGSB-BG-1 (19-20)	10/19/2017	4.6	3	<25	5.2	38,000 B	48	<9.9	<12	0.33	40
BGSB-BG-2 (2-3)	10/19/2017	5.1	6.8	<11	4.1	47,000 B	100	1.2	47	0.29	110
BGSB-BG-2 (6-7)	10/19/2017	5.2	1.3	<12	13	49,000 B	200	<4.7	<13	0.19	120
BGSB-GWA-25 (6-7)	10/19/2017	4.9	1.5	<13	15	52,000 B,M	93	3.7 j	<12	0.65	120
BGSB-GWA-25 (14-15)	10/19/2017	5.2	2.8	<5.1	23	15,000 B	**850**	1.7 j	<12 M	0.3	44
GWA-25D (8.5 - 10)	05/11/2015	5.1 j	<5.6	<14	11.8	23,500	254	<2.8	<268	<5.6	51.4
Beyond Ash Basin Waste Boundary											
AS-1D (3.5 - 5)	05/13/2015	5.3 j	<7.1	9 j	8.6	12,800	357	<3.5	<347	<7.1	15.8
AS-1D (28.5 - 30)	05/13/2015	6.1 j	<7	16.6 j	10.4	22,800	300	3 j	<356	<7	32.4
AS-1D (58.5 - 60)	05/13/2015	**7.2 j**	<6.9	<17.2	<6.9	3,120	22.4	8.2	<338	<6.9	<6.9
AS-1D (68.5 - 70)	05/13/2015	5.5 j	<7	<17.4	<7	4,310	30	4.3	<350	<7	<7
AS-4D (63.5 - 65)	05/05/2015	5.6 j	<6.6	<16.6	<6.6	6,690	148	2.1 j	<323	<6.6	<6.6
AS-5BRU (33.5 - 35)	04/10/2015	6.5 j	<6.1	<15.3	<6.1	3,280	95.7	<3.1	<295	<6.1	<6.1
AS-6D (48.5 - 50)	04/30/2015	5.3 j	5.7 j	12.4 j	22.1	14,700	**944**	<3.1	<323	<6.3	20.9
AS-7D (3.5 - 5)	05/18/2015	5.1 j	<7.7	14.5 j	6.5 j	20,900	168	<3.9	<374	<7.7	24.6
BG-1D (3.5 - 5)	02/23/2015	5.4 j	<3	<3	7.5	35,900	75.2	4.4	<314	<1.2	59.7
BG-1D (8.5 - 10)	02/23/2015	5.7 j	1.4	<13.3	8.1	17,400	64.7	7.6	<267	0.7 j	31
GWA-20D (3 - 5)	04/23/2015	**7.8 j**	<5	<12.6	2.9 j	5,150	225	2.1 j	<264	<5	10.2
GWA-21BRU (5 - 5)	05/08/2015	**7.8 j**	2.9 j	<14	7.1	19,200	242	5.4	224 j-	<5.6	22.7
GWA-21BRU (10 - 10)	05/08/2015	5.5 j	3.6 j	<14.8	31.3	23,600	243	3.9	239 j-	<5.9	26.7
GWA-22S (3 - 5)	05/04/2015	**9.2 j**	<8.1	<20.2	6.6 j	27,900	256	3.9 j	<407	<8.1	50.4
GWA-23D (15.8 - 15.8)	05/08/2015	4.2 j	<5.1	<12.7	21.2	36,800	170	<2.5	<256	<5.1	22.4
GWA-26D (13.5 - 15)	05/07/2015	5.9 j	<6.3	<15.7	5.9 j	16,200	189	<3.1	<322	<6.3	17.8
GWA-27D (13.5 - 15)	03/03/2015	5.5 j	0.95 j	16.1	**73.3**	17,600	**1,240**	0.39 j	<292	0.74 j	23.8
GWA-27D (24.9 - 24.9)	06/08/2015	5.6 j	4.8 j	<12.7	**73.8**	24,900	**1,190**	<2.5	<252	<5.1	30.3

Prepared by: TJG Checked by: VJH

Notes:

- Bold highlighted concentration indicates exceedance of the Inactive Hazardous Sites Branch PSRG Table (May 2019) for Protection of Groundwater or the Background Threshold Value (BTV), whichever is higher.

< - Concentration not detected at or above the adjusted reporting limit.

B - Target analyte detected in method blank at or above the reporting limit. Target analyte concentration in sample is less than 10X the concentration in the method blank. Analyte concentration in sample could be due to blank contamination.

j - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

j- Estimated concentration, biased low.

M - Matrix spike / matrix spike dup failure.

mg/kg - milligrams per kilogram

NE - not established

PSRG - preliminary soil remediation goals

S.U. - standard units

TABLE 6-4
SOURCE AREA INTERIM ACTIONS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Groundwater Remedy Component	Rationale
Active Ash Basin Decanting	Active source remediation by removing ponded water in the AAB. Decanting will lower the hydraulic head within the coal ash basin and reduce hydraulic gradients, reducing groundwater seepage velocities and COI transport potential. Decanting will return the groundwater flow system to its approximate condition, prior to construction of the ash basin, with the re-establishment of the former Suck Creek stream channel.
Source Area Stabilization	AAB downstream dam modifications including spillway and riser repair and the installation of a new spillway.

Prepared by: SAS Checked by: TJG

Notes:
COI – Constituent of Interest

TABLE 6-5
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
Background Locations																	
BG-01S	Shallow	4.9	< 0.1	< 50	0.230	0.9	1.7	171	1.6	39	21	1	< 0.1	41	0.538	< 0.0005	< 0.3
GWA-24S	Shallow	5.1	0.1	< 50	0.134	1.4	5.2	113	2.0	52	10	2	< 0.1	30	< 0.732	-	0.5
GWA-25S	Shallow	5.2	< 0.1	< 50	0.094	< 0.5	2.7	88	1.7	26	36	< 1	< 0.1	38	-	-	< 0.3
BG-01D	Deep	5.7	0.1	< 50	0.045	< 0.5	0.6	< 50	1.7	12	30	2	< 0.1	56	0.772	< 0.0005	< 0.3
GWA-24D	Deep	5.5	< 0.1	< 50	0.032	< 0.5	0.2	< 50	1.7	5	24	3	< 0.1	45	< 0.443	-	< 0.3
BG-01BRA	Bedrock	11.5	-	< 50	-	-	-	-	-	-	-	-	-	-	-	-	-
GWA-24BR	Bedrock	6.0	< 0.1	< 50	0.038	< 0.5	0.1	54	2.8	< 5	29	7	< 0.1	52	-	-	< 0.3
MW-22BR	Bedrock	6.4	0.1	< 50	0.084	< 0.5	1.0	369	2.7	49	43	8	< 0.1	67	-	-	0.3
MW-22DR	Bedrock	5.8	< 0.1	< 50	0.036	< 0.5	1.2	511	2.3	52	24	5	< 0.1	39	-	-	< 0.3
MW-24DR	Bedrock	7.2	< 0.1	< 50	0.033	0.5	< 0.1	1297	6.9	58	80	11	< 0.1	108	2.134	< 0.0005	< 0.3
Within the Waste Boundary Locations																	
AB-03MA15	Ash Pore Water	9.6	282	1708	< 0.025	0.7	< 0.1	< 50	210	< 5	1358	112	< 0.1	327	< 0.0939	0.0003	109
AB-03S	Ash Pore Water	7.4	372	2970	< 0.025	1.0	1.0	4268	119	1185	3007	386	0.7	975	0.564	0.0027	5.1
AB-03SL	Ash Pore Water	9.6	851	1138	< 0.025	1.1	0.1	128	198	32	897	66	< 0.1	191	1.207	0.0001	75.8
AB-04LA15	Ash Pore Water	5.6	184	606	0.051	0.6	5.4	4108	14.5	686	354	1	0.3	77	1.420	0.0001	1.4
AB-04S	Ash Pore Water	9.4	92.6	2513	< 0.025	< 0.5	0.1	< 50	119	< 5	2207	127	< 0.1	471	0.784	0.0006	41.8
AB-04SL	Ash Pore Water	9.0	1692	1506	0.051	0.7	0.1	97	56.5	9	1640	31	< 0.1	172	0.415	0.0056	45.9
AB-04UA15	Ash Pore Water	10.0	92.3	2913	< 0.025	0.8	< 0.1	< 50	141	< 5	2270	126	< 0.1	470	1.190	0.0001	38.9
AB-05S	Ash Pore Water	8.0	1782	5242	< 0.025	< 0.5	0.1	1728	92.4	211	3540	88	< 0.1	423	1.146	0.1167	1.6
AB-06S	Ash Pore Water	8.6	323	8380	0.058	< 0.5	< 0.1	161	103	46	2510	111	< 0.1	377	0.946	0.0010	8.9
AB-07S	Ash Pore Water	9.2	157	1760	0.048	0.7	0.1	< 50	133	11	1430	97	0.1	352	< 0.695	0.0017	52.0
AB-08S	Ash Pore Water	7.9	65.1	4360	0.033	< 0.5	0.4	120	151	73	2775	842	1.0	1605	< 0.851	0.0725	52.5
AB-09S	Ash Pore Water	8.6	1965	5910	0.071	< 0.5	< 0.1	119	106	43	2335	139	< 0.1	415	0.329	0.0019	0.7
AB-01S	Shallow	5.2	0.3	50	< 0.025	< 0.5	**68.6**	1478	2.5	**6045**	32	4	**0.5**	110	-	0.0001	0.4
AB-02S	Shallow	5.5	0.8	330	< 0.025	1.9	**39.7**	**9102**	2.8	**17598**	**76**	24	**0.3**	124	-	-	0.5
AB-03I	Shallow	6.6	3.1	50	0.447	1.1	0.2	156	**5.8**	127	**131**	3	**0.4**	70	-	-	**2.4**
AB-08I	Shallow	6.4	3.1	**809**	< 0.025	< 0.5	11.8	**24250**	1.8	**10570**	**109**	24	0.1	201	0.750	0.0004	< 0.3
CLMW-05S	Shallow	5.2	0.2	< 50	< 0.025	0.4	**56.6**	294	0.9	**4790**	25	4	**0.4**	65	-	-	< 0.3
AB-01D	Deep	6.6	0.2	**804**	< 0.025	1.3	1.1	**9187**	4.5	**2317**	**256**	36	< 0.1	302	-	-	0.4
AB-02D	Deep	6.7	0.1	291	0.027	2.5	2.6	**17746**	**15.3**	**2524**	**345**	50	< 0.1	259	-	-	< 0.3
AB-03BRUA	Deep	11.4	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-04D	Deep	4.6	0.1	< 50	0.095	< 0.5	**5.3**	55	1.9	180	8	< 1	< 0.1	30	-	< 0.0005	< 0.3
AB-05BRU	Deep	5.4	0.4	< 50	0.031	< 0.5	3.5	104	2.3	171	38	5	0.1	43	-	-	0.3
AB-06D	Deep	5.2	0.1	< 50	0.027	< 0.5	0.6	< 50	1.6	38	29	< 1	< 0.1	34	-	< 0.0005	< 0.3
AB-07BRU	Deep	7.4	-	94	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-08BRU	Deep	6.6	0.5	438	< 0.025	1.5	1.4	1357	**14.4**	245	**172**	9	< 0.1	237	1.164	**0.0015**	0.4
AB-09D	Deep	5.9	0.2	77	0.039	0.6	**12.0**	580	3.4	254	42	3	0.1	48	0.777	0.0001	0.3
AB-01BROR	Bedrock	7.0	0.2	397	0.034	**15.1**	**3.8**	1550	6.9	**1555**	**268**	11	< 0.1	364	-	-	0.7
AB-02BRO	Bedrock	6.9	0.9	476	< 0.025	2.1	**8.7**	**12352**	1.8	**2188**	**517**	53	< 0.1	292	-	-	0.4
AB-03BR	Bedrock	12.4	-	46	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-03BRA	Bedrock	12.5	-	33	-	-	-	-	-	-	-	-	-	-	-	-	-
AB-04BR	Bedrock	6.3	< 0.1	< 50	< 0.025	< 0.5	< 0.1	**11847**	5.8	**155**	**105**	4	< 0.1	120	2.037	< 0.0005	< 0.3
AB-05BR	Bedrock	5.5	0.1	< 50	0.029	0.4	1.7	49	1.6	109	23	6	< 0.1	47	-	-	< 0.3
AB-06BR	Bedrock	6.3	< 0.1	< 50	0.026	0.5	< 0.1	4214	9.1	69	**101**	5	< 0.1	89	-	< 0.0005	< 0.3
AB-07BR	Bedrock	7.8	0.4	92	< 0.025	2.5	0.2	1018	10.6	**168**	**168**	5	< 0.1	163	**3.285**	0.0003	0.3

TABLE 6-5
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
ACTIVE ASH BASIN
CORRECTIVE ACTIVE PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
Within the Waste Boundary Locations (Continued)																	
AB-08BR	Bedrock	6.4	0.8	336	< 0.025	0.9	1.3	2095	8.0	**577**	**164**	13	< 0.1	246	1.101	**0.0010**	0.2
AB-09BR	Bedrock	7.4	0.3	< 50	< 0.025	0.6	0.2	2035	8.3	91	93	15	< 0.1	117	0.661	0.0001	0.3
Between Waste Boundary and Compliance Boundary																	
Upgradient of the Ash Basin																	
GWA-23D	Deep	5.2	< 0.1	< 50	0.062	< 0.5	0.8	< 50	1.7	9	16	< 1	< 0.1	61	-	-	< 0.3
MW-21D	Deep	5.1	0.1	< 50	0.077	< 0.5	0.9	178	1.5	12	22	2	< 0.1	33	-	-	< 0.3
MW-24D	Deep	5.2	0.2	< 50	0.059	< 0.5	0.1	< 50	1.6	< 5	26	< 1	< 0.1	41	0.427	< 0.0005	< 0.3
CCR-17BR	Bedrock	6.0	< 0.1	< 50	< 0.025	2.0	2.0	143	2.1	47	33	6	< 0.1	68	0.906	< 0.0005	0.3
GWA-48BR	Bedrock	6.7	< 0.1	< 50	< 0.025	0.6	< 0.1	2300	6.3	49	66	11	< 0.1	91	-	-	< 0.3
MW-21BR	Bedrock	6.9	0.2	< 50	0.029	< 0.5	< 0.1	< 50	4.0	55	53	8	< 0.1	99	-	-	0.3
Downgradient of the Ash Basin																	
CCR-06S	Shallow	4.3	7.0	**1317**	-	2.5	**97.6**	-	**9.1**	-	-	**508**	**0.5**	**867**	**3.664**	-	-
CCR-07S	Shallow	6.6	0.2	**2714**	0.042	0.6	3.0	70	0.9	**5496**	**2648**	**495**	**0.5**	**1153**	0.776	-	< 0.3
CCR-11S	Shallow	7.1	0.1	**1207**	-	< 0.5	0.5	-	0.8	-	-	125	< 0.1	476	0.624	-	-
CCR-12S	Shallow	5.0	0.4	**1144**	3.475	4.7	16.5	300	**3.7**	**3512**	**74**	47	**0.2**	177	**2.310**	-	< 0.3
CCR-16S	Shallow	4.4	0.9	**2580**	-	1.1	**77.5**	-	2.8	-	-	76	**0.2**	174	1.493	-	-
CLMW-01	Shallow	4.7	0.8	**1420**	0.203	3.1	2.4	224	1.2	213	**895**	111	**0.5**	318	1.446	< 0.0005	< 0.3
CLMW-06	Shallow	5.0	< 0.1	< 50	0.123	< 0.5	11.5	144	1.1	165	17	< 1	< 0.1	34	-	-	< 0.3
GWA-20S	Shallow	6.4	0.2	283	0.104	0.6	13.3	968	< 0.5	**6013**	**149**	92	< 0.1	349	0.487	< 0.0005	< 0.3
GWA-26S	Shallow	4.8	0.1	< 50	0.032	0.6	0.8	243	1.1	22	< 5	< 1	< 0.1	< 25	-	-	< 0.3
GWA-28S	Shallow	4.8	0.2	< 50	0.109	1.1	2.3	244	1.8	35	5	2	0.1	30	-	-	0.3
GWA-42S	Shallow	5.3	< 0.1	29	0.120	< 0.5	0.7	41	-	14	**87**	49	< 0.1	81	-	-	< 0.3
GWA-43S	Shallow	5.1	0.1	79	0.464	0.9	1.3	174	0.9	21	**167**	44	< 0.1	92	-	-	< 0.3
GWA-57S	Shallow	5.5	0.1	< 50	< 0.025	< 0.5	14.5	246	2.9	**1855**	**132**	99	< 0.1	207	0.518	0.0004	0.3
GWA-58S	Shallow	5.6	0.1	< 50	1.700	1.4	4.2	40	2.2	**1890**	**175**	245	0.1	**510**	< 1.14	< 0.0005	0.3
GWA-63S	Shallow	5.8	< 0.1	< 50	0.290	**31.6**	2.8	188	2.4	485	13	1	0.1	32	< 0.855	< 0.0005	< 0.3
MW-08S	Shallow	7.0	0.3	206	0.025	1.0	3.6	1123	< 0.5	**2910**	**134**	57	< 0.1	310	0.976	0.0002	0.4
MW-10S	Shallow	5.1	0.5	216	0.552	1.0	1.6	334	2.1	197	**56**	60	0.1	189	0.652	-	0.3
MW-11S	Shallow	5.3	0.2	**766**	1.617	6.0	1.2	235	2.1	**1754**	**47**	40	< 0.1	230	0.672	< 0.0005	< 0.3
CCR-04D	Deep	5.4	0.1	56	-	0.5	0.8	-	1.0	-	-	22	0.1	84	0.753	-	-
CCR-05D	Deep	5.2	0.2	55	-	< 0.5	**10.7**	-	1.7	-	-	12	0.1	88	0.570	-	-
CCR-06D	Deep	5.0	1.4	**1464**	-	2.6	**5.9**	-	4.0	-	-	196	**0.4**	361	1.077	-	-
CCR-07D	Deep	5.6	< 0.1	616	0.139	< 0.5	< 0.1	< 50	1.1	99	**155**	35	**0.3**	146	1.247	-	< 0.3
CCR-08D	Deep	5.2	7.2	**1991**	0.051	< 0.5	**294**	< 50	4.4	**8995**	**1350**	**328**	**1.5**	**673**	1.355	< 0.0005	< 0.3
CCR-09D	Deep	4.7	2.1	**838**	-	0.7	**83.0**	-	2.1	-	-	**321**	0.1	461	0.716	-	-
CCR-11D	Deep	6.8	0.1	**1210**	-	< 0.5	2.1	-	< 0.5	-	-	94	**0.2**	379	0.837	-	-
CCR-12D	Deep	6.2	0.2	373	0.028	1.2	**9.4**	**13800**	6.6	**1037**	**76**	25	< 0.1	173	1.540	-	< 0.3
CCR-13D	Deep	5.0	< 0.1	54	0.028	< 0.5	1.5	82	2.0	35	14	3	< 0.1	41	< 0.646	-	< 0.3
CCR-14D	Deep	4.7	0.3	**1095**	-	< 0.5	1.6	-	3.5	-	-	65	0.2	259	1.260	-	-
CCR-15D	Deep	4.8	< 0.1	117	< 0.025	1.0	3.6	< 50	0.9	102	10	< 1	< 0.1	39	< 0.626	-	< 0.3
CCR-16D	Deep	6.2	0.1	30	-	< 0.5	0.2	-	4.4	-	-	3	< 0.1	68	0.716	-	-
GWA-20D	Deep	5.7	0.2	**921**	0.041	< 0.5	**100**	1664	2.0	**6015**	**549**	178	**0.7**	433	1.551	< 0.0005	< 0.3
GWA-27DA	Deep	5.1	0.2	**980**	0.127	0.7	0.8	97	1.5	**1296**	**107**	65	0.2	261	0.510	< 0.0005	< 0.3
GWA-28BRU	Deep	6.3	0.3	< 50	0.029	0.5	**5.5**	**7330**	9.6	53	50	11	< 0.1	98	-	-	< 0.3
GWA-43D	Deep	6.3	0.1	< 50	0.128	0.7	0.3	< 50	**21.5**	< 5	**165**	81	< 0.1	253	-	-	0.7
GWA-51D	Deep	5.1	1.2	**796**	0.526	1.9	**71.3**	141	3.4	**8184**	**237**	229	**0.3**	486	**5.815**	< 0.0005	0.3

TABLE 6-5
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
ACTIVE ASH BASIN
CORRECTIVE ACTIVE PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
Downgradient of the Ash Basin (Continued)																	
GWA-57BRU	Deep	6.9	1.3	78	< 0.025	< 0.5	3.3	1330	**15.1**	**286**	**293**	167	< 0.1	492	**15.405**	**0.0083**	0.9
GWA-58BRU	Deep	5.9	0.3	< 50	< 0.025	< 0.5	**11.7**	**3140**	5.0	**720**	**274**	**260**	0.1	**507**	1.769	**0.0006**	< 0.3
GWA-59D	Deep	5.5	0.7	597	0.166	1.2	**118**	1210	7.4	**9850**	**200**	187	**0.3**	379	1.933	0.0001	0.4
GWA-63BRU	Deep	6.6	0.4	115	< 0.025	1.6	2.3	643	10.3	**390**	**91**	8	< 0.1	153	0.558	0.0002	0.3
MW-08D	Deep	6.0	< 0.1	130	0.034	< 0.5	4.8	**35460**	6.7	**5356**	**106**	52	< 0.1	212	**4.600**	< 0.0005	< 0.3
MW-10D	Deep	5.1	< 0.1	153	0.120	0.9	2.0	193	2.6	92	51	16	0.1	69	0.858	-	0.3
MW-11DA	Deep	6.9	0.5	79	0.048	2.2	**51.0**	**5012**	9.4	252	**145**	38	< 0.1	327	**2.833**	-	0.3
CCR-03BR	Bedrock	6.1	0.5	12	-	3.7	0.8	-	2.9	-	-	7	< 0.1	110	1.124	-	-
CCR-08BR	Bedrock	5.4	0.2	**901**	< 0.025	1.2	**4.7**	541	1.4	**2265**	**306**	65	**0.4**	243	1.332	< 0.0005	< 0.3
CCR-12BR	Bedrock	6.3	0.3	38	< 0.025	1.7	0.6	1001	6.4	**278**	**115**	17	< 0.1	179	0.725	< 0.0005	< 0.3
GWA-20BR	Bedrock	8.3	0.7	258	0.027	< 0.5	0.3	**8625**	**27.7**	**489**	**524**	82	< 0.1	283	**3.673**	0.0002	< 0.3
GWA-27BR	Bedrock	6.5	0.3	258	0.029	1.4	0.1	997	**19.0**	29	**206**	5	< 0.1	198	1.255	**0.0019**	< 0.3
GWA-28BR	Bedrock	6.6	0.1	< 50	0.031	0.4	0.4	5662	5.3	83	80	7	< 0.1	119	-	-	< 0.3
GWA-57BR	Bedrock	7.2	0.1	231	< 0.025	2.6	0.6	305	3.2	**965**	**199**	64	< 0.1	324	**5.715**	**0.0009**	0.6
GWA-58BR	Bedrock	6.7	< 0.1	366	< 0.025	0.6	0.3	**19350**	11.0	**1034**	**241**	124	< 0.1	342	**10.370**	0.0004	< 0.3
GWA-59BR	Bedrock	5.8	0.2	593	< 0.025	0.7	**2.1**	4760	**15.9**	**922**	**304**	144	< 0.1	366	**3.221**	0.0001	< 0.3
GWA-64BRL	Bedrock	7.8	0.6	236	< 0.025	< 0.5	0.1	5675	**43.5**	**576**	**436**	21	< 0.1	348	**3.220**	**0.0011**	< 0.3
GWA-65BR	Bedrock	10.9	-	381	-	-	-	-	-	-	-	-	-	-	-	-	-
GWA-65BRL	Bedrock	12.8	-	83	-	-	-	-	-	-	-	-	-	-	-	-	-
GWA-66BRL	Bedrock	7.5	0.1	403	< 0.025	< 0.5	0.2	1480	**28.8**	**299**	**395**	17	< 0.1	292	**7.135**	0.0001	< 0.3
MW-11BRL	Bedrock	10.8	-	38	-	-	-	-	-	-	-	-	-	-	-	-	-
MW-11BRO	Bedrock	6.6	< 0.1	108	< 0.025	0.9	0.3	**11700**	6.5	**1497**	**129**	8	< 0.1	279	**4.270**	-	0.3
Near or Beyond Compliance Boundary																	
Downgradient of the Ash Basin																	
AS-07S	Ash Pore Water	7.2	83.7	1447	< 0.025	1.6	3.5	14176	85.9	12196	2828	497	1.3	1078	0.650	0.0051	1.8
AS-08S	Ash Pore Water	6.7	58.2	147	0.067	0.7	2.4	4414	6.4	2923	1318	28	0.2	247	-	-	0.5
AS-01SB	Shallow	4.3	6.1	**1596**	0.158	1.4	14.5	222	**8.3**	913	**113**	**273**	**0.6**	**537**	-	**0.0011**	< 0.3
AS-02S	Shallow	4.5	5.6	**1003**	0.609	1.6	16.8	< 50	2.4	**9650**	**202**	**315**	**0.4**	**594**	0.823	< 0.0005	< 0.3
AS-04S	Shallow	5.9	0.3	< 50	0.255	14.8	2.0	336	**3.4**	107	**45**	3	0.1	76	-	-	0.5
AS-05S	Shallow	5.3	0.3	< 50	0.057	1.0	0.2	215	2.9	19	7	< 1	< 0.1	28	-	< 0.0005	< 0.3
AS-06S	Shallow	5.4	< 0.1	< 50	0.150	2.5	0.3	219	1.7	100	12	< 1	< 0.1	33	0.474	-	< 0.3
AS-07I	Shallow	5.5	3.9	645	0.029	< 0.5	15.5	**3913**	**4.9**	**6477**	**177**	209	**0.7**	447	< 1.27	0.0002	< 0.3
CLMW-02	Shallow	4.1	1.1	538	0.105	0.8	18.5	88	**5.6**	**1530**	**92**	226	**0.4**	451	-	-	< 0.3
CLMW-03S	Shallow	4.2	3.9	**911**	0.091	0.7	**37.1**	127	**9.3**	**3425**	**36**	**253**	**0.3**	498	< 0.833	< 0.0005	0.4
CLP-01	Shallow	5.2	0.3	204	0.110	0.6	2.2	326	-	101	**36**	14	0.2	58	-	-	0.5
CLP-02	Shallow	5.7	0.1	47	< 0.025	5.9	2.5	368	-	123	27	18	< 0.1	70	-	-	0.3
GWA-21S	Shallow	9.4	**10.4**	158	0.453	1.5	0.6	72	**3.0**	23	**204**	96	**0.3**	259	0.507	**0.0006**	**6.2**
GWA-22S	Shallow	5.5	0.1	264	0.032	1.3	1.6	468	1.2	43	**67**	3	< 0.1	103	0.797	< 0.0005	**1.1**
GWA-33S	Shallow	4.9	0.2	< 50	0.030	1.1	14.6	**6566**	**6.2**	546	**142**	97	< 0.1	179	-	0.0000	0.4
GWA-54S	Shallow	4.9	< 0.1	75	0.044	1.0	6.9	137	2.8	219	21	< 1	0.2	58	1.219	< 0.0005	< 0.3
MW-23S	Shallow	4.9	0.1	< 50	2.360	3.0	1.1	150	2.2	64	**120**	121	0.1	219	-	-	< 0.3
AS-01D	Deep	5.5	0.1	672	0.444	2.1	0.4	157	2.5	**291**	**186**	56	**0.3**	167	-	< 0.0005	0.3
AS-02D	Deep	7.3	1.3	343	0.072	1.5	0.5	286	**28.5**	**471**	**533**	217	< 0.1	463	1.367	< 0.0005	0.7
AS-03BRU	Deep	5.2	< 0.1	< 50	< 0.025	0.9	0.1	229	1.8	13	19	< 1	< 0.1	36	-	-	< 0.3
AS-04D	Deep	5.4	0.1	< 50	0.333	1.3	0.7	107	6.2	39	29	1	< 0.1	62	0.710	-	0.4
AS-05BRU	Deep	5.8	0.2	< 50	0.068	1.8	0.2	271	0.8	12	22	< 1	< 0.1	41	-	< 0.0005	0.3
AS-06D	Deep	5.6	< 0.1	< 50	0.068	0.9	0.2	126	0.9	11	29	< 1	< 0.1	50	0.747	-	< 0.3

TABLE 6-5
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
Downgradient of the Ash Basin (Continued)																	
AS-07D	Deep	5.5	0.2	**836**	0.266	1.5	0.3	122	7.7	**1950**	**259**	129	0.1	305	-	-	< 0.3
AS-08D	Deep	6.1	0.5	**798**	< 0.025	2.0	**8.2**	**4310**	3.8	**4968**	**280**	185	< 0.1	429	-	-	< 0.3
AS-09D	Deep	5.9	0.4	138	0.107	4.2	**30.8**	265	1.6	**470**	34	4	0.1	73	< 0.866	< 0.0002	0.5
CLMW-03D	Deep	5.2	0.2	**912**	0.135	1.1	0.2	283	4.2	43	**295**	**280**	< 0.1	**529**	1.351	< 0.0005	0.3
GWA-21BRU	Deep	6.5	< 0.1	156	< 0.025	< 0.5	1.0	516	1.9	168	**174**	23	0.1	200	1.184	< 0.0005	< 0.3
GWA-22BRU	Deep	8.0	0.3	< 50	0.069	0.7	< 0.1	174	11.7	11	**128**	4	< 0.1	146	0.536	-	0.8
GWA-33D	Deep	6.1	0.2	< 50	0.044	0.4	0.4	709	**24.2**	89	**169**	106	< 0.1	278	-	-	0.4
GWA-47D	Deep	5.3	0.1	333	0.064	0.9	1.1	161	2.8	140	**70**	< 1	0.1	88	1.063	-	0.6
GWA-54D	Deep	7.3	0.5	74	0.047	1.0	0.1	851	4.9	210	**230**	48	< 0.1	292	0.552	< 0.0005	< 0.3
GWA-62BRU	Deep	6.5	0.6	72	0.361	2.1	3.8	959	**36.0**	**573**	**160**	146	< 0.1	353	< 1.4	0.0003	0.7
MW-20D	Deep	6.5	0.2	442	< 0.025	1.5	1.1	**3723**	2.8	**282**	**148**	15	< 0.1	189	< 1.53	-	0.4
MW-23D	Deep	6.9	0.8	< 50	0.026	0.8	0.7	1028	**19.6**	**632**	**323**	**335**	< 0.1	**649**	-	-	< 0.3
AS-02BR	Bedrock	8.0	2.0	418	0.050	1.3	0.1	176	**12.4**	**363**	**222**	97	< 0.1	289	-	**0.0016**	< 0.3
AS-05BR	Bedrock	6.9	0.7	< 50	**0.928**	1.8	< 0.1	99	6.1	9	47	7	< 0.1	79	-	0.0001	**1.6**
AS-06BRA	Bedrock	6.6	0.3	< 50	0.044	0.8	0.1	84	2.8	26	60	4	< 0.1	96	0.955	-	0.8
AS-07BRB	Bedrock	7.6	1.6	72	0.127	2.4	0.3	148	3.8	24	78	40	< 0.1	166	0.601	**0.0040**	0.8
AS-07BRL	Bedrock	12.0	-	< 50	-	-	-	-	-	-	-	-	-	-	-	-	-
AS-08BR	Bedrock	7.3	0.6	43	0.310	1.7	0.2	63	1.3	44	**133**	71	< 0.1	268	0.760	**0.0044**	**1.0**
AS-09BR	Bedrock	8.1	6.5	< 50	0.057	1.8	0.2	202	4.8	40	49	7	< 0.1	124	< 0.464	**0.0035**	0.7
GWA-21BR	Bedrock	7.2	< 0.1	133	< 0.025	< 0.5	0.4	3630	7.0	**410**	**271**	< 1	< 0.1	237	**6.116**	< 0.0005	< 0.3
GWA-21BRL	Bedrock	7.2	0.4	213	< 0.025	< 0.5	0.2	3520	9.8	**662**	**267**	2	< 0.1	268	**3.440**	< 0.0002	0.3
GWA-33BR	Bedrock	8.2	< 0.1	160	< 0.025	< 0.5	< 0.1	1304	**31.1**	**334**	**204**	79	< 0.1	282	-	-	< 0.3
GWA-54BRO	Bedrock	6.6	0.9	92	0.042	4.1	0.2	965	**13.9**	54	**165**	109	< 0.1	310	0.878	**0.0021**	< 0.3
GWA-62BR	Bedrock	9.2	-	307	-	-	-	-	-	-	-	-	-	-	-	-	-
MW-02DA	Bedrock	6.6	0.8	< 50	0.066	1.4	1.6	1609	**21.7**	**801**	**140**	21	< 0.1	143	-	-	< 0.3
MW-20DR	Bedrock	7.1	< 0.1	175	< 0.025	< 0.5	< 0.1	301	8.3	**577**	**344**	< 1	< 0.1	283	1.247	-	< 0.3
MW-23DR	Bedrock	7.1	0.3	< 50	< 0.025	< 0.5	< 0.1	992	7.3	53	**106**	25	< 0.1	152	-	-	< 0.3
MW-25DR	Bedrock	6.4	0.6	< 50	0.196	0.6	1.0	53	2.1	10	51	2	< 0.1	70	-	-	0.3

Prepared by: TJG Checked by: TAW

Notes:

[1] - Background threshold values were calculated using data from background groundwater samples collected June 2015 to September 2017.

[2] - Background threshold values were calculated using data from background groundwater samples collected March 2011 to December 2018.

[3] - Statistical mean, geomean, or median calculated from data ranging from January 2018 to June 2019. Ash pore water results are not compared to groundwater standards or criteria.

Mean or geomean results were used based on the central tendency of the data set.

For wells with datasets containing fewer than four valid results, the most recent valid sample data was used.

Means were calculated for wells with four or more valid sample results. Sample results were excluded from calculations:

1) if turbidity >10 NTU (for COIs other than boron)
2) for unusable data (R0 qualified)
3) if a result was non-detect at a reporting limit (RL) greater than the normal laboratory RL

Bold text - Constituent concentration exceeds applicable comparison criteria.

- bold highlighted concentration indicates value is greater than the 15A NCAC 02L .0202 Standard or the IMAC. (Effective date for 15A NCAC 02L .0202 Standard and IMAC is April 1, 2013)
- bold highlighted concentration indicates value is greater than greatest background threshold value where there is no regulatory standard, or background threshold values are greater than regulatory standard
- highlighted concentration indicates value is either within range of background threshold values for constituents where there is no regulatory standard/background threshold values are greater than regulatory standard, or within range of background threshold value and the regulatory standard

* - Interim Maximum Allowable Concentrations (IMACs) of the 15A NCAC 02L Standard, Appendix 1, April 1, 2013.

< - concentration not detected at or above the adjusted reporting limit.

- - value not available

NE - not established

mg/L - milligrams per liter

pCi/L - picocuries per liter

µg/L - micrograms per liter

S.U. standard unit

TABLE 6-6
COI MANAGEMENT MATRIX
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituents of Interest[1] (2018 CSA Update)	Regulatory Criterion	Groundwater Zone Statistically Derived Background Value[2,3]			Cliffside Steam Station Background Dataset Range (All Flow Zones)	Piedmont Background Value Range	Maximum Mean Concentration Near or Beyond Compliance Boundary[4]	Exceedance Ratio[5]	Number of Wells Above Criterion Near or Beyond Compliance Boundary	Groundwater Monitoring Wells With COI Concentration Greater Than Comparative Criteria	Present in Ash Pore Water Above Comparative Criteria (data of ash pore water from January 2015 to June 2019)	Exceeds Flow Zone Background Range	Exceeds Site-specific Background Range	Exceeds Piedmont Province Background Range	Downgradient of Source Areas at Concentrations Greater than Criteria	Geochemical Mobility[6]	Rationale for Selection of COIs for Corrective Action Evaluation (for constituents where no means are greater than comparative criteria in all flow zones and/or multiple lines of evidence support that constituent occurrences are not related to the source area, no corrective action is warranted)
		Flow Zone	2017	2019													
Constituent Standards and Values - 02L Criterion											**Lines of Evidence (LOE) - 02L Criterion**						**Rationale - 02L Criterion**
Arsenic	10 (µg/L)	Shallow	1	0.2	<0.1 - 2	0.1 - 6.35	10.40	1.04	1	GWA-21S		1	1	1	Y	Non-Conservative	One mean greater than 02L standard, GWA-21S exhibits fluctuating pH and highly variable arsenic concentrations **(Figure 6-17)**
		Transition Zone	1	2			1.30	0.13	0	-	Y	0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
		Bedrock	1	1			6.50	0.65	0	-		0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
Boron	700 (µg/L)	Shallow	50	50	<50 - 150	49.09 - 176.8	1596	2.28	3	AS-15B, AS-2S, CLMW-3S		3	3	3	Y	Conservative	Multiple means greater than 02L standard near or beyond compliance boundary and exhibits discernable plume at upstream dam and ash storage area **(Figure 6-18a)**
		Transition Zone	50	50			912	1.30	3	AS-7D, AS-8D, CLMW-3D	Y	3	3	3	Y		Multiple means greater than 02L standard near or beyond compliance boundary and exhibits discernable plume at upstream dam, ash storage area, and ridge south of upstream dam **(Figure 6-18b)**
		Bedrock	50	50			418	0.60	0	-		0	0	0	N		No means greater than 02L standard, however boron greater than background value is mapped as an indicator of potential ash basin influence **(Figure 6-18c)**
Chromium (Total)	10 (µg/L)	Shallow	4	26	<0.5 - 26.2	1 - 26	14.8	0.57	0	-		0	0	0	N	Non-Conservative	No means greater than background value near or beyond compliance boundary
		Transition Zone	2	2			4.2	0.42	0	-	N	0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
		Bedrock	4	3			4.1	0.41	0	-		0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
Iron	300 (µg/L)	Shallow	684	1700	<50 - 11000	56.3 - 37500	6566	3.86	2	AS-7I, GWA-33S		1	0	0	Y	Variable	Multiple means greater than background value near or beyond compliance boundary, although isolated in nature **(Figure 6-20a)**
		Transition Zone	515	1840			4310	2.34	2	AS-8D, MW-20D	Y	2	0	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume near upstream and downstream dams **(Figure 6-20b)**
		Bedrock	6220	7680			3630	0.47	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary, exhibits discernable plume near upstream dam **(Figure 6-20c)**
Manganese	50 (µg/L)	Shallow	169	969	5 - 1000	7 - 9170	9650	9.96	4	AS-2S, AS-7I, CLMW-2, CLMW-3S		4	4	1	Y	Variable	Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-22a)**
		Transition Zone	78	260			4968	19.11	8	AS-1D, AS-2D, AS-7D, AS-8D, AS-9D, GWA-62BRU, MW-20D, MW-23D	Y	6	2	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-22b)**
		Bedrock	89	113			801	9.00	6	AS-2BR, GWA-21BR, GWA-21BRL, GWA-33BR, MW-20A, MW-20DR		6	0	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-22c)**
Sulfate	250 (mg/l)	Shallow	1	4	<1 - 18.5	1.2 - 510	315	1.26	3	AS-15B, AS-2S, CLMW-3S		3	3	0	Y	Conservative	Multiple means greater than 02L standard near or beyond compliance boundary and exhibits discernable plume in ash storage area **(Figure 6-24a)**
		Transition Zone	10	15			335	1.34	2	CLMW-3D, MW-23D	Y	2	2	0	Y		Multiple means greater than 02L standard near or beyond compliance boundary and exhibits discernable plume at upstream dam and ash storage area **(Figure 6-24b)**
		Bedrock	15	17			109	0.44	0	-		0	0	0	N		No means greater than 02L standard, sulfate greater than background value mapped **(Figure 6-24c)**
Total Dissolved Solids	500 (mg/l)	Shallow	75	57	<25 - 10700	50 - 1200	594	1.19	2	AS-15B, AS-2S		0	0	0	Y	Conservative	Multiple means greater than 02L standard near or beyond compliance boundary and exhibits discernable plume in ash storage area **(Figure 6-25a)**
		Transition Zone	71	107			649	1.30	2	CLMW-3D, MW-23D	Y	2	0	0	Y		Multiple means greater than 02L standard near or beyond compliance boundary and exhibits discernable plume in ash storage area **(Figure 6-25b)**
		Bedrock	120	120			310	0.62	0	-		0	0	0	N		No means greater than 02L standard, TDS greater than background value mapped **(Figure 6-25c)**
Constituent Standards and Values - IMAC Criterion											**Lines of Evidence (LOE) - IMAC Criterion**						**Rationale - IMAC Criterion**
Cobalt	1 (µg/L)	Shallow	11	21	<0.1 - 22.9	0.2 - 88.85	37.1	1.77	1	CLMW-3S		1	1	0	Y	Variable	Only one mean greater than background value near or beyond compliance boundary, means greater than background value isolated in nature **(Figure 6-19a)**
		Transition Zone	5	5			30.8	6.16	2	AS-8D, AS-9D	Y	2	1	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at upstream dam and ash storage area **(Figure 6-19b)**
		Bedrock	1	2			1.6	0.80	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
Thallium	0.2 (µg/L)	Shallow	0.1	0.2	<0.1 - 0.5	0.1 - 0.2	0.7	3.50	6	AS-15B, AS-2S, AS-7I, CLMW-2, CLMW-3S, GWA-21S		4	2	6	Y	Variable	Multiple means greater than IMAC near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-26a)**
		Transition Zone	0.1	0.2			0.3	1.50	1	AS-1D	Y	1	0	1	Y		Only one mean greater than IMAC near or beyond compliance boundary but constituent exhibits discernable plume at upstream dam and ash storage area **(Figure 6-26b)**
		Bedrock	0.2	0.2			< 0.1	NA	0	-		0	0	0	N		No means greater than IMAC near or beyond compliance boundary
Vanadium	0.3 (µg/L)	Shallow	1	1	<0.3 - 12.2	0.38 - 26	6.2	6.20	2	GWA-21S, GWA-22S		1	0	0	Y	Non-Conservative	Multiple means greater than background value near or beyond compliance boundary, however means greater than background value isolated in nature **(Figure 6-28)**
		Transition Zone	1	11			0.8	0.07	0	-	Y	0	0	0	N		No means greater than background value near or beyond compliance boundary
		Bedrock	0.4	1			1.6	1.60	2	AS-58R, AS-88R		1	0	0	Y		Two locations with means greater than background value, constituent not present as a discernable plume. Locations AS-58R and AS-88R generally do not have other indicator constituents present
Constituent Standards and Values - Background Criterion											**Lines of Evidence (LOE) - Background Criterion**						**Rationale - Background Criterion**
Chromium (Hexavalent)	NE (µg/L)	Shallow	0.5	4	<0.025 - 4.8	0.03 - 12	2.360	0.59	0	-		0	0	0	N	Variable	No means greater than background value near or beyond compliance boundary
		Transition Zone	0.2	0.6			0.444	0.74	0	-	N	0	0	0	N		No means greater than background value near or beyond compliance boundary
		Bedrock	0.1	0.7			0.928	1.33	1	AS-58R		1	0	0	Y		Only one location mean exceeds background value. Constituent not present greater than background value in ash pore water. Location of exceedance (AS-58R) does not have other indicator constituents present
Lithium	NE (µg/L)	Shallow	-	3	<0.5 - 13.4	2 - 95.39	9.3	3.14	7	AS-15B, AS-4S, AS-7I, CLMW-2, CLMW-3S, GWA-21S, GWA-33S		5	0	0	Y	Conservative	Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume in ash storage area **(Figure 6-21a)**
		Transition Zone	-	12			36.0	3.00	4	AS-2D, GWA-33D, GWA-62BRU, MW-23D	Y	4	4	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at upstream dam **(Figure 6-21b)**
		Bedrock	-	11			31.1	2.83	4	AS-2BR, GWA-33BR, GWA-54BRO, MW-20A		4	3	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume in ash storage area **(Figure 6-21c)**
Strontium	NE (µg/L)	Shallow	37	34	6.3 - 116	27 - 2272	204	6.00	9	AS-15B, AS-2S, AS-4S, AS-7I, CLMW-2, GWA-21S, GWA-22S, GWA-33S, MW-21S		6	5	0	Y	Non-Conservative	Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-23a)**
		Transition Zone	56	69			533	7.72	13	AS-1D, AS-2D, AS-7D, AS-8D, CLMW-3D, GWA-21BRU, GWA-22BRU, GWA-33D, GWA-47D, GWA-54D, GWA-62BRU, MW-20D, MW-23D	Y	12	12	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-23b)**
		Bedrock	107	93			344	3.70	8	AS-2BR, AS-88R, GWA-21BR, GWA-21BRL, GWA-33BR, GWA-54BRO, MW-20A, MW-20DR		8	8	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume at downstream dam, upstream dam, and ash storage area **(Figure 6-23c)**
Total Radium	NE (pCi/L)	Shallow	3	2	0 - 3.46	1 - 35	1.2	0.61	0	-		0	0	0	N	Variable	No means greater than background value near or beyond compliance boundary
		Transition Zone	2	2			1.4	0.68	0	-	N	0	0	0	N		No means greater than background value near or beyond compliance boundary
		Bedrock	3	3			6.1	2.04	2	GWA-21BR, GWA-21BRL		1	1	0	Y		Constituent greater than background value in two bedrock wells at one well cluster, not detected greater than comparative criteria in ash pore water, not present as a discernable plume, not present in shallow or deep flow zones
Total Uranium	NE (µg/L)	Shallow	0.0005	0.0005	<0.0005	0.0002 - 0.0167	0.0011	2.20	2	AS-15B, GWA-21S		2	2	0	Y	Non-Conservative	Multiple means greater than background value near or beyond compliance boundary, means greater than background value isolated in nature **(Figure 6-27a)**
		Transition Zone	0.0005	0.0005			<0.0005	N/A	0	-	Y	0	0	0	N		No means greater than background value near or beyond compliance boundary
		Bedrock	0.0005	0.0005			0.0044	8.80	5	AS-2BR, AS-78RB, AS-88R, AS-98R, GWA-54BRO		5	5	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume in ash storage area **(Figure 6-27b)**

Prepared by: TJG Checked by: JAS

Notes:
- Reference Criterion
- Evidence supports inclusion
- Evidence supports exclusion

1 - Constituent list reflects the CO I list identified in the 2018 CSA Update, with the addition of lithium.
2 - Background threshold values were calculated using data from background groundwater samples collected June 2015 to April 2017
3 - Updated background threshold values are in the third column and were calculated using data from background groundwater samples collected October 2010 to December 2018 and submitted to NCDEQ June 2019
4 - Arithmetic mean was used for COI with concentration range less than or equal to one order of magnitude. Geometric mean was used for COI with concentration range greater than one order of magnitude.
5 - The exceedance ratio is the ratio of the mean constituent concentration divided by the comparative criterion.
6 - Assignment of conservative, non-conservative, or variable behavior is based on geochemical modeling results.
> - greater than
< - less than
COI - constituent of interest
CSA - Comprehensive Site Assessment
IMAC - interim maximum allowable concentration
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Applicable
NE - Not Established
S.U. Standard units
Y - Yes
N - No

TABLE 6-7
SUMMARY TREND ANALYSIS RESULTS
FOR MONITORING WELLS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Wells Within the Waste Boundary				
Well ID	**Boron**	**Lithium**	**Sulfate**	**Total Dissolved Solids**
Ash Pore Water				
AB-03S	NT	S	NT	NT
AB-03SL	I (1210)	NE	D	S
AB-03SLA	S	S	S	S
AB-04LA15	NT	NE	D	NT
AB-04S	I (2750)	S	NT	NT
AB-04SL	NT	S	NT	I
AB-05S	I (5650)	S	S	I (479)
AB-06S	NT	I (130)	NT	D
Shallow Flow Zone				
AB-03I	D	S	D	S
Deep Flow Zone				
AB-03BRUA	I	NE	NE	NE
AB-04D	ND	S	ND	ND
AB-05BRU	ND	S	NT	S
AB-06D	ND	S	D	S
Bedrock Flow Zone				
AB-04BR	S	S	S	S
AB-05BR	ND	S	D	NT
AB-06BR	ND	S	S	S

Wells Between Waste Boundary and Compliance Boundary				
Well ID	**Boron**	**Lithium**	**Sulfate**	**Total Dissolved Solids**
Shallow Flow Zone				
AB-01S	ND	NT	NT	I
AB-02S	I (852)	NT	NT	NT
CCR-06S	I (1580)	S	S	S
CCR-07S	S	NT	D	NT
CCR-12S	S	D	I	I
CCR-16S	S	D	D	S
CLMW-01	S	I (1.8)	NT	NT
CLMW-05S	ND	S	I	I
GWA-20S	I (379)	D	I	I (406)
GWA-21S	NT	D	S	S
GWA-26S	ND	S	ND	ND
GWA-28S	ND	NE	D	NT
GWA-43S	S	S	I	NT
MW-08S	S	I	S	S
MW-10S	D	NT	D	NT
MW-11S	D	S	S	S
Deep Flow Zone				
AB-01D	NT	S	S	I (345)
CCR-13D	NT	D	NT	NT
CCR-14D	I (1120)	S	S	S
CCR-15D	S	NT	ND	S
GWA-20D	I (1180)	NT	I (225)	I (744)
GWA-21BRU	S	NT	D	S
GWA-27DA	S	S	D	I (293)
GWA-28BRU	ND	NT	S	S
GWA-43D	S	S	I	I (266)
MW-04D	ND	NE	I	S
MW-11DA	S	D	D	D

Wells Between Waste Boundary and Compliance Boundary				
Well ID	**Boron**	**Lithium**	**Sulfate**	**Total Dissolved Solids**
Deep Flow Zone Cont.				
CCR-16D	NT	NT	D	S
GWA-26D	ND	NE	NE	NE
MW-08D	I	S	S	I
AB-02D	I	NT	S	S
CCR-09D	NT	NT	NT	S
CCR-12D	NT	I (8.5)	S	I
GWA-51D	S	S	D	S
CCR-07D	S	NT	D	I
CCR-08D	S	I (7.9)	S	I (751)
CCR-06D	I (1690)	S	I (239)	I (420)
CCR-05D	NT	D	NT	NT
MW-10D	S	S	S	NT
CCR-04D	S	S	NT	NT
Bedrock Flow Zone				
AB-01BROR	S	NE	NT	I (424)
AB-02BRO	S	NT	S	S
CCR-03BR	ND	S	D	S
CCR-17BR	ND	D	S	S
GWA-20BR	I (359)	S	S	S
GWA-21BR	I	S	ND	I (290)
GWA-27BR	I (381)	S	D	S
MW-11BRO	S	S	S	S

Wells Downgradient of the Source Area Near or Beyond Compliance Boundary				
Well ID	**Boron**	**Lithium**	**Sulfate**	**Total Dissolved Solids**
Shallow Flow Zone				
AS-02S	S	S	S	S
AS-01SB	S	S	S	S
AS-05S	ND	NT	ND	ND
AS-06S	ND	S	D	NT
CLMW-02	I (621)	S	I (250)	I (518)
CLMW-03S	I (1000)	S	I (272)	I (549)
GWA-22S	I (419)	S	I	S
GWA-33S	S	S	S	D
GWA-54S	S	D	ND	I
MW-23S	S	S	NT	S
Deep Flow Zone				
AS-02D	I	NT	S	I (509)
AS-01D	I (692)	S	I	I
AS-03BRU	ND	S	ND	I
AS-04D	ND	D	D	D
AS-05BRU	ND	S	ND	S
AS-06D	ND	S	NT	NT
AS-07D	I (941)	NT	I (134)	I (328)
AS-08D	S	S	I (220)	I (561)
AS-09D	NE	NE	NE	NE
CLMW-03D	I (1070)	S	I (303)	I (575)
GWA-22BRU	ND	NT	S	I
GWA-23D	ND	S	S	NT
GWA-33D	ND	S	I	I (293)
GWA-47D	I (399)	S	ND	S
GWA-54D	I	D	NT	I (343)
MW-20D	I (600)	S	I	D
MW-21D	ND	S	D	NT
MW-23D	ND	S	S	D
Bedrock Flow Zone				
AS-02BR	S	S	S	S
GWA-54BRO	S	S	S	S
MW-02DA	ND	NE	I	I

Wells Downgradient of the Source Area Near or Beyond Compliance Boundary				
Well ID	**Boron**	**Lithium**	**Sulfate**	**Total Dissolved Solids**
Bedrock Flow Zone Cont.				
AS-05BR	ND	NT	D	D
AS-06BRA	ND	S	D	S
CCR-16D	NT	NT	D	S
GWA-33BR	I	I (45.3)	I	I (313)
MW-20DR	I	S	ND	NT
MW-21BR	ND	S	S	NT
MW-23DR	ND	S	I	S

Mann-Kendall trend analysis and results prepared by Arcadis U.S. Inc.

Prepared by: MAF Checked by: HES

Notes:

1. Summary of results and trends are presented for samples collected from 2008 - 2019.
2. Trend results are presented when at least four samples were available and frequency of detection was >50%. Statistically significant trends are reported at the 90% confidence level.
3. Variability Index (VI) is calculated as the (maximum - minimum) / median concentration and is calculated using detected concentrations only. Values less than 1 indicate low variability in the dataset.
4. For pH, statistically significant, increasing trend with a maximum recent result (2018 - 2019) less than the lower end of the standard range or greater than the upper end of the standard range. Maximum detected result for 2018 and 2019 time period shown in parentheses.
5. Wells that had insufficient samples collected (n<4) for all four consitituents were removed from table. See designation 'NE'.

ND	= Greater than 50 percent of constituent concentrations were non-detect
D	= Statistically significant, decreasing concentration trend
S	= Stable. No significant trend and variability is low (VI ≤ 1)
NT	= No significant trend and variability is high (VI > 1)
I	= Statistically significant, increasing concentration trend.
NE	= Insufficient number of samples to evaluate trend (n < 4)

TABLE 6-8
SEEP CORRECTIVE ACTION STRATEGY
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Seep ID	Regulatory Program	General Location	Approximate Average Present Flow (cfs)	Anticipated Seep Corrective Action Strategy
S-04	NPDES	Channel flow north of ash storage area	0.05	This location is to be covered by the NPDES permit and designated as Outfall #104.
S-06	NPDES	Channel flow north of toe of AAB downstream dam	0.1	This location is to be covered by the NPDES permit and designated as Outfall #106.
S-07	SOC	Northeast of AAB downstream dam	0.001	As decanting continues, the portion of flow from the AAB to this seep location is expected to be reduced or eliminated. If seep S-7 sustains near its average flow rate after AAB decanting is complete, it is expected that the COI concentrations are reduced. Under these circumstances, the current proposed action for this area is continued monitoring.
S-14	SOC	Toe of AAB upstream dam	<0.001	Location is associated with the AAB upstream dam. Decanting has been effective in reducing visible standing water at the seep location. Further decanting and groundwater corrective action might cause the volume of water at the toe of the AAB upstream dam to reduce more or be eliminated. If the seep continues to have low flow conditions, and is not dispositioned after decanting is complete, phytoremediation technology could be implemented to capture and extract shallow groundwater to reduce or eliminate flow at this seep location.
S-15	SOC	Toe of AAB upstream dam	<0.001	Location is associated with the AAB upstream dam. Decanting has been effective in reducing visible standing water at the seep location. Further decanting and groundwater corrective action might cause the volume of water at the toe of the AAB upstream dam to reduce more or be eliminated. If the seep continues to have low flow conditions, and is not dispositioned after decanting is complete, phytoremediation technology could be implemented to capture and extract shallow groundwater to reduce or eliminate flow at this seep location.

TABLE 6-8
SEEP CORRECTIVE ACTION STRATEGY
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Seep ID	Regulatory Program	General Location	Approximate Average Present Flow (cfs)	Anticipated Seep Corrective Action Strategy
S-16	SOC	Toe of AAB upstream dam	<0.001	Location is associated with the AAB upstream dam. Decanting has been effective in reducing visible standing water at the seep location. Further decanting and groundwater corrective action might cause the volume of water at the toe of the AAB upstream dam to reduce more or be eliminated. If the seep continues to have low flow conditions, and is not dispositioned after decanting is complete, phytoremediation technology could be implemented to capture and extract shallow groundwater to reduce or eliminate flow at this seep location.
S-21	SOC	Toe of AAB upstream dam	<0.001	Location is associated with the AAB upstream dam. Decanting has been effective in reducing visible standing water at the seep location. Further decanting and groundwater corrective action might cause the volume of water at the toe of the AAB upstream dam to reduce more or be eliminated. If the seep continues to have low flow conditions, and is not dispositioned after decanting is complete, phytoremediation technology could be implemented to capture and extract shallow groundwater to reduce or eliminate flow at this seep location.

Prepared by: SAS Checked by: TJG

Notes:
cfs- cubic feet per second
NPDES – National Pollution Discharge Elimination System
SOC – Special Order by Consent

TABLE 6-9
WATER SUPPLY WELL ANALYTICAL RESULTS SUMMARY
CORRECTIVE ACTIVE PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Turbidity	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium	Impacted by coal ash?	Alternative Water Supplied?	Water Type
Reporting Units		S.U.	NTUs	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L			
15A NCAC 02L Standard		6.5 - 8.5	NE	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*			
2017 Background Values (Bedrock Flow Zone)[1]		5.4 - 7.4	NE	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4			
2019 Background Values (Bedrock Flow Zone)[2]		4.5 - 7.5	NE	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**			
Cliffside Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	NE	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5			
Piedmont Background Value Range (Bedrock Flow Zone)[2]		4.5-9.0	NE	1.0 - 6.0	49.1 - 50	0.03 - 8	2.8 - 11	0.2 - 18	147 - 7680	NE	7 - 1773	93 - 2272	2 - 130	0.1 - 0.2	120 - 675	1.0 - 6.0	0.0005 - 0.006	0.38 - 26			
Sample ID	**Sample Date**	**Analytical Results**																			
C1 Well 2	02/04/2015	7.5	<1	2.6	<25	<20	<5	<5	540	NA	7.6	26	13	NA	42	NA	NA	<5	No	Yes-municipal water supply connection	Calcium Bicarbonate
C1 Well 2	05/27/2015	6.2	1.4	<0.5	<5	<0.6	3.2	<0.5	218	NA	13.1	50.1	9	NA	53	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C1 Well 3	02/04/2015	6.7	<1	<1	<25	<20	<5	<5	210	NA	11	48	8.5	NA	60	NA	NA	<5	No	Yes-municipal water supply connection	Calcium Bicarbonate
C10	02/04/2015	8.0	<1	1.6	<25	<20	<5	<5	650	NA	42	39	8.1	NA	54	NA	NA	<5	No	Yes-municipal water supply connection	Calcium Bicarbonate
C10	05/27/2015	7.0	2.2	1.3	<5	<0.6	2.3	<0.5	<50	NA	49.6	38.2	7.6	NA	79	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1001: C2801 Riverfront	05/07/2014	NM	NM	<2	<50	NA	<10	NA	78	NA	NA	33	2	NA	NA	NA	NA	NA	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1001: C2801 Riverfront	10/18/2016	6.4	2.2	0.44	<25	<0.03	<0.5	0.18	289	NA	47.3	36.3	5.9	NA	62	NA	NA	<0.3	No	Yes-municipal water supply connection	ND
C-1002: 2901 Fox Place	10/18/2016	6.2	6.4	0.19	<25	<0.03	<0.5	0.46	2970	NA	27.6	30.1	15.3	NA	63	NA	NA	<0.3	No	Yes-municipal water supply connection	ND
C-1003	10/18/2016	7.6	<1	0.98	<25	<0.03	<0.5	<0.1	<50	NA	8.3	65.1	6.1	NA	108	NA	NA	<0.3	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1004: C2800 Riverfront	05/07/2014	NM	NM	<2	<50	NA	<10	NA	<50	NA	NA	20	NA	NA	NA	NA	NA	NA	No	Yes-municipal water supply connection	ND
C-1004: C2800 Riverfront	10/18/2016	4.9	<1	<0.1	<25	0.63	1.2	<0.1	<50	NA	1.5	20.4	<2	NA	27	NA	NA	<0.3	No	Yes-municipal water supply connection	ND
C-1005 S1	10/17/2016	6.8	1.1	0.3	<25	<0.03	<0.5	0.15	311	NA	23.5	41.1	2.9	NA	108	NA	NA	0.64	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1005 S2	10/17/2016	6.1	5.2	0.17	<25	0.32	0.79	<0.1	161	NA	5.4	20.5	<2	NA	36	NA	NA	**1.1**	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1005 S4	10/17/2016	7.0	10.8	0.73	<25	0.17	<0.5	0.41	1670	NA	110	26.4	2.4	NA	43	NA	NA	0.32	No	Yes-municipal water supply connection	ND
C-1005 S5	10/18/2016	6.9	4.1	<0.1	82	<0.15	<0.5	0.41	483	NA	56.9	26.4	<2	NA	34	NA	NA	0.41	No	Yes-municipal water supply connection	Calcium Sulfate
C-1005 W1	10/17/2016	5.3	<1	<0.1	<25	0.13	<0.5	<0.1	<50	NA	1.5	15.6	2.3	NA	31	NA	NA	<0.3	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1005 W2	10/17/2016	6.1	<1	0.56	<25	<0.03	<0.5	0.41	392	NA	59.1	54	5.8	NA	65	NA	NA	**1.1**	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1005 W3	10/17/2016	7.0	<1	<0.1	<25	<0.03	<0.5	<0.1	754	NA	34.9	54.5	5.9	NA	92	NA	NA	<0.3	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1006: 2910 Fox Place	11/03/2016	7.3	<1	0.28	<25	0.026	<0.5	<0.1	81.6	NA	14.3	50.9	10.3	NA	104	NA	NA	<0.3	No	Yes-municipal water supply connection	Calcium Bicarbonate
C-1007: 433 Dysart Place	11/03/2016	7.4	<1	0.23	<25	<0.12	<0.5	<0.1	455	NA	**166**	59.3	12.7	NA	98	NA	NA	<0.3	No	Not eligible, outside 1/2 mile radius	Calcium Bicarbonate
C-1007: 433 Dysart Place	03/31/2017	7.4	1.2	0.25	<25	<0.025	0.88	<0.1	453	NA	**173**	61.5	12	<0.1	115	NA	NA	<0.3	No	Not eligible, outside 1/2 mile radius	Calcium Bicarbonate
C-1008	11/03/2016	5.2	<1	<0.1	<25	<0.025	<0.5	0.65	<50	NA	12.3	18.4	<2	NA	<25	NA	NA	<0.3	No	Not eligible, outside 1/2 mile radius	ND
C105 Downriver	04/09/2014	5.4	1	<2	<50	NA	<10	NA	320	NA	NA	NA	6.8	NA	99	NA	NA	NA	No	Yes-municipal water supply connection	ND
C11	05/01/2015	6.6	4.2	<0.5	<5	0.096	<0.5	<0.5	<50	NA	3	39.3	<2	NA	<25	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Sulfate
C15	02/04/2015	8.0	2.3	1	<25	<20	<5	<5	2200	NA	**230**	**140**	11	NA	190	NA	NA	<5	No	Yes-municipal water supply connection	Calcium Bicarbonate
C16	02/04/2015	6.6	4.9	<1	<25	<20	<5	<5	380	NA	<5	30	2.6	NA	38	NA	NA	<5	No	Yes-municipal water supply connection	ND
C17	02/04/2015	7.6	1.1	1.1	<25	<20	<5	<5	3200	NA	**630**	81	1.2	NA	330	NA	NA	<5	No	Yes-municipal water supply connection	ND
C19	02/04/2015	7.7	2.4	<1	<25	<20	<5	<5	240	NA	<5	33	2.5	NA	25	NA	NA	<5	No	Yes-municipal water supply connection	ND
C23	05/27/2015	6.9	1.1	<0.5	<5	**0.83**	1.5	<0.5	110	NA	3.1	15.7	<2	NA	44	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C24	05/27/2015	6.4	<1	<0.5	<5	<0.6	0.91	1.9	<50	NA	40.3	71.4	2.2	NA	106	NA	NA	<1	No	Yes-municipal water supply connection	ND
C24	08/18/2015	6.3	1	<0.5	<50	0.44	<5	<0.5	<50	NA	NA	60.8	2	NA	101	NA	NA	<1	No	Yes-municipal water supply connection	ND
C24-1	05/27/2015	6.7	<1	<0.5	<5	0.63	0.88	<0.5	<50	NA	2.7	58.2	2.9	NA	90	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C25	05/27/2015	6.5	3.9	<0.5	<5	<0.6	**14.1**	<0.5	540	NA	3.6	28	5.6	NA	53	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C25	08/17/2015	6.4	1.2	<0.5	<50	0.11	<0.5	<0.5	<50	NA	NA	28.2	4.8	NA	54	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C26	05/27/2015	6.1	<1	<0.5	5.6	<0.6	0.81	<0.5	188	NA	2.7	26	3.5	NA	41	NA	NA	<1	No	Not eligible-outside 1/2 mile radius	ND
C26	08/17/2015	6.2	1.5	<0.5	<50	0.15	<0.5	<0.5	52.5	NA	NA	27.1	3	NA	61	NA	NA	<1	No	Not eligible-outside 1/2 mile radius	ND
C2968 Riverfront	04/09/2014	NM	5.6	NA	<50	NA	<10	NA	790	NA	33	NA	2	NA	101	NA	NA	NA	No	Yes-municipal water supply connection	ND
C3	02/04/2015	7.2	<1	<1	<25	<20	<5	<5	360	NA	20	51	4.8	NA	48	NA	NA	<5	No	Yes-municipal water supply connection	Calcium Bicarbonate
C3	05/27/2015	6.5	<1	<0.5	5	<0.6	0.56	1.2	<50	NA	25.5	44	4.4	NA	36	NA	NA	<1	No	Yes-municipal water supply connection	Calcium Bicarbonate
C4 Well 2	02/04/2015	7.0	1.2	<10	<25	<20	<50	<50	290	NA	<50	<100	2.3	NA	<10	NA	NA	<50	No	Not eligible-business/church/school	ND
C4 Well 3	02/04/2015	7.0	210	<1	27	<20	6.7	<5	3200	NA	11	24	7	NA	160	NA	NA	**11**	No	Not eligible-business/church/school	ND
C5	05/01/2015	6.6	<1	<0.5	6.2	**2.2**	2.2	<0.5	<50	NA	1	20.2	2.3	NA	80	NA	NA	<1	No	Yes-municipal water supply connection	ND
C7	05/01/2015	7.6	<1	1.3	<5	<0.03	<0.5	<0.5	<50	NA	7.9	60.6	6.5	NA	94	NA	NA	<1	No	Yes-municipal water supply connection	ND
C8	05/01/2015	6.2	<1	<0.5	<5	**0.74**	0.86	0.72	57.3	NA	11	16	<2	NA	59	NA	NA	<1	No	Yes-municipal water supply connection	ND
C8 Spring	05/01/2015	5.6	34.8	<0.5	6.5	<0.03	2.2	1.6	<50	NA	16.8	14.9	5.9	NA	45	NA	NA	**3**	No	Yes-municipal water supply connection	ND
C9A	05/01/2015	5.7	<1	<0.5	6.2	0.01	<0.5	<0.5	<50	NA	2.3	14.1	2.6	NA	32	NA	NA	<1	No	Yes-municipal water supply connection	ND
C9B	05/01/2015	7.1	<1	<0.5	<5	<0.03	<0.5	<0.5	749	NA	32.4	48.9	6.2	NA	97	NA	NA	<1	No	Yes-municipal water supply connection	ND

Prepared by: TJG Checked by: SAS

Notes:

[1] - Background threshold values were calculated using data from background groundwater samples collected June 2015 to September 2017.

[2] - Background threshold values were calculated using data from background groundwater samples collected March 2011 to December 2018.

Turbidity of Sample ≥ 10 NTUs

Bold text - Constituent concentration exceeds applicable comparison criteria.

* - Interim Maximum Allowable Concentrations (IMACs) of the 15A NCAC 02L Standard, Appendix 1, April 1, 2013.

< - concentration not detected at or above the adjusted reporting limit.

NA - not analyzed

ND - water type of sample not determined due to charge balance >10 or <-10

NM - not measured

NE - not established

NTU - Nephelometric Turbidity Unit

mg/L - milligrams per liter

pCi/L - picocuries per liter

µg/L - micrograms per liter

S.U. standard unit

TABLE 6-10
NPDES PERMIT LIMITS AND ANTICIPATED GROUNDWATER REMEDIATION PARAMETER LEVELS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

NPDES Outfalls	Outfall 002[1]		Outfall 005		Maximum Detected Concentrations by Flow Zone[2]		
Effluent Limitations and Monitoring Requirements							
Parameter	**Monthly Average**	**Daily Maximum**	**Monthly Average**	**Daily Maximum**	**Saprolite**	**Transition Zone**	**Bedrock**
Flow (MGD)	NS	1 MGD	NS	NS	NA	NA	NA
Oil & Grease	15.0 mg/L	20.0 mg/L	15.0 mg/L	20.0 mg/L	NA	NA	NA
TSS	30.0 mg/L	50.0 mg/L	30.0 mg/L	50.0 mg/L	23.2 mg/L	14.7 mg/L	15.8 mg/L
Total Chromium	0.2 mg/L	0.20 mg/L	0.2 mg/L	0.2 mg/L	0.008 mg/L	0.02 mg/L	0.02 mg/L
Total Zinc	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L	0.07 mg/L	0.04 mg/L	0.04 mg/L
pH	From 6.0 to 9.0 S.U.		From 6.0 to 9.0 S.U.		4.1 - 5.8 S.U.	4.4 – 9.7 S.U.	6.4 - 8.3 S.U.
Total Copper[3]	NA	NA	251 µg/L	272 µg/L	3.6 µg/L	5.3 µg/L	4.9 µg/L
Chronic Toxicity	NA	NA	Note 4		NA	NA	NA
Total Iron[3]	NA	NA	1.0 mg/L	1.0 mg/L	4.58 mg/L	9.37 mg/L	2.55 mg/L
Total Residual Chlorine	NA	NA	NS	28 µg/L	NA	NA	NA
5-day BOD; 20° C	NA	NA	30.0 mg/L	45.0 mg/L	NA	NA	NA
Fecal Coliform (geo. Mean)	NA	NA	200/100 mL	400/100 mL	NA	NA	NA
Temperature	NA	NA	NS	100° F	NA	NA	NA

Prepared by: VTV Checked by TJG

Notes:

1 - Effective beginning on the commencement of the dewatering operation and lasting until permit expiration.
2 - Downgradient groundwater monitoring wells in area of groundwater remediation; Q1 2018 through Q2 2019 data.
3 - Monitoring shall be per occurrence of chemical metal cleaning and sample from a representative discharge.
4 - Chronic Toxicity (Ceriodaphnia) P/F at 3.14%; March, June, September, and December.
MGD - million gallons per day
NS - not specified
NA - not analyzed
TSS - total suspended solids
S.U. - standard units
BOD - biological oxygen demand
mg/L - milligrams per liter
µg - micrograms per liter
mL - milliliters

TABLE 6-11
FEATURE IRRIGATION SYSTEM SETBACK
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Feature	Irrigation System Setback (feet)	
	Spray	Drip
Private residence	400	100
Place of assembly owned by permittee	200	15
Surface waters	100	100
Property line	150	50

Prepared by: VTV Checked by: TJG

TABLE 6-12
REMEDIAL TECHNOLOGY SCREENING SUMMARY
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Summary of Remedial Technology Screening	Retain Technology for Further Consideration	
Technology	**Yes/No**	**Rationale**
Monitored Natural Attenuation (MNA)	Yes	COIs pose no unacceptable risk to human health or the environment under conservative exposure scenarios. MNA could be implemented in conjunction with source control measures.
In-Situ Technologies		
Low Permeability Barriers (LPB)	No	Technically challenging and costly.
Groundwater Flushing	Yes	Possible application to enhance capture of mobile COIs (*e.g.*, boron) or to add amendments to immobilize certain COIs.
Encapsulation	No	No area where COIs are concentrated.
Permeable Reactive Barrier (PRB)	No	Boron is not amenable to treatment in a PRB.
Groundwater Extraction Technologies		
Vertical Extraction Wells	Yes	Commonly used technology for groundwater extraction.
Horizontal or Angular Extraction Wells	No	Modeling indicates that vertical extraction wells are sufficient.
Extraction Trenches	No	Modeling indicates that vertical extraction wells are sufficient.
Hydraulic Fracturing	No	Not warranted based upon the limited extent of COIs in bedrock.
Phytoremediation	No	Limited additional mass removal.
Groundwater Treatment Technologies		
pH Adjustment	Yes	Retained for remedial alternatives that include groundwater extraction.
Precipitation	Yes	Part of the treatment in the WWTP associated with Outfall 005.
Ion Exchange	No	Expensive and not expected to be needed to meet discharge requirements.
Membrane Filtration	No	Expensive and not expected to be needed to meet discharge requirements.

TABLE 6-12
REMEDIAL TECHNOLOGY SCREENING SUMMARY
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Summary of Remedial Technology Screening	Retain Technology for Further Consideration	
Technology	**Yes/No**	**Rationale**
Management of Extracted Groundwater		
NPDES Permitted Discharge	Yes	Potential to discharge at Outfall 002 or 005; must modify permit to include discharge of extracted groundwater
Publicly Owned Treatment Works (POTW)	No	Would require installation of infrastructure; NPDES is a better option.
Non-Discharge Permit/Infiltration Gallery	No	Site soils have limited capacity to transmit water.
Non-Discharge Permit/Land Application	No	Will not be considered as long as disposal via NPDES permitted outfall is a viable option.
Beneficial Reuse		
Fire Protection	No	Limited application. Storage is problematic
Non-Contact Cooling Water	No	Limited application.
Dust Suppression and Truck Wash	No	Limited application.

Prepared by: JEC Checked by: TJG

TABLE 6-13
REMEDIAL ALTERNATIVE 2 GROUNDWATER EXTRACTION AND CLEAN WATER INFILTRATION WELL SUMMARY
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Groundwater Extraction Well System		
Number of Wells	**Flow Zone**	**Total Depth (ft bgs)**
3	Saprolite	54 - 60
4	Saprolite/Transition Zone	92 - 112
16	Saprolite/Transition Zone/Bedrock	69 - 153
Total Extraction Well Count: 23		
Groundwater extraction system flow and operation assumptions: Modeled groundwater extraction rate: 0.4 to 7.8 gpm per well; average 5.3 gpm per well. Estimated total system groundwater extraction rate: 122 gpm. Groundwater extraction wells operate to maintain water level near top of the submersible pump.		

Groundwater Infiltration Well System		
Number of Wells	**Flow Zone**	**Total Depth (ft bgs)**
21	Saprolite	30 - 79
17	Saprolite/Transition Zone	70 - 108
8	Saprolite/Transition Zone/Bedrock	87 – 134
1 Horizontal Well	Saprolite	5
Total Infiltration Well Count: 47		
Groundwater infiltration system flow and operation assumptions: Modeled groundwater extraction rate: 1.6 to 5.7 gpm per well; average 3 gpm per well. Modeled horizontal well groundwater infiltration rate: 44.7 gpm per well. Estimated total system groundwater infiltration rate: 184 gpm.		

Prepared by: RAG Checked by: GTC

Notes:
ft bgs – feet below ground surface
gpm – gallons per minute

TABLE 6-14
ENVIRONMENTAL SUSTAINABILITY COMPARISONS FOR REMEDIATION ALTERNATIVES
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS LLC, MOORESBORO, NC

Remedial Alternative		Remedial Alternative 1 – Groundwater Remediation by MNA	Remedial Alternative 2 – Groundwater Remediation by Extraction and Clean Water Infiltration	Remedial Alternative 3 – Groundwater Remediation by Extraction and Clean Water Infiltration Wells and Galleries
Emissions	**Units**			
CO_2 Emissions	metric ton	2.07E+01	4.57E+03	3.31E+04
Onsite NO_x emissions	metric ton	2.43E-02	1.26E+01	1.39E+00
Onsite SO_x Emissions	metric ton	2.48E-03	1.29E+00	1.42E-01
Onsite PM_{10} Emissions	metric ton	2.19E-03	1.14E+00	1.25E-01
Total NO_x emissions	metric ton	4.25E-02	2.21E+01	6.81E+01
Total SO_x Emissions	metric ton	1.34E-02	8.84E+00	8.74E+01
Total PM_{10} Emissions	metric ton	3.88E-03	5.85E+00	1.25E+01
Total Energy Used	MMBTU	3.88E+03	7.50E+05	4.32E+06
Total Emissions	**metric ton**	**2.08E+01**	**4.62E+03**	**3.33E+04**

Notes:

Prepared by: GTC Checked by: SJB

CO_2 - Airborne emissions of carbon dioxide

MMBTU - Million British Thermal Units

NO_X - Airborne emissions of nitrogen oxides (combination of nitrogen monoxide and nitrogen dioxide)

SO_X - Airborne emissions of sulfur oxides (combination of sulfur monoxide, sulfur dioxide, sulfur trioxide, and others)

PM_{10} - Airborne emissions of particulate matter that is 10 micrometers or less in diameter

TABLE 6-15
MODELED CLEAN WATER INFILTRATION WELL DETAILS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Easting	Northing	Approximate Ground Surface Elevation (feet)	Pressure at Well Head (ft of Head Above Ground Surface)	Well Depth (ft BGS)	Targeted Flow Zones	Total Simulated Flow (gpm)
Vertical Clean Water Infiltration Wells							
IW-1	1177609.77	544864.72	776	10	129	Saprolite/Transition Zone/Bedrock	5.4
IW-2	1177669.80	544866.70	770	10	125	Saprolite/Transition Zone/Bedrock	5.4
IW-3	1177844.15	544863.18	745	10	103	Saprolite/Transition Zone/Bedrock	5.4
IW-4	1177961.75	544866.28	732	10	87	Saprolite/Transition Zone/Bedrock	5.4
IW-5	1178072.26	544864.91	747	10	98	Saprolite/Transition Zone/Bedrock	5.4
IW-6	1178183.46	544866.51	792	10	133	Saprolite/Transition Zone/Bedrock	5.4
IW-7	1178279.21	544863.41	799	10	128	Saprolite/Transition Zone/Bedrock	5.4
IW-8	1178368.50	544864.30	815	10	134	Saprolite/Transition Zone/Bedrock	5.7
IW-9	1178187.90	545042.20	758	10	101	Saprolite/Transition Zone	4.3
IW-10	1178125.00	545045.70	729	10	83	Saprolite/Transition Zone	4.3
IW-11	1178187.40	545163.00	736	10	86	Saprolite/Transition Zone	4.3
IW-12	1178243.25	545157.33	754	10	98	Saprolite/Transition Zone	4.3
IW-13	1178188.54	545270.10	721	10	65	Saprolite/Transition Zone	4.3
IW-14	1178240.34	545272.30	734	10	75	Saprolite/Transition Zone	4.3
IW-15	1177802.60	545097.50	730	10	70	Saprolite	1.9
IW-16	1177849.10	545097.50	720	10	61	Saprolite	1.9
IW-17	1177782.00	545044.50	744	10	79	Saprolite	1.9
IW-18	1177850.40	545040.60	731	10	65	Saprolite	1.9
IW-19	1177785.10	544939.30	750	10	78	Saprolite	1.9
IW-20	1177844.90	544938.30	739	10	66	Saprolite	1.9
IW-21	1178237.57	545099.15	759	10	60	Saprolite	1.9
IW-22	1178180.00	545242.80	725	10	33	Saprolite	1.6
IW-23	1178233.30	545244.60	734	10	37	Saprolite	1.6
IW-24	1178135.60	545185.10	721	10	34	Saprolite	1.6
IW-25	1178186.20	545187.80	733	10	39	Saprolite	1.6
IW-26	1178239.50	545187.80	746	10	44	Saprolite	1.6
IW-27	1178134.70	545130.00	726	10	37	Saprolite	1.6
IW-28	1178188.00	545132.70	740	10	43	Saprolite	1.6
IW-29	1178232.40	545127.40	753	10	49	Saprolite	1.6
IW-30	1178142.70	545076.80	737	10	43	Saprolite	1.6
IW-31	1178188.00	545075.90	752	10	50	Saprolite	1.6
IW-32	1178236.00	545072.30	766	10	56	Saprolite	1.6
IW-33	1177845.50	545126.88	719	10	70	Saprolite/Transition Zone	3.1
IW-34	1177776.10	545370.60	714	10	79	Saprolite/Transition Zone	3.1
IW-35	1177733.70	545332.40	728	10	91	Saprolite/Transition Zone	3.1
IW-36	1177715.30	545299.80	740	10	99	Saprolite/Transition Zone	3.1
IW-37	1177677.10	545270.10	745	10	103	Saprolite/Transition Zone	3.1
IW-38	1177664.40	545244.70	753	10	108	Saprolite/Transition Zone	3.1
IW-39	1177653.10	545192.30	757	10	107	Saprolite/Transition Zone	3.1
IW-40	1177603.60	545130.10	760	10	104	Saprolite/Transition Zone	3.1
IW-41	1177565.40	545074.90	764	10	102	Saprolite/Transition Zone	3.1
IW-42	1177798.80	545401.10	702	10	70	Saprolite/Transition Zone	3.1
IW-43	1177832.60	545447.30	696	10	66	Saprolite/Transition Zone	3.1
IW-44	1178182.70	545300.50	721	10	30	Saprolite	1.6
IW-45	1178237.70	545300.50	729	10	35	Saprolite	1.6
IW-46	1178136.50	545242.80	715	10	30	Saprolite	1.6
Horizontal Clean Water Infiltration Wells							
HW-1	NA	NA	752-765	10	10-15	Saprolite	44.7

Prepared by: GTC Checked by: RAG

Notes:

All depths are approximated and may change depending on site conditions.

Flowrates are approximate and may change depending on site conditions.

DTW - depth to water

ft - feet

ft BGS - feet below ground surface

gpm - gallons per minute

NA - Not applicable

TABLE 6-16
MODELED GROUNDWATER EXTRACTION WELL DETAILS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Easting	Northing	Approximate Ground Surface Elevation (feet)	Operational DTW Maintained In Well (ft BGS)	Well Depth (ft BGS)	Targeted Flow Zones	Total Simulated Flow (gpm)
Vertical Extraction Wells							
EX-1	1177675.17	544940.59	766	25	127	Saprolite/Transition Zone/Bedrock	5.6
EX-2	1177792.42	544977.73	747	15	115	Saprolite/Transition Zone/Bedrock	5.6
EX-3	1177908.52	544976.93	725	5	95	Saprolite/Transition Zone/Bedrock	5.6
EX-4	1178026.12	544980.03	726	5	91	Saprolite/Transition Zone/Bedrock	5.6
EX-5	1178136.63	544978.66	749	18	105	Saprolite/Transition Zone/Bedrock	5.6
EX-6	1178247.83	544980.26	780	39	126	Saprolite/Transition Zone/Bedrock	5.6
EX-7	1178343.59	544977.16	793	43	133	Saprolite/Transition Zone/Bedrock	5.6
EX-8	1178432.87	544978.05	819	69	153	Saprolite/Transition Zone/Bedrock	5.6
EX-9	1178135.50	545099.80	731	15	97	Saprolite/Transition Zone/Bedrock	5.6
EX-10	1178188.50	545104.30	748	27	109	Saprolite/Transition Zone/Bedrock	5.6
EX-11	1178138.90	545219.30	718	15	83	Saprolite/Transition Zone/Bedrock	5.6
EX-12	1178182.90	545215.90	728	18	89	Saprolite/Transition Zone/Bedrock	5.6
EX-13	1178244.90	545217.10	746	26	102	Saprolite/Transition Zone/Bedrock	5.6
EX-14	1178129.90	545332.00	710	13	69	Saprolite/Transition Zone/Bedrock	5.6
EX-15	1178185.10	545329.80	716	15	70	Saprolite/Transition Zone/Bedrock	5.6
EX-16	1178243.70	545328.70	730	20	83	Saprolite/Transition Zone/Bedrock	5.6
EX-17	1177798.90	545070.60	733	13	97	Saprolite/Transition Zone	7.8
EX-18	1177857.40	545158.40	718	12	92	Saprolite/Transition Zone	7.8
EX-19	1177690.74	544972.35	758	18	112	Saprolite/Transition Zone	7.8
EX-20	1177750.80	545007.50	755	24	109	Saprolite/Transition Zone	7.8
EX-21	1177846.70	545520.40	682	12	54	Saprolite	0.4
EX-22	1177788.80	545520.40	685	14	60	Saprolite	0.4
EX-23	1177729.90	545521.30	683	14	58	Saprolite	0.4

Prepared by: GTC Checked by: RAG

Notes:

All depths are approximated and may change depending on site conditions.

Flowrates are approximate and may change depending on site conditions.

DTW - depth to water

ft - feet

ft BGS - feet below ground surface

gpm - gallons per minute

NA - Not applicable

TABLE 6-17
EFFECTIVENESS MONITORING PLAN ELEMENTS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

	Effectiveness Monitoring Plan (EMP) Implemented 30 days after CAP Approval	Post-Closure Monitoring Plan (PCMP) Implemented after completion of ash basin closure activities
Groundwater Monitoring Network	**EMP Groundwater Well Monitoring Network (background, downgradient of source areas)**	**PCMP Groundwater Well Monitoring Network (background, downgradient of source areas)**
	Performance Monitoring Network AS-2S, AS-2D, AS-2BR, CCR-7S, CCR-7D, CCR-7BR*, PMW-1S, PMW-1D PMW-1BR, PMW-2S, PMW-2D, PMW-2BR, PMW-3S, PMW-3D, PMW-3BR, PMW-4S PMW-4D, PMW-4BR, PMW-5S, PMW-5D, PMW-5BR, PMW-6S, PMW-6D, PMW-6BR **Continued Monitoring Network** GWA-20S, GWA-20D, GWA-20BR, GWA-21S, GWA-21BRU, GWA-21BR, GWA-21BRL, GWA-22S, GWA-22BRU, GWA-22BR*, GWA-28S, GWA-28BRU GWA-28BR, GWA-33S, GWA-33D, GWA-33BR, GWA-43S, GWA-43D, GWA-43BR*, GWA-57S, GWA-57BRU, GWA-57BR, GWA-59D GWA-59BR, GWA-62BRU, GWA-62BR, MW-11S, MW-11DA, MW-11BRO, MW-20D, MW-20DR, MW-23S, MW-23D, MW-23DR **Background Monitoring Wells[1]** BG-1S, BG-1D, GWA-24S GWA-24D, GWA-24BR, GWA-25S MW-22DR, MW-22BR, MW-24DR	A PCMP will be implemented at the Site in accordance with G.S. 130A-309.214(a)(4)k.2 after completion of ash basin closure activities.
Sampling Parameters and Frequency	**EMP Groundwater Quality[3, 4] (Semi-Annual Sampling Frequency)** *Alkalinity*, *Aluminum*, Arsenic[2], *Bicarbonate Alkalinity*, Boron[2], *Calcium*, Cobalt[2], *Ferrous Iron* *Iron*[2], Lithium[2], *Magnesium*, *Manganese*[2], *Nitrate + Nitrite*, *Potassium*, *Sodium* Strontium[2], *Sulfate*[2], Thallium[2], Total Dissolved Solids[2], *Total Organic Carbon*, Total Uranium[2], Vanadium[2]	**PCMP Groundwater Quality (Sampling frequency to be determined)** Parameters and sampling frequency to be included in the PCMP in accordance with G.S. 130A-309.214(a)(4)k.2 when submitted.
	CMP and PCMP Groundwater Field Parameters Water Level, Specific Conductivity, Temperature pH, Oxidation Reduction Potential, Dissolved Oxygen	
Review and Reporting	**EMP Review** Annual Effectiveness Monitoring Evaluation and Reporting 1) Summary of annual groundwater monitoring results 2) Evaluate statistical concentration trends 2) Comparison of observed concentrations to model predictions 3) Evaluation of compliance with applicable Standards 4) Evaluation of system performance and effectiveness 4) Recommend plan adjustments, if applicable, to optimize the remedial action 5-Year Performance Review Reporting 1) Update background analysis 2) Confirm Risk Assessment assumptions remain valid 3) Re-evaluate effectiveness of technology 4) Verify modeling results, update model if needed 5) Modify corrective action approach, as needed, to achieve compliance goal established	**PCMP Review** Annual Evaluation and Reporting: 1) Summary of annual groundwater monitoring results 2) Evaluate statistical concentration trends 2) Comparison of observed concentrations to model predictions 3) Evaluation 02L compliance 4) Recommend plan adjustments, if applicable At a frequency no greater than 5 years: 1) Update background analysis 2) Confirm Risk Assessment assumptions remain valid 3) Verify model results, update if needed
Monitoring Program Duration	**EMP Duration** 30 days after CAP approval, the EMP will be implemented at the Site and will continue until there is a total of three years of data confirming COIs are below applicable Standards at or beyond the compliance boundary, at which time a request for completion of active remediation will be filed with NCDEQ. If applicable standards are not met, the EMP will continue and transition to post-closure monitoring if necessary.	**PCMP Duration** After ash basin closure and following ash basin closure certification, a PCMP will be implemented at the Site for a minimum of 30 years in accordance with G. S. 130A-309.214(4)(k)(2). Early termination: If groundwater monitoring results are below applicable Standards at the compliance boundary for three years, Duke Energy will request completion of corrective action in accordance with G.S. 130A-309.214(a)(3)b. If groundwater monitoring results are above applicable Standards, the PCMP will continue.

Prepared by: TJG Checked by: SAS

[1] Approved background groundwater monitoring locations
[2] Corrective action COIs to monitor plume stability and physical attenuation either from active remedy or natural dilution/dispersion
[3] The number of monitoring wells and parameters may be adjusted based on additional data and the effects of corrective action.
[4] Groundwater standards may be modified over time in accordance with 02L .0106(k)
* Proposed new well
Proposed performance monitoring well clusters PMW-1 through PMW-6 are considered replacement wells for well clusters AS-1, AS-7, AS-8, AS-9, CLMW-3, and MW-2, which will be abandoned prior to excavation of the ash storage area. The location of the replacement well clusters has been optimized for performance monitoring.
Italicized parameters - parameters for general water quality to evaluate monitoring data quality
Wells indicated in red will have geochemical sondes placed to monitor geochemical conditions

Source Area 2
(Former Units 1-4 Ash Basin)

TABLE 6-18
BORON CONCENTRATIONS IN GROUNDWATER BELOW SOURCE AREA
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well Beneath Ash (Flow Zone)	Number of Sample Events	Time Period of Record	Boron Concentration Range in Groundwater (µg/L)	Boron Concentration Range in Overlying Pore Water (µg/L)
IB-1D (Deep)	5	06/2015 – 04/2016	<50[1]	165 – 241 (~5' saturated ash)
IB-2AL (Shallow - Alluvial)	2	06/2015 – 09/2015	480 – 490	220 – 240 (~12' saturated ash)
IB-2BRU (Deep)	2	06/2015 – 09/2015	<50[1]	
IB-2I (Shallow)	2	06/2015 – 09/2015	99	
IB-4BR (Bedrock)	3	06/2015 – 09/2015	52 - 57	320 – 390 (~13' saturated ash)
IB-4D (Deep)	2	06/2015 – 09/2015	<50[1]	

Prepared by: TJG Checked by: SAS

Notes:

< – concentration not detected at or above the adjusted reporting limit

[1] – Concentrations have not been detected at or above the adjusted reporting limit across all sampling events

TABLE 6-19
SUMMARY OF UNSATURATED SOIL ANALYTICAL RESULTS
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameters		pH	Arsenic	Boron	Cobalt	Iron	Manganese	Strontium	Sulfate	Thallium	Vanadium
Reporting Units		**S.U.**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
PSRG Protection of Groundwater		**NE**	**5.8**	**45**	**0.9**	**150**	**65**	**1,500**	**1,438**	**0.28**	**350**
Background Threshold Values		**4.0-6.8**	**7.8**	**31**	**48**	**74,362**	**672**	**9.9**	**13**	**1.1**	**161**
Sample ID	**Sample Collection Date**	**Analytical Results**									
Background											
BGSB-MW-30 (6-7)	10/17/2017	5.2	4.3 B	<9.6 M	6.2	73,000 M	160	16	<13	0.39	180 B
BGSB-MW-30 (14-15)	10/17/2017	5.2	2.7 B	<5.9	30	49,000	190	0.89 j	<13	0.32	130 B
BGSB-MW-30 (24-25)	10/17/2017	5.6	0.73 B	<15	12	38,000	390	<6.2	<13 M	0.41	83 B
BGSB-MW-32 (2-3)	10/19/2017	4.8	**12**	<14	2.4	44,000 B	40	6.9	35	0.31	89
BGSB-MW-32 (14-15)	10/19/2017	4.4	6.4	<4.8	2.6	40,000 B	130	0.6 j	<12	0.15	71
MW-30D (3.5 - 5.5)	02/23/2015	5.9 j	3.2 j	<3.9	7.3	48,500	145	1.1	<394	<1.6	97.8
MW-30D (8.5 - 10)	02/23/2015	6.0 j	2.4 j	<4.1	3.3 j	27,300	89	1.6	<396	<4.1	70.3
MW-30D (18.5 - 20)	02/23/2015	5.0 j	3.5 j	<4.7	2.4 j	60,600	215	<0.94	<488	<1.9	125
MW-30D (28.5 - 30)	02/23/2015	6.1 j	3.6 j	27.3 j	36.1	38,700	**979**	<7.7	<380	1 j	93.8
MW-32D (3.5 - 5)	02/23/2015	5.2 j	3.8	<30.1	5.7	48,700	148	1.4	204 j	<1.2	96.7
MW-32D (8.5 - 10)	02/25/2015	6 j	1.9 j	<30.6	6.7	44,800	107	2	<309	<1.2	74.5
MW-32D (18.5 - 20)	02/25/2015	5.9 j	1.7	<3.3	3.2	2,760	62	13.3	<321	<1.3	3
MW-32S (22.5 - 24)	03/12/2015	6.3 j	**7.9**	<38.9	33.8	46,400	**910**	1.4 j+	<387	<3.9	90.1
Beyond Ash Basin Waste Boundary											
GWA-10D (13.5 - 15)	04/21/2015	**7.6 j**	**10.3**	11.1 j	5.4 j+	11,100	208	4.2	228 j	<6.8	20.2
GWA-12BRU (20 - 23.5)	03/31/2015	6.5 j	<2.7	6.8 j	3	7,640	152	<2.7	<266	<2.7	5
GWA-13BR (13 - 14.5)	03/04/2015	5.9 j	2.2	24.8 j	22.9	34,700	624	<7.7	<377	0.85 j	73.7
GWA-29D (16.2 - 16.2)	05/07/2015	6.6 j	<5	<12.4	9.2	20,000	174	<2.5	<258	<5	17.3

Prepared by: TJG Checked by: VJH

Notes:

- Bold highlighted concentration indicates exceedance of the Inactive Hazardous Sites Branch PSRG Table (May 2019) for Protection of Groundwater or the Background Threshold Value (BTV), whichever is higher.

< - Concentration not detected at or above the adjusted reporting limit.

B - Target analyte detected in method blank at or above the reporting limit. Target analyte concentration in sample is less than 10X the concentration in the method blank. Analyte concentration in sample could be due to blank contamination.

j - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

j+ - Estimated concentration, biased high.

M - Matrix spike / matrix spike dup failure.

mg/kg - milligrams per kilogram

NE - not established

PSRG - preliminary soil remediation goals

S.U. - standard units

TABLE 6-20
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTIVE PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
Background Locations																	
GWA-30S	Shallow	5.7	0.1	< 50	0.041	1.3	5.0	264	1.1	269	24	< 1	0.2	43	-	-	< 0.3
MW-30S	Shallow	5.3	0.1	< 50	3.12	3.0	0.4	159	1.2	8	10	< 1	< 0.1	33	0.490	< 0.0005	< 0.3
MW-32S	Shallow	5.0	0.1	< 50	0.177	0.6	1.1	73	2.5	37	27	< 1	0.1	59	1.107	< 0.0005	< 0.3
MW-30D	Deep	8.3	1.6	< 50	0.076	< 0.5	< 0.1	53	11.1	8	61	16	< 0.1	107	1.333	0.0003	10.0
MW-30DA	Deep	6.7	0.2	< 50	< 0.025	0.6	0.8	241	10.2	219	65	10	< 0.1	116	0.536	< 0.0005	0.3
MW-32D	Deep	5.9	0.1	< 50	0.034	< 0.5	1.8	< 50	2.8	11	40	7	< 0.1	73	0.533	< 0.0005	< 0.3
GWA-30BR	Bedrock	6.3	0.2	< 50	< 0.025	0.7	< 0.1	7198	3.6	70	52	14	< 0.1	90	-	-	0.2
MW-32BR	Bedrock	7.0	0.1	< 50	< 0.025	0.8	< 0.1	5305	6.1	33	57	16	< 0.1	103	0.386	< 0.0005	< 0.3
Between Waste Boundary and Compliance Boundary																	
Upgradient of the Ash Basin																	
GWA-14S	Shallow	6.0	0.2	63	1.300	2.1	0.4	392	-	19	**95**	85	0.1	217	-	-	**1.1**
GWA-14D	Deep	5.9	0.1	101	**0.986**	1.3	0.2	79	0.7	6	**228**	186	< 0.1	413	-	-	0.5
GWA-13BR	Bedrock	6.5	0.2	84	< 0.025	1.0	< 0.1	5674	**17.7**	**249**	**157**	91	< 0.1	321	-	-	0.4
GWA-14BR	Bedrock	8.5	1.3	< 50	0.162	1.4	0.2	227	**17.9**	52	**123**	54	< 0.1	184	-	-	**1.4**
Downgradient of the Ash Basin																	
GWA-10S	Shallow	5.2	0.6	97	0.043	< 0.5	5.9	182	**5.0**	**1038**	**227**	131	**0.2**	259	1.347	-	< 0.3
GWA-12S	Shallow	5.6	0.1	< 50	0.042	1.0	0.2	117	0.6	6	18	13	< 0.1	86	-	-	< 0.3
GWA-10D	Deep	5.9	< 0.1	< 50	**0.780**	1.1	3.1	< 50	6.2	174	**139**	24	< 0.1	125	< 0.573	-	0.4
GWA-12BRU	Deep	6.0	0.1	< 50	< 0.025	< 0.5	2.3	503	2.7	43	49	9	< 0.1	101	-	-	< 0.3
Near Compliance Boundary																	
Downgradient of the Ash Basin																	
CCR-IB-01S	Shallow	5.8	0.2	151	0.028	0.6	2.8	858	< 0.5	**1706**	**395**	79	< 0.1	196	< 1.14	-	< 0.3
CCR-IB-03S	Shallow	6.3	**109**	270	0.027	0.9	16.6	**4740**	**15.7**	**2068**	**898**	200	0.1	471	< 1.09	-	< 0.3
GWA-11S	Shallow	5.9	1.2	398	< 0.025	0.6	1.6	621	2.6	**1970**	**554**	105	< 0.1	299	0.456	< 0.0005	**1.2**
IB-06S	Shallow	5.5	0.1	590	0.028	1.5	18.3	606	**3.3**	**7333**	**369**	**258**	0.1	457	1.620	< 0.0005	< 0.3
IB-07S	Shallow	5.7	**12.6**	268	< 0.025	1.4	10.5	1613	**10.0**	**1627**	**305**	109	0.2	307	1.240	< 0.0005	0.5
CCR-IB-01D	Deep	5.8	0.2	< 50	0.027	0.7	0.3	**3328**	3.8	110	60	14	0.1	97	< 0.711	-	< 0.3
CCR-IB-03D	Deep	9.6	0.8	65	**2.543**	2.5	< 0.1	< 50	**28.1**	< 5	**229**	86	< 0.1	321	-	-	1.7
GWA-11BRU	Deep	6.5	0.3	350	0.120	0.7	0.7	421	**16.2**	**740**	**285**	103	< 0.1	319	**2.947**	< 0.0005	0.6
GWA-29D	Deep	5.7	< 0.1	< 50	0.167	0.9	0.3	150	1.6	9	35	8	< 0.1	66	1.368	< 0.0005	< 0.3
GWA-32D	Deep	6.0	0.1	< 50	0.097	< 0.5	0.1	124	0.6	10	11	2	< 0.1	27	-	0.0002	< 0.3
IB-06D	Deep	7.0	0.1	128	< 0.025	1.6	0.1	**2090**	**12.2**	**289**	**209**	51	< 0.1	253	**4.930**	0.0001	< 0.3
IB-07D	Deep	6.7	0.7	< 50	0.028	2.0	1.3	350	5.7	196	**126**	30	< 0.1	221	-	0.0002	0.5
CCR-IB-03BR	Bedrock	6.6	0.4	< 50	< 0.025	0.7	**4.6**	**25750**	**21.6**	**9570**	**813**	**1395**	< 0.1	**2298**	**37.833**	0.0002	0.4
GWA-11BR	Bedrock	7.5	1.3	207	< 0.025	< 0.5	0.8	46	7.2	84	**299**	67	< 0.1	322	1.980	**0.0016**	0.9
GWA-11BRL	Bedrock	8.3	-	< 50	-	-	-	-	-	-	-	-	-	-	-	-	-
GWA-29BRA	Bedrock	7.7	1.8	< 50	0.067	0.7	0.2	153	0.4	29	**213**	11	< 0.1	146	-	-	**1.2**

Prepared by: TJG Checked by: TAW

Notes:

[1] - Background threshold values were calculated using data from background groundwater samples collected June 2015 to September 2017.
[2] - Background threshold values were calculated using data from background groundwater samples collected March 2011 to December 2018.
[3] - Statistical mean, geomean, or median calculated from data ranging from January 2018 to June 2019. Ash pore water results are not compared to groundwater standards or criteria.
Mean or geomean results were used based on the central tendency of the data set.
For wells with datasets containing fewer than four valid results, the most recent valid sample data was used.
Means were calculated for wells with four or more valid sample results. Sample results were excluded from calculations:
1) if turbidity >10 NTU (for COIs other than boron)
2) for unusable data (R0 qualified)
3) if a result was non-detect at a reporting limit (RL) greater than the normal laboratory RL

NE - not established
mg/L - milligrams per liter
pCi/L - picocuries per liter
µg/L - micrograms per liter
S.U. standard unit

Bold text - Constituent concentration exceeds applicable comparison criteria.
- bold highlighted concentration indicates value is greater than the 15A NCAC 02L .0202 Standard or the IMAC. (Effective date for 15A NCAC 02L .0202 Standard and IMAC is April 1, 2013)
- bold highlighted concentration indicates value is greater than greatest background threshold value where there is no regulatory standard, or background threshold values are greater than regulatory standard
- highlighted concentration indicates value is either within range of background threshold values for constituents where there is no regulatory standard/background threshold values are greater than regulatory standard, or within range of background threshold value and the regulatory standard

* - Interim Maximum Allowable Concentrations (IMACs) of the 15A NCAC 02L Standard, Appendix 1, April 1, 2013.
< - concentration not detected at or above the adjusted reporting limit.
- - value not available

TABLE 6-21
COI MANAGEMENT MATRIX
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituents of Interest[1] (2018 CSA Update)	Regulatory Criterion	Groundwater Zone Statistically Derived Background Value[2,3]			Cliffside Steam Station Background Dataset Range (All Flow Zones)	Piedmont BTV Range (All Flow Zones)	Maximum Mean Concentration Near Compliance Boundary[4]	Exceedance Ratio[5]	Number of Wells Above Criterion Near Compliance Boundary	Groundwater Monitoring Wells With COI Concentration Greater Than Comparative Criteria	Presently ash groundwater above comparative criteria (present in ash pore water January 2018 to future 2019)	Exceeds Flow Zone Background Range	Exceeds Site-Specific Background Range	Exceeds Piedmont Province Background Range	Downgradient of Source Area, Not Concentrations Greater than Criteria	Geochemical Mobility[6]	Rationale for Selection of COIs for Corrective Action Evaluation (for constituents where no means are greater than comparative criteria in all flow zones and/or multiple lines of evidence support that constituent occurrences are not related to the source area, no corrective action is warranted)
		Flow Zone	2017	2019													
Constituent Standards and Values - 02L Criterion											**Lines of Evidence (LOE) - 02L Criterion**						**Rationale - 02L Criterion**
Arsenic	10 (µg/L)	Shallow	1	0.2	<0.1 - 2	0.1 - 6.35	108.90	10.89	2	CCR-1B-3S, 1B-7S	Y	2	2	2	Y	Non-Conservative	Multiple means greater than 02L standard near compliance boundary and exhibits discernable plume **(Figure 6-46)**
		Transition Zone	1	2			0.80	0.08	0	-		0	0	0	N		No means greater than 02L standard near compliance boundary
		Bedrock	1	1			1.80	0.18	0	-		0	0	0	N		No means greater than 02L standard near compliance boundary
Boron	700 (µg/L)	Shallow	50	50	<50 - 150	49.09 - 176.8	590	0.84	0	-	Y	0	0	0	N	Conservative	No means greater than 02L standard, however boron greater than background value is mapped as an indicator of potential ash basin influence **(Figure 6-47a)**
		Transition Zone	50	50			350	0.50	0	-		0	0	0	N		No means greater than 02L standard, however boron greater than background value is mapped as an indicator of potential ash basin influence **(Figure 6-47b)**
		Bedrock	50	50			207	0.30	0	-		0	0	0	N		No means greater than 02L standard, however boron greater than background value is mapped as an indicator of potential ash basin influence **(Figure 6-47c)**
Chromium (Total)	10 (µg/L)	Shallow	4	26	<0.5 - 26.2	1 - 26	1.5	0.06	0	-	N	0	0	0	N	Non-Conservative	No means greater than background value near compliance boundary
		Transition Zone	2	2			2.5	0.25	0	-		0	0	0	N		No means greater than 02L standard near compliance boundary
		Bedrock	4	3			0.7	0.07	0	-		0	0	0	N		No means greater than 02L standard near compliance boundary
Iron	300 (µg/L)	Shallow	684	1700	<50 - 11000	56.3 - 37500	4740	2.79	1	CCR-1B-3S	Y	0	0	0	Y	Variable	One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-49a)**
		Transition Zone	515	1840			3328	1.81	2	CCR-1B-1D, 1B-6D		1	0	0	Y		Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-49b)**
		Bedrock	6220	7680			25750	3.35	1	CCR-1B-3BR		1	1	0	Y		One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-49c)**
Manganese	50 (µg/L)	Shallow	169	969	5 - 1000	7 - 9170	7333	7.57	5	CCR-1B-1S, CCR-1B-3S, GWA-11S, 1B-6S, 1B-7S	Y	5	5	0	Y	Variable	Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-51a)**
		Transition Zone	78	260			740	2.85	2	GWA-11BRU, 1B-6D		1	0	0	Y		Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-51b)**
		Bedrock	89	113			9570	107.53	1	CCR-1B-3BR		1	1	1	Y		One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-51c)**
Sulfate	250 (mg/l)	Shallow	1	4	<1 - 18.5	1.2 - 510	258	1.03	1	1B-6S	Y	1	1	0	Y	Conservative	One mean greater than 02L standard near compliance boundary, isolated occurrence **(Figure 6-53a)**
		Transition Zone	10	15			103	0.41	0	-		0	0	0	N		No means greater than 02L standard near compliance boundary
		Bedrock	15	17			1395	5.58	1	CCR-1B-3BR		1	1	1	Y		One mean greater than 02L standard near compliance boundary, isolated occurrence **(Figure 6-53b)**
Total Dissolved Solids	500 (mg/l)	Shallow	75	57	<25 - 10700	50 - 1200	471	0.94	0	-	Y	0	0	0	N	Conservative	No means greater than 02L standard near compliance boundary
		Transition Zone	71	107			321	0.64	0	-		0	0	0	N		No means greater than 02L standard near compliance boundary
		Bedrock	120	120			2298	4.60	1	CCR-1B-3BR		1	0	1	Y		One mean greater than 02L standard near compliance boundary, isolated occurrence **(Figure 6-54)**
Constituent Standards and Values - IMAC Criterion											**Lines of Evidence (LOE) - IMAC Criterion**						**Rationale - IMAC Criterion**
Cobalt	1 (µg/L)	Shallow	11	21	< 0.1 - 22.9	0.2 - 88.85	18.3	0.87	0	-	Y	0	0	0	N	Variable	No means greater than background value near compliance boundary
		Transition Zone	5	5			1.3	0.26	0	-		0	0	0	N		No means greater than background value near compliance boundary
		Bedrock	1	2			4.6	2.30	1	CCR-1B-3BR		1	0	0	Y		One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-48)**
Thallium	0.2 (µg/L)	Shallow	0.1	0.2	<0.1 - 0.5	0.1 - 0.2	0.2	1.00	0	-	Y	0	0	0	N	Variable	No means greater than IMAC near compliance boundary
		Transition Zone	0.1	0.2			0.1	0.50	0	-		0	0	0	N		No means greater than IMAC near compliance boundary
		Bedrock	0.2	0.2			< 0.1	NA	0	-		0	0	0	N		No means greater than IMAC near compliance boundary
Vanadium	0.3 (µg/L)	Shallow	1	1	< 0.3 - 12.2	0.38 - 26	1.2	1.20	1	GWA-11S	Y	0	0	0	Y	Non-Conservative	One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-56a)**
		Transition Zone	1	11			1.7	0.15	0	-		0	0	0	N		No means greater than background value near compliance boundary
		Bedrock	0.4	1			1.2	1.20	1	GWA-29BRA		0	0	0	Y		One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-56b)**
Constituent Standards and Values - Background Criterion											**Lines of Evidence (LOE) - Background Criterion**						**Rationale - Background Criterion**
Chromium (Hexavalent)	NE (µg/L)	Shallow	0.5	4	<0.025 - 4.8	0.03 - 12	0.028	0.01	0	-	N	0	0	0	N	Variable	No means greater than background value near compliance boundary
		Transition Zone	0.2	0.6			2.543	4.24	1	CCR-1B-3D		1	0	0	Y		One mean exceeds comparative criteria, constituent not present greater than comparative criteria in ash pore water, probably not related to ash basin
		Bedrock	0.1	0.7			0.067	0.10	0	-		0	0	0	N		No means greater than background value near compliance boundary
Lithium	NE (µg/L)	Shallow	-	3	< 0.5 - 13.4	2 - 95.39	15.7	5.30	3	CCR-1B-3S, 1B-6S, 1B-7S	Y	2	1	0	Y	Conservative	Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-50a)**
		Transition Zone	-	12			28.1	2.34	3	CCR-1B-3D, GWA-11BRU, 1B-6D		2	2	0	Y		Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-50b)**
		Bedrock	-	11			21.6	1.96	1	CCR-1B-3BR		1	1	0	Y		One mean greater than background value near compliance boundary, isolated occurrence **(Figure 6-50c)**
Strontium	NE (µg/L)	Shallow	37	34	6.3 - 116	27 - 2272	898	26.41	5	CCR-1B-1S, CCR-1B-3S, GWA-11S, 1B-6S, 1B-7S	Y	5	5	0	Y	Non-Conservative	Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-52a)**
		Transition Zone	56	69			285	4.13	4	CCR-1B-3D, GWA-11BRU, 1B-6D, 1B-7D		4	4	0	Y		Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-52b)**
		Bedrock	107	93			813	8.74	3	CCR-1B-3BR, GWA-11BR, GWA-29BRA		3	3	0	Y		Multiple means greater than background value near compliance boundary and exhibits discernable plume **(Figure 6-52c)**
Total Radium	NE (pCi/L)	Shallow	3	2	0 - 3.46	1 - 35	1.6	0.81	0	-	N	0	0	0	N	Variable	No means greater than background value near compliance boundary
		Transition Zone	2	2			4.9	2.47	2	GWA-11BRU, 1B-6D		2	1	0	Y		Multiple means greater than background value near compliance boundary and exhibits discernable plume, constituent not present in ash pore water greater than background value **(Figure 6-55a)**
		Bedrock	3	3			37.8	12.61	1	CCR-1B-3BR		1	1	1	Y		One mean greater than background value near compliance boundary, isolated occurrence, constituent not present in ash pore water greater than background value **(Figure 6-55b)**
Total Uranium	NE (µg/L)	Shallow	0.0005	0.0005	<0.0005	0.0002 - 0.0167	<0.0005	N/A	0	-	Y	0	0	0	N	Non-Conservative	No means greater than background value near compliance boundary
		Transition Zone	0.0005	0.0005			<0.0005	N/A	0	-		0	0	0	N		No means greater than background value near compliance boundary
		Bedrock	0.0005	0.0005			0.0016	3.20	1	GWA-11BR		1	1	0	Y		One mean greater than background value, first sampling event concentration was greater than background value, but has since been less than background value

Prepared by: TJG Checked by: SAS

Notes:
- Reference Criterion
- Evidence supports inclusion
- Evidence supports exclusion

[1] - Constituent list reflects the COI list identified in the 2018 CSA Update, with the addition of lithium.
[2] - Background threshold values were calculated using data from background groundwater samples collected June 2015 to April 2017
[3] - Updated background threshold values are in the third column and were calculated using data from background groundwater samples collected October 2010 to December 2018 and summitted to NCDEQ June 2019
[4] - Arithmetic mean was used for COI with concentration ranges less than or equal to one order of magnitude. Geometric mean was used for COI with concentration range greater than one order of magnitude.
[5] - The exceedance ratio is the ratio of the mean constituent concentration divided by the comparative criterion.
[6] - Assignment of conservative, non-conservative, or variable behavior is based on geochemical modeling results.

>- greater than
<- less than
COI - constituent of interest
CSA - Comprehensive Site Assessment
IMAC - interim maximum allowable concentration
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Applicable
NE - Not Established
S.U. Standard units
Y - Yes
N - No

TABLE 6-22
SUMMARY TREND ANALYSIS RESULTS
FOR MONITORING WELLS
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Wells Between Waste Boundary and Compliance Boundary

Well ID	Boron	Lithium	Sulfate	Total Dissolved Solids
Shallow Flow Zone				
GWA-10S	D	NT	D	D
GWA-12S	ND	NT	S	I
Deep Flow Zone				
GWA-10D	ND	D	I	D
GWA-12BRU	ND	S	S	I

Wells Downgradient of the Source Area Near Compliance Boundary

Well ID	Boron	Lithium	Sulfate	Total Dissolved Solids
Deep Flow Zone				
CCR-IB-01S	D	NT	NT	I (292)
CCR-IB-03S	I	NT	NT	S
GWA-11S	S	NT	D	D
Deep Flow Zone				
CCR-IB-01D	ND	S	S	I
CCR-IB-03D	D	NT	D	S
GWA-11BRU	S	I (23.3)	D	D
GWA-29D	ND	NT	D	S
Bedrock Flow Zone				
CCR-IB-03BR	S	S	S	S
GWA-29BRA	ND	D	D	S

Mann-Kendall trend analysis and results prepared by Arcadis U.S. Inc.

Prepared by: MAF Checked by: HES

Notes:

1. Summary of results and trends are presented for samples collected from 2015 - 2019.
2. Trend results are presented when at least four samples were available and frequency of detection was >50%. Statistically significant trends are reported at the 90% confidence level.
3. Variability Index (VI) is calculated as the (maximum - minimum) / median concentration and is calculated using detected concentrations only. Values less than 1 indicate low variability in the dataset.
4. For pH, statistically significant, increasing trend with a maximum recent result (2018 - 2019) less than the lower end of the standard range or greater than the upper end of the standard range. Maximum detected result for 2018 and 2019 time period shown in parentheses.
5. Wells that had insufficient samples collected (n<4) for all four consitituents were removed from table. See designation 'NE'.

ND	= Greater than 50 percent of constituent concentrations were non-detect
D	= Statistically significant, decreasing concentration trend
S	= Stable. No significant trend and variability is low (VI ≤ 1)
NT	= No significant trend and variability is high (VI > 1)
I	= Statistically significant, increasing concentration trend.
NE	= Insufficient number of samples to evaluate trend (n < 4)

TABLE 6-23
SEEP CORRECTIVE ACTION STRATEGY
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Seep ID	Regulatory Program	General Location	Approximate Average Present Flow (cfs)	Anticipated Seep Corrective Action Strategy
S-03	SOC	North of U1-4 AB	0.1	Corrective action at this location may consist of capturing and treating the seep or other remedial actions. Final corrective action plans for seeps that are not dispositioned after completion of decanting will be proposed in an amendment to the CAP Update and submitted based on the schedule outlined in the SOC.

Prepared by: SAS Checked by: TJG

Notes:
cfs- cubic feet per second
NPDES – National Pollution Discharge Elimination System
SOC – Special Order by Consent

TABLE 6-24
REMEDIAL TECHNOLOGY SCREENING SUMMARY
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Summary of Remedial Technology Screening	Retain Technology for Further Consideration	
Technology	**Yes/No**	**Rationale**
Monitored Natural Attenuation (MNA)	Yes	COIs pose no unacceptable risk to human health or the environment under conservative exposure scenarios. MNA could be implemented in conjunction with source control measures.
In-Situ Technologies		
Low Permeability Barriers (LPB)	No	Technically challenging and costly.
Groundwater Flushing	No	The source of COIs has been excavated and the concentrations of COIs appear to be stable.
Encapsulation	No	No area where COIs are concentrated.
Permeable Reactive Barrier (PRB)	No	Boron is not amenable to treatment in a PRB.
Groundwater Extraction Technologies		
Vertical Extraction Wells	No	The source of COIs has been excavated and the concentrations of COIs appear to be stable.
Horizontal or Angular Extraction Wells	No	The source of COIs has been excavated and the concentrations of COIs appear to be stable.
Extraction Trenches	No	The source of COIs has been excavated and the concentrations of COIs appear to be stable.
Hydraulic Fracturing	No	Not warranted based upon the limited extent of COIs in bedrock.
Phytoremediation	Yes	Groundwater extraction by TreeWells™ could act as a barrier to mitigate COIs to the Broad River.
Groundwater Treatment Technologies		
pH Adjustment	No	No extraction of groundwater is anticipated for Former Units 1-4 Ash Basin.
Precipitation	No	No extraction of groundwater is anticipated for Former Units 1-4 Ash Basin.

TABLE 6-24
REMEDIAL TECHNOLOGY SCREENING SUMMARY
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Summary of Remedial Technology Screening	Retain Technology for Further Consideration	
Technology	**Yes/No**	**Rationale**
Ion Exchange	No	No extraction of groundwater is anticipated for Former Units 1-4 Ash Basin.
Membrane Filtration	No	No extraction of groundwater is anticipated for Former Units 1-4 Ash Basin.
Management of Extracted Groundwater		
NPDES Permitted Discharge	No	Groundwater extraction is not retained
Publicly Owned Treatment Works (POTW)	No	Groundwater extraction is not retained
Non-Discharge Permit/Infiltration Gallery	No	Groundwater extraction is not retained
Non-Discharge Permit/Land Application	No	Groundwater extraction is not retained
Beneficial Reuse		
Fire Protection	No	Groundwater extraction is not retained
Non-Contact Cooling Water	No	Groundwater extraction is not retained
Dust Suppression and Truck Wash	No	Groundwater extraction is not retained

Prepared by: TJG Checked by: JEC

TABLE 6-25
REMEDIAL ALTERNATIVE 2 TREEWELL SUMMARY
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Phytoremediation and TreeWell Technology System		
Number of TreeWells	**Flow Zone**	**Total Depth (ft bgs)**
286	Saprolite/Transition Zone	30-40
Groundwater removal projections for TreeWell system: Groundwater removal rate of the system will be approximately 3.1 million gallons per year upon reaching maturity		

Prepared by: VTV Checked by: GTC

Notes:
ft bgs – feet below ground surface
gpm – gallons per minute

TABLE 6-26
ENVIRONMENTAL SUSTAINABILITY COMPARISONS FOR REMEDIATION ALTERNATIVES
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS LLC, MOORESBORO, NC

Remedial Alternative		Remedial Alternative 1 – Groundwater Remediation by MNA	Remedial Alternative 2 – Groundwater Remediation by TreeWells™
Emissions	Units		
CO_2 Emissions	metric ton	2.07E+01	-1.74E+02
Onsite NO_x emissions	metric ton	2.43E-02	1.54E-01
Onsite SO_x Emissions	metric ton	2.48E-03	1.58E-02
Onsite PM_{10} Emissions	metric ton	2.19E-03	1.39E-02
Total NO_x emissions	metric ton	4.25E-02	1.81E-01
Total SO_x Emissions	metric ton	1.34E-02	3.27E-02
Total PM_{10} Emissions	metric ton	3.88E-03	1.70E-02
Total Energy Used	MMBTU	3.88E+03	4.06E+03
Total Emissions	**metric ton**	**2.08E+01**	**-1.73E+02**

Prepared by: GTC Checked by: SJB

Notes:

CO_2 - Airborne emissions of carbon dioxide

MMBTU - Million British Thermal Units

NO_X - Airborne emissions of nitrogen oxides (combination of nitrogen monoxide and nitrogen dioxide)

SO_X - Airborne emissions of sulfur oxides (combination of sulfur monoxide, sulfur dioxide, sulfur trioxide, and others)

PM_{10} - Airborne emissions of particulate matter that is 10 micrometers or less in diameter

TABLE 6-27
EFFECTIVENESS MONITORING PLAN ELEMENTS
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

	Effectiveness Monitoring Plan (EMP) Implemented 30 days after CAP Approval	Post-Closure Monitoring Plan (PCMP) Implemented after completion of ash basin closure activities
Groundwater Monitoring Network	**EMP Groundwater Well Monitoring Network (background, downgradient of source areas)**	**PCMP Groundwater Well Monitoring Network (background, downgradient of source areas)**
	Performance Monitoring Network	A PCMP will be implemented at the Site in accordance with G.S. 130A-309.214(a)(4)k.2 after completion of ash basin closure activities.
	CCR-IB-1S, GWA-10S, IB-6S CCR-IB-1D, GWA-10D, IB-6D CCR-IB-3S, GWA-11S, IB-6BR* CCR-IB-3D, GWA-11BRU, IB-7S CCR-IB-3BR, GWA-11BR, IB-7D	
	Background Monitoring Wells[1]	
	GWA-30S, MW-30DA, MW-32D GWA-30BR, MW-32S, MW-32BR MW-30S	
Sampling Parameters and Frequency	**EMP Groundwater Quality[3, 4] (Semi-Annual Sampling Frequency)**	**PCMP Groundwater Quality (Sampling frequency to be determined)**
	Alkalinity, *Ferrous Iron*, *Sodium* *Aluminum*, *Iron*[2], Strontium[2] Arsenic[2], Lithium[2], *Sulfate*[2] *Bicarbonate Alkalinity*, *Magnesium*, Total Dissolved Solids[2] Boron[2], *Manganese*[2], *Total Organic Carbon* *Calcium*, *Nitrate + Nitrite*, Total Radium[2] Cobalt[2], *Potassium*, Vanadium[2]	Parameters and sampling frequency to be included in the PCMP in accordance with G.S. 130A-309.214(a)(4)k.2 when submitted.
	CMP and PCMP Groundwater Field Parameters	
	Water Level, Specific Conductivity, Temperature pH, Oxidation Reduction Potential, Dissolved Oxygen	
Review and Reporting	**EMP Review**	**PCMP Review**
	Annual Effectiveness Monitoring Evaluation and Reporting 1) Summary of annual groundwater monitoring results 2) Evaluate statistical concentration trends 2) Comparison of observed concentrations to model predictions 3) Evaluation of compliance with applicable Standards 4) Evaluation of system performance and effectiveness 4) Recommend plan adjustments, if applicable, to optimize the remedial action 5-Year Performance Review Reporting 1) Update background analysis 2) Confirm Risk Assessment assumptions remain valid 3) Re-evaluate effectiveness of technology 4) Verify modeling results, update model if needed 5) Modify corrective action approach, as needed, to achieve compliance goal established	Annual Evaluation and Reporting: 1) Summary of annual groundwater monitoring results 2) Evaluate statistical concentration trends 2) Comparison of observed concentrations to model predictions 3) Evaluation 02L compliance 4) Recommend plan adjustments, if applicable At a frequency no greater than 5 years: 1) Update background analysis 2) Confirm Risk Assessment assumptions remain valid 3) Verify model results, update if needed
Monitoring Program Duration	**EMP Duration**	**PCMP Duration**
	30 days after CAP approval, the EMP will be implemented at the Site and will continue until there is a total of three years of data confirming COIs are below applicable Standards at or beyond the compliance boundary, at which time a request for completion of active remediation will be filed with NCDEQ. If applicable standards are not met, the EMP will continue and transition to post-closure monitoring if necessary.	After ash basin closure and following ash basin closure certification, a PCMP will be implemented at the Site for a minimum of 30 years in accordance with G. S. 130A-309.214(4)(k)(2). Early termination: If groundwater monitoring results are below applicable Standards at the compliance boundary for three years, Duke Energy will request completion of corrective action in accordance with G.S. 130A-309.214(a)(3)b. If groundwater monitoring results are above applicable Standards, the PCMP will continue.

Prepared by: TJG Checked by: SAS

[1] Approved background groundwater monitoring locations
[2] Corrective action COIs to monitor plume stability and physical attenuation either from active remedy or natural dilution/dispersion
[3] The number of monitoring wells and parameters may be adjusted based on additional data and the effects of corrective action.
[4] Groundwater standards may be modified over time in accordance with 02L .0106(k)
* Proposed new well
Italicized parameters - parameters for general water quality to evaluate monitoring data quality
Wells indicated in red will have geochemical sondes placed to monitor geochemical conditions

Source Area 3
(Unit 5 Inactive Ash Basin)

TABLE 6-28
BORON CONCENTRATIONS IN GROUNDWATER BELOW SOURCE AREA
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well Beneath Ash (Flow Zone)	Number of Sample Events	Time Period of Record	Boron Concentration Range in Groundwater (µg/l)	Boron Concentration Range in Overlying Pore Water (µg/l)
U5-2BR (Bedrock)	13	03/2016 – 01/2019	58.3 – 140	192 – 470 (~10' saturated ash)
U5-2D (Deep)	16	06/2015 – 01/2019	109 – 286	
U5-7D (Deep)	6	06/2015 – 06/2016	103 – 160	170 – 190 (~50' saturated ash)

Prepared by: TJG Checked by: SAS

TABLE 6-29
SUMMARY OF UNSATURATED SOIL ANALYTICAL RESULTS
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameters		pH	Arsenic	Boron	Chromium	Cobalt	Iron	Manganese	Strontium	Sulfate	Thallium	Vanadium
Reporting Units		S.U.	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PSRG Protection of Groundwater		NE	5.8	45	3.8	0.9	150	65	1,500	1,438	0.28	350
Background Threshold Values		4.0-6.8	7.8	31	142	48	74,362	672	9.9	13	1.1	161
Sample ID	**Sample Collection Date**	**Analytical Results**										
Background												
BG-02D (3.5 - 5)	02/23/2015	5.5 j	<3.5	<69.4	84	15.2	61,500	234	1.1	<353	<1.4	110
BG-02D (8.5 - 10)	02/23/2015	5.2 j	3.3 j	18.4 j-	85.5	22	39,100	591 j	<3.2	<310	<3.2	75.7
BG-02D (18.5 - 20)	02/23/2015	5.5 j	3.4 j	21.7	109	19.3	22,000	415	<0.83	<400	<4.2	60.1
BG-02D (28.5 - 30)	02/23/2015	5.7 j	3.5	<16.9	71.2	25.6	16,600	517	0.9	<330	<1.4	52.9
BGSB-MW-30 (6-7)	10/17/2017	5.2	4.3 B	<9.6 M	120	6.2	73,000 M	160	16	<13	0.39	180 B
BGSB-MW-30 (14-15)	10/17/2017	5.2	2.7 B	<5.9	91	30	49,000	190	0.89 j	<13	0.32	130 B
BGSB-MW-30 (24-25)	10/17/2017	5.6	0.73 B	<15	94	12	38,000	390	<6.2	<13 M	0.41	83 B
BGSB-MW-32 (2-3)	10/19/2017	4.8	**12**	<14	69	2.4	44,000 B	40	6.9	35	0.31	89
BGSB-MW-32 (14-15)	10/19/2017	4.4	6.4	<4.8	41	2.6	40,000 B	130	0.6 j	<12	0.15	71
MW-30D (3.5 - 5.5)	02/23/2015	5.9 j	3.2 j	<3.9	79.9	7.3	48,500	145	1.1	<394	<1.6	97.8
MW-30D (8.5 - 10)	02/23/2015	6.0 j	2.4 j	<4.1	48.1	3.3 j	27,300	89	1.6	<396	<4.1	70.3
MW-30D (18.5 - 20)	02/23/2015	5.0 j	3.5 j	<4.7	80.6	2.4 j	60,600	215	<0.94	<488	<1.9	125
MW-30D (28.5 - 30)	02/23/2015	6.1 j	3.6 j	27.3 j	88.6	36.1	38,700	**979**	<7.7	<380	1 j	93.8
MW-32D (3.5 - 5)	02/23/2015	5.2 j	3.8	<30.1	79.8	5.7	48,700	148	1.4	204 j	<1.2	96.7
MW-32D (8.5 - 10)	02/25/2015	6 j	1.9 j	<30.6	50.5	6.7	44,800	107	2	<309	<1.2	74.5
MW-32D (18.5 - 20)	02/25/2015	5.9 j	1.7	<3.3	3.7	3.2	2,760	62	13.3	<321	<1.3	3
MW-32S (22.5 - 24)	03/12/2015	6.3 j	**7.9**	<38.9	116	33.8	46,400	**910**	1.4 j+	<387	<3.9	90.1
MW-42D (28.5 - 30)	02/23/2015	6.6 j	1.8	<4	85.4	13.1	21,600	321	7.1	<423	0.89 j	50.9
Beyond Ash Basin Waste Boundary												
GWA-03D (48.5 - 50)	04/16/2015	6.5 j	3.9 j-	<17.9	**144**	17.9	42,800	463	4.5	<355	<7.2	105
GWA-05BRU (13.5 - 15)	02/23/2015	5.7 j	2.6 j	<19.7	129	25.2	26,700	498	2.7	<386	0.84 j	85.8
GWA-05S (13.5 - 15)	03/06/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GWA-06D (28.5 - 30)	05/08/2015	6.0 j	<9.7	<24.2	130	20.7	32,800	601	10.1	<466	<9.7	78.8
GWA-31BR (4 - 4)	04/21/2015	**7.1 j**	7.7	31.3	98.8	17.5	35,200	401	5.5	<317	<6.6	79.9
GWA-31D (7 - 7)	04/23/2015	**10.7 j**	<5	20.9	69.2	5.8	22,900	266	2 j	135 j	<5	61.5
GWA-31D (8.7 - 8.7)	04/23/2015	**11.5 j**	4.5 j	41.6	43	7.1	15,500	403	115	162 j	<5.3	37.1
GWA-32D (11.7 - 11.7)	06/05/2015	5.8 j	<5.3	<13.2	<1.3	<5.3	1,720	13.2	<2.6	<264	<5.3	<5.3
MW-38D (33.5 - 35)	03/02/2015	6.0 j	3	<3	16.3	43.7	15,100	317	4.1	<298	<1.2	31.7
MW-38S (33.5 - 35)	03/04/2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-40BRU (3.5 - 5)	03/30/2015	**7.1 j**	<6.1	<15.2	89.2	22.2	31,100	411	3.9	<295	<6.1	71.6

Prepared by: TJG Checked by: VJH

Notes:

- Bold highlighted concentration indicates exceedance of the Inactive Hazardous Sites Branch PSRG Table (May 2019) for Protection of Groundwater or the Background Threshold Value (BTV), whichever is higher.

< - Concentration not detected at or above the adjusted reporting limit.

B - Target analyte detected in method blank at or above the reporting limit. Target analyte concentration in sample is less than 10X the concentration in the method blank. Analyte concentration in sample could be due to blank contamination.

j - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

j- - Estimated concentration, biased low.

j+ - Estimated concentration, biased high.

M - Matrix spike / matrix spike dup failure.

mg/kg - milligrams per kilogram

NA - not analyzed

NE - not established

PSRG - preliminary soil remediation goals

S.U. - standard units

TABLE 6-30
SOURCE AREA INTERIM ACTIONS
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Groundwater Remedy Component	Rationale
Source Area Stabilization	U5 AB main dam modifications including the installation of a new spillway.

Prepared by: SAS Checked by: TJG

TABLE 6-31
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTIVE PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
Background Locations																	
GWA-30S	Shallow	5.7	0.1	< 50	0.041	1.3	5.0	264	1.1	269	24	< 1	0.2	43	-	-	< 0.3
MW-30S	Shallow	5.3	0.1	< 50	3.120	3.0	0.4	159	1.2	8	10	< 1	< 0.1	33	0.490	< 0.0005	< 0.3
MW-32S	Shallow	5.0	0.1	< 50	0.177	0.6	1.1	73	2.5	37	27	< 1	0.1	59	1.206	< 0.0005	< 0.3
CCPMW-01S	Deep	5.3	< 0.1	< 50	0.324	0.8	2.2	53	2.0	42	< 5	< 1	< 0.1	< 25	0.138	< 0.0005	0.3
MW-30D	Deep	8.3	1.6	< 50	0.076	< 0.5	< 0.1	53	11.1	8	61	16	< 0.1	107	2.13	0.0003	10.0
MW-30DA	Deep	6.7	0.2	< 50	< 0.025	0.6	0.8	241	10.2	219	65	10	< 0.1	116	0.420	< 0.0005	0.3
MW-32D	Deep	5.9	0.1	< 50	0.034	< 0.5	1.8	< 50	2.8	11	40	7	< 0.1	73	0.526	< 0.0005	< 0.3
CCPMW-01D	Bedrock	5.2	< 0.1	< 50	0.056	< 0.5	0.3	< 50	1.1	8	22	1	< 0.1	40	0.693	< 0.0005	< 0.3
GWA-30BR	Bedrock	6.3	0.2	< 50	< 0.025	0.7	< 0.1	7198	3.6	70	52	14	< 0.1	90	-	-	0.2
MW-32BR	Bedrock	7.0	0.1	< 50	< 0.025	0.8	< 0.1	5305	6.1	33	57	16	< 0.1	103	< 0.249	< 0.0005	< 0.3
Within the Waste Boundary Locations																	
U5-02S-SLB	Ash Pore Water	6.6	5175.0	267	< 0.025	0.6	11.9	67850	54.9	643	1865	145	1.3	429	0.145	0.0110	0.6
U5-01S	Shallow	6.2	4.2	< 50	< 0.025	0.7	7.5	**54348**	< 0.5	**4504**	**138**	5	< 0.1	217	-	-	0.5
U5-04S	Shallow	5.4	0.2	135	2.640	3.8	1.5	353	1.2	23	14	22	< 0.1	77	-	-	0.4
U5-06S	Shallow	4.2	0.6	158	< 0.025	21	**107**	**4010**	**8.8**	**5480**	**374**	167	**0.5**	301	-	-	1.0
U5-08S	Shallow	6.5	**12.0**	< 50	< 0.025	< 0.5	1.1	**6580**	< 0.5	**2980**	**150**	27	< 0.1	211	-	-	< 0.3
U5-01D	Deep	6.5	0.5	< 50	0.094	< 0.5	1.0	232	**20.7**	221	68	3	0.1	129	-	-	1.6
U5-02D	Deep	6.7	**4170**	125	0.034	0.6	3.1	**36740**	**16.7**	**872**	**1440**	86	< 0.1	338	1.5	< 0.0005	< 0.3
U5-04D	Deep	7.3	1.4	< 50	0.105	1.7	0.3	456	9.6	28	**113**	65	< 0.1	183	-	-	1.3
U5-05D	Deep	6.3	1.4	331	0.035	3.1	**19.2**	**11632**	**28.7**	**3222**	**186**	194	< 0.1	422	**3.3**	**0.0019**	0.5
U5-06D	Deep	5.7	1.0	162	0.029	1.1	**28.0**	**14182**	**21.4**	**1442**	**408**	163	0.1	319	-	-	1.2
U5-08D	Deep	10.1	0.1	< 50	**1.068**	1.3	0.2	< 50	1.6	8	39	2	< 0.1	72	-	-	0.7
U5-02BR	Bedrock	6.0	**164**	120	< 0.025	1.2	**25.1**	6266	1.3	**5910**	**396**	22	**0.3**	195	-	**0.0011**	0.4
U5-04BRA	Bedrock	10.6	2.0	< 50	0.580	0.5	0.3	113	-	9	57	18	< 0.1	108	-	-	**1.4**
U5-05BR	Bedrock	8.9	**11.7**	447	0.057	2.0	**2.1**	59	**67.1**	31	**1342**	**555**	< 0.1	**1424**	-	-	**9.6**
U5-08BR	Bedrock	10.0	3.9	< 50	0.690	1.4	0.0	47	**11.3**	< 5	33	13	< 0.1	124	-	-	**2.6**
Between Waste Boundary and Compliance Boundary																	
Sidegradient of the Ash Basin																	
CCR-U5-10S	Shallow	5.0	< 0.1	4	-	2.5	1.7	-	1.2	-	-	< 1	< 0.1	52	0.642	-	-
GWA-05S	Shallow	5.2	0.4	< 50	1.320	3.2	2.8	122	1.9	410	**113**	**532**	**0.4**	**793**	-	-	0.3
CCR-U5-10D	Deep	5.5	< 0.1	10	-	1.3	0.8	-	0.9	-	-	15	0.1	88	0.277	-	-
GWA-05BRU	Deep	7.3	0.4	< 50	0.073	0.6	< 0.1	172	8.4	195	**207**	53	< 0.1	433	-	-	0.4
Downgradient of the Ash Basin																	
CCR-U5-03S	Shallow	5.9	< 0.1	94	0.579	1.5	0.2	102	0.4	290	**165**	50	< 0.1	169	-	-	0.3
CCR-U5-04S	Shallow	5.4	1.2	563	1.200	1.9	**83.7**	683	**5.2**	**1830**	**550**	182	**0.5**	338	0.366	-	0.6
CCR-U5-06S	Shallow	4.0	0.3	139	-	< 0.5	**33.3**	-	**8.0**	-	-	150	**0.6**	289	1.4	-	-
CCR-U5-08S	Shallow	5.6	0.4	17	-	2.6	**25.1**	-	1.0	-	-	218	**0.2**	372	0.459	-	-
CCR-U5-09S	Shallow	5.2	< 0.1	324	-	0.6	5.2	-	1.4	-	-	12	0.1	61	0.827	-	-
GWA-02S	Shallow	5.5	< 0.1	129	0.202	< 0.5	0.2	203	0.5	206	**129**	65	0.1	181	0.331	< 0.0005	< 0.3
GWA-04S	Shallow	4.3	0.8	159	< 0.025	< 0.5	**59.4**	**18260**	**5.8**	**2014**	**537**	194	**1.3**	343	1.5	< 0.0005	< 0.3
GWA-36S	Shallow	5.3	1.2	79	< 0.025	0.5	**51.6**	**1851**	**7.5**	**1028**	**234**	109	**0.6**	206	0.613	< 0.0005	< 0.3
CCR-U5-01D	Deep	5.9	< 0.1	7	-	0.7	1.4	-	1.1	-	-	53	< 0.1	195	1.3	-	-
CCR-U5-02D	Deep	5.3	0.1	80	-	4.3	0.7	-	0.9	-	-	43	0.1	116	< 0.28	-	-
CCR-U5-03D	Deep	5.8	0.1	127	0.153	0.6	2.8	297	0.4	**2033**	**253**	72	0.2	212	1.3	-	0.3
CCR-U5-04D	Deep	5.2	0.6	**800**	< 0.025	< 0.5	**61.3**	1605	6.8	**3620**	**555**	**341**	**0.9**	**529**	1.6	-	0.4
CCR-U5-06DA	Deep	4.6	0.1	173	-	< 0.5	**107**	-	1.0	-	-	219	0.2	401	0.521	-	-
CCR-U5-08D	Deep	4.6	1.1	189	-	1.8	**179**	-	**17.8**	-	-	**463**	**2.4**	**981**	1.7	-	-
GWA-02BRU	Deep	6.2	0.2	127	< 0.025	< 0.5	0.5	431	10.7	115	**158**	69	< 0.1	269	1.2	**0.0005**	< 0.3
GWA-03D	Deep	5.7	0.2	400	0.362	2.0	3.3	174	4.7	**1464**	**233**	184	0.1	362	1.6	< 0.0005	0.6
GWA-04D	Deep	5.4	0.4	165	< 0.025	< 0.5	**93.9**	**16200**	7.4	**4320**	**449**	232	< 0.1	433	**4.3**	**0.0007**	< 0.3
GWA-31D	Deep	6.7	0.4	46	0.214	0.7	0.3	91	4.4	6	**461**	**381**	< 0.1	**874**	**7.5**	-	0.4
GWA-36D	Deep	5.6	0.4	165	< 0.025	0.5	**37.4**	1368	5.6	**4436**	**323**	**308**	< 0.1	**572**	0.707	< 0.0005	0.4
CCR-U5-04BR	Bedrock	6.8	0.5	414	< 0.025	0.9	0.1	7120	9.0	**598**	**281**	**258**	< 0.1	**577**	2.7	0.0003	0.4

TABLE 6-31
MEANS OF GROUNDWATER COIs - JANUARY 2018 TO JUNE 2019
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTIVE PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Analytical Parameter		pH	Arsenic	Boron	Chromium (VI)	Chromium	Cobalt	Iron	Lithium	Manganese	Strontium	Sulfate	Thallium	Total Dissolved Solids	Total Radium	Total Uranium	Vanadium
Reporting Units		S.U.	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	pCi/L	µg/L	µg/L
15A NCAC 02L Standard		6.5 - 8.5	**10**	**700**	NE	**10**	1*	300	NE	50	NE	**250**	**0.2***	**500**	NE	NE	0.3*
2017 Background Threshold Values (Shallow Flow Zone)[1]		4.4 - 6.1	1	50	0.5	4	11	684	NE	169	37	1	0.1	75	3	0.0005	1
2019 Background Threshold Values (Shallow Flow Zone)[2]		4.0 - 6.0	0.2	50	**4**	**26**	**21**	**1700**	**3**	**969**	**34**	4	0.2	57	**2**	**0.0005**	**1**
2019 Background Dataset Range (Shallow Flow Zone)[2]		3.3 - 6.1	<0.1 - 0.73	<50	<0.025 - 4.8	<0.5 - 26.2	0.16 - 22.9	<50 - 5750	<0.5 - 4.6	6.7 - 1000	6.8 - 103	<1 - 5.5	<0.1 - 0.3	<25 - 10700	0.0976 - 1.961	<0.0002 - <0.0005	<0.3 - 1.9
2017 Background Threshold Values (Deep Flow Zone)[1]		4.8 - 6.1	1	50	0.2	2	5	515	NE	78	56	10	0.1	71	2	0.0005	1
2019 Background Threshold Values (Deep Flow Zone)[2]		4.9 - 7.2	2	50	**0.6**	2	**5**	**1840**	**12**	**260**	**69**	15	0.2	107	**2**	**0.0005**	**11**
2019 Background Dataset Range (Deep Flow Zone)[2]		3.8 - 7.3	<0.1 - 2	<50 - 150	<0.025 - 1.2	<0.5 - 9.9	<0.1 - 6.1	<50 - 3200	1.5 - 13.4	5.2 - 408	6.3 - 70.5	<1 - 18.5	<0.1 - <0.2	<25 - 407	0.017 - 2.323	<0.0005	<0.3 - 12.2
2017 Background Threshold Values (Bedrock Flow Zone)[1]		5.4 - 7.4	1	50	0.1	4	1	6220	NE	89	107	15	0.2	120	3	0.0005	0.4
2019 Background Threshold Values (Bedrock Flow Zone)[2]		4.5 - 7.5	1	50	**0.7**	3	**2**	**7680**	**11**	**113**	**93**	17	0.2	120	**3**	**0.0005**	**1**
2019 Background Dataset Range (Bedrock Flow Zone)[2]		4.8 - 7.6	<0.1 - 1.2	<50 - 83	<0.025 - 0.8	<0.5 - 10.5	<0.1 - 2.6	<50 - 11000	1.1 - 7.3	5 - 134	16.6 - 116	<1 - 17.6	<0.1 - 0.5	<25 - 330	0 - 3.46	<0.0005	<0.3 - 1.5
Sample ID	**Flow Zone**	**Mean, Geomean, or Median Result[3]**															
CCR-U5-05D	Bedrock	6.9	1.1	384	-	0.7	**5.4**	-	4.5	-	-	151	< 0.1	452	< 0.599	-	-
GWA-02BRA	Bedrock	8.2	0.6	85	< 0.025	1.0	0.1	852	5.4	**125**	**117**	48	< 0.1	209	1.7	0.0004	0.7
GWA-31BRA	Bedrock	7.8	1.7	< 50	0.031	1.0	< 0.1	278	**35.3**	55	52	112	< 0.1	302	< 0.518	-	0.5
GWA-67BR	Bedrock	11.8	-	< 50	-	-	-	-	-	-	-	-	-	-	-	-	-
GWA-67BRL	Bedrock	7.4	0.2	133	< 0.025	< 0.5	0.1	1825	8.8	**197**	**174**	76	< 0.1	241	**3.7**	0.0004	0.4
GWA-68BRL	Bedrock	7.7	0.3	68	0.060	< 0.5	0.1	276	9.0	**116**	**306**	95	< 0.1	302	1.5	**0.0019**	0.6
Near or Beyond Compliance Boundary																	
Upgradient of the Ash Basin																	
MW-42S	Shallow	5.6	0.2	< 50	0.850	2.6	0.3	178	0.5	11	45	7	< 0.1	67	-	< 0.0005	< 0.3
GWA-45D	Deep	8.2	0.9	< 50	< 0.025	1.2	0.1	118	-	24	**136**	27	< 0.1	201	-	-	2.6
MW-42DA	Deep	7.2	0.7	< 50	0.079	0.8	0.3	152	**36.5**	43	**112**	105	< 0.1	302	-	**0.0019**	1.0
Downgradient of the Ash Basin																	
GWA-34S	Shallow	5.9	0.1	< 50	0.047	< 0.5	0.3	385	0.7	65	19	2	< 0.1	53	-	< 0.0005	< 0.3
GWA-35S	Shallow	5.8	0.7	110	< 0.025	< 0.5	16.9	**16040**	< 0.5	**1692**	**50**	41	0.1	131	-	-	< 0.3
GWA-37S	Shallow	5.8	0.9	80	< 0.025	1.3	**92.7**	**15860**	0.6	**7866**	**74**	71	0.1	182	-	-	0.3
GWA-56S	Shallow	6.1	0.2	< 50	0.383	1.8	2.1	820	1.3	146	**66**	138	< 0.1	314	0.435	< 0.0005	0.4
MW-34S	Shallow	5.2	< 0.1	< 50	0.063	< 0.5	1.2	130	1.2	25	5	< 1	< 0.1	< 25	-	< 0.0005	< 0.3
MW-36S	Shallow	5.7	0.1	57	0.200	0.6	< 0.1	261	0.4	15	**41**	10	< 0.1	57	-	-	0.4
MW-38S	Shallow	5.3	0.1	126	0.540	1.5	3.7	377	1.1	366	**81**	153	< 0.1	276	0.655	< 0.0005	0.3
MW-40S	Shallow	5.5	< 0.1	< 50	0.694	1.2	0.6	356	0.6	28	**158**	113	< 0.1	247	-	-	0.6
GWA-01BRU	Deep	7.1	0.1	< 50	0.067	0.6	0.2	795	3.0	59	45	8	< 0.1	95	-	-	< 0.3
GWA-32D	Deep	6.0	0.1	< 50	0.097	< 0.5	0.1	124	0.6	10	11	2	< 0.1	27	-	0.0002	< 0.3
GWA-35D	Deep	6.4	0.1	128	< 0.025	< 0.5	0.5	**4578**	10.5	119	**112**	63	< 0.1	189	-	-	< 0.3
GWA-37D	Deep	5.3	0.2	62	**0.685**	**11.1**	1.3	925	11.6	48	**587**	**289**	< 0.1	**541**	-	-	1.5
GWA-56D	Deep	6.5	0.2	< 50	< 0.025	1.4	0.6	1547	**16.5**	**290**	**169**	114	< 0.1	312	**3.0**	< 0.0005	0.3
MW-34BRU	Deep	7.4	0.1	< 50	0.028	< 0.5	< 0.1	783	1.3	40	64	12	< 0.1	118	-	-	< 0.3
MW-36BRU	Deep	6.9	< 0.1	< 50	0.026	< 0.5	< 0.1	216	2.9	67	**71**	7	< 0.1	121	-	-	< 0.3
MW-38D	Deep	5.8	0.2	233	0.109	1.1	2.6	196	7.8	**398**	**211**	232	< 0.1	424	1.2	< 0.0005	0.5
MW-40BRU	Deep	7.7	0.5	< 50	0.082	< 0.5	< 0.1	159	2.9	196	**201**	98	< 0.1	298	**4.6**	-	0.5
GWA-34BR	Bedrock	8.0	0.1	< 50	< 0.025	< 0.5	0.1	1057	1.5	80	66	28	< 0.1	163	-	< 0.0005	< 0.3
MW-38BR	Bedrock	6.6	0.8	52	< 0.025	1.0	0.9	2358	**16.1**	**252**	**378**	**254**	< 0.1	**509**	**3.3**	< 0.0005	< 0.3

Prepared by: TJG Checked by: TAW

Notes:

[1] - Background threshold values were calculated using data from background groundwater samples collected June 2015 to September 2017.

[2] - Background threshold values were calculated using data from background groundwater samples collected March 2011 to December 2018.

[3] - Statistical mean, geomean, or median calculated from data ranging from January 2018 to June 2019. Ash pore water results are not compared to groundwater standards or criteria.

Mean or geomean results were used based on the central tendency of the data set.

For wells with datasets containing fewer than four valid results, the most recent valid sample data was used.

Means were calculated for wells with four or more valid sample results. Sample results were excluded from calculations:

1) if turbidity >10 NTU (for COIs other than boron)

2) for unusable data (R0 qualified)

3) if a result was non-detect at a reporting limit (RL) greater than the normal laboratory RL

Bold text - Constituent concentration exceeds applicable comparison criteria.

- bold highlighted concentration indicates value is greater than the 15A NCAC 02L .0202 Standard or the IMAC. (Effective date for 15A NCAC 02L .0202 Standard and IMAC is April 1, 2013)

- bold highlighted concentration indicates value is greater than greatest background threshold value where there is no regulatory standard, or background threshold values are greater than regulatory standard

- highlighted concentration indicates value is either within range of background threshold values for constituents where there is no regulatory standard/background threshold values are greater than regulatory standard, or within range of background threshold value and the regulatory standard

* - Interim Maximum Allowable Concentrations (IMACs) of the 15A NCAC 02L Standard, Appendix 1, April 1, 2013.

< - concentration not detected at or above the adjusted reporting limit.

- - value not available

NE - not established

mg/L - milligrams per liter

pCi/L - picocuries per liter

µg/L - micrograms per liter

S.U. standard unit

TABLE 6-32
COI MANAGEMENT MATRIX
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Constituents of Interest[1] (2018 CSA Update)	Regulatory Criterion	Groundwater Zone Statistically Derived Background Value[2,3]			Cliffside Steam Station Background Dataset Range (All Flow Zones)	Piedmont Background Value Range	Maximum Mean Concentration Near or Beyond Compliance Boundary[4]	Exceedance Ratio[5]	Number of Wells Above Criterion Near or Beyond Compliance Boundary	Groundwater Monitoring Wells With COI Concentration Greater Than Comparative Criteria	Present in Ash Pore Water Above Comparative Criteria (Ash pore water January 2018 to June 2018)	Exceeds Flow Zone Background Range	Exceeds Site-Specific Background Range	Exceeds Piedmont Province Background Range	Downgradient of Source Area at Concentration Greater than Criteria	Geochemically Mobile[6]	Rationale for Selection of COIs for Corrective Action Evaluation (for constituents where no means are greater than comparative criteria in all flow zones and/or multiple lines of evidence support that constituent occurrences are not related to the source area, no corrective action is warranted)
		Flow Zone	2017	2019													
Constituent Standards and Values - 02L Criterion											**Lines of Evidence (LOE) - 02L Criterion**						**Rationale - 02L Criterion**
Arsenic	10 (µg/L)	Shallow	1	0.2	<0.1 - 2	0.1 - 6.35	0.90	0.09	0	-		0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
		Transition Zone	1	2			0.50	0.05	0	-	Y	0	0	0	N	Non Conservative	No means greater than 02L standard near or beyond compliance boundary
		Bedrock	1	1			0.80	0.08	0	-		0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
Boron	700 (µg/L)	Shallow	50	50	<50 - 150	49.09 - 176.8	126	0.18	0	-		0	0	0	N		No means greater than 02L standard, however boron greater than the background value is a potential indicator of ash basin influence **(Figure 6-75a)**
		Transition Zone	50	50			233	0.33	0	-	Y	0	0	0	N	Conservative	No means greater than 02L standard, however boron greater than the background value is a potential indicator of ash basin influence **(Figure 6-75b)**
		Bedrock	50	50			52	0.07	0	-		0	0	0	N		No means greater than 02L standard, however boron greater than the background value is a potential indicator of ash basin influence **(Figure 6-75c)**
Chromium (Total)	10 (µg/L)	Shallow	4	26	<0.5 - 26.2	1 - 26	1.8	0.07	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
		Transition Zone	2	2			11.1	1.11	1	GWA-37D	N	1	0	0	Y	Non Conservative	One mean greater than 02L standard, isolated occurrence, constituent not present greater than comparative criteria in ash pore water **(Figure 6-76)**
		Bedrock	4	3			1.0	0.10	0	-		0	0	0	N		No means greater than 02L standard near or beyond compliance boundary
Iron	300 (µg/L)	Shallow	684	1700	<50 - 11000	56.3 - 37500	16040	9.44	2	GWA-35S, GWA-37S		2	2	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume **(Figure 6-79a)**
		Transition Zone	515	1840			4578	2.49	1	GWA-35D	Y	1	0	0	Y	Variable	One mean greater than background value near or beyond compliance boundary, exhibits discernable plume **(Figure 6-79b)**
		Bedrock	6220	7680			2358	0.31	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
Manganese	50 (µg/L)	Shallow	169	969	5 - 1000	7 - 9170	7866	8.12	2	GWA-35S, GWA-37S		2	2	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume **(Figure 6-81a)**
		Transition Zone	78	260			398	1.53	2	GWA-56D, MW-38D	Y	0	0	0	Y	Variable	Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume **(Figure 6-81b)**
		Bedrock	89	113			252	2.83	1	MW-38BR		1	0	0	Y		One mean greater than background value near or beyond compliance boundary, exhibits discernable plume **(Figure 6-81c)**
Sulfate	250 (mg/l)	Shallow	1	4	<1 - 18.5	1.2 - 510	153	0.61	0			0	0	0	N		No means greater than 02L standard near or beyond compliance boundary, sulfate greater than background value mapped **(Figure 6-83a)**
		Transition Zone	10	15			289	1.16	1	GWA-37D	Y	1	1	0	Y	Conservative	One mean greater than 02L standard near or beyond compliance boundary, exhibits discernable plume **(Figure 6-83b)**
		Bedrock	15	17			254	1.02	1	MW-38BR		1	1	0	Y		One mean greater than 02L standard near or beyond compliance boundary, exhibits discernable plume **(Figure 6-83c)**
Total Dissolved Solids	500 (mg/l)	Shallow	75	57	<25 - 10700	50 - 1200	314	0.63	0	-		0	0	0	N		No means greater than 02L standard near or beyond compliance boundary, TDS greater than background value mapped **(Figure 6-84a)**
		Transition Zone	71	107			541	1.08	1	GWA-37D	Y	1	0	0	Y	Conservative	One mean greater than 02L standard near or beyond compliance boundary, exhibits discernable plume **(Figure 6-84b)**
		Bedrock	120	120			509	1.02	1	MW-38BR		1	0	0	Y		One mean greater than 02L standard near or beyond compliance boundary, exhibits discernable plume **(Figure 6-84c)**
Constituent Standards and Values - IMAC Criterion											**Lines of Evidence (LOE) - IMAC Criterion**						**Rationale - IMAC Criterion**
Cobalt	1 (µg/L)	Shallow	11	21	< 0.1 - 22.9	0.2 - 88.85	92.7	4.41	1	GWA-37S		1	1	1	Y		One mean greater than background value near or beyond compliance boundary, exhibits discernable plume **(Figure 6-78)**
		Transition Zone	5	5			2.6	0.52	0	-	Y	0	0	0	N	Variable	No means greater than background value near or beyond compliance boundary
		Bedrock	1	2			0.9	0.45	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
Thallium	0.2 (µg/L)	Shallow	0.1	0.2	< 0.1 - 0.5	0.1 - 0.2	0.1	0.50	0	-		0	0	0	N		No means greater than IMAC near or beyond compliance boundary
		Transition Zone	0.1	0.2			<0.1	NA	0	-	Y	0	0	0	N	Variable	No means greater than IMAC near or beyond compliance boundary
		Bedrock	0.2	0.2			< 0.1	NA	0	-		0	0	0	N		No means greater than IMAC near or beyond compliance boundary
Vanadium	0.3 (µg/L)	Shallow	1	1	<0.3 - 12.2	0.38 - 26	0.6	0.60	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
		Transition Zone	1	11			1.5	0.14	0	-	Y	0	0	0	N	Non Conservative	No means greater than background value near or beyond compliance boundary
		Bedrock	0.4	1			<0.3	NA	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
Constituent Standards and Values - Background Criterion											**Lines of Evidence (LOE) - Background Criterion**						**Rationale - Background Criterion**
Chromium (Hexavalent)	NE (µg/L)	Shallow	0.5	4	<0.025 - 4.8	0.03 - 12	0.694	0.17	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
		Transition Zone	0.2	0.6			0.685	1.14	1	GWA-37D	N	0	0	0	Y	Variable	One mean greater than background value, constituent not present greater than background value in ash pore water, mean is also within range of deep flow zone background concentrations detected at Cliffside **(Figure 6-77)**
		Bedrock	0.1	0.7			<0.025	NA	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
Lithium	NE (µg/L)	Shallow	-	3	< 0.5 - 13.4	2 - 95.39	1.3	0.44	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary, however discernable plume is present within compliance boundary **(Figure 6-80a)**
		Transition Zone	-	12			16.5	1.38	1	GWA-56D	Y	1	1	0	Y	Conservative	One mean greater than background value near or beyond compliance boundary, location probably not influenced by ash basin, discernable plume exists within the waste boundary **(Figure 6-80b)**
		Bedrock	-	11			16.1	1.46	1	MW-38BR		1	1	0	Y		One mean greater than background value near or beyond compliance boundary **(Figure 6-80c)**
Strontium	NE (µg/L)	Shallow	37	34	6.3 - 116	27 - 2272	158	4.65	6	GWA-35S, GWA-37S, GWA-56S, MW-36S, MW-38S, MW-40S		1	1	0	Y		Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume **(Figure 6-82a)**
		Transition Zone	56	69			587	8.51	6	GWA-35D, GWA-37D, GWA-56D, MW-36BRU, MW-38D, MW-40BRU	Y	6	4	0	Y	Non Conservative	Multiple means greater than background value near or beyond compliance boundary and exhibits discernable plume **(Figure 6-82b)**
		Bedrock	107	93			378	4.06	1	MW-38BR		1	1	0	Y		One mean greater than background value near or beyond compliance boundary, exhibits discernable plume **(Figure 6-82c)**
Total Radium	NE (pCi/L)	Shallow	3	2	0 - 3.46	1 - 35	0.7	0.33	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
		Transition Zone	2	2			4.6	2.30	2	GWA-56D, MW-40BRU	N	2	1	0	Y	Variable	Two means greater than background value occur at locations GWA-56D and MW-40BRU, which are outside the detectable boron plume and therefore probably not indicative of ash basin influence. Constituent not present in ash pore water greater than background value.
		Bedrock	3	3			3.3	1.10	1	MW-38BR		0	0	0	Y		One mean greater than background value near or beyond compliance boundary, isolated occurence. Constituent not present in ash pore water greater than background value **(Figure 6-85)**
Total Uranium	NE (µg/L)	Shallow	0.0005	0.0005	<0.0005	0.0002 - 0.0167	<0.0005	NA	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary
		Transition Zone	0.0005	0.0005			<0.0005	N/A	0	-	Y	0	0	0	N	Non Conservative	No means greater than background value near or beyond compliance boundary
		Bedrock	0.0005	0.0005			<0.0005	N/A	0	-		0	0	0	N		No means greater than background value near or beyond compliance boundary

Prepared by: TEL Checked by: DMS

Notes:
- Reference Criterion
- Evidence supports inclusion
- Evidence supports exclusion

[1] - Constituent list reflects the COI list identified in the 2018 CSA Update, with the addition of lithium.
[2] - Background threshold values were calculated using data from background groundwater samples collected June 2015 to April 2017
[3] - Updated background threshold values are in the third column and were calculated using data from background groundwater samples collected October 2010 to December 2018 and summitted to NCDEQ June 2019
[4] - Arithmetic mean was used for COI with concentration ranges less than or equal to one order of magnitude. Geometric mean was used for COI with concentration range greater than one order of magnitude.
[5] - The exceedance ratio is the ratio of the mean constituent concentration divided by the comparative criterion.
[6] - Assignment of conservative, non-conservative, or variable behavior is based on geochemical modeling results.

> - greater than
< - less than
COI - constituent of interest
CSA - Comprehensive Site Assessment
IMAC - interim maximum allowable concentration
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not Applicable
NE - Not Established
S.U. Standard units
Y - Yes
N - No

TABLE 6-33
SUMMARY TREND ANALYSIS RESULTS
FOR MONITORING WELLS
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Wells Within the Waste Boundary

Well ID	Boron	Lithium	Sulfate	Total Dissolved Solids
Shallow Flow Zone				
U5-01S	ND	ND	D	NT
U5-08S	S	S	D	D
Deep Flow Zone				
U5-01D	ND	NT	D	D
U5-02D	D	S	S	D
U5-08D	D	S	D	NT
Bedrock Flow Zone				
U5-02BR	I	S	I	I
U5-08BR	S	NE	NE	NE

Wells Between Waste Boundary and Compliance Boundary

Well ID	Boron	Lithium	Sulfate	Total Dissolved Solids
Shallow Flow Zone				
CCR-U5-03S	S	D	D	D
CCR-U5-04S	S	NT	S	S
CCR-U5-06S	D	D	D	S
CCR-U5-08S	NT	D	NT	S
CCR-U5-09S	S	NT	NT	NT
CCR-U5-10S	ND	NT	ND	NT
GWA-02S	S	S	D	S
GWA-04S	D	S	S	I (370)
GWA-05S	ND	S	NT	S
GWA-36S	NT	NT	D	S
U5-04S	NT	S	NT	NT
U5-08S	S	S	D	D
Deep Flow Zone				
CCR-U5-01D	ND	NT	I	NT
CCR-U5-02D	S	D	S	NT
CCR-U5-03D	S	NT	D	S
CCR-U5-04D	S	S	S	S
CCR-U5-05D	D	NT	S	S
CCR-U5-06DA	S	D	D	D
CCR-U5-08D	D	D	S	I (1600)
CCR-U5-10D	ND	D	NT	S
GWA-02BRU	I	S	S	I (275)
GWA-03D	S	NE	S	S
GWA-04D	S	S	S	S
GWA-05BRU	S	S	D	D
GWA-31D	S	NT	I (542)	I (1270)
GWA-36D	D	S	S	S
U5-04D	ND	NE	I	I
U5-05D	S	S	D	D
U5-06D	D	S	S	S

Wells Between Waste Boundary and Compliance Boundary

Well ID	Boron	Lithium	Sulfate	Total Dissolved Solids
Bedrock Flow Zone				
CCR-U5-04BR	S	NE	S	S
GWA-31BRA	S	D	D	D
U5-05BR	I (538)	D	S	S
U5-08BR	S	NE	NE	NE

Wells Downgradient of the Source Area Near or Beyond Compliance Boundary

Well ID	Boron	Lithium	Sulfate	Total Dissolved Solids
Shallow Flow Zone				
GWA-34S	ND	NE	NT	NT
GWA-35S	S	NE	S	S
GWA-37S	S	S	D	S
GWA-56S	S	NT	S	S
MW-34S	ND	NE	ND	ND
MW-36S	S	NE	NT	D
MW-38S	S	NT	S	S
MW-40S	S	S	I	I (292)
Deep Flow Zone				
GWA-01BRU	ND	NT	S	S
GWA-35D	S	NE	D	D
GWA-37D	I	S	D	I (559)
GWA-56D	ND	S	S	S
MW-34BRU	ND	NE	S	NT
MW-36BRU	ND	NE	D	S
MW-38D	S	S	D	D
MW-40BRU	ND	D	I	I (332)
Bedrock Flow Zone				
MW-38BR	S	S	D	D

Mann-Kendall trend analysis and results prepared by Arcadis U.S. Inc.

Prepared by: MAE Checked by: HES

Notes:

1. Summary of results and trends are presented for samples collected from 2015 - 2019.
2. Trend results are presented when at least four samples were available and frequency of detection was >50%. Statistically significant trends are reported at the 90% confidence level.
3. Variability Index (VI) is calculated as the (maximum - minimum) / median concentration and is calculated using detected concentrations only. Values less than 1 indicate low variability in the dataset.
4. For pH, statistically significant, increasing trend with a maximum recent result (2018 - 2019) less than the lower end of the standard range or greater than the upper end of the standard range. Maximum detected result for 2018 and 2019 time period shown in parentheses.
5. Wells that had insufficient samples collected (n<4) for all four consitituents were removed from table. See designation 'NE'.

ND	= Greater than 50 percent of constituent concentrations were non-detect
D	= Statistically significant, decreasing concentration trend
S	= Stable. No significant trend and variability is low (VI ≤ 1)
NT	= No significant trend and variability is high (VI > 1)
I	= Statistically significant, increasing concentration trend.
NE	= Insufficient number of samples to evaluate trend (n < 4)

TABLE 6-34
SEEP CORRECTIVE ACTION STRATEGY
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Seep ID	Regulatory Program	General Location	Approximate Average Present Flow (cfs)	Seep Corrective Action Strategy
S-02	SOC	North of U5 AB	0.1	Corrective action at this location may consist of capturing and treating the seep or other remedial actions. Final corrective action plans for seeps that are not dispositioned after completion of decanting will be proposed in an amendment to the CAP Update and submitted based on the schedule outlined in the SOC.

Prepared by: SAS Checked by: TJG

Notes:
cfs- cubic feet per second
NPDES – National Pollution Discharge Elimination System
SOC – Special Order by Consent

TABLE 6-35
NPDES PERMIT LIMITS AND ANTICIPATED GROUNDWATER REMEDIATION PARAMETER LEVELS
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

NPDES Outfalls	Outfall 002[1]		Outfall 005		Maximum Detected Concentrations by Flow Zone[2]		
Effluent Limitations and Monitoring Requirements							
Parameter	**Monthly Average**	**Daily Maximum**	**Monthly Average**	**Daily Maximum**	**Saprolite**	**Transition Zone**	**Bedrock**
Flow (MGD)	NS	1 MGD	NS	NS	NA	NA	NA
Oil & Grease	15.0 mg/L	20.0 mg/L	15.0 mg/L	20.0 mg/L	NA	NA	NA
TSS	30.0 mg/L	50.0 mg/L	30.0 mg/L	50.0 mg/L	9.2 mg/L	12.7 mg/L	6 mg/L
Total Chromium	0.2 mg/L	0.20 mg/L	0.2 mg/L	0.2 mg/L	0.003 mg/L	0.02 mg/L	0.002 mg/L
Total Zinc	1.0 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L	0.05 mg/L	0.25 mg/L	0.008 mg/L
pH	From 6.0 to 9.0 S.U.		From 6.0 to 9.0 S.U.		3.7 – 6.4 S.U.	3.0 – 6.1 S.U.	6.4 – 6.9 S.U.
Total Copper[3]	NA	NA	251 µg/L	272 µg/L	9.6 µg/L	2.8 µg/L	0.72 µg/L
Chronic Toxicity	NA	NA	Note 4		NA	NA	NA
Total Iron[3]	NA	NA	1.0 mg/L	1.0 mg/L	20.9 mg/L	23.4 mg/L	2.95 mg/L
Total Residual Chlorine	NA	NA	NS	28 µg/L	NA	NA	NA
5-day BOD; 20° C	NA	NA	30.0 mg/L	45.0 mg/L	NA	NA	NA
Fecal Coliform (geo. Mean)	NA	NA	200/100 mL	400/100 mL	NA	NA	NA
Temperature	NA	NA	NS	100° F	NA	NA	NA

Prepared by: VTV Checked by TJG

Notes:
1 - Effective beginning on the commencement of the dewatering operation and lasting until permit expiration.
2 - Downgradient groundwater monitoring wells in area of groundwater remediation; Q1 2018 through Q2 2019 data.
3 - Monitoring shall be per occurrence of chemical metal cleaning and sample from a representative discharge.
4 - Chronic Toxicity (Ceriodaphnia) P/F at 3.14%; March, June, September, and December.
MGD - million gallons per day
NS - not specified
NA - not analyzed
TSS - total suspended solids
S.U. - standard units
BOD - biological oxygen demand
mg/L - milligrams per liter
µg - micrograms per liter
mL - milliliters

TABLE 6-36
REMEDIAL TECHNOLOGY SCREENING SUMMARY
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Summary of Remedial Technology Screening	Retain Technology for Further Consideration	
Technology	**Yes/No**	**Rationale**
Monitored Natural Attenuation (MNA)	Yes	COIs pose no unacceptable risk to human health or the environment under conservative exposure scenarios. MNA could be implemented in conjunction with source control measures.
In-Situ Technologies		
Low Permeability Barriers (LPB)	No	Technically challenging and costly.
Groundwater Flushing	No	Mobile COIs are not the major concern. Modeling indicates that extraction will exert hydraulic control.
Encapsulation	No	No area where COIs are concentrated.
Permeable Reactive Barrier (PRB)	Yes	Potentially applicable for mitigation of low pH water.
Groundwater Extraction Technologies		
Vertical Extraction Wells	Yes	Commonly used technology for groundwater extraction.
Horizontal or Angular Extraction Wells	No	Modeling indicates that vertical extraction wells are sufficient.
Extraction Trenches	Yes	A shallow trench could capture and control of the acidic groundwater near the saddle dam.
Hydraulic Fracturing	No	Not warranted based upon the limited extent of COIs in bedrock.
Phytoremediation	No	Limited additional mass removal.
Groundwater Treatment Technologies		
pH Adjustment	Yes	Retained for remedial alternatives that include groundwater extraction.
Precipitation	Yes	Part of the treatment in the WWTP associated with Outfall 005.
Ion Exchange	No	Expensive and not expected to be needed to meet discharge requirements.
Membrane Filtration	No	Expensive and not expected to be needed to meet discharge requirements.

TABLE 6-36
REMEDIAL TECHNOLOGY SCREENING SUMMARY
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Summary of Remedial Technology Screening	Retain Technology for Further Consideration	
Technology	**Yes/No**	**Rationale**
Management of Extracted Groundwater		
NPDES Permitted Discharge	Yes	Potential to discharge at Outfall 002 or 005; must modify permit to include discharge of extracted groundwater
Publicly Owned Treatment Works (POTW)	No	Would require installation of infrastructure; NPDES is a better option.
Non-Discharge Permit/Infiltration Gallery	No	Site soils have limited capacity to transmit water.
Non-Discharge Permit/Land Application	No	Will not be considered as long as disposal via NPDES permitted outfall is a viable option.
Beneficial Reuse		
Fire Protection	No	Limited application. Storage is problematic
Non-Contact Cooling Water	No	Limited application.
Dust Suppression and Truck Wash	No	Limited application.

Prepared by: TJG Checked by: JEC

TABLE 6-37
REMEDIAL ALTERNATIVE 3 EXTRACTION WELL AND SOURCE CONTROL TRENCH SUMMARY
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Groundwater Extraction System		
Number of Wells	**Flow Zone**	**Total Depth (ft bgs)**
12	Saprolite/Transition Zone	98 - 122
1 (Source Control Trench)	Saprolite	17 - 19
Total Extraction Well Count: 13		
Groundwater extraction system flow and operation assumptions: Modeled groundwater extraction rate: 0.6 to 2.7 gpm per well; average 1.8 gpm per well. Estimated total system groundwater extraction rate: 21.6 gpm. Groundwater extraction wells operate to maintain water level near top of the submersible pump.		

Prepared by: VTV Checked by: RAG

Notes:
ft bgs – feet below ground surface
gpm – gallons per minute

TABLE 6-38
ENVIRONMENTAL SUSTAINABILITY COMPARISONS FOR REMEDIATION ALTERNATIVES
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS LLC, MOORESBORO, NC

Remedial Alternative		Remedial Alternative 1 – Groundwater Remediation by MNA	Remedial Alternative 2 – Groundwater Remediation by pH Adjustment Gallery	Remedial Alternative 3 – Groundwater Remediation by Extraction Wells and Source Control Trench
Emissions	**Units**			
CO_2 Emissions	metric ton	1.14E+00	1.51E+03	5.09E+02
Onsite NO_x emissions	metric ton	0.00E+00	2.50E-01	4.02E-01
Onsite SO_x Emissions	metric ton	0.00E+00	1.61E-02	2.04E-02
Onsite PM_{10} Emissions	metric ton	0.00E+00	1.25E-02	1.43E-02
Total NO_x emissions	metric ton	4.23E-04	3.78E+00	1.89E+00
Total SO_x Emissions	metric ton	1.49E-05	5.29E+00	1.18E+00
Total PM_{10} Emissions	metric ton	8.58E-05	1.07E+00	2.47E-01
Total Energy Used	MMBTU	1.44E+01	4.55E+05	4.48E+05
Total Emissions	**metric ton**	**1.14E+00**	**1.52E+03**	**5.12E+02**

Prepared by: GTC Checked by: SJB

Notes:

CO_2 - Airborne emissions of carbon dioxide

MMBTU - Million British Thermal Units

NO_X - Airborne emissions of nitrogen oxides (combination of nitrogen monoxide and nitrogen dioxide)

SO_X - Airborne emissions of sulfur oxides (combination of sulfur monoxide, sulfur dioxide, sulfur trioxide, and others)

PM_{10} - Airborne emissions of particulate matter that is 10 micrometers or less in diameter

TABLE 6-39
MODELED GROUNDWATER EXTRACTION WELL DETAILS
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

Well ID	Easting	Northing	Approximate Ground Surface Elevation (feet)	Operational DTW Maintained In Well (ft BGS)	Well Depth (ft BGS)	Targeted Flow Zones	Total Simulated Flow (gpm)
Vertical Extraction Wells							
EX-U5-1	1174126.90	545805.10	709	14	98	Saprolite/Transition Zone	2.5
EX-U5-2	1174180.80	545752.90	711	17	98	Saprolite/Transition Zone	2.5
EX-U5-3	1174241.40	545707.50	711	17	106	Saprolite/Transition Zone	2.7
EX-U5-4	1174000.70	545764.70	710	13	98	Saprolite/Transition Zone	2.4
EX-U5-5	1173854.20	545720.90	707	12	106	Saprolite/Transition Zone	2.4
EX-U5-6	1173945.10	545512.20	714	19	90	Saprolite/Transition Zone	0.6
EX-U5-7	1174014.10	545517.20	714	21	98	Saprolite/Transition Zone	1.1
EX-U5-8	1174093.30	545524.00	715	23	114	Saprolite/Transition Zone	1.8
EX-U5-9	1174201.00	545547.50	711	22	114	Saprolite/Transition Zone	2.0
EX-U5-10	1174148.80	545466.70	715	24	122	Saprolite/Transition Zone	0.7
EX-U5-11	1174249.80	545401.00	708	29	122	Saprolite/Transition Zone	1.4
EX-U5-12	1174259.90	545337.10	709	27	122	Saprolite/Transition Zone	1.4

Prepared by: GTC Checked by: RAG

Notes:
All depths are approximated and may change depending on site conditions.
Flowrates are approximate and may change depending on site conditions.
DTW - depth to water
ft - feet
ft BGS - feet below ground surface
gpm - gallons per minute
NA - Not applicable

TABLE 6-40
EFFECTIVENESS MONITORING PLAN ELEMENTS
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
DUKE ENERGY CAROLINAS, LLC, MOORESBORO, NC

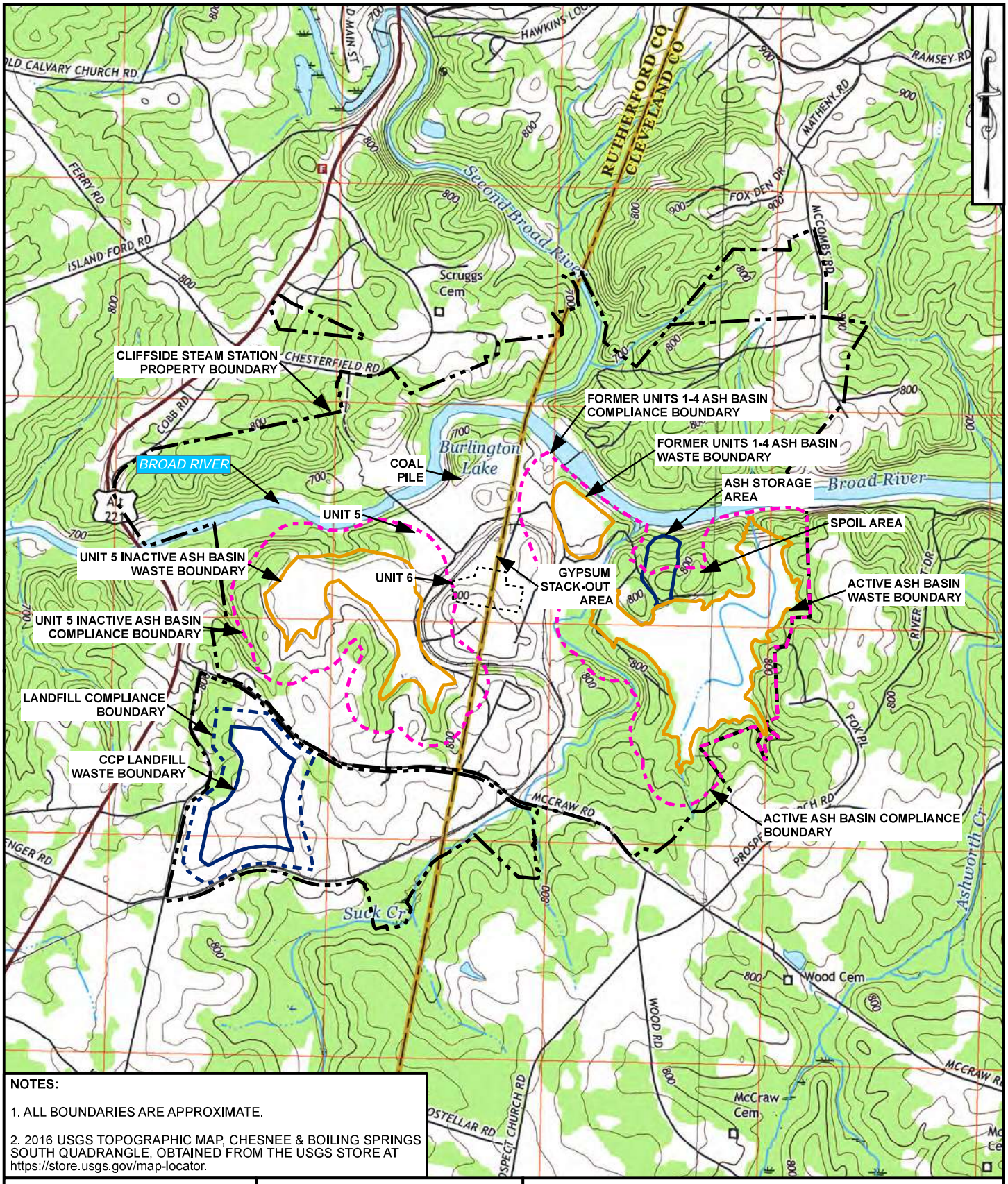
	Effectiveness Monitoring Plan (EMP) Implemented 30 days after CAP Approval	Post-Closure Monitoring Plan (PCMP) Implemented after completion of ash basin closure activities
Groundwater Monitoring Network	**EMP Groundwater Well Monitoring Network (background, downgradient of source areas)**	**PCMP Groundwater Well Monitoring Network (background, downgradient of source areas)**
	Performance Monitoring Network CCR-U5-6S, GWA-36S, GWA-37BR* CCR-U5-6DA, GWA-36D, MW-38S GWA-4S, GWA-36BR*, MW-38D GWA-4D, GWA-37S, MW-38BR GWA-4BR*, GWA-37D **Continued Monitoring Network** CCR-U5-3S, GWA-2S, GWA-35D CCR-U5-3D, GWA-2BRU, GWA-35BR* CCR-U5-4S, GWA-2BRA, GWA-67BR CCR-U5-4D, GWA-3D, MW-36S CCR-U5-4BR, GWA-3BR*, MW-36BRU CCR-U5-5D, GWA-35S, MW-36BR* **Background Monitoring Wells[1]** GWA-30S, MW-30DA, MW-32D GWA-30BR, MW-32S, MW-32BR MW-30S	A PCMP will be implemented at the Site in accordance with G.S. 130A-309.214(a)(4)k.2 after completion of ash basin closure activities.
Sampling Parameters and Frequency	**EMP Groundwater Quality[3, 4] (Semi-Annual Sampling Frequency)** *Alkalinity*, Cobalt[2], *Potassium* *Aluminum*, *Ferrous Iron*, *Sodium* *Bicarbonate Alkalinity*, *Iron*[2], Strontium[2] Boron[2], Lithium[2], *Sulfate*[2] *Calcium*, *Magnesium*, Total Dissolved Solids[2] Chromium (Total)[2], *Manganese*[2], *Total Organic Carbon* Chromium (VI)[2], *Nitrate + Nitrite*, Total Radium[2]	**PCMP Groundwater Quality (Sampling frequency to be determined)** Parameters and sampling frequency to be included in the PCMP in accordance with G.S. 130A-309.214(a)(4)k.2 when submitted.
	CMP and PCMP Groundwater Field Parameters Water Level, Specific Conductivity, Temperature pH, Oxidation Reduction Potential, Dissolved Oxygen	
Review and Reporting	**EMP Review** Annual Effectiveness Monitoring Evaluation and Reporting 1) Summary of annual groundwater monitoring results 2) Evaluate statistical concentration trends 2) Comparison of observed concentrations to model predictions 3) Evaluation of compliance with applicable Standards 4) Evaluation of system performance and effectiveness 4) Recommend plan adjustments, if applicable, to optimize the remedial action 5-Year Performance Review Reporting 1) Update background analysis 2) Confirm Risk Assessment assumptions remain valid 3) Re-evaluate effectiveness of technology 4) Verify modeling results, update model if needed 5) Modify corrective action approach, as needed, to achieve	**PCMP Review** Annual Evaluation and Reporting: 1) Summary of annual groundwater monitoring results 2) Evaluate statistical concentration trends 2) Comparison of observed concentrations to model predictions 3) Evaluation 02L compliance 4) Recommend plan adjustments, if applicable At a frequency no greater than 5 years: 1) Update background analysis 2) Confirm Risk Assessment assumptions remain valid 3) Verify model results, update if needed
Monitoring Program Duration	**EMP Duration** 30 days after CAP approval, the EMP will be implemented at the Site and will continue until there is a total of three years of data confirming COIs are below applicable Standards at or beyond the compliance boundary, at which time a request for completion of active remediation will be filed with NCDEQ. If applicable standards are not met, the EMP will continue and transition to post-closure monitoring if necessary.	**PCMP Duration** After ash basin closure and following ash basin closure certification, a PCMP will be implemented at the Site for a minimum of 30 years in accordance with G. S. 130A-309.214(4)(k)(2). Early termination: If groundwater monitoring results are below applicable Standards at the compliance boundary for three years, Duke Energy will request completion of corrective action in accordance with G.S. 130A-309.214(a)(3)b. If groundwater monitoring results are above applicable Standards, the PCMP will continue.

Prepared by: TJG Checked by: SAS

[1] Approved background groundwater monitoring locations
[2] Corrective action COIs to monitor plume stability and physical attenuation either from active remedy or natural dilution/dispersion
[3] The number of monitoring wells and parameters may be adjusted based on additional data and the effects of corrective action.
[4] Groundwater standards may be modified over time in accordance with 02L .0106(k)
* Proposed new well
Italicized parameters - parameters for general water quality to evaluate monitoring data quality
Wells indicated in red will have geochemical sondes placed to monitor geochemical conditions

FIGURES

(CAP Content Section 10)



NOTES:

1. ALL BOUNDARIES ARE APPROXIMATE.

2. 2016 USGS TOPOGRAPHIC MAP, CHESNEE & BOILING SPRINGS SOUTH QUADRANGLE, OBTAINED FROM THE USGS STORE AT https://store.usgs.gov/map-locator.

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synTerra

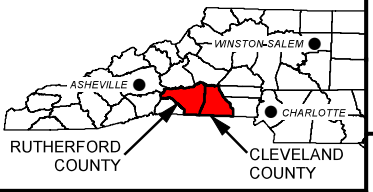

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FIGURE ES-1
USGS LOCATION MAP
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

DRAWN BY: J. KIRTZ	DATE: 06/12/2019	
REVISED BY: C. DAVIS	DATE: 12/27/2019	
CHECKED BY: T. GRANT	DATE: 12/27/2019	
APPROVED BY: T. GRANT	DATE: 12/27/2019	
PROJECT MANAGER: S. SPINNER		

GRAPHIC SCALE
0 500 1,000 2,000 3,000
(IN FEET)

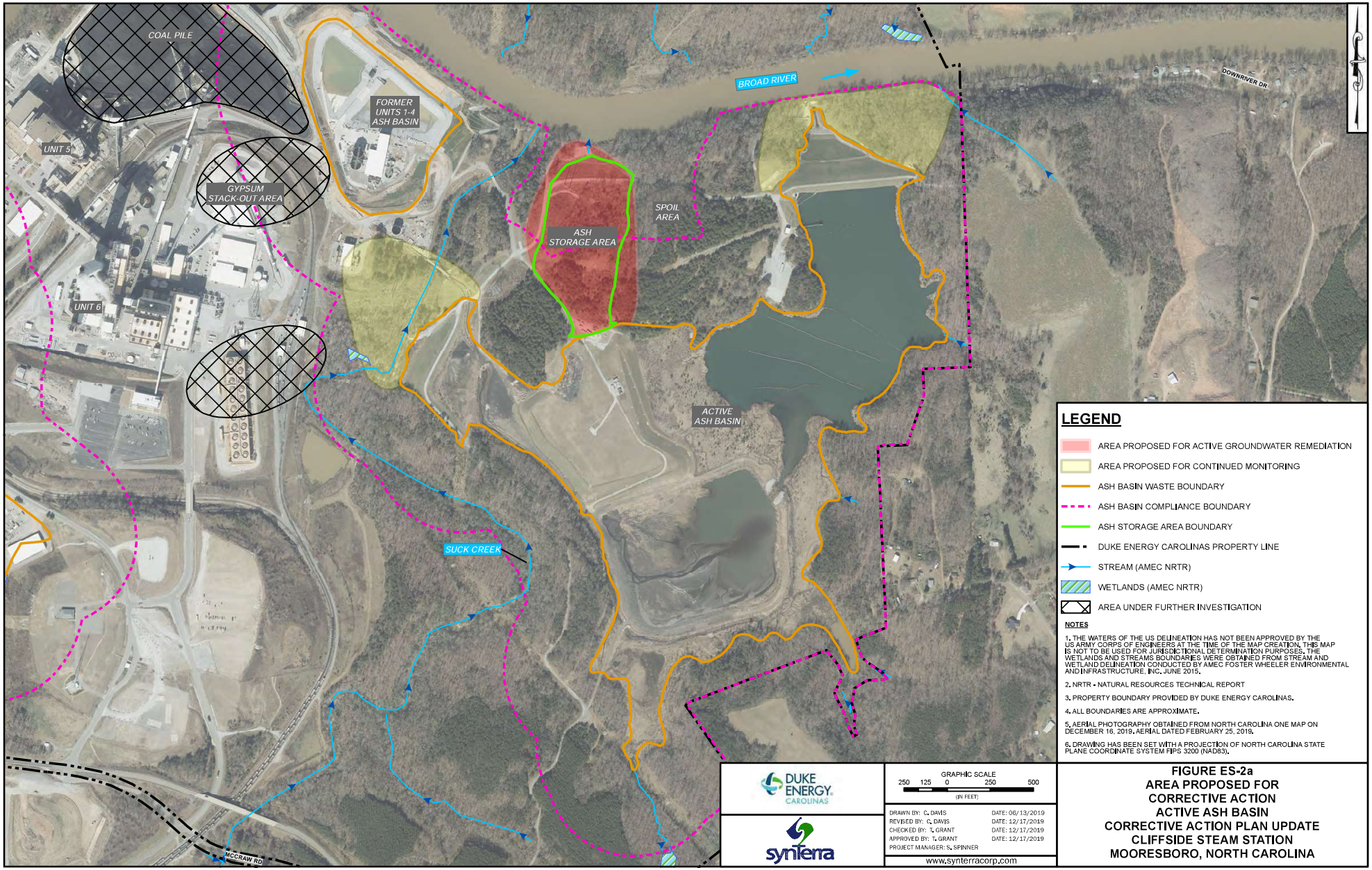
COAL PILE
UNIT 5
GYPSUM STACK-OUT AREA
FORMER UNITS 1-4 ASH BASIN
BROAD RIVER
DOWNRIVER DR
SPOIL AREA
ASH STORAGE AREA
UNIT 6
ACTIVE ASH BASIN
SUCK CREEK
MCCRAW RD
LEGEND
AREA PROPOSED FOR ACTIVE GROUNDWATER REMEDIATION
AREA PROPOSED FOR CONTINUED MONITORING
ASH BASIN WASTE BOUNDARY
ASH BASIN COMPLIANCE BOUNDARY
ASH STORAGE AREA BOUNDARY
DUKE ENERGY CAROLINAS PROPERTY LINE
STREAM (AMEC NRTR)
WETLANDS (AMEC NRTR)
AREA UNDER FURTHER INVESTIGATION
NOTES
1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC, JUNE 2015.
2. NRTR - NATURAL RESOURCES TECHNICAL REPORT
3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 16, 2019. AERIAL DATED FEBRUARY 25, 2019.
6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).
DUKE ENERGY CAROLINAS
synterra
GRAPHIC SCALE
250 125 0 250 500
(IN FEET)
DRAWN BY: C. DAVIS DATE: 06/13/2019
REVISED BY: C. DAVIS DATE: 12/17/2019
CHECKED BY: T. GRANT DATE: 12/17/2019
APPROVED BY: T. GRANT DATE: 12/17/2019
PROJECT MANAGER: S. SPINNER
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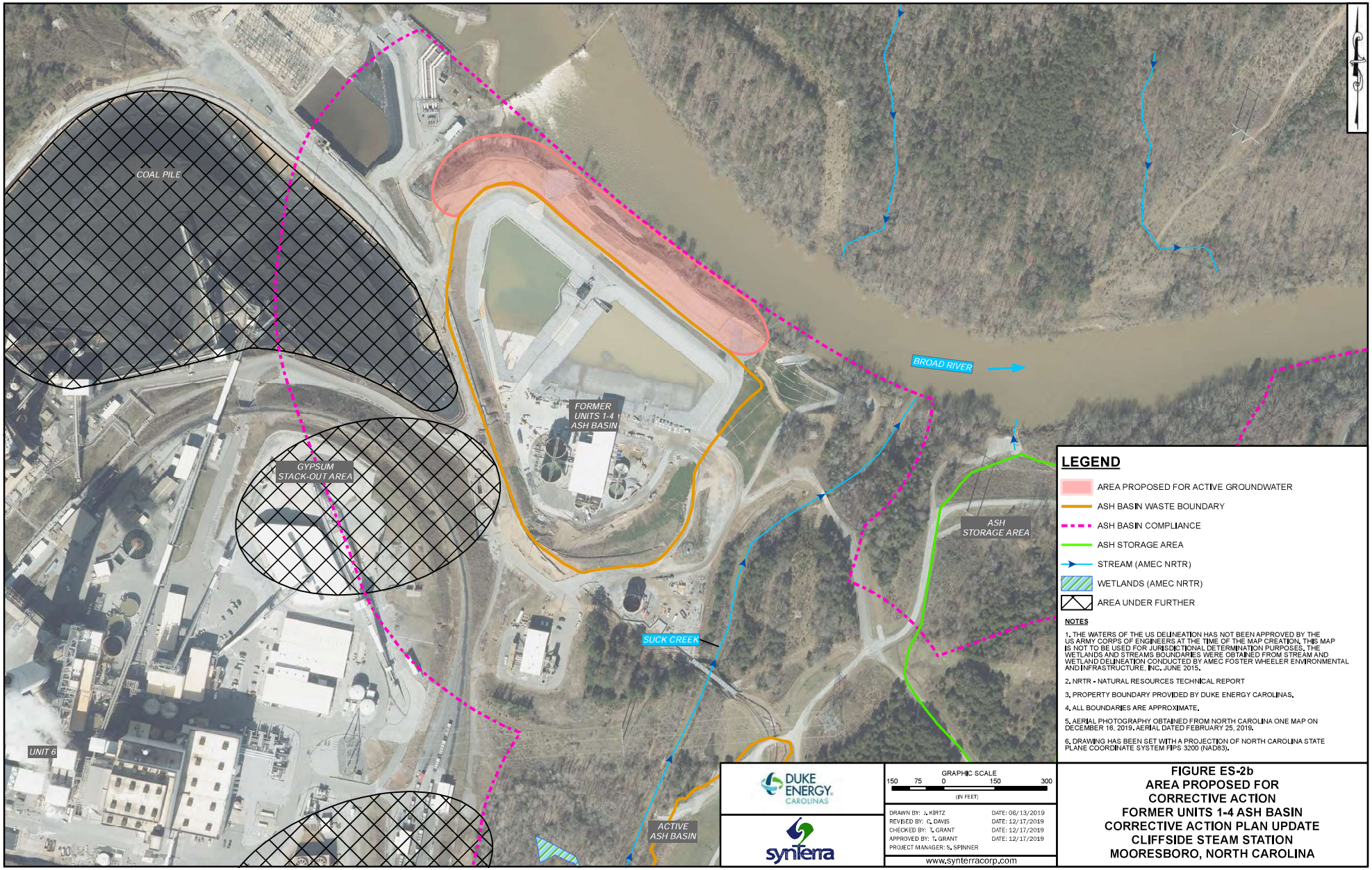
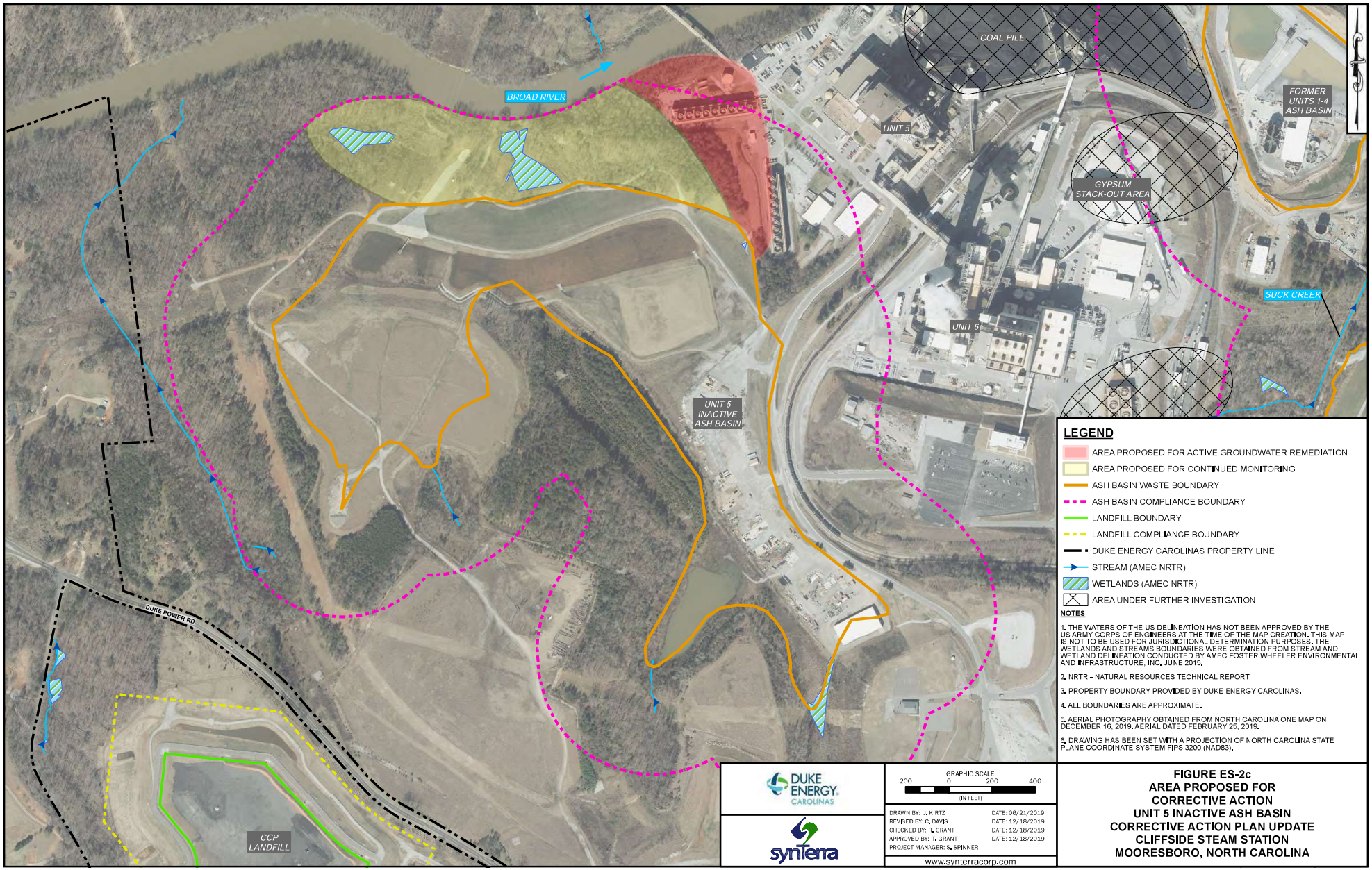
FIGURE ES-2a
AREA PROPOSED FOR
CORRECTIVE ACTION
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA


COAL PILE
GYPSUM STACK-OUT AREA
FORMER UNITS 1-4 ASH BASIN
BROAD RIVER
ASH STORAGE AREA
SUCK CREEK
ACTIVE ASH BASIN
UNIT 6
LEGEND
AREA PROPOSED FOR ACTIVE GROUNDWATER
ASH BASIN WASTE BOUNDARY
ASH BASIN COMPLIANCE
ASH STORAGE AREA
STREAM (AMEC NRTR)
WETLANDS (AMEC NRTR)
AREA UNDER FURTHER
NOTES
1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
2. NRTR - NATURAL RESOURCES TECHNICAL REPORT
3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 16, 2019. AERIAL DATED FEBRUARY 25, 2019.
6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).
DUKE ENERGY CAROLINAS
synterra
GRAPHIC SCALE
150 75 0 150 300
(IN FEET)
DRAWN BY: J. KIRTZ DATE: 06/13/2019
REVISED BY: C. DAVIS DATE: 12/17/2019
CHECKED BY: T. GRANT DATE: 12/17/2019
APPROVED BY: T. GRANT DATE: 12/17/2019
PROJECT MANAGER: S. SPINNER
www.synterracorp.com
FIGURE ES-2b
AREA PROPOSED FOR
CORRECTIVE ACTION
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA


BROAD RIVER
COAL PILE
UNIT 5
FORMER UNITS 1-4 ASH BASIN
GYPSUM STACK-OUT AREA
SUCK CREEK
UNIT 6
UNIT 5 INACTIVE ASH BASIN
DUKE POWER RD
CCP LANDFILL
LEGEND
AREA PROPOSED FOR ACTIVE GROUNDWATER REMEDIATION
AREA PROPOSED FOR CONTINUED MONITORING
ASH BASIN WASTE BOUNDARY
ASH BASIN COMPLIANCE BOUNDARY
LANDFILL BOUNDARY
LANDFILL COMPLIANCE BOUNDARY
DUKE ENERGY CAROLINAS PROPERTY LINE
STREAM (AMEC NRTR)
WETLANDS (AMEC NRTR)
AREA UNDER FURTHER INVESTIGATION
NOTES
1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC, JUNE 2015.
2. NRTR - NATURAL RESOURCES TECHNICAL REPORT
3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 16, 2019. AERIAL DATED FEBRUARY 25, 2019.
6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).
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200 0 200 400
(IN FEET)
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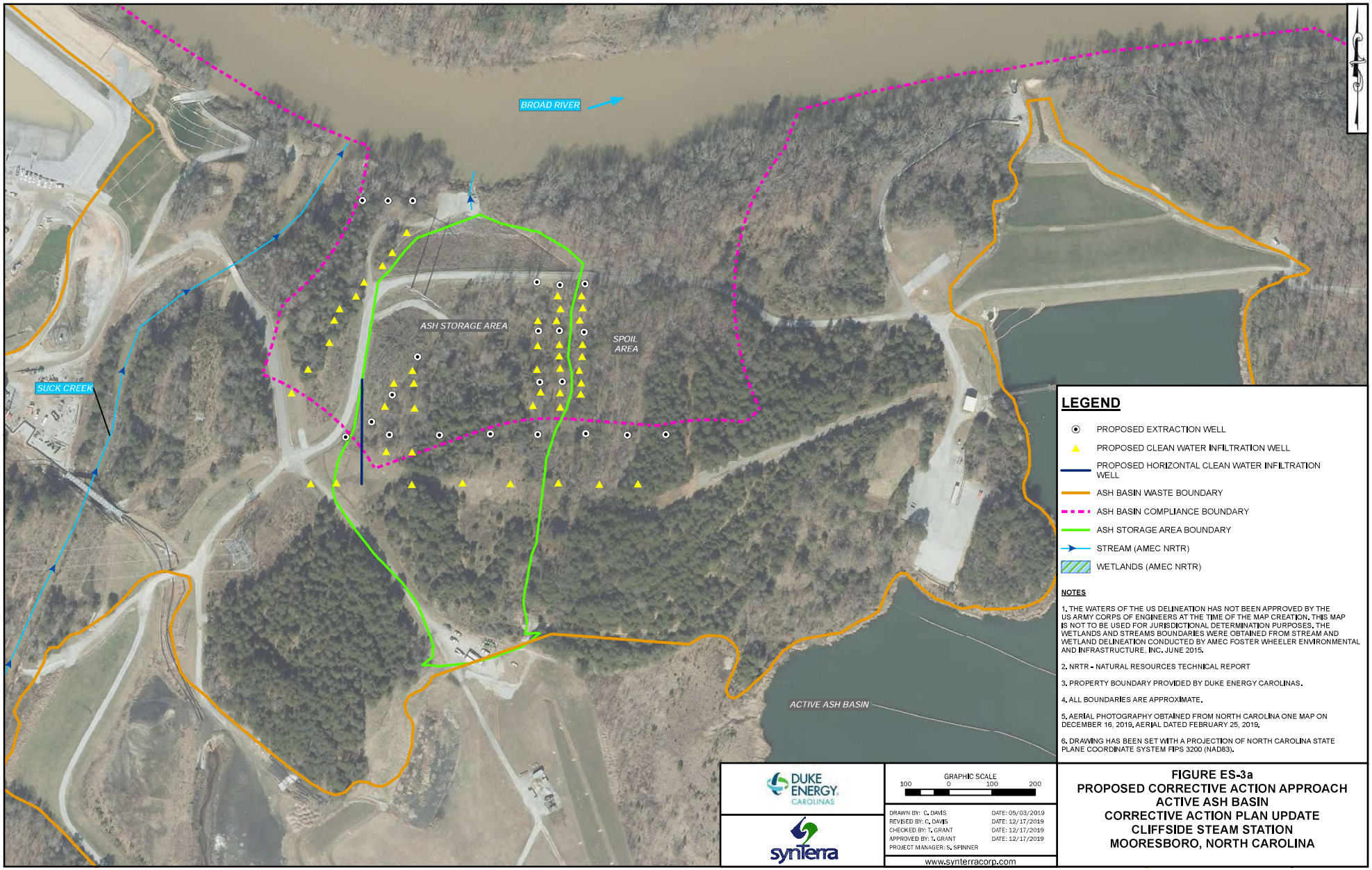
FIGURE ES-2c
AREA PROPOSED FOR
CORRECTIVE ACTION
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- PROPOSED EXTRACTION WELL
- PROPOSED CLEAN WATER INFILTRATION WELL
- PROPOSED HORIZONTAL CLEAN WATER INFILTRATION WELL
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- ASH STORAGE AREA BOUNDARY
- STREAM (AMEC NRTR)
- WETLANDS (AMEC NRTR)

NOTES

1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.

2. NRTR - NATURAL RESOURCES TECHNICAL REPORT

3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.

4. ALL BOUNDARIES ARE APPROXIMATE.

5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 16, 2019. AERIAL DATED FEBRUARY 25, 2019.

6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

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100 0 100 200

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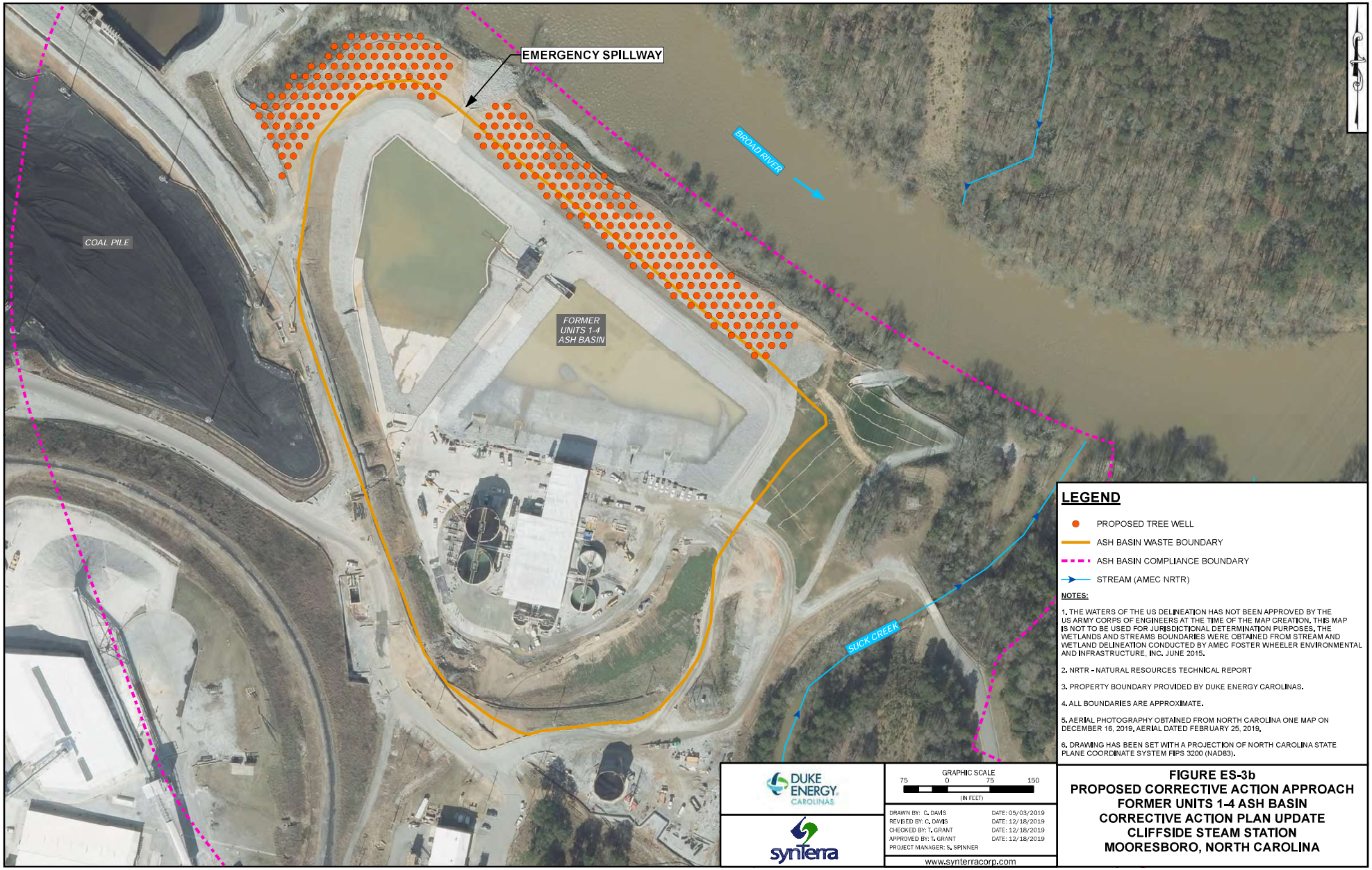
FIGURE ES-3a
PROPOSED CORRECTIVE ACTION APPROACH
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- PROPOSED TREE WELL
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- STREAM (AMEC NRTR)

NOTES:

1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
2. NRTR - NATURAL RESOURCES TECHNICAL REPORT
3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 16, 2019. AERIAL DATED FEBRUARY 25, 2019.
6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

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75 0 75 150
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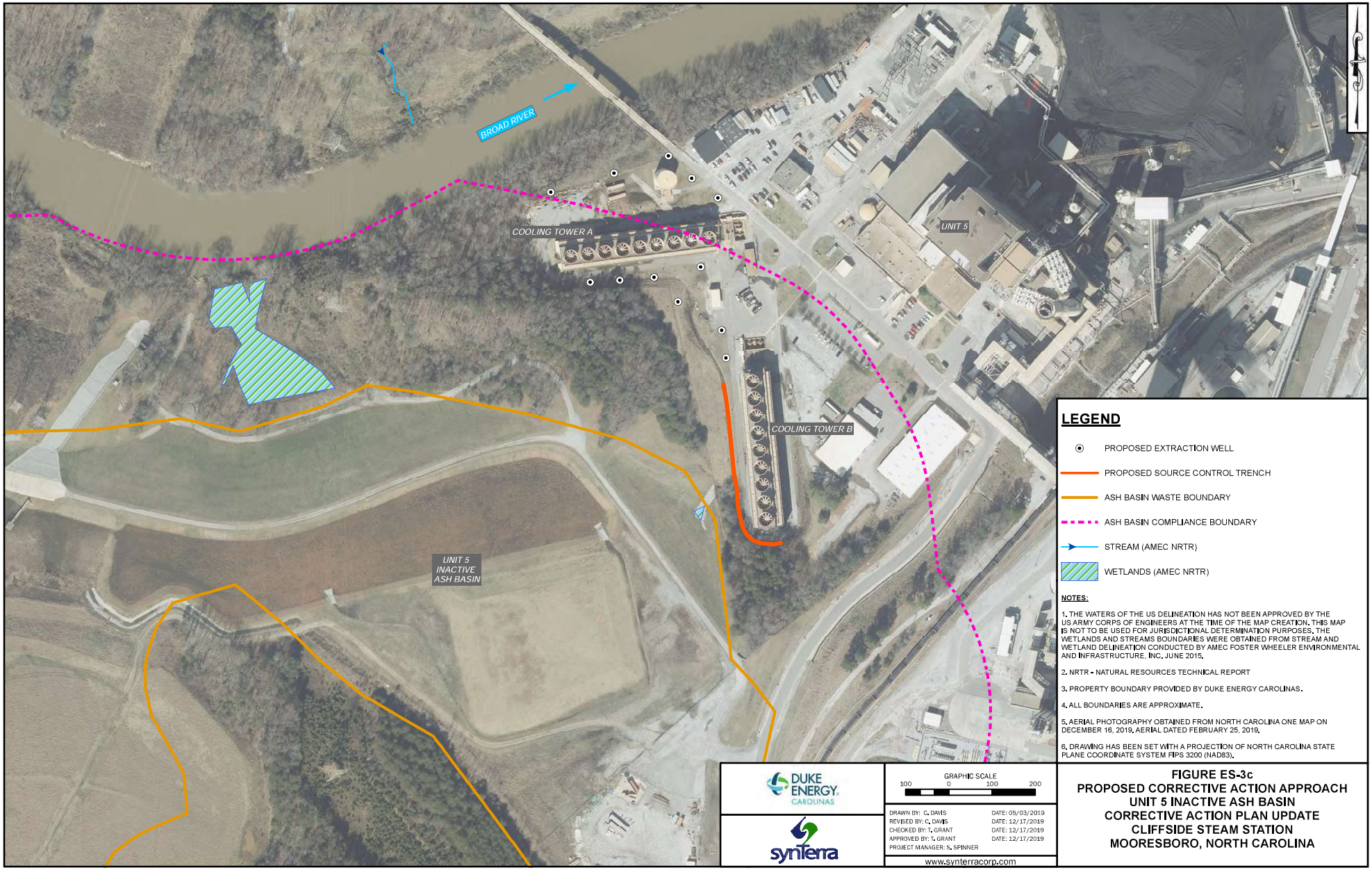
FIGURE ES-3b
PROPOSED CORRECTIVE ACTION APPROACH
FORMER UNITS 1-4 ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- PROPOSED EXTRACTION WELL
- PROPOSED SOURCE CONTROL TRENCH
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- STREAM (AMEC NRTR)
- WETLANDS (AMEC NRTR)

NOTES:

1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
2. NRTR - NATURAL RESOURCES TECHNICAL REPORT
3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 16, 2019. AERIAL DATED FEBRUARY 25, 2019.
6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

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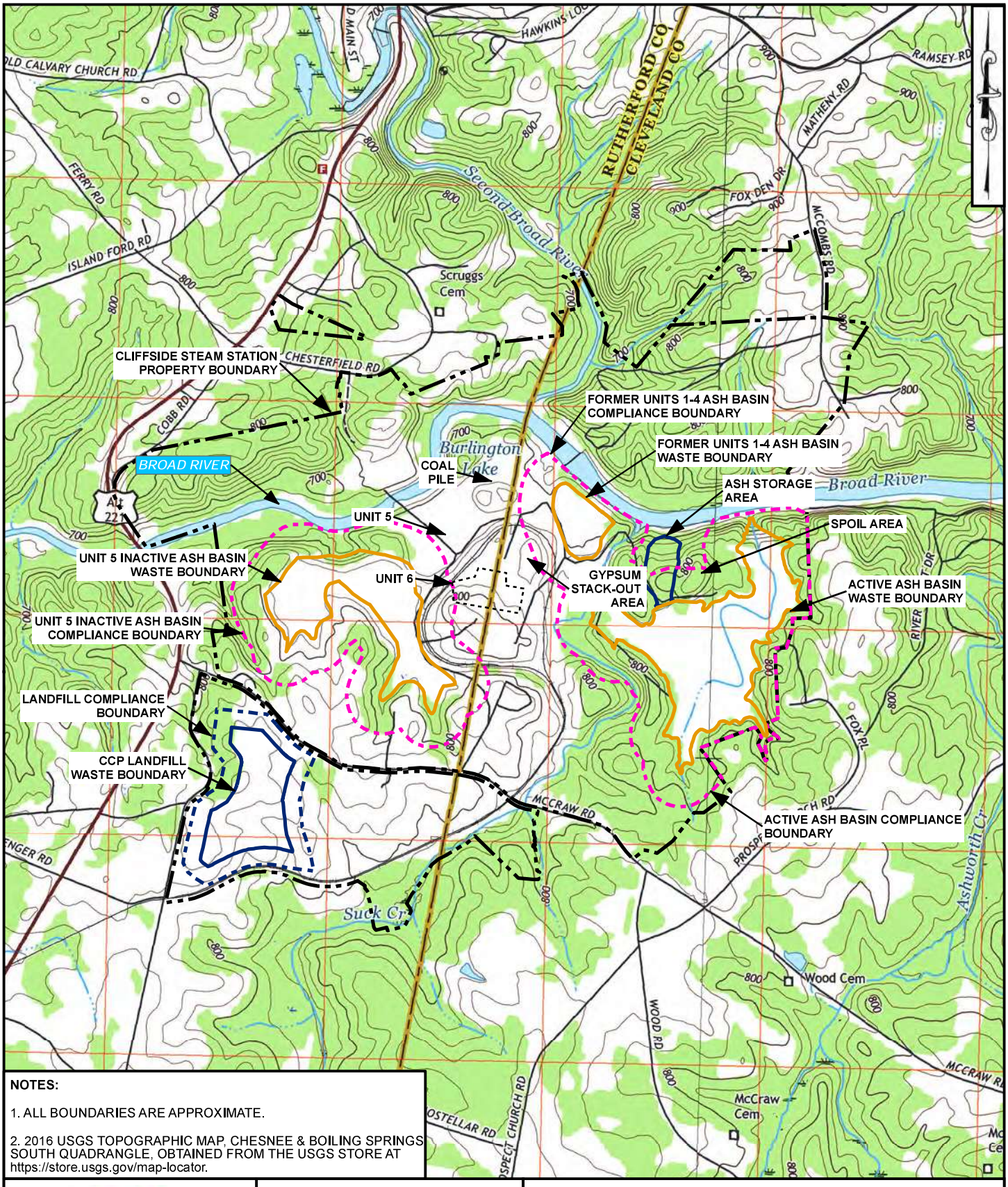
FIGURE ES-3c
PROPOSED CORRECTIVE ACTION APPROACH
UNIT 5 INACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



NOTES:

1. ALL BOUNDARIES ARE APPROXIMATE.

2. 2016 USGS TOPOGRAPHIC MAP, CHESNEE & BOILING SPRINGS SOUTH QUADRANGLE, OBTAINED FROM THE USGS STORE AT https://store.usgs.gov/map-locator.

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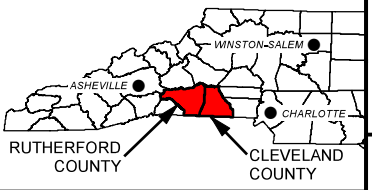

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FIGURE 1-1
USGS LOCATION MAP
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

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PROJECT MANAGER: S. SPINNER		

GRAPHIC SCALE
0 500 1,000 2,000 3,000
(IN FEET)

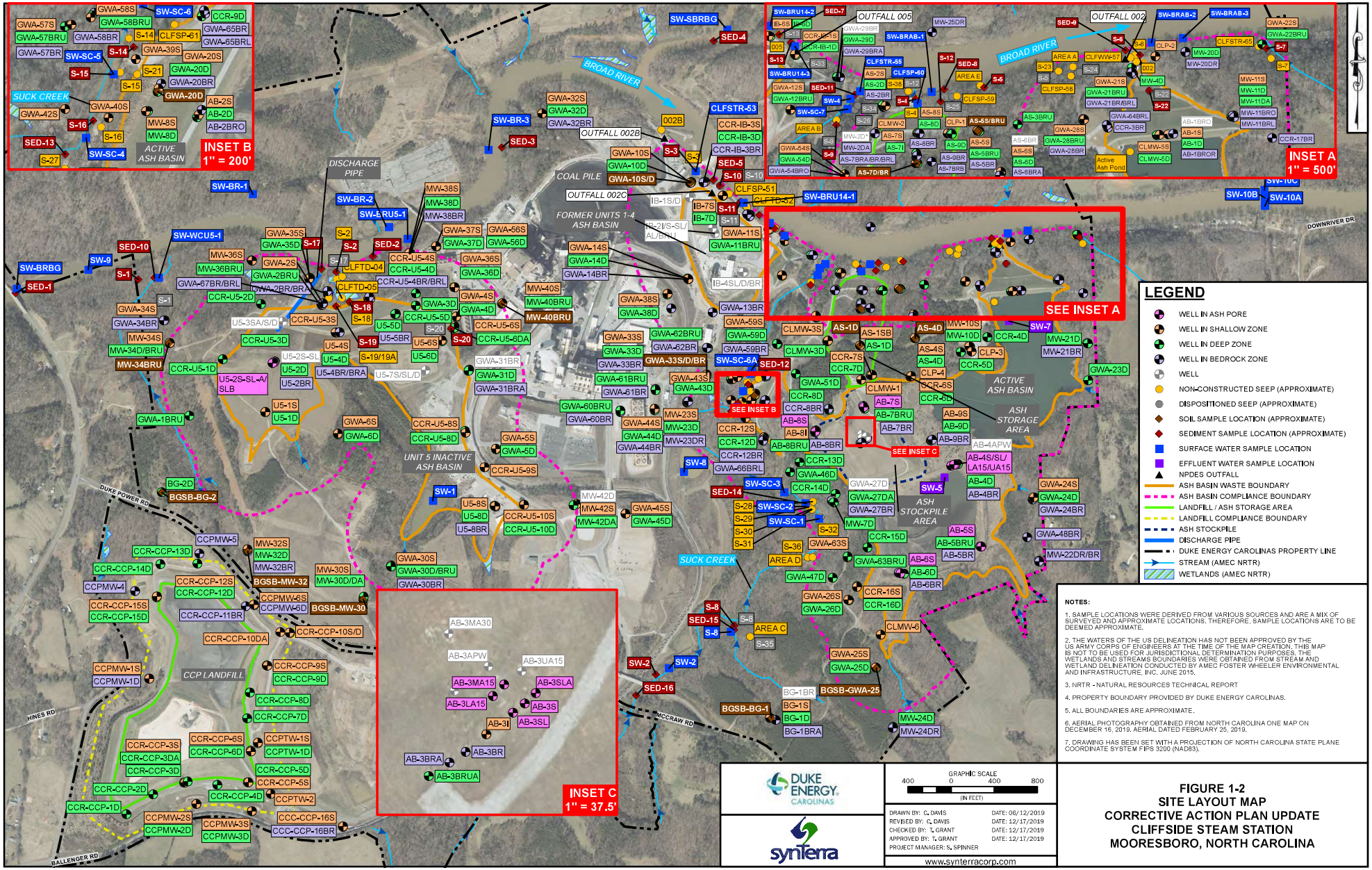
INSET A
1" = 500'
INSET B
1" = 200'
INSET C
1" = 37.5'
SEE INSET A
SEE INSET B
SEE INSET C
BROAD RIVER
SUCK CREEK
DISCHARGE PIPE
COAL PILE
FORMER UNITS 1-4 ASH BASIN
UNIT 5 INACTIVE ASH BASIN
ACTIVE ASH BASIN
ASH STORAGE AREA
ASH STOCKPILE AREA
CCP LANDFILL
OUTFALL 002B
OUTFALL 002C
OUTFALL 005
OUTFALL 002
DUKE POWER RD
HINES RD
BALLENGER RD
MCCRAW RD
DOWNRIVER DR
LEGEND
WELL IN ASH PORE
WELL IN SHALLOW ZONE
WELL IN DEEP ZONE
WELL IN BEDROCK ZONE
WELL
NON-CONSTRUCTED SEEP (APPROXIMATE)
DISPOSITIONED SEEP (APPROXIMATE)
SOIL SAMPLE LOCATION (APPROXIMATE)
SEDIMENT SAMPLE LOCATION (APPROXIMATE)
SURFACE WATER SAMPLE LOCATION
EFFLUENT WATER SAMPLE LOCATION
NPDES OUTFALL
ASH BASIN WASTE BOUNDARY
ASH BASIN COMPLIANCE BOUNDARY
LANDFILL / ASH STORAGE AREA
LANDFILL COMPLIANCE BOUNDARY
ASH STOCKPILE
DISCHARGE PIPE
DUKE ENERGY CAROLINAS PROPERTY LINE
STREAM (AMEC NRTR)
WETLANDS (AMEC NRTR)
NOTES:
1. SAMPLE LOCATIONS WERE DERIVED FROM VARIOUS SOURCES AND ARE A MIX OF SURVEYED AND APPROXIMATE LOCATIONS. THEREFORE, SAMPLE LOCATIONS ARE TO BE DEEMED APPROXIMATE.
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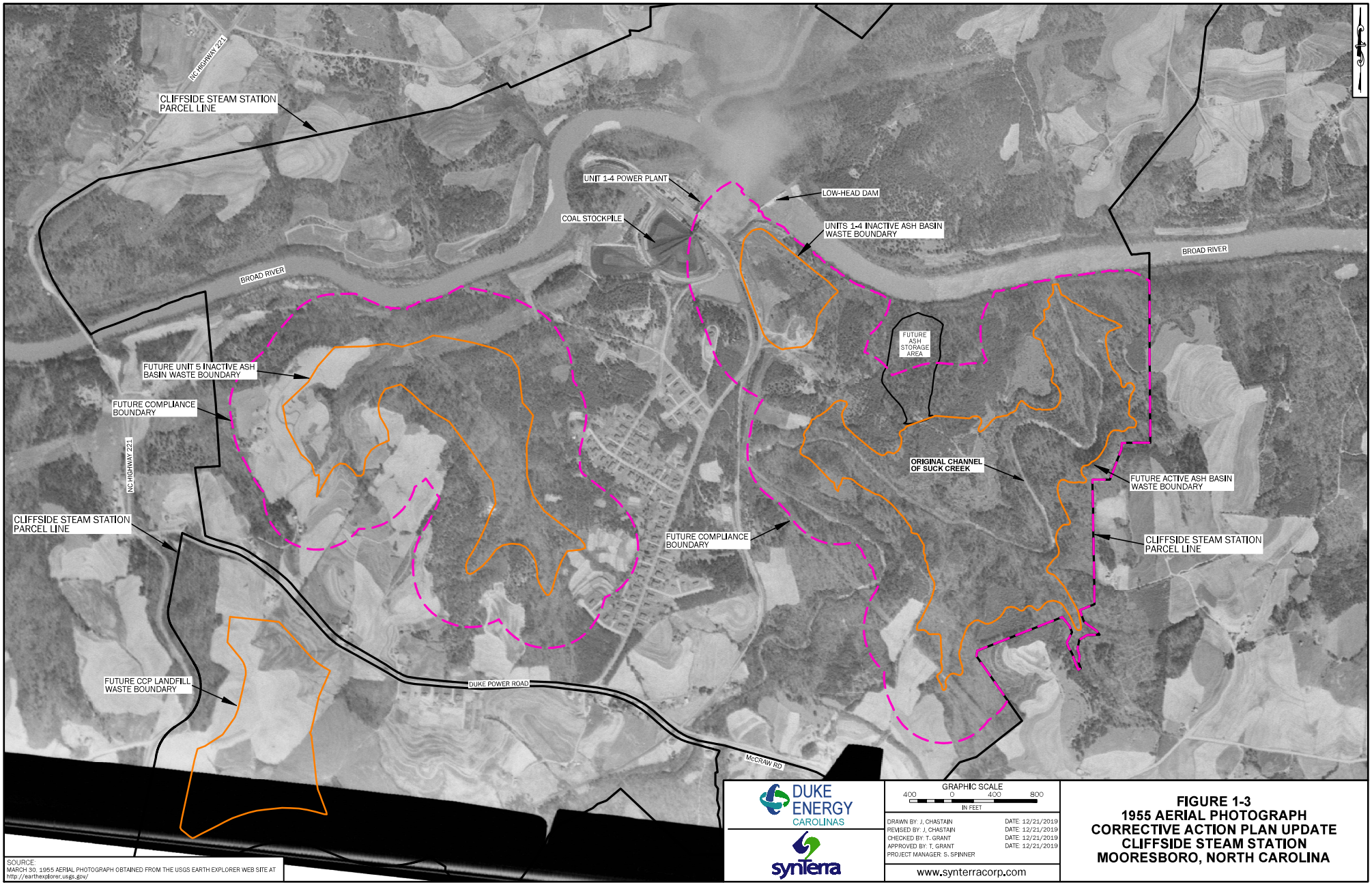
FIGURE 1-2
SITE LAYOUT MAP
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



SOURCE:
MARCH 30, 1955 AERIAL PHOTOGRAPH OBTAINED FROM THE USGS EARTH EXPLORER WEB SITE AT http://earthexplorer.usgs.gov/

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GRAPHIC SCALE
400 0 400 800
IN FEET

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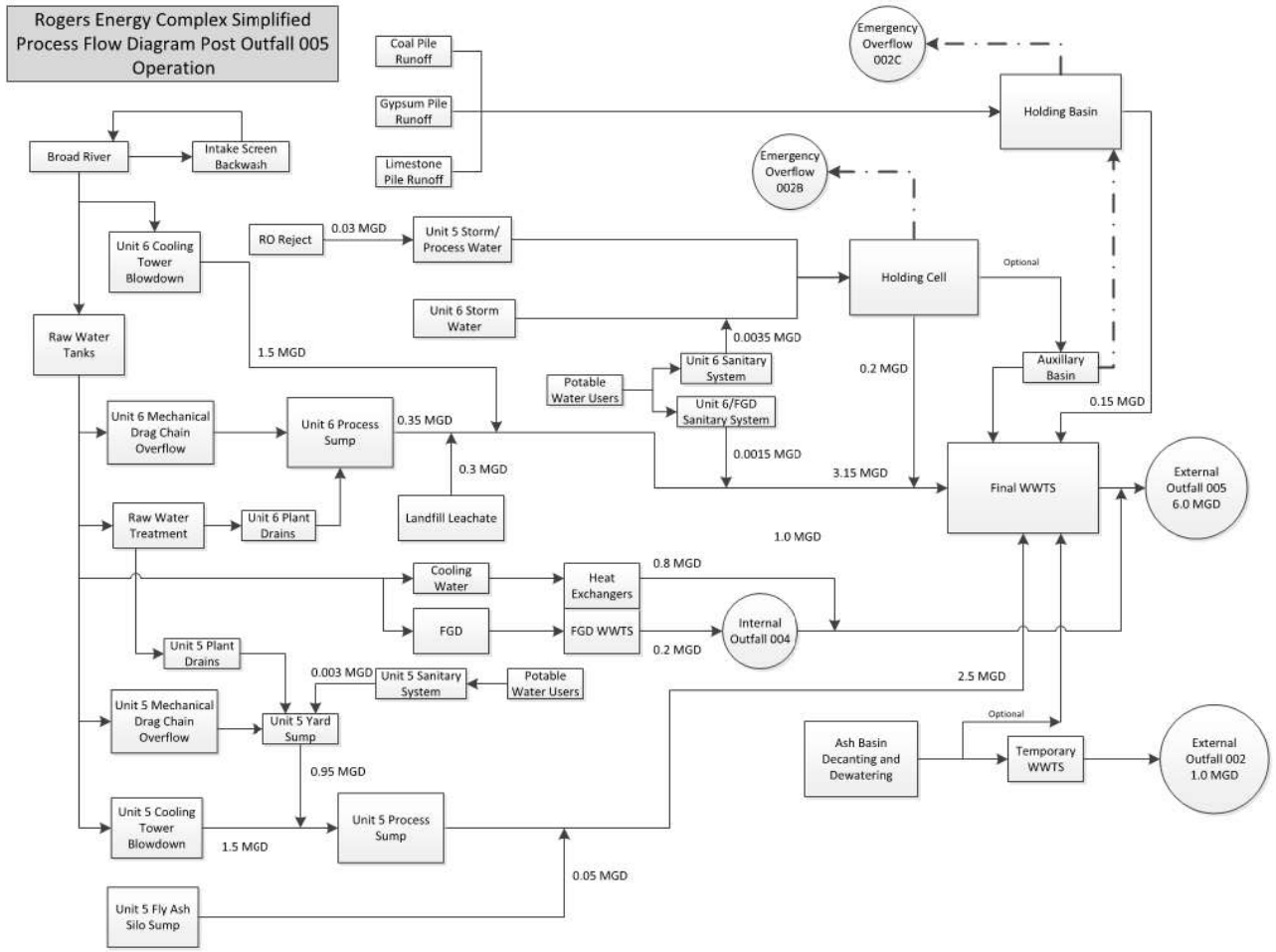
FIGURE 1-3
1955 AERIAL PHOTOGRAPH
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



Not to Scale

Legend

= Process Flows

= Overflows

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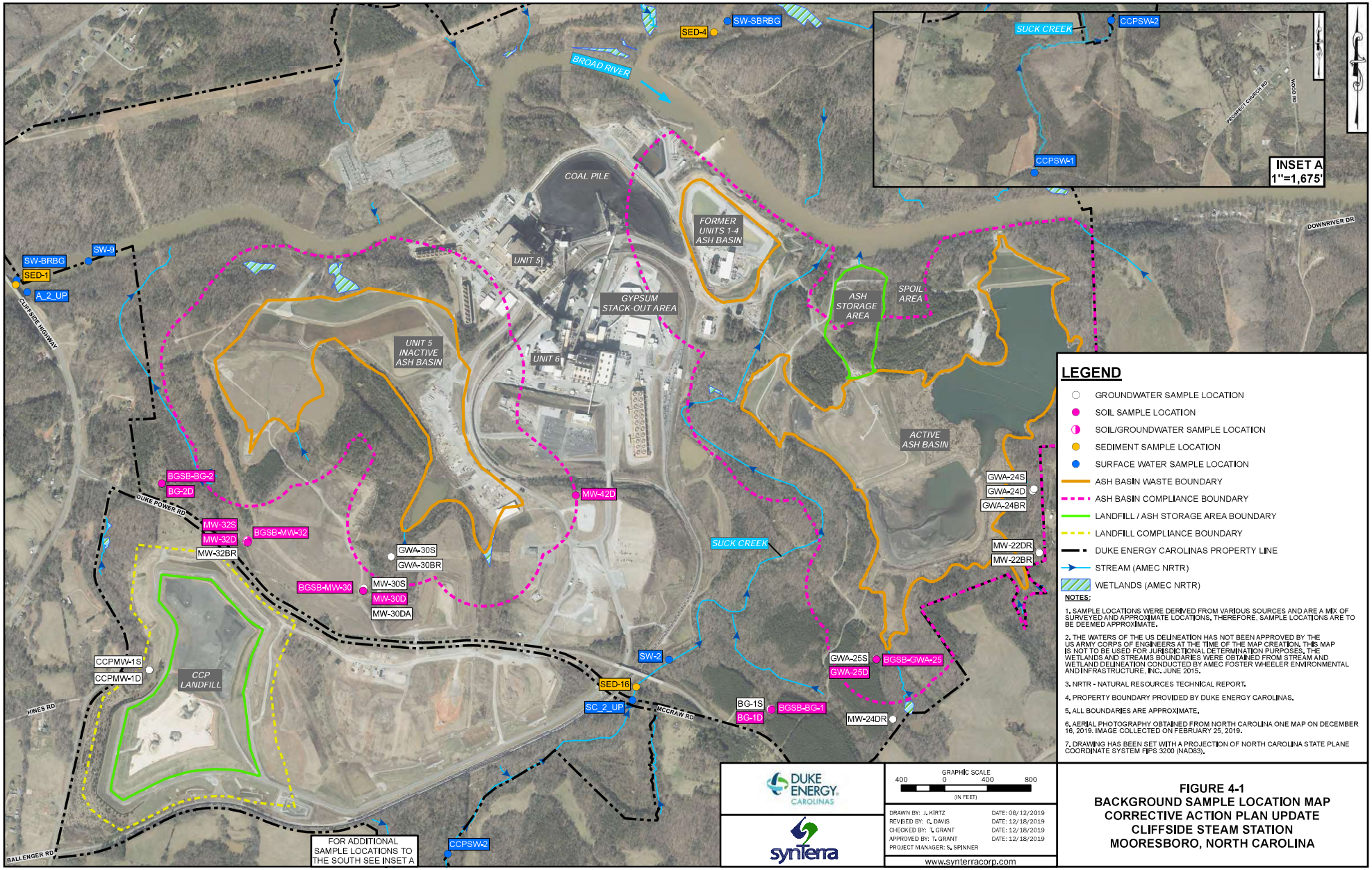
FIGURE 1-4
SIMPLIFIED PROCESS FLOW DIAGRAM POST OUTFALL 005 OPERATION
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STREAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- GROUNDWATER SAMPLE LOCATION
- SOIL SAMPLE LOCATION
- SOIL/GROUNDWATER SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- LANDFILL / ASH STORAGE AREA BOUNDARY
- LANDFILL COMPLIANCE BOUNDARY
- DUKE ENERGY CAROLINAS PROPERTY LINE
- STREAM (AMEC NRTR)
- WETLANDS (AMEC NRTR)

NOTES:

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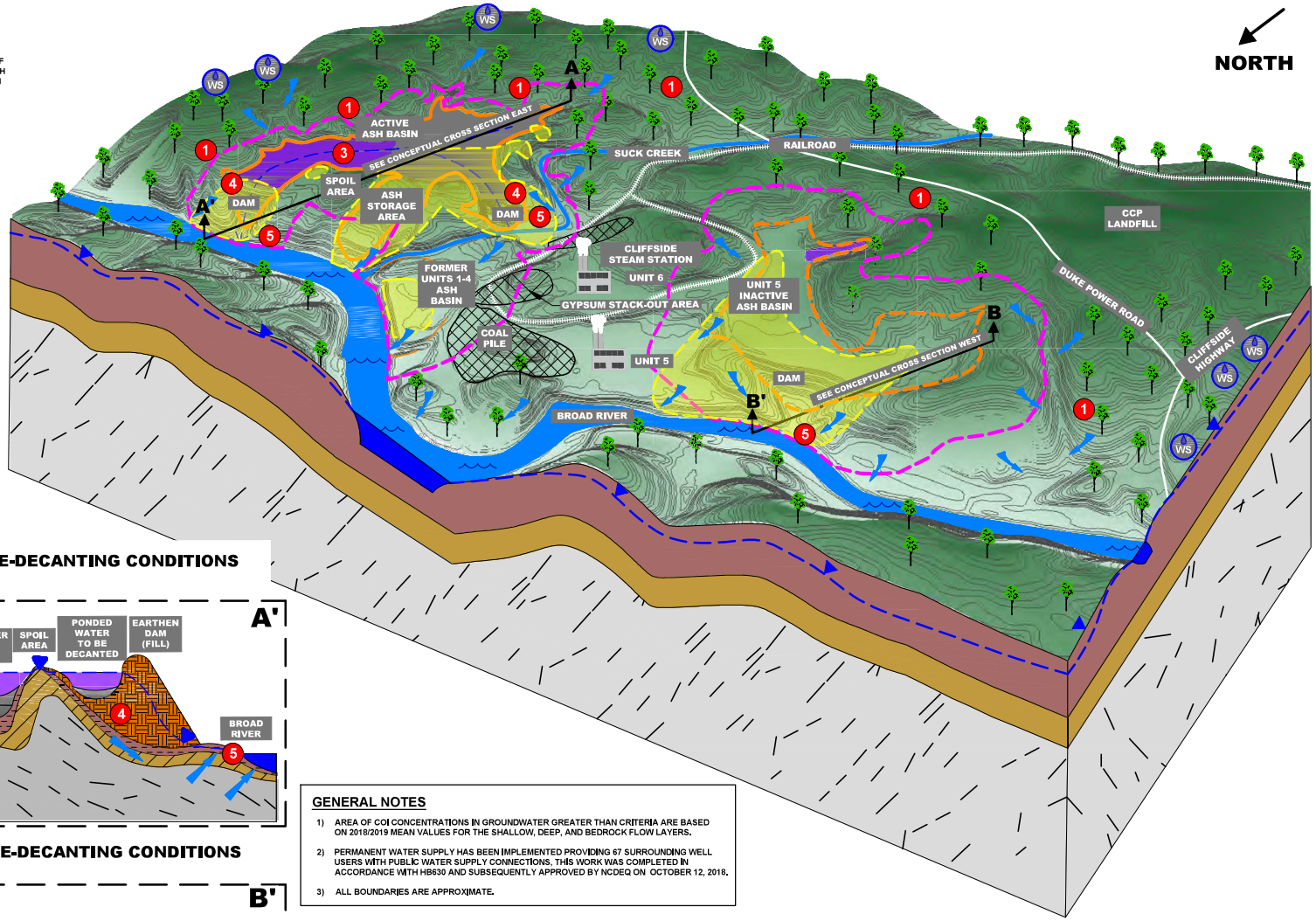
FIGURE 4-1
BACKGROUND SAMPLE LOCATION MAP
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

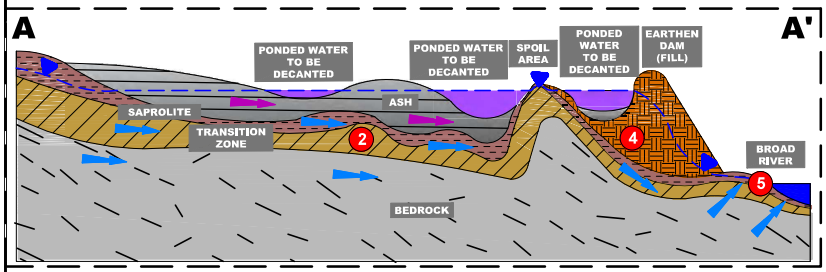
SITE FEATURES KEY

1. GROUNDWATER FLOWS FROM RIDGES TO THE SOUTH ALONG PORTIONS OF DUKE POWER ROAD (MCCRAW ROAD), TO THE EAST OF THE ACTIVE ASH BASIN, AND WEST OF THE UNIT 5 INACTIVE ASH BASIN, THAT COINCIDES WITH GROUNDWATER DIVIDES WHICH PROVIDE HYDRAULIC CONTROL OF CONSTITUENT MIGRATION WITHIN FORMER STREAM VALLEYS AND AWAY FROM POTENTIAL RECEPTORS AND WATER SUPPLY WELLS
2. LIMITED COI MIGRATION THROUGH TRANSITION ZONE AND INTERCONNECTED BEDROCK. BEDROCK FRACTURE OCCURRENCE DIMINISHES WITH DEPTH
3. FORMER SUCK CREEK CHANNEL PRIOR TO RE-DIRECT DURING CONSTRUCTION OF THE ACTIVE ASH BASIN
4. IMPOUNDED ASH BASIN WATER CAUSES LIMITED AREA OF DOWNWARD VERTICAL MIGRATION OF CONSTITUENTS NEAR THE DAM DUE TO ELEVATED HYDRAULIC HEAD
5. GROUNDWATER DISCHARGES TO SUCK CREEK AND THE BROAD RIVER

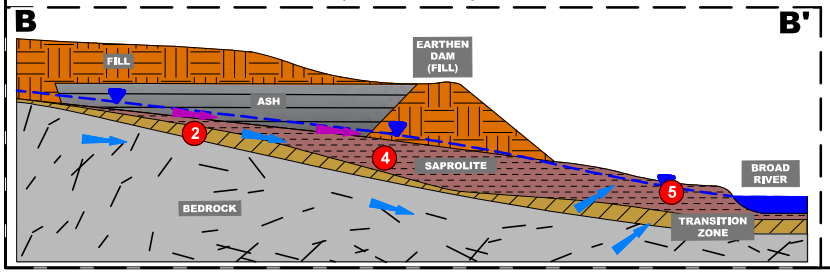
- AREA OF COI CONCENTRATION IN GROUNDWATER GREATER THAN CRITERIA (SEE GENERAL NOTE 1)
- AREA UNDER FURTHER INVESTIGATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- GENERALIZED ASH PORE WATER FLOW DIRECTION
- STREAM
- APPROXIMATE FORMER STREAM WITH FLOW DIRECTION
- ACTIVE ASH BASIN WASTE BOUNDARY
- FORMER/INACTIVE ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- WS GENERAL AREA OF WATER SUPPLY WELL USERS (SEE GENERAL NOTE 2)
- GENERALIZED BEDROCK FRACTURE



EAST CONCEPTUAL CROSS-SECTION OF PRE-DECANTING CONDITIONS
(NOT TO SCALE)



WEST CONCEPTUAL CROSS-SECTION OF PRE-DECANTING CONDITIONS
(NOT TO SCALE)



GENERAL NOTES

1) AREA OF COI CONCENTRATIONS IN GROUNDWATER GREATER THAN CRITERIA ARE BASED ON 2018/2019 MEAN VALUES FOR THE SHALLOW, DEEP, AND BEDROCK FLOW LAYERS.
2) PERMANENT WATER SUPPLY HAS BEEN IMPLEMENTED PROVIDING 67 SURROUNDING WELL USERS WITH PUBLIC WATER SUPPLY CONNECTIONS. THIS WORK WAS COMPLETED IN ACCORDANCE WITH HB630 AND SUBSEQUENTLY APPROVED BY NCDEQ ON OCTOBER 12, 2018.
3) ALL BOUNDARIES ARE APPROXIMATE.

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APPROVED BY: S. SPINNER	DATE: 12/17/2019
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FIGURE 5-1
CONCEPTUAL SITE MODEL - PRE-DECANTING CONDITIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

Figure 5-2

LeGrand Slope Aquifer System

Included in Section 5 text

Figure 5-3

Ash Basin Current Flow Conditions

Included in Section 5 text

Figure 5-4a

Water Level Map (East) – Shallow Flow Zone

Provided in separate electronic figure file as a large sheet size

Figure 5-4b

Water Level Map (East) – Deep Flow Zone

Provided in separate electronic figure file as a large sheet size

Figure 5-4c

Water Level Map (East) – Bedrock Flow Zone

Provided in separate electronic figure file as a large sheet size

Figure 5-5a

Water Level Map (West) – Shallow Flow Zone

Provided in separate electronic figure file as a large sheet size

Figure 5-5b

Water Level Map (West) – Deep Flow Zone

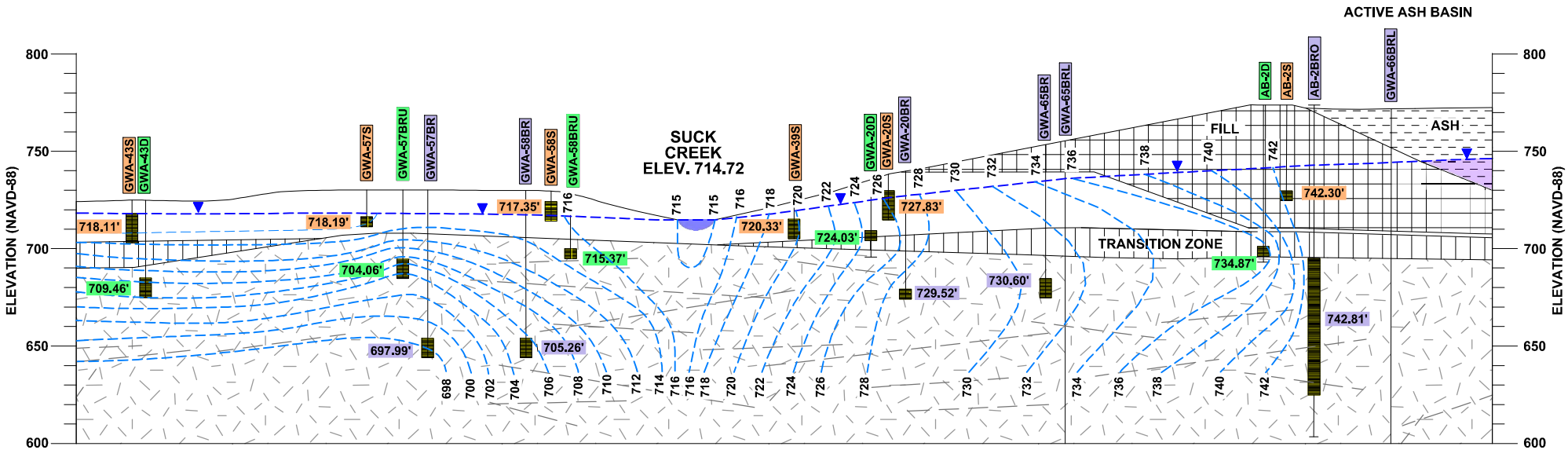
Provided in separate electronic figure file as a large sheet size

Figure 5-5c

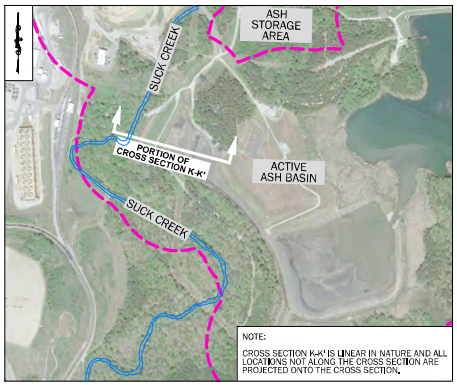
Water Level Map (West) – Bedrock Flow Zone

Provided in separate electronic figure file as a large sheet size

PORTION OF CROSS SECTION K-K'



FRACTURES CONCEPTUALLY DEPICTED ON THIS CROSS SECTION REPRESENT GENERALIZED ORIENTATIONS OF FRACTURES OBSERVED BASED ON TELEVIEWER LOGGING. THE DEPICTED FRACTURE ORIENTATIONS ACCOUNT FOR APPARENT DIP WITHIN THE PLANE OF THE CROSS SECTION, AND VERTICAL EXAGGERATION. THE ACTUAL NUMBER OF FRACTURES IS FAR TOO NUMEROUS TO ILLUSTRATE AT THIS SCALE. IN ADDITION, THE DEPTHS AND LENGTHS OF FRACTURES VERSUS DEPTH ARE CONCEPTUAL ONLY.



CROSS SECTION LOCATION

LEGEND

- GWA-58S — WELL IN SHALLOW LAYER
- GWA-58D — WELL IN DEEP LAYER
- GWA-58BR — WELL IN BEDROCK LAYER
- GENERALIZED WATER TABLE
- GENERALIZED VERTICAL POTENTIOMETERIC LINES
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- 715.37' — WATER LEVEL ELEVATION (NAVD 88) (LABEL COLORING BY FLOW ZONE)
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- WELL SCREEN
- COMPLIANCE BOUNDARY

1. DEPTH TO GROUNDWATER GAUGED IN MONITORING WELLS ON APRIL 22, 2019.
2. SURFACE WATER ELEVATION ESTIMATED FROM SURVEY DATA COLLECTED ON APRIL 22, 2019.
3. ALL VERTICAL ELEVATIONS ARE MEASURED IN FEET, NORTH AMERICA VERTICAL DATUM (NAVD) OF 1988.

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0 25 50
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 50'
1X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: C.BRUCE	DATE: 12/10/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
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FIGURE 5-6
GROUNDWATER FLOW CROSS SECTION
AAB UPSTREAM DAM
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

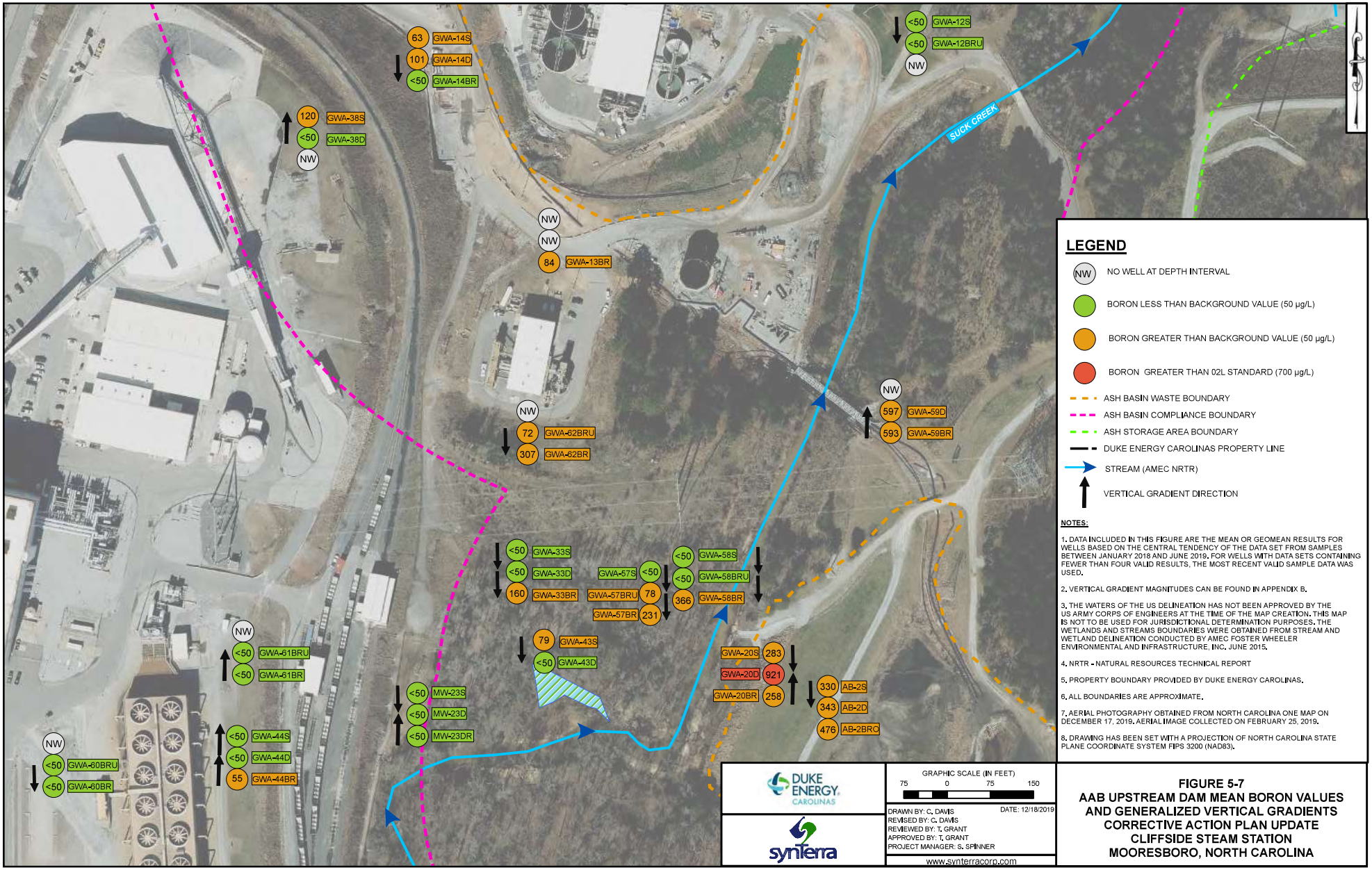
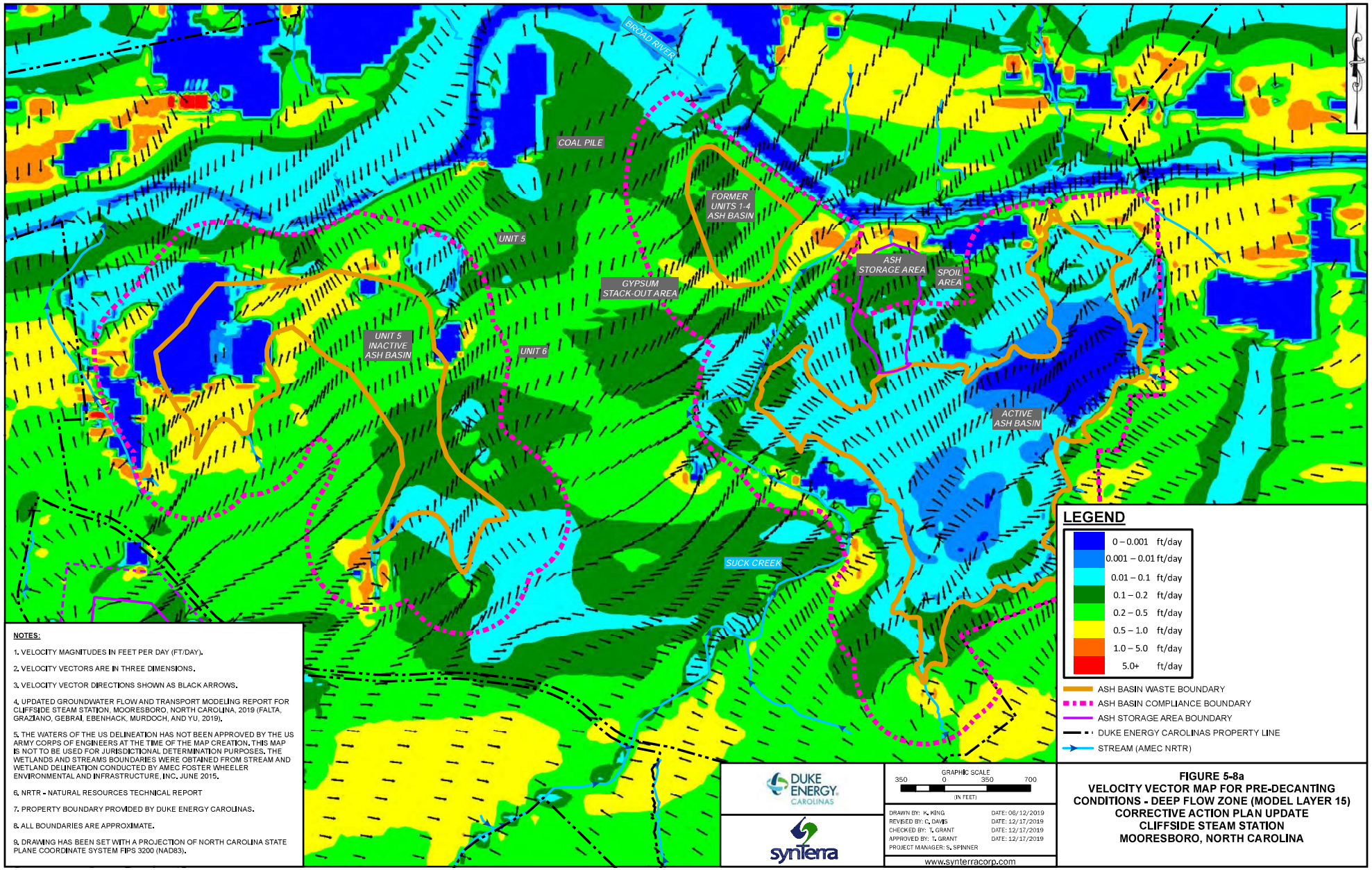


FIGURE 5-7
AAB UPSTREAM DAM MEAN BORON VALUES AND GENERALIZED VERTICAL GRADIENTS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



NOTES:

1. VELOCITY MAGNITUDES IN FEET PER DAY (FT/DAY).
2. VELOCITY VECTORS ARE IN THREE DIMENSIONS.
3. VELOCITY VECTOR DIRECTIONS SHOWN AS BLACK ARROWS.
4. UPDATED GROUNDWATER FLOW AND TRANSPORT MODELING REPORT FOR CLIFFSIDE STEAM STATION, MOORESBORO, NORTH CAROLINA, 2019 (FALTA, GRAZIANO, GEBRAI, EBENHACK, MURDOCH, AND YU, 2019).
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6. NRTR - NATURAL RESOURCES TECHNICAL REPORT
7. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
8. ALL BOUNDARIES ARE APPROXIMATE.
9. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

DUKE ENERGY CAROLINAS

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GRAPHIC SCALE
350 0 350 700
(IN FEET)

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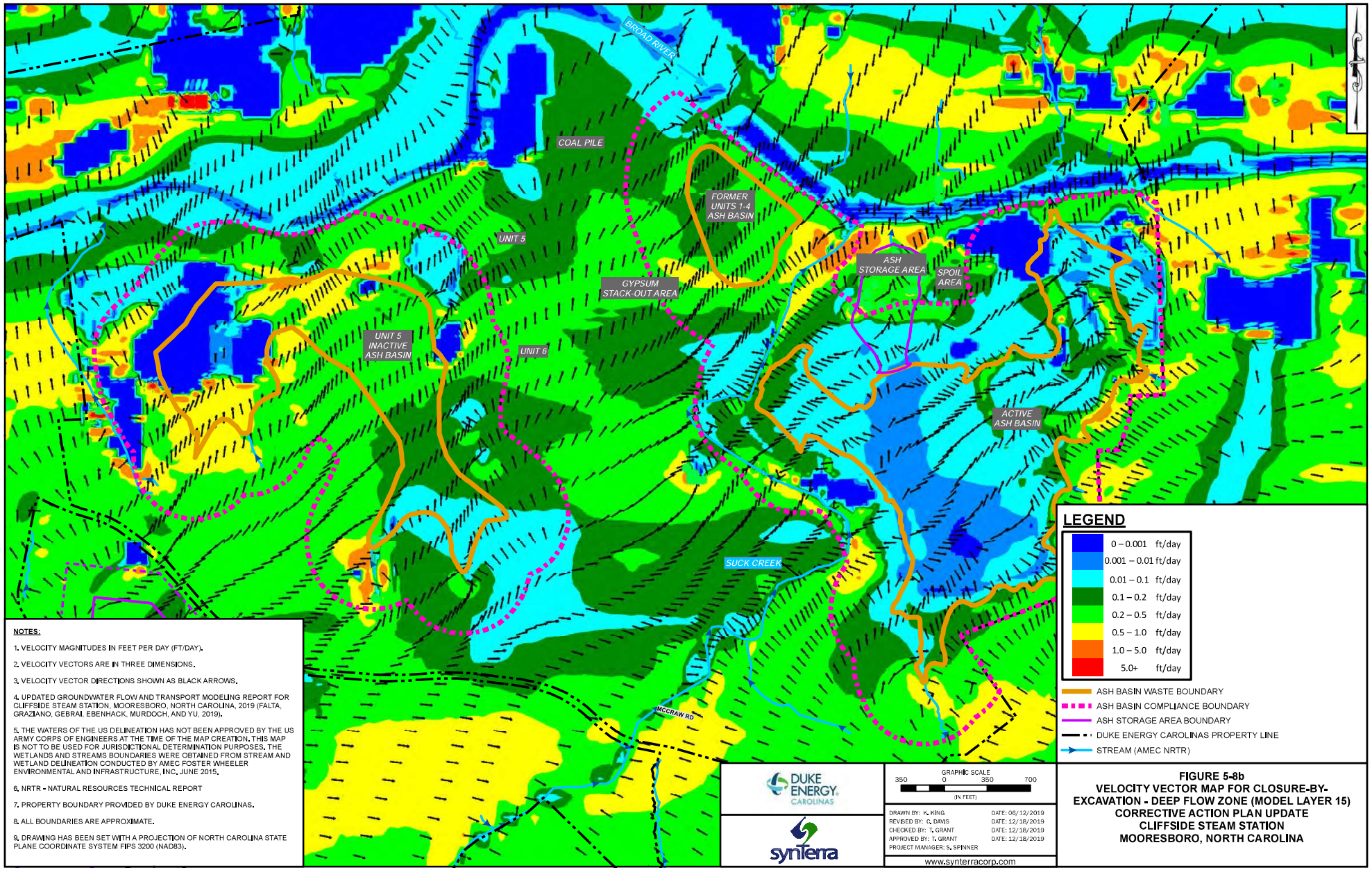
FIGURE 5-8a
VELOCITY VECTOR MAP FOR PRE-DECANTING CONDITIONS - DEEP FLOW ZONE (MODEL LAYER 15)
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



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GRAPHIC SCALE
350 0 350 700
(IN FEET)

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FIGURE 5-8b
VELOCITY VECTOR MAP FOR CLOSURE-BY-EXCAVATION - DEEP FLOW ZONE (MODEL LAYER 15)
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

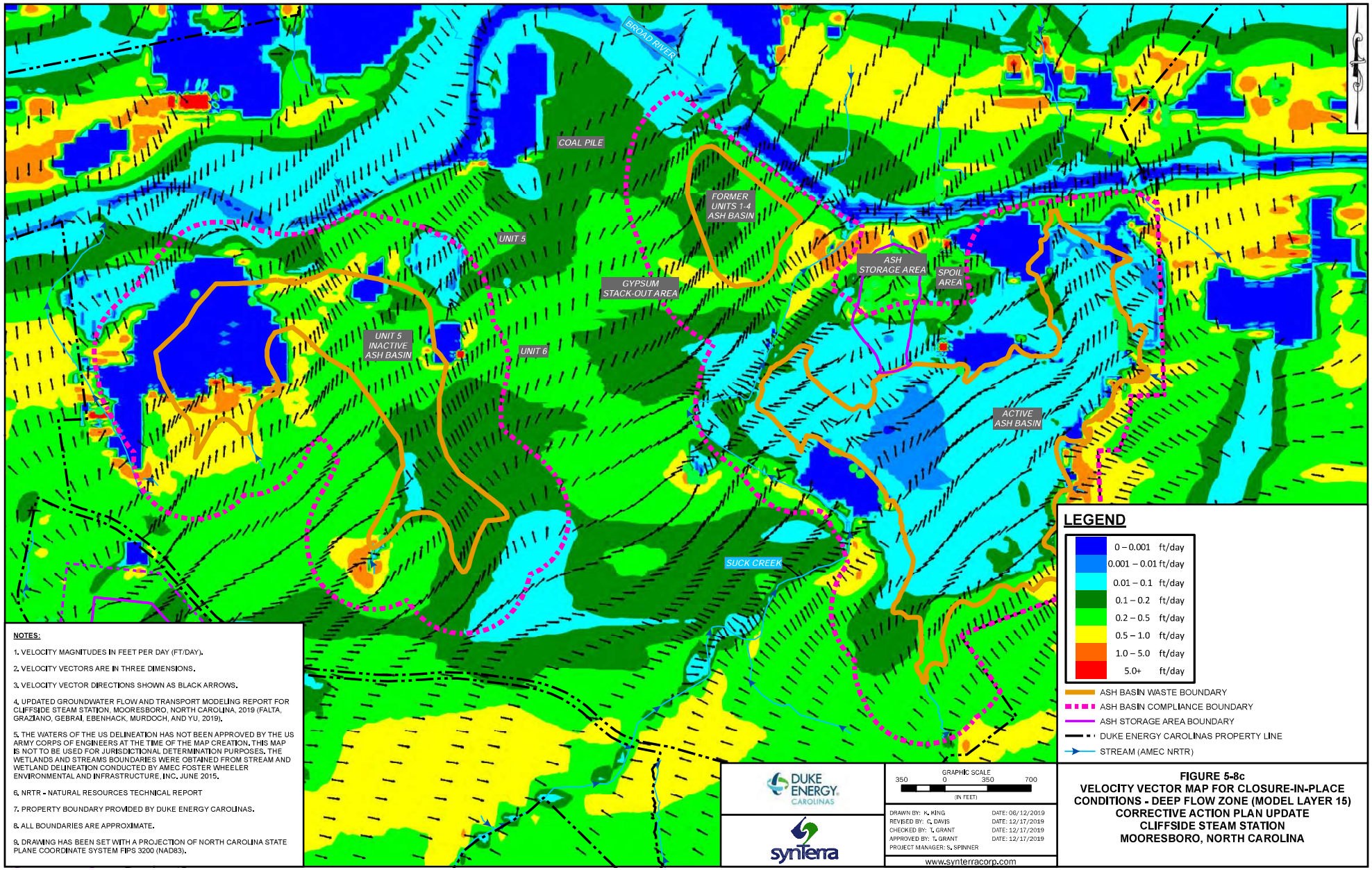

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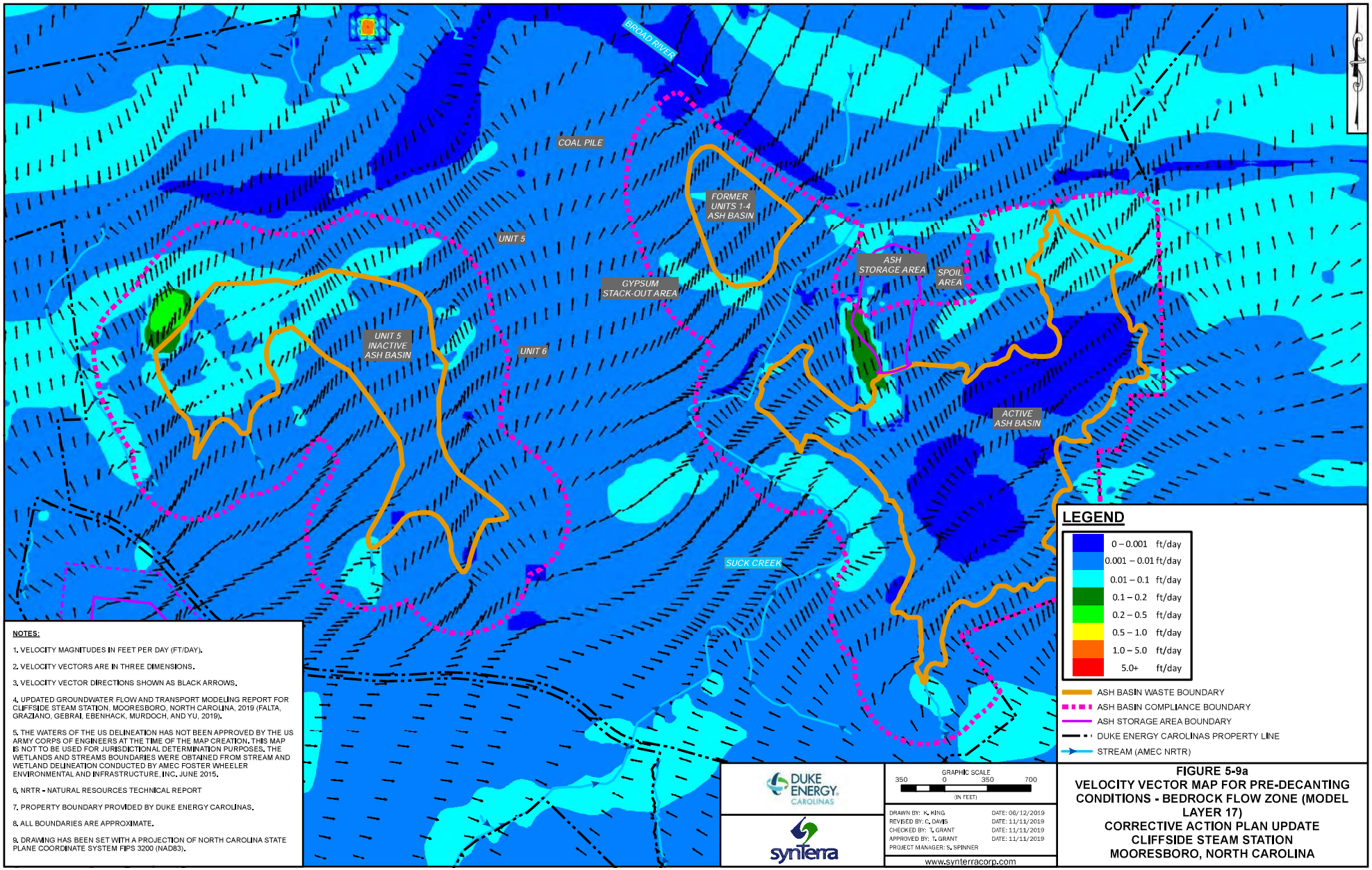
FIGURE 5-8c
VELOCITY VECTOR MAP FOR CLOSURE-IN-PLACE CONDITIONS - DEEP FLOW ZONE (MODEL LAYER 15)
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



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GRAPHIC SCALE
350 0 350 700
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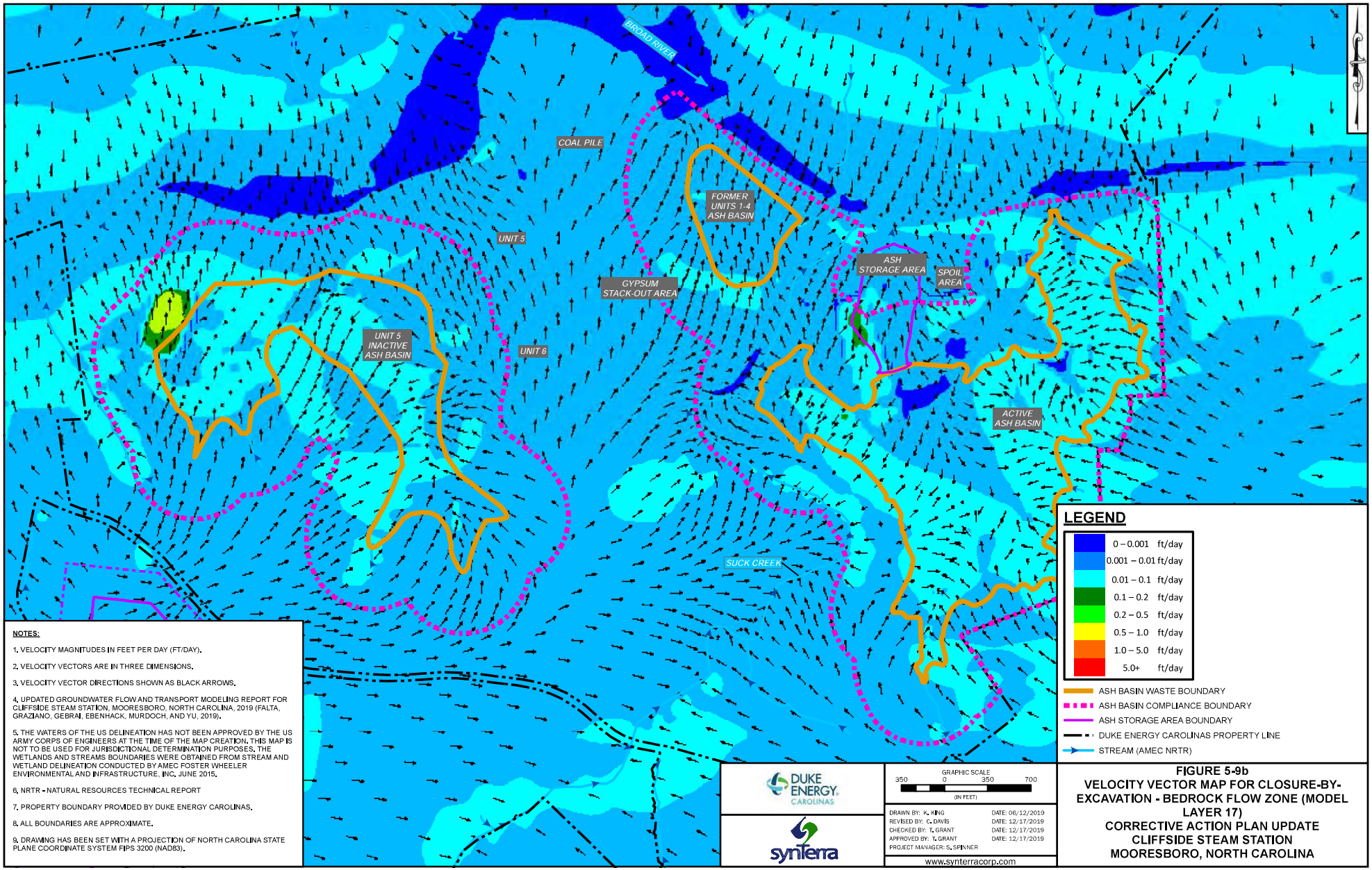
FIGURE 5-9a
VELOCITY VECTOR MAP FOR PRE-DECANTING CONDITIONS - BEDROCK FLOW ZONE (MODEL LAYER 17)
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



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350 0 350 700
(IN FEET)

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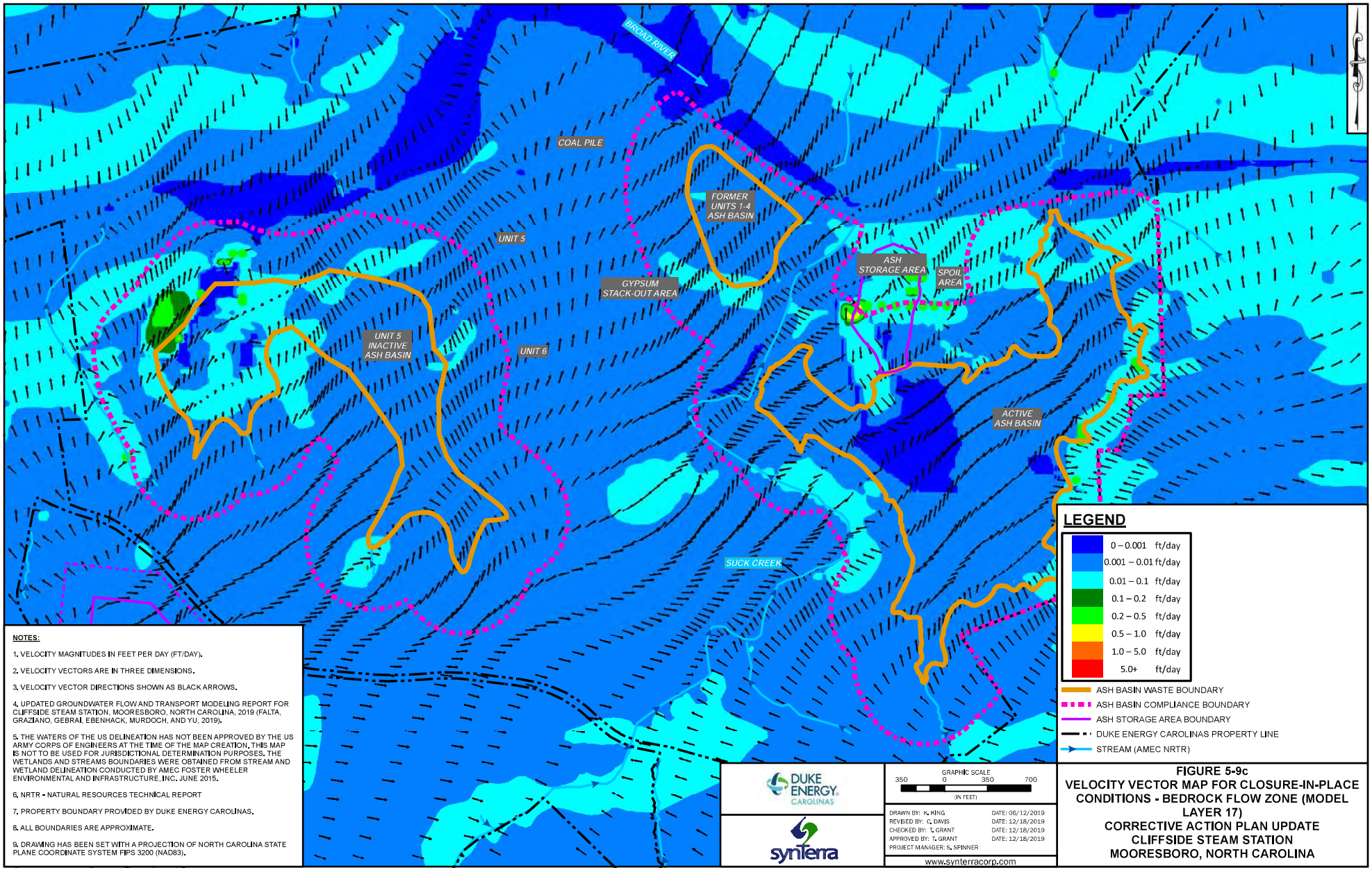
FIGURE 5-9b
VELOCITY VECTOR MAP FOR CLOSURE-BY-EXCAVATION - BEDROCK FLOW ZONE (MODEL LAYER 17)
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



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DUKE ENERGY CAROLINAS

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GRAPHIC SCALE
350 0 350 700
(IN FEET)

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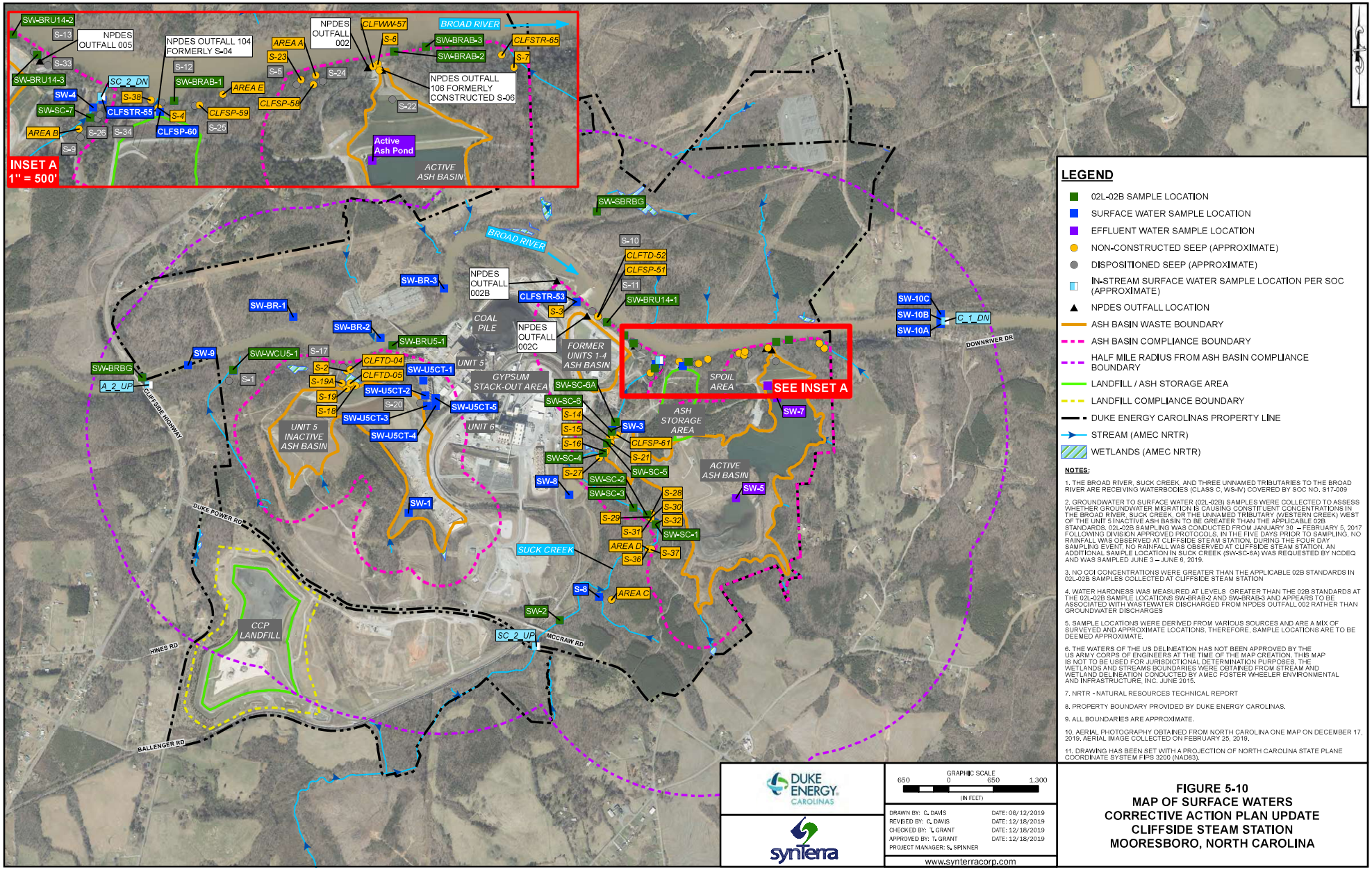
FIGURE 5-9c
VELOCITY VECTOR MAP FOR CLOSURE-IN-PLACE CONDITIONS - BEDROCK FLOW ZONE (MODEL LAYER 17)
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- 02L-02B SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION
- EFFLUENT WATER SAMPLE LOCATION
- NON-CONSTRUCTED SEEP (APPROXIMATE)
- DISPOSITIONED SEEP (APPROXIMATE)
- IN-STREAM SURFACE WATER SAMPLE LOCATION PER SOC (APPROXIMATE)
- NPDES OUTFALL LOCATION
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- HALF MILE RADIUS FROM ASH BASIN COMPLIANCE BOUNDARY
- LANDFILL / ASH STORAGE AREA
- LANDFILL COMPLIANCE BOUNDARY
- DUKE ENERGY CAROLINAS PROPERTY LINE
- STREAM (AMEC NRTR)
- WETLANDS (AMEC NRTR)

NOTES:

1. THE BROAD RIVER, SUCK CREEK, AND THREE UNNAMED TRIBUTARIES TO THE BROAD RIVER ARE RECEIVING WATERBODIES (CLASS C, WS-IV) COVERED BY SOC NO. S17-009
2. GROUNDWATER TO SURFACE WATER (02L-02B) SAMPLES WERE COLLECTED TO ASSESS WHETHER GROUNDWATER MIGRATION IS CAUSING CONSTITUENT CONCENTRATIONS IN THE BROAD RIVER, SUCK CREEK, OR THE UNNAMED TRIBUTARY (WESTERN CREEK) WEST OF THE UNIT 5 INACTIVE ASH BASIN TO BE GREATER THAN THE APPLICABLE 02B STANDARDS. 02L-02B SAMPLING WAS CONDUCTED FROM JANUARY 30 – FEBRUARY 5, 2017 FOLLOWING DIVISION APPROVED PROTOCOLS. IN THE FIVE DAYS PRIOR TO SAMPLING, NO RAINFALL WAS OBSERVED AT CLIFFSIDE STEAM STATION. DURING THE FOUR DAY SAMPLING EVENT, NO RAINFALL WAS OBSERVED AT CLIFFSIDE STEAM STATION. AN ADDITIONAL SAMPLE LOCATION IN SUCK CREEK (SW-SC-6A) WAS REQUESTED BY NCDEQ AND WAS SAMPLED JUNE 3 – JUNE 6, 2019.
3. NO COI CONCENTRATIONS WERE GREATER THAN THE APPLICABLE 02B STANDARDS IN 02L-02B SAMPLES COLLECTED AT CLIFFSIDE STEAM STATION
4. WATER HARDNESS WAS MEASURED AT LEVELS GREATER THAN THE 02B STANDARDS AT THE 02L-02B SAMPLE LOCATIONS SW-BRAB-2 AND SW-BRAB-3 AND APPEARS TO BE ASSOCIATED WITH WASTEWATER DISCHARGED FROM NPDES OUTFALL 002 RATHER THAN GROUNDWATER DISCHARGES
5. SAMPLE LOCATIONS WERE DERIVED FROM VARIOUS SOURCES AND ARE A MIX OF SURVEYED AND APPROXIMATE LOCATIONS. THEREFORE, SAMPLE LOCATIONS ARE TO BE DEEMED APPROXIMATE.
6. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
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10. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 17, 2019. AERIAL IMAGE COLLECTED ON FEBRUARY 25, 2019.
11. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

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650 0 650 1,300
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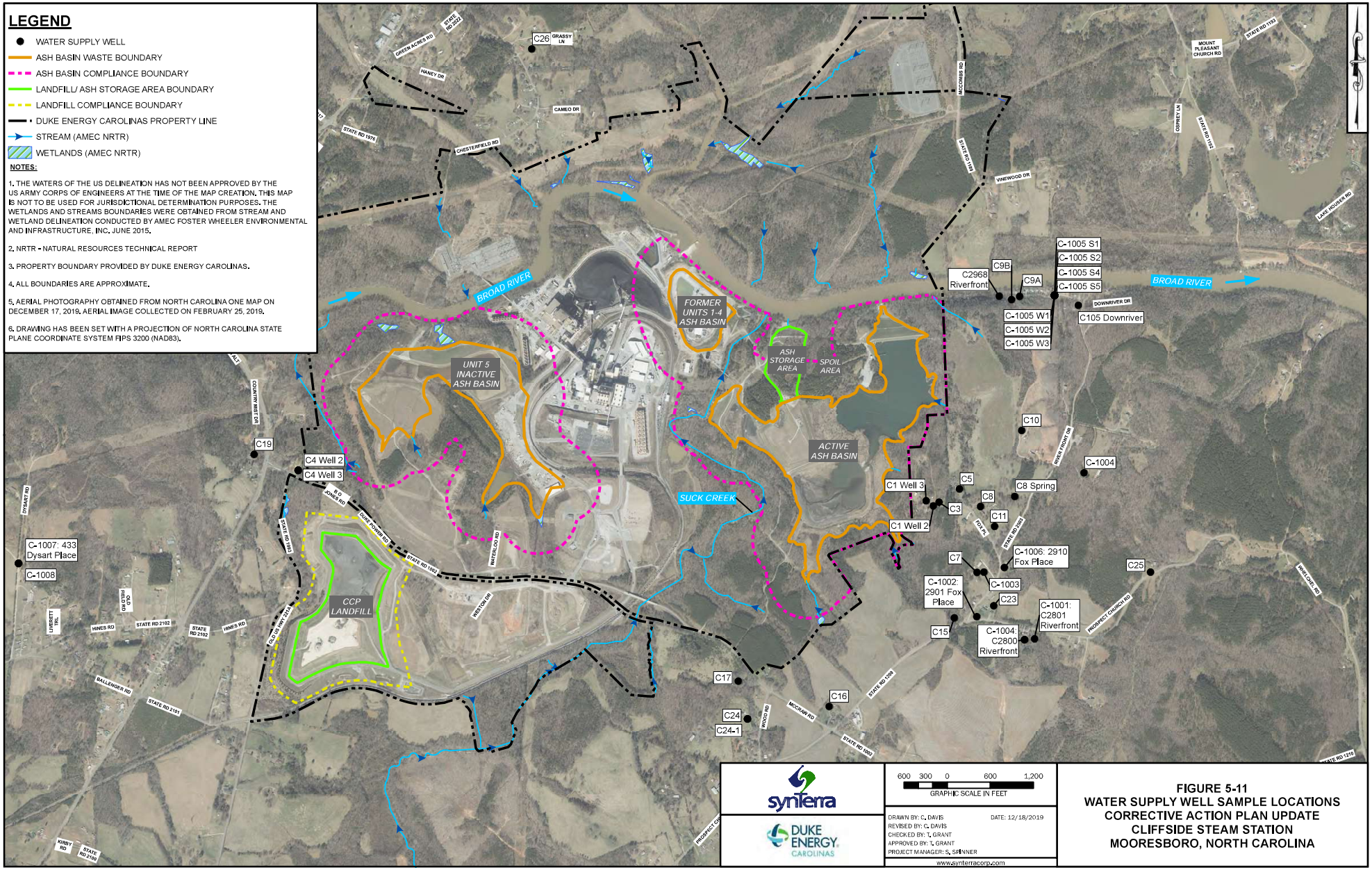
FIGURE 5-10
MAP OF SURFACE WATERS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA


LEGEND
WATER SUPPLY WELL
ASH BASIN WASTE BOUNDARY
ASH BASIN COMPLIANCE BOUNDARY
LANDFILL/ ASH STORAGE AREA BOUNDARY
LANDFILL COMPLIANCE BOUNDARY
DUKE ENERGY CAROLINAS PROPERTY LINE
STREAM (AMEC NRTR)
WETLANDS (AMEC NRTR)
NOTES:
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BROAD RIVER
FORMER UNITS 1-4 ASH BASIN
UNIT 5 INACTIVE ASH BASIN
ASH STORAGE AREA
SPOIL AREA
ACTIVE ASH BASIN
SUCK CREEK
CCP LANDFILL
C26
C19
C4 Well 2
C4 Well 3
C-1007: 433 Dysart Place
C-1008
C-1005 S1
C-1005 S2
C-1005 S4
C-1005 S5
C2968 Riverfront
C9B
C9A
C-1005 W1
C-1005 W2
C-1005 W3
C105 Downriver
C10
C-1004
C1 Well 3
C1 Well 2
C5
C8
C3
C11
C8 Spring
C-1006: 2910 Fox Place
C7
C-1002: 2901 Fox Place
C-1003
C23
C-1001: C2801 Riverfront
C15
C-1004: C2800 Riverfront
C25
C17
C16
C24
C24-1
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DUKE ENERGY CAROLINAS
600 300 0 600 1,200
GRAPHIC SCALE IN FEET
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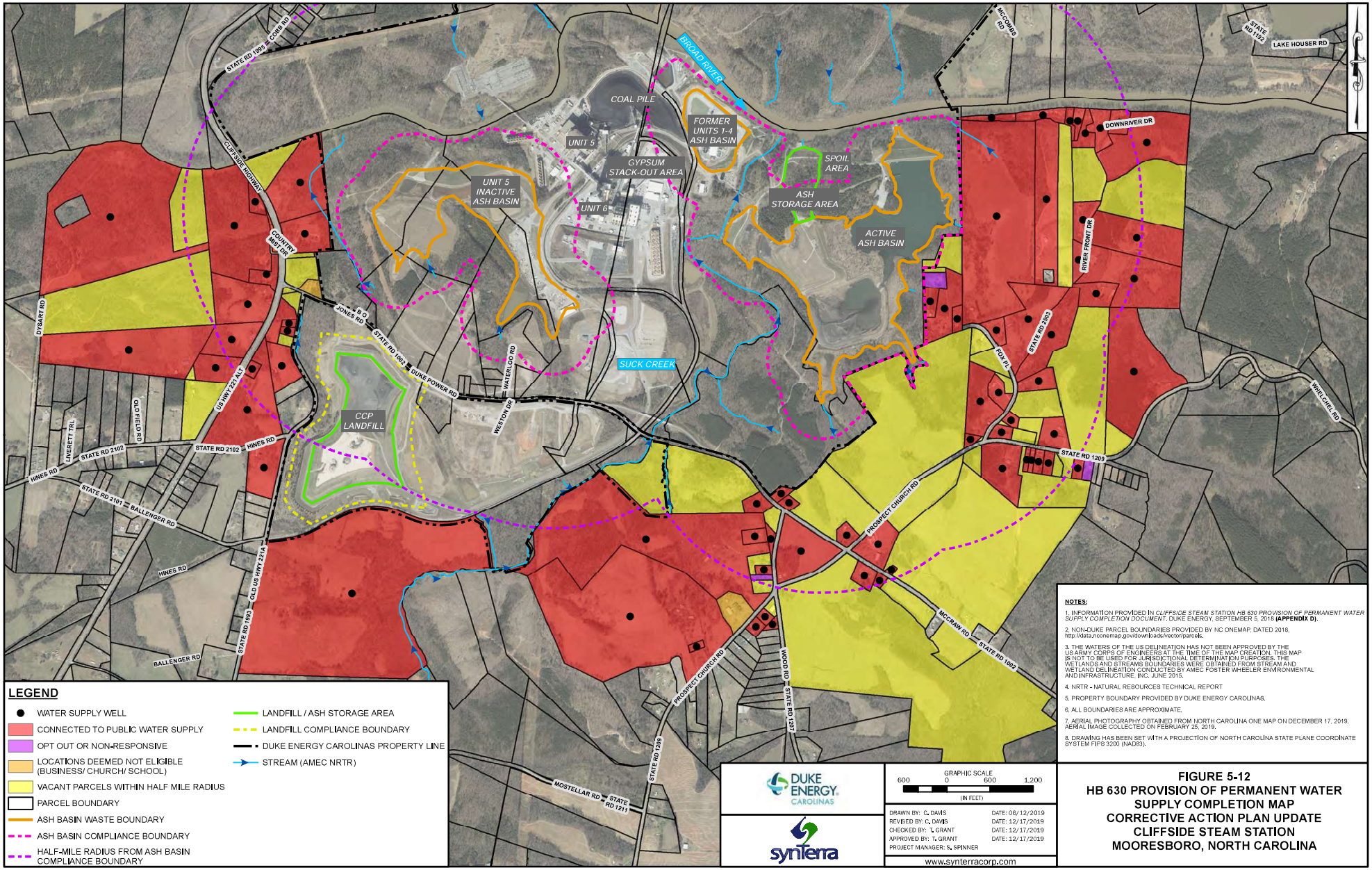
FIGURE 5-11
WATER SUPPLY WELL SAMPLE LOCATIONS
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- WATER SUPPLY WELL
- CONNECTED TO PUBLIC WATER SUPPLY
- OPT OUT OR NON-RESPONSIVE
- LOCATIONS DEEMED NOT ELIGIBLE (BUSINESS/ CHURCH/ SCHOOL)
- VACANT PARCELS WITHIN HALF MILE RADIUS
- PARCEL BOUNDARY
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- HALF-MILE RADIUS FROM ASH BASIN COMPLIANCE BOUNDARY
- LANDFILL / ASH STORAGE AREA
- LANDFILL COMPLIANCE BOUNDARY
- DUKE ENERGY CAROLINAS PROPERTY LINE
- STREAM (AMEC NRTR)

NOTES:

1. INFORMATION PROVIDED IN *CLIFFSIDE STEAM STATION HB 630 PROVISION OF PERMANENT WATER SUPPLY COMPLETION DOCUMENT*. DUKE ENERGY, SEPTEMBER 5, 2018 **(APPENDIX D)**.
2. NON-DUKE PARCEL BOUNDARIES PROVIDED BY NC ONEMAP, DATED 2018, http://data.nconemap.gov/downloads/vector/parcels.
3. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
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GRAPHIC SCALE
600 0 600 1,200
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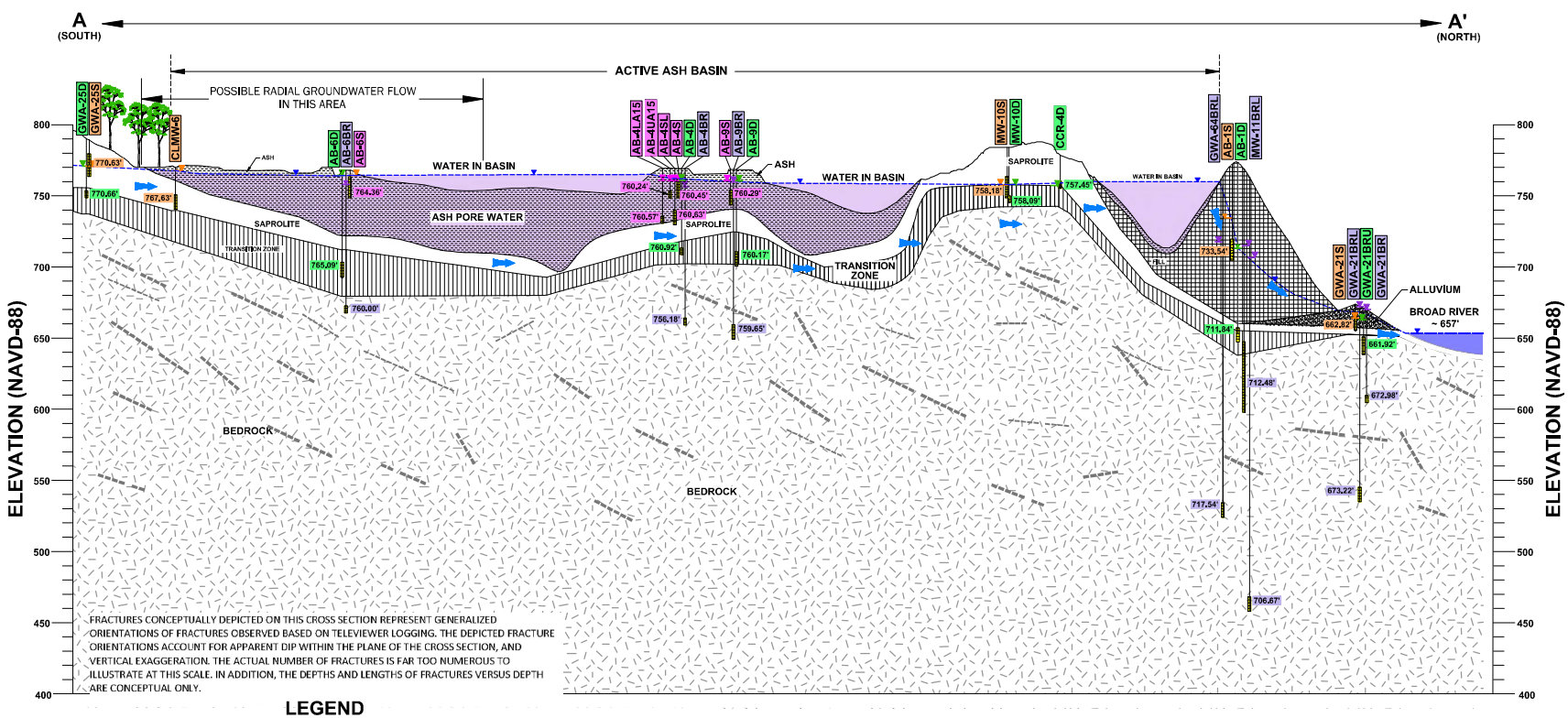
FIGURE 5-12
HB 630 PROVISION OF PERMANENT WATER SUPPLY COMPLETION MAP
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

Source Area 1
(Active Ash Basin and Ash Storage Area)

Figure 6-1

Fly Ash and Bottom Ash Interbedded Depiction

Included in Section 6 text



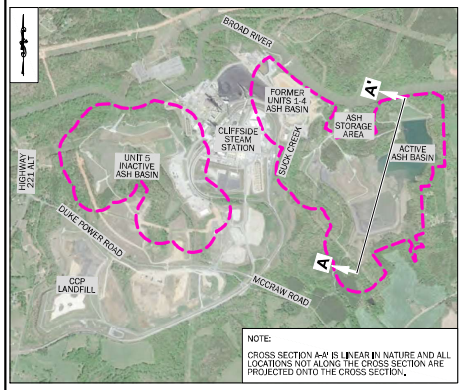
FRACTURES CONCEPTUALLY DEPICTED ON THIS CROSS SECTION REPRESENT GENERALIZED ORIENTATIONS OF FRACTURES OBSERVED BASED ON TELEVIEWER LOGGING. THE DEPICTED FRACTURE ORIENTATIONS ACCOUNT FOR APPARENT DIP WITHIN THE PLANE OF THE CROSS SECTION, AND VERTICAL EXAGGERATION. THE ACTUAL NUMBER OF FRACTURES IS FAR TOO NUMEROUS TO ILLUSTRATE AT THIS SCALE. IN ADDITION, THE DEPTHS AND LENGTHS OF FRACTURES VERSUS DEPTH ARE CONCEPTUAL ONLY.

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- 770.66' — WATER LEVEL ELEVATION (NAVD 88) (LABEL COLORING BY FLOW ZONE)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES

1. DEPTH TO WATER GAUGED IN MONITORING WELLS ON APRIL 22, 2019.
2. NM - NOT MEASURED DURING 24-HOUR WATER LEVEL EVENT.
3. ALL VERTICAL ELEVATIONS ARE MEASURED IN FEET, NORTH AMERICA VERTICAL DATUM (NAVD) OF 1988.



CROSS SECTION LOCATION

DUKE ENERGY CAROLINAS

synTerra

0 100 200 400
HORIZONTAL SCALE: 1" = 400'
VERTICAL SCALE: 1" = 80'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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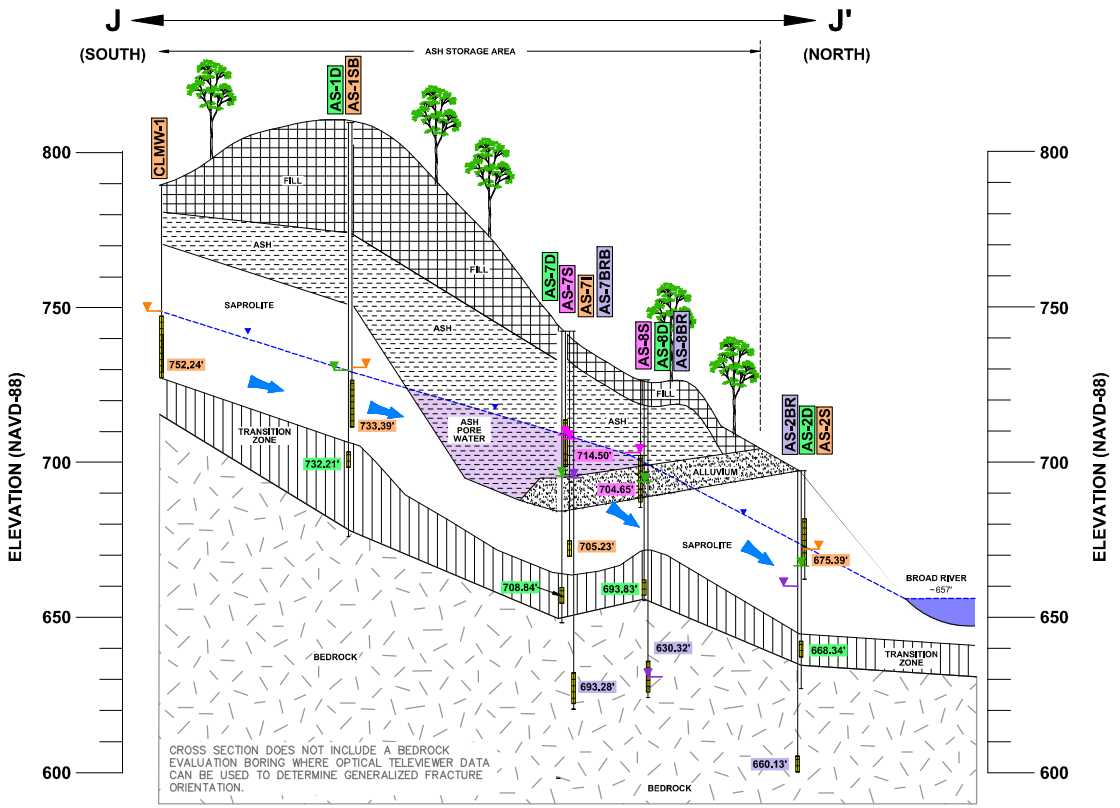
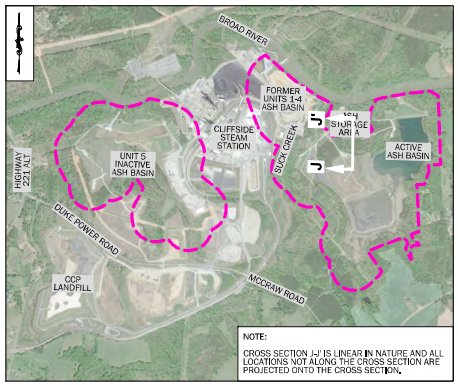
FIGURE 6-2
GENERAL CROSS SECTION A-A'
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- 708.84' — WATER LEVEL ELEVATION (NAVD 88) (LABEL COLORING BY FLOW ZONE)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES

1. DEPTH TO WATER GAUGED IN MONITORING WELLS ON APRIL 22, 2019.
2. NM - NOT MEASURED DURING 24-HOUR WATER LEVEL EVENT.
3. ALL VERTICAL ELEVATIONS ARE MEASURED IN FEET, NORTH AMERICA VERTICAL DATUM (NAVD) OF 1988.

DUKE ENERGY CAROLINAS

synterra

0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/3/2019
REVISED BY: D. KREFSKI	DATE: 10/30/2019
CHECKED BY: T. GRANT	DATE: 10/30/2019
APPROVED BY: S. SPINNER	DATE: 10/30/2019
PROJECT MANAGER: S. SPINNER	

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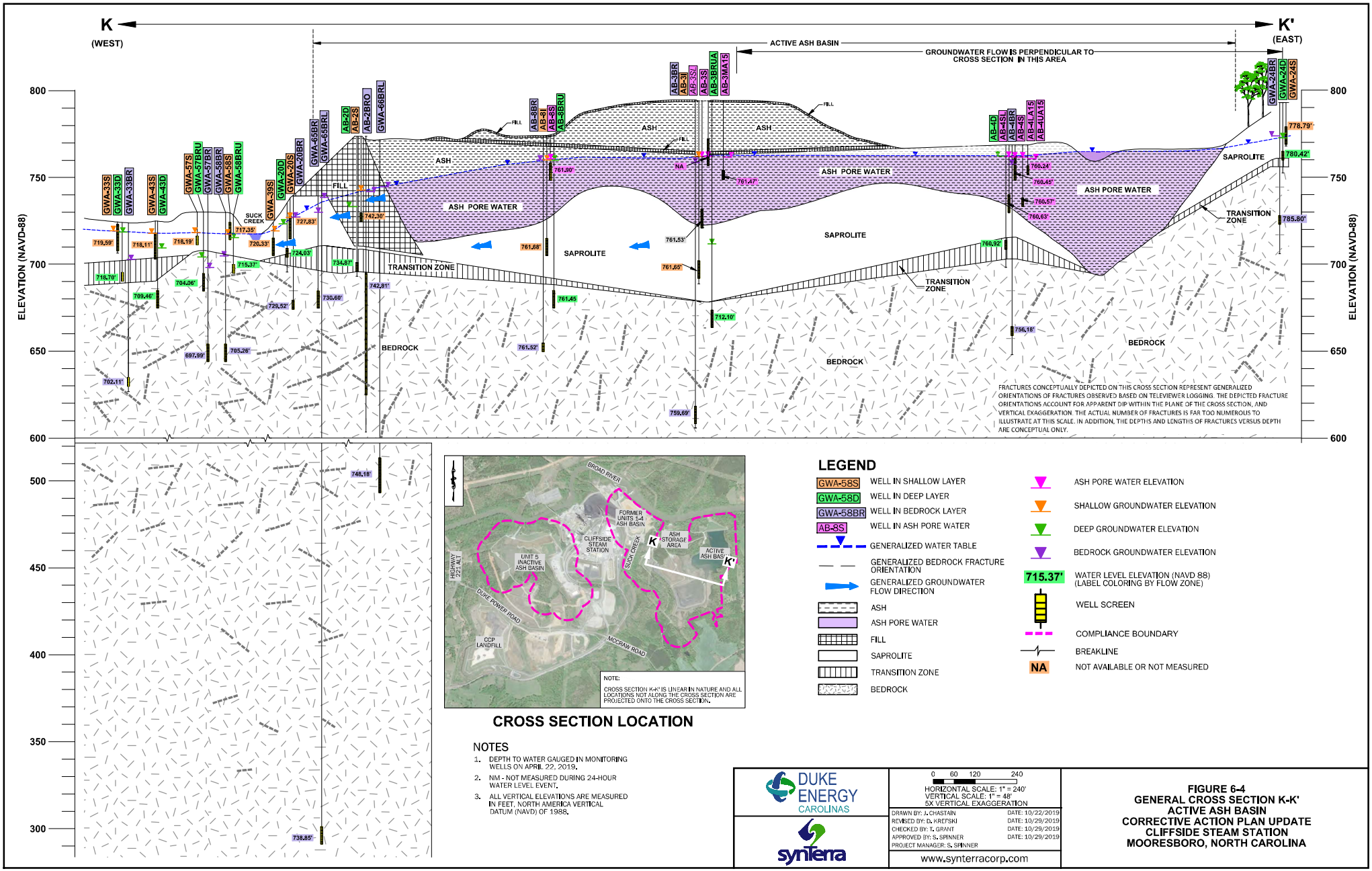
FIGURE 6-3
GENERAL CROSS SECTION J-J'
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



CROSS SECTION LOCATION

LEGEND

- GWA-58S — WELL IN SHALLOW LAYER
- GWA-58D — WELL IN DEEP LAYER
- GWA-58BR — WELL IN BEDROCK LAYER
- AB-8S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- 715.37' — WATER LEVEL ELEVATION (NAVD 88) (LABEL COLORING BY FLOW ZONE)
- WELL SCREEN
- COMPLIANCE BOUNDARY
- BREAKLINE
- NA — NOT AVAILABLE OR NOT MEASURED

NOTES

1. DEPTH TO WATER GAUGED IN MONITORING WELLS ON APRIL 22, 2019.
2. NM - NOT MEASURED DURING 24-HOUR WATER LEVEL EVENT.
3. ALL VERTICAL ELEVATIONS ARE MEASURED IN FEET, NORTH AMERICA VERTICAL DATUM (NAVD) OF 1988.

DUKE ENERGY CAROLINAS

synterra

0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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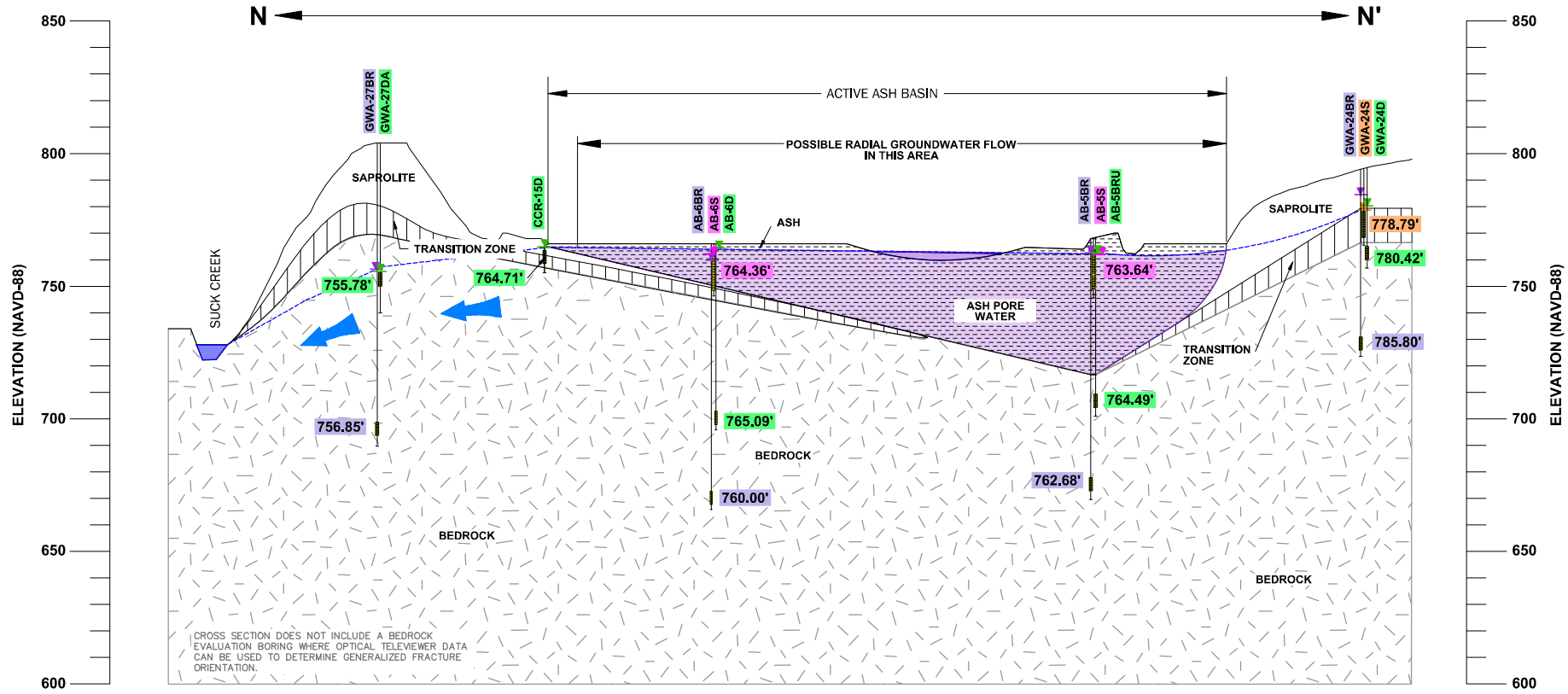
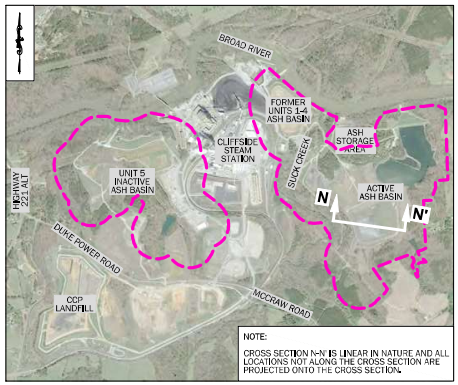
FIGURE 6-4
GENERAL CROSS SECTION K-K'
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-37S — WELL IN SHALLOW LAYER
- GWA-37D — WELL IN DEEP LAYER
- U5-5BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- 711.13' — WATER LEVEL ELEVATION (NAVD 88) (LABEL COLORING BY FLOW ZONE)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES

1. DEPTH TO WATER GAUGED IN MONITORING WELLS ON APRIL 22, 2019.
2. NM - NOT MEASURED DURING 24-HOUR WATER LEVEL EVENT.
3. ALL VERTICAL ELEVATIONS ARE MEASURED IN FEET, NORTH AMERICA VERTICAL DATUM (NAVD) OF 1988.

DUKE ENERGY CAROLINAS

synterra

0 50 100 200
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 40'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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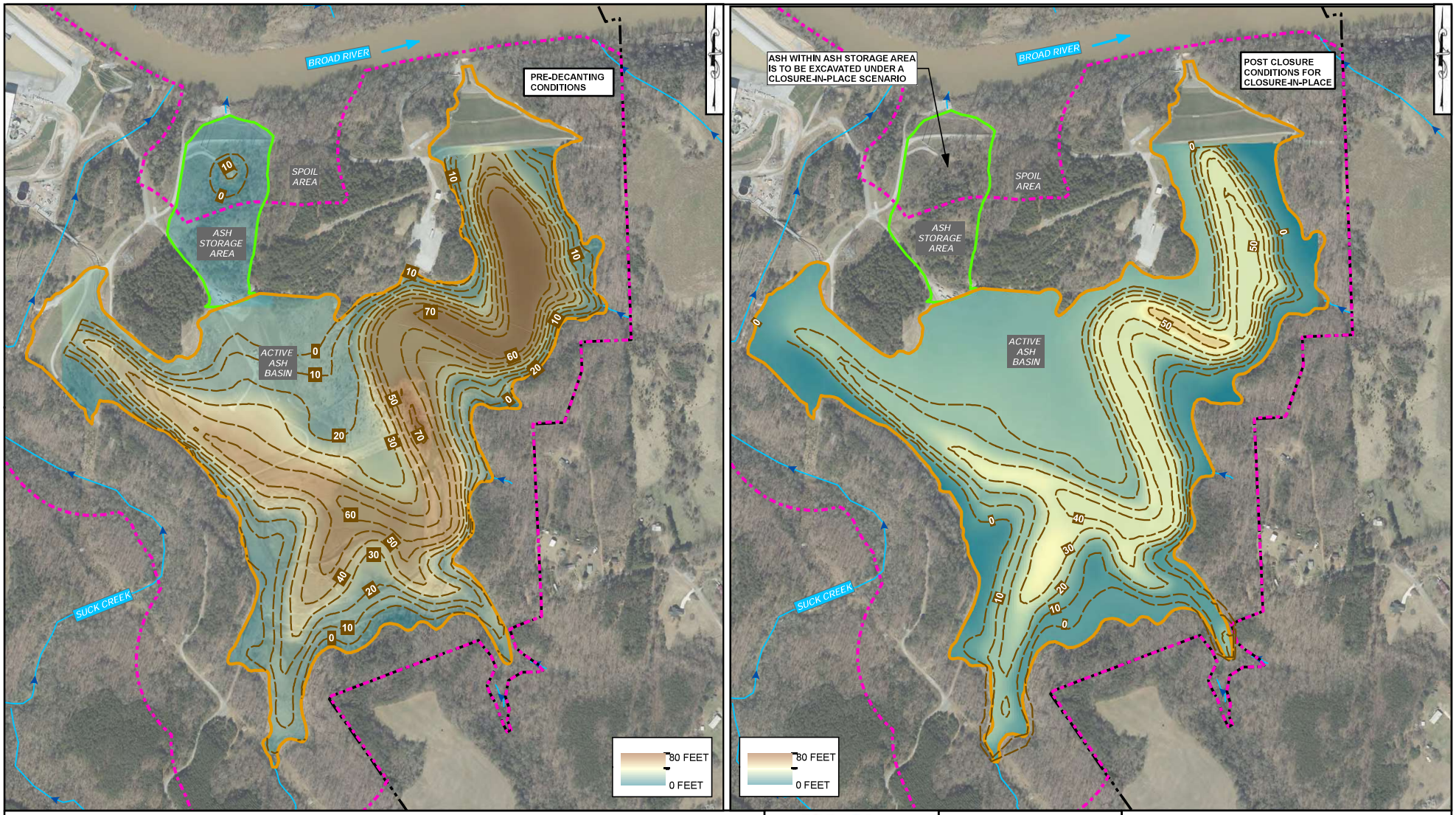
FIGURE 6-5
GENERAL CROSS SECTION N-N'
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- APPROXIMATE SATURATED ASH THICKNESS ISOPACH
- ASH BASIN WASTE BOUNDARY
- ASH STORAGE AREA BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- DUKE ENERGY CAROLINAS PROPERTY LINE
- STREAM (AMEC NRTR)
- WETLANDS (AMEC NRTR)

NOTES:

1. ASH THICKNESS ISOPACH SURFACES FROM FLOW AND TRANSPORT MODELS (FALTA AND OTHERS, 2019).
2. THE SATURATED ASH THICKNESS IS CALCULATED USING THE APPROXIMATED BOTTOM OF ASH FROM THE FLOW AND TRANSPORT MODEL SIMULATION AND SIMULATED HYDRAULIC HEADS UNDER CURRENT CONDITIONS. THE HYDRAULIC HEAD IN THE SIMULATION IS ABOVE THE TOP OF ASH IN AREAS WHERE PONDED WATER OCCURS, AND IN THESE AREAS THE SATURATED ASH THICKNESS IS OVERESTIMATED.
3. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
4. NRTR - NATURAL RESOURCES TECHNICAL REPORT
5. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
6. ALL BOUNDARIES ARE APPROXIMATE.
7. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 17, 2019. AERIAL IMAGE COLLECTED ON FEBRUARY 25, 2019.
8. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

DUKE ENERGY CAROLINAS

synterra

GRAPHIC SCALE
250 0 250 500
(IN FEET)

DRAWN BY: C. DAVIS	DATE: 06/07/2019
REVISED BY: C. DAVIS	DATE: 12/19/2019
CHECKED BY: T. GRANT	DATE: 12/19/2019
APPROVED BY: T. GRANT	DATE: 12/19/2019
PROJECT MANAGER: S. SPINNER	

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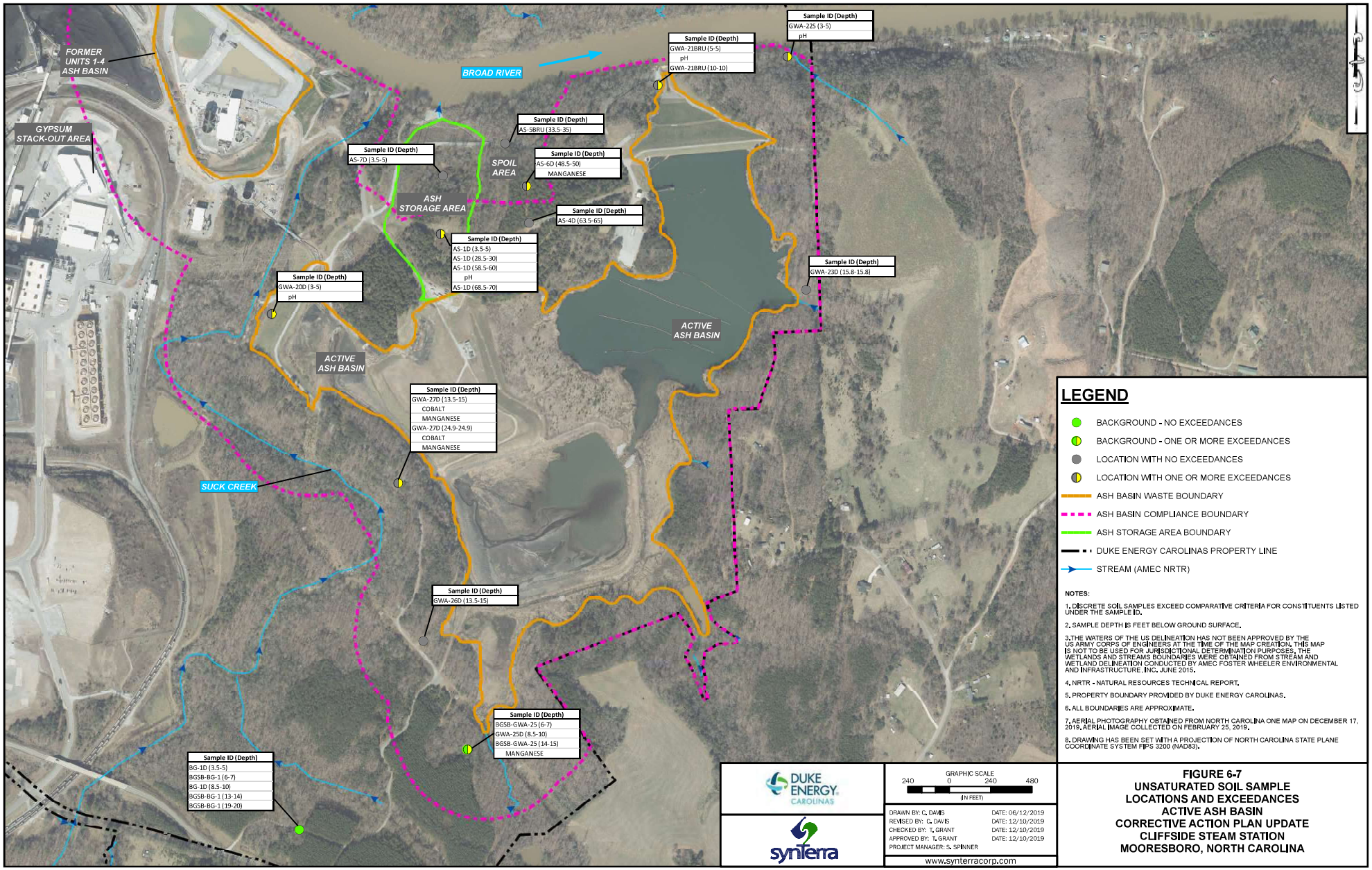
FIGURE 6-6
MODELED SATURATED ASH THICKNESS MAP
FOR PRE-DECANTING AND POST-CLOSURE CONDITIONS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- BACKGROUND - NO EXCEEDANCES
- BACKGROUND - ONE OR MORE EXCEEDANCES
- LOCATION WITH NO EXCEEDANCES
- LOCATION WITH ONE OR MORE EXCEEDANCES
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- ASH STORAGE AREA BOUNDARY
- DUKE ENERGY CAROLINAS PROPERTY LINE
- STREAM (AMEC NRTR)

NOTES:

1. DISCRETE SOIL SAMPLES EXCEED COMPARATIVE CRITERIA FOR CONSTITUENTS LISTED UNDER THE SAMPLE ID.
2. SAMPLE DEPTH IS FEET BELOW GROUND SURFACE.
3. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
4. NRTR - NATURAL RESOURCES TECHNICAL REPORT.
5. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
6. ALL BOUNDARIES ARE APPROXIMATE.
7. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 17, 2019. AERIAL IMAGE COLLECTED ON FEBRUARY 25, 2019.
8. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).

DUKE ENERGY CAROLINAS

synterra

GRAPHIC SCALE
240 0 240 480
(IN FEET)

DRAWN BY: C. DAVIS	DATE: 06/12/2019
REVISED BY: C. DAVIS	DATE: 12/10/2019
CHECKED BY: T. GRANT	DATE: 12/10/2019
APPROVED BY: T. GRANT	DATE: 12/10/2019
PROJECT MANAGER: S. SPINNER	

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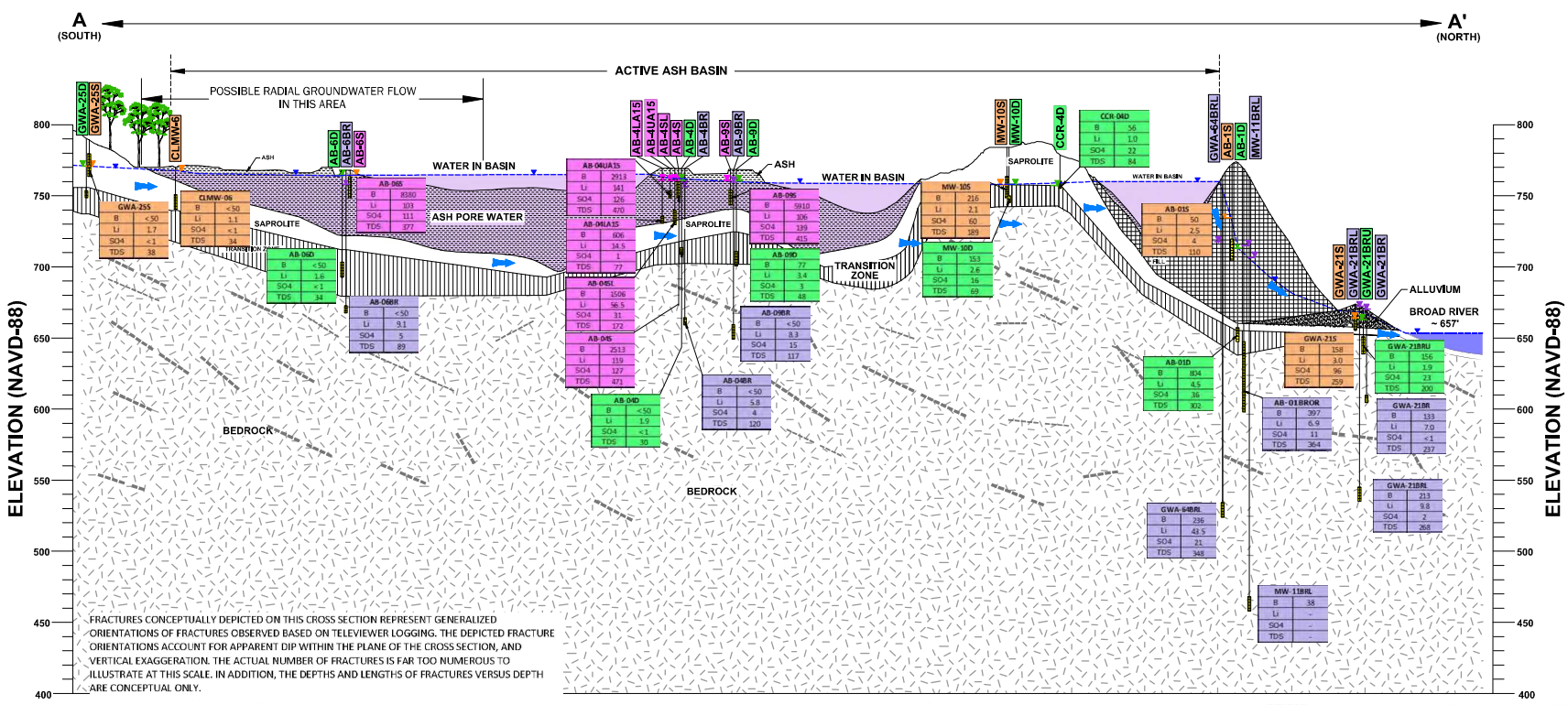
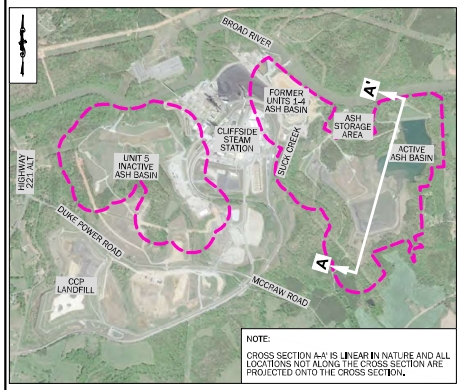
FIGURE 6-7
UNSATURATED SOIL SAMPLE LOCATIONS AND EXCEEDANCES
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW FLOW LAYER
- GWA-25D — WELL IN DEEP FLOW LAYER
- GWA-21BR — WELL IN BEDROCK FLOW LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- GWA-64BRL (B 236 / Li 43.5 / SO4 21 / TDS 348) — MEAN BORON (B) CONCENTRATION (µg/L); MEAN LITHIUM (Li) CONCENTRATION (µg/L); MEAN SULFATE (SO4) CONCENTRATION (mg/L); MEAN TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION (mg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. BORON (B) AND LITHIUM (Li) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)
3. SULFATE (SO4) AND TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATIONS ARE IN MILLIGRAMS PER LITER (mg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	B	Li	SO4	TDS
REPORTING UNITS	µg/L	µg/L	mg/L	mg/L
15A NCAC 02L STANDARD	700	NE	250	500
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	50	3	4	57
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	50	12	15	107
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	50	11	17	120

[1] - UPDATED BACKGROUND THRESHOLD VALUES WER CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

NE - NOT ESTABLISHED

DUKE ENERGY CAROLINAS

synTerra

0 100 200 400
HORIZONTAL SCALE: 1" = 400'
VERTICAL SCALE: 1" = 80'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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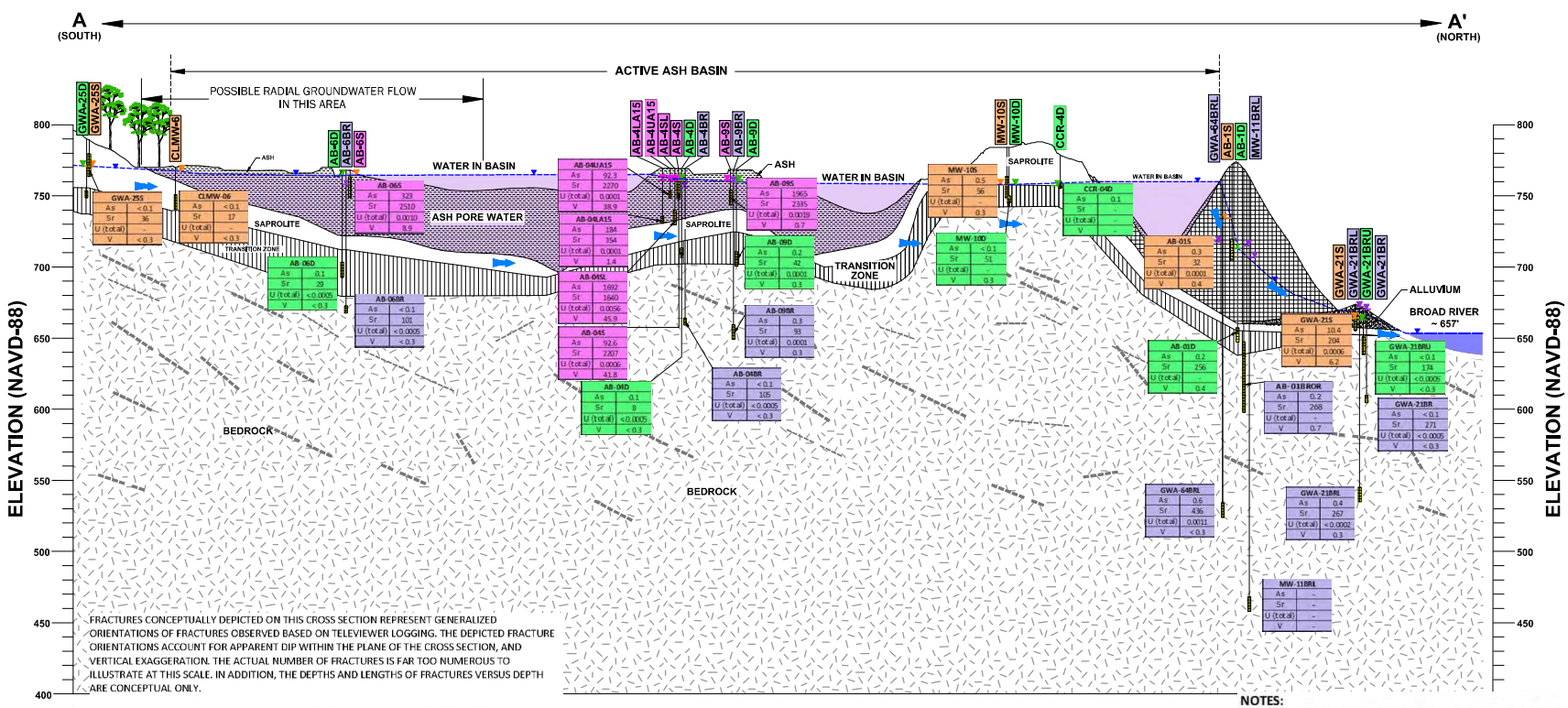
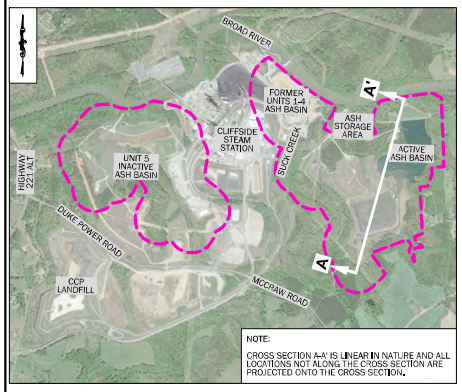
FIGURE 6-8a
GENERAL CROSS SECTION A-A'
CONSERVATIVE GROUP
MEAN OF BORON, LITHIUM, SULFATE AND TOTAL DISSOLVED SOLIDS (TDS)
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW FLOW LAYER
- GWA-25D — WELL IN DEEP FLOW LAYER
- GWA-21BR — WELL IN BEDROCK FLOW LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- GWA-64BRL — MEAN ARSENIC (As) CONCENTRATION (µg/L); MEAN STRONTIUM (Sr) CONCENTRATION (µg/L); MEAN TOTAL URANIUM (U) CONCENTRATION (µg/L); MEAN VANADIUM (V) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.

2. ARSENIC (As), STRONTIUM (Sr), TOTAL URANIUM (U), AND VANADIUM (V) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L).

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	As	Sr	U	V
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	10	NE	NE	3*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)1	0.2	34	0.0005	1
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	2	69	0.0005	11
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	1	93	0.0005	1

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WER CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

DUKE ENERGY CAROLINAS

synTerra

0 100 200 400
HORIZONTAL SCALE: 1" = 400'
VERTICAL SCALE: 1" = 80'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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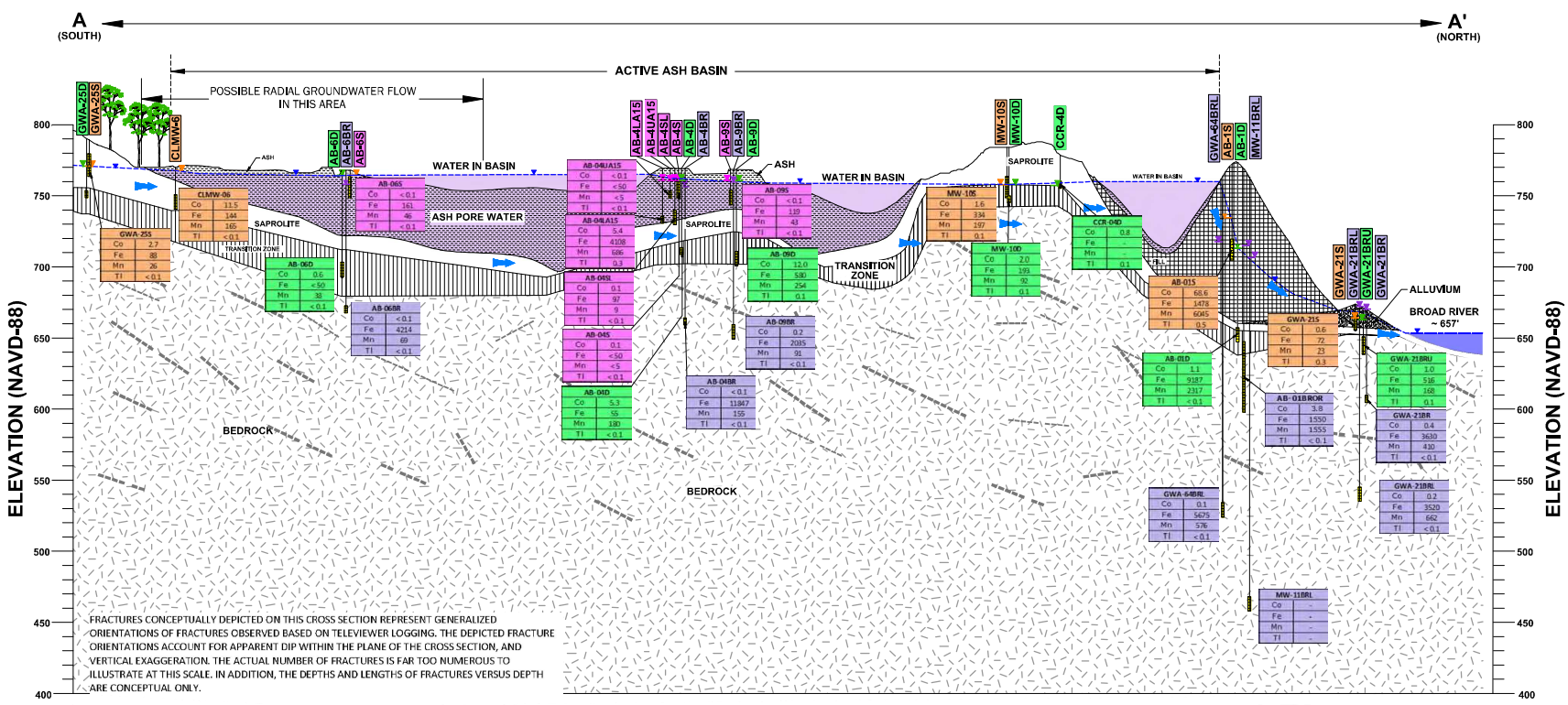
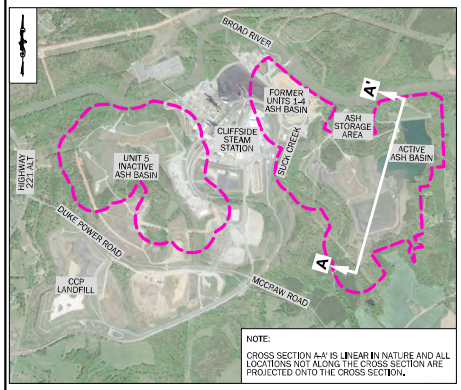
FIGURE 6-8b
GENERAL CROSS SECTION A-A'
NON-CONSERVATIVE GROUP
MEAN OF ARSENIC, STRONTIUM, TOTAL URANIUM AND VANADIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW FLOW LAYER
- GWA-25D — WELL IN DEEP FLOW LAYER
- GWA-21BR — WELL IN BEDROCK FLOW LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- GWA-64BRL: Co 0.1, Fe 5675, Mn 576, Tl <0.1 — MEAN COBALT (Co) CONCENTRATION (µg/L); MEAN IRON (Fe) CONCENTRATION (µg/L); MEAN MANGANESE (Mn) CONCENTRATION (µg/L); MEAN THALLIUM (Tl) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.

2. COBALT (Co), IRON (Fe), MANGANESE (Mn), AND THALLIUM (Tl) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	Co	Fe	Mn	Tl
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	1*	300	50	0.2*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	21	1700	760	760
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	5	1840	760	760
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	2	7680	232	232

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WER CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

DUKE ENERGY CAROLINAS

synTerra

0 100 200 400
HORIZONTAL SCALE: 1" = 400'
VERTICAL SCALE: 1" = 80'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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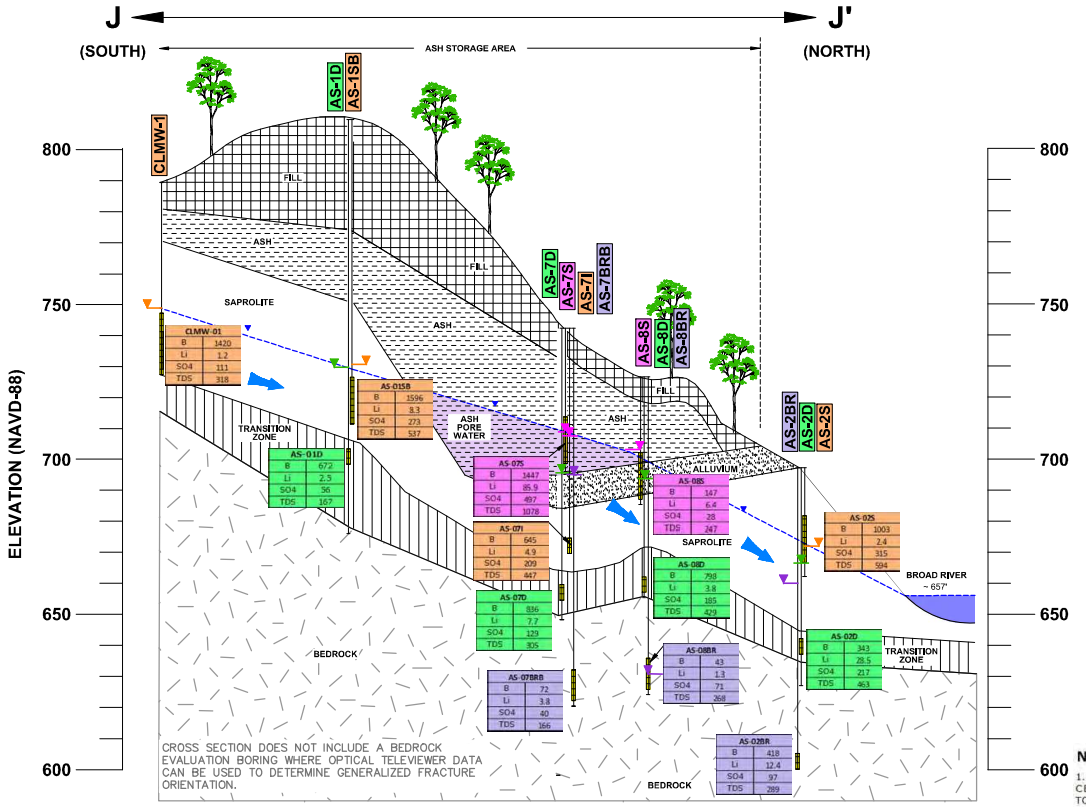
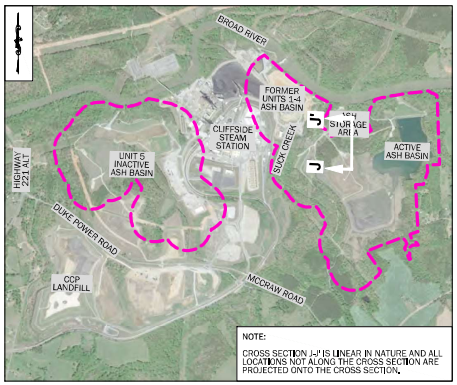
FIGURE 6-8c
GENERAL CROSS SECTION A-A'
VARIABLE GROUP
MEAN OF COBALT, IRON, MANGANESE, AND THALLIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- AS-07BRB: B 72, Li 3.8, SO4 40, TDS 166 — MEAN BORON (B) CONCENTRATION (µg/L); MEAN LITHIUM (Li) CONCENTRATION (µg/L); MEAN SULFATE (SO4) CONCENTRATION (mg/L); MEAN TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION (mg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. BORON (B) AND LITHIUM (Li) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)
3. SULFATE (SO4) AND TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATIONS ARE IN MILLIGRAMS PER LITER (mg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	B	Li	SO4	TDS
REPORTING UNITS	µg/L	µg/L	mg/L	mg/L
15A NCAC 02L STANDARD	700	NE	250	500
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	50	3	4	57
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	50	12	15	107
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	50	11	17	120

[1] - UPDATED BACKGROUND THRESHOLD VALUES WERE CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

NE - NOT ESTABLISHED

DUKE ENERGY CAROLINAS

synterra

0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/3/2019
REVISED BY: D. KREFSKI	DATE: 10/30/2019
CHECKED BY: T. GRANT	DATE: 10/30/2019
APPROVED BY: S. SPINNER	DATE: 10/30/2019
PROJECT MANAGER: S. SPINNER	

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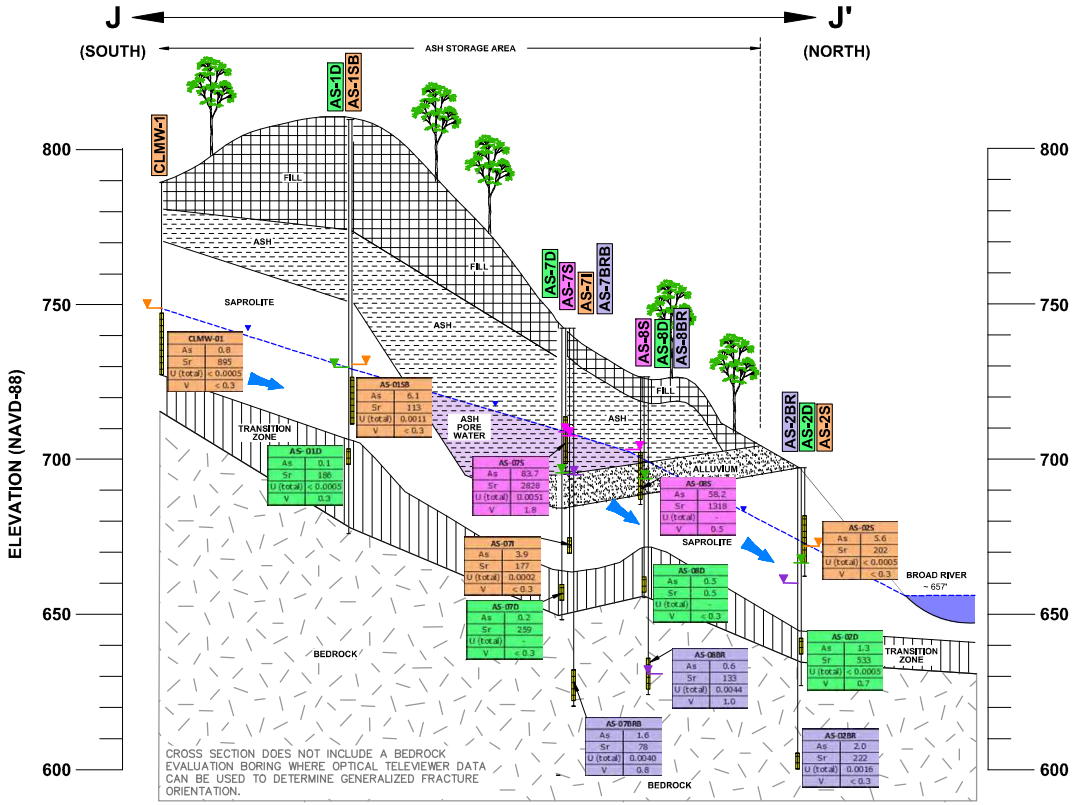
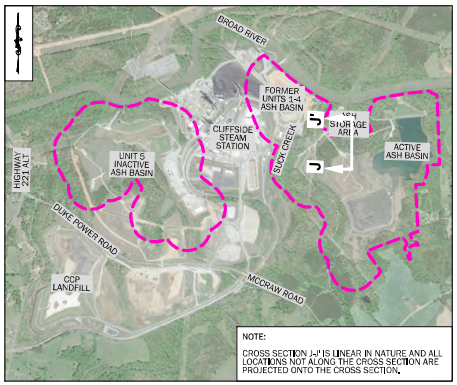
FIGURE 6-9a
GENERAL CROSS SECTION J-J'
CONSERVATIVE GROUP
MEAN OF BORON, LITHIUM, SULFATE AND TOTAL DISSOLVED SOLIDS (TDS)
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- MEAN ARSENIC (As) CONCENTRATION (µg/L)
- MEAN STRONTIUM (Sr) CONCENTRATION (µg/L)
- MEAN TOTAL URANIUM (U) CONCENTRATION (µg/L)
- MEAN VANADIUM (V) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. ARSENIC (As), STRONTIUM (Sr), TOTAL URANIUM (U), AND VANADIUM (V) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L).

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	As	Sr	U	V
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	10	NE	NE	3*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)1	0.2	34	0.0005	1
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	2	69	0.0005	11
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	1	93	0.0005	1

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WERE CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

DUKE ENERGY CAROLINAS

synterra

0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/3/2019
REVISED BY: D. KREFSKI	DATE: 10/30/2019
CHECKED BY: T. GRANT	DATE: 10/30/2019
APPROVED BY: S. SPINNER	DATE: 10/30/2019
PROJECT MANAGER: S. SPINNER	

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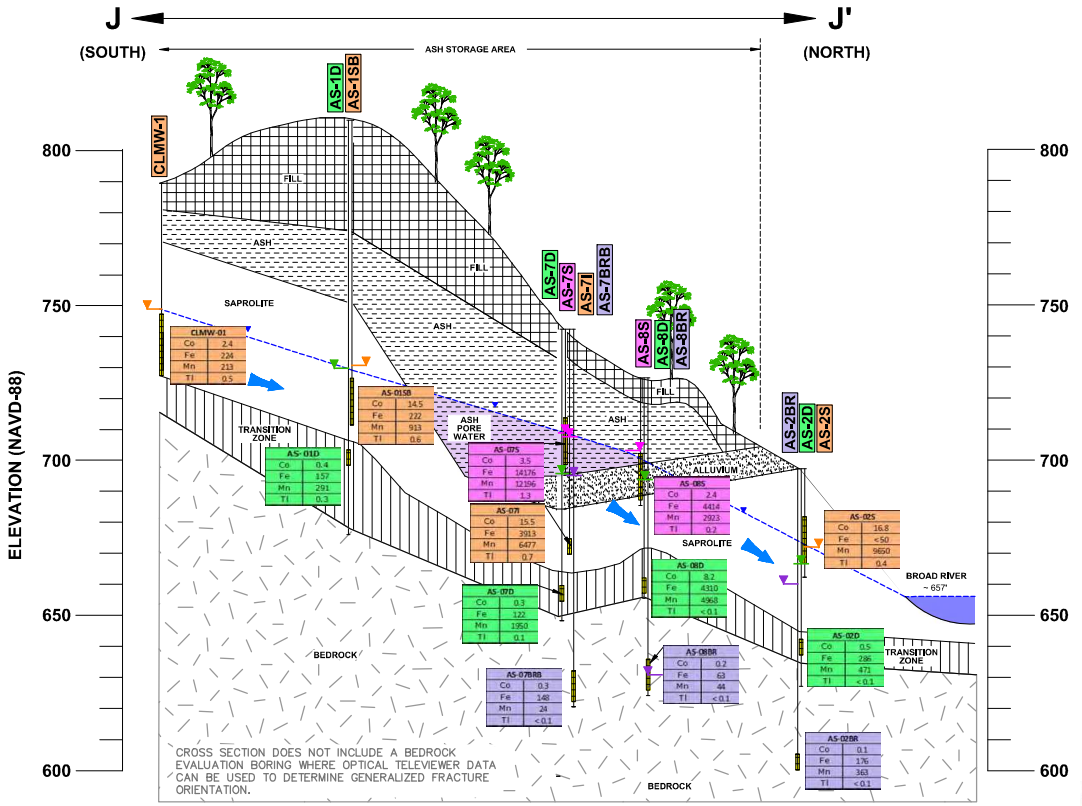
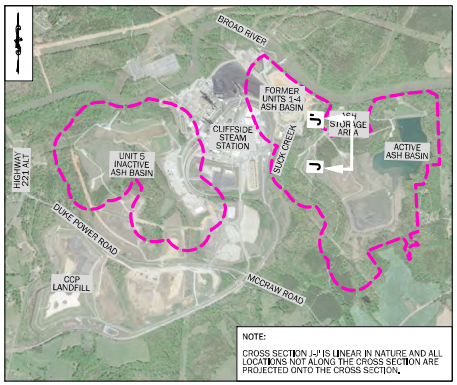
FIGURE 6-9b
GENERAL CROSS SECTION J-J'
NON-CONSERVATIVE GROUP
MEAN OF ARSENIC, STRONTIUM, TOTAL URANIUM AND VANADIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- AS-07BRB: Co 0.3, Fe 148, Mn 24, Tl <0.1 — MEAN COBALT (Co) CONCENTRATION (µg/L); MEAN IRON (Fe) CONCENTRATION (µg/L); MEAN MANGANESE (Mn) CONCENTRATION (µg/L); MEAN THALLIUM (Tl) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY



CROSS SECTION LOCATION

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. COBALT (Co), IRON (Fe), MANGANESE (Mn), AND THALLIUM (Tl) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	Co	Fe	Mn	Tl
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	1*	300	50	0.2*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	21	1700	760	760
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	5	1840	760	760
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	2	7680	232	232

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WERE CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

DUKE ENERGY CAROLINAS

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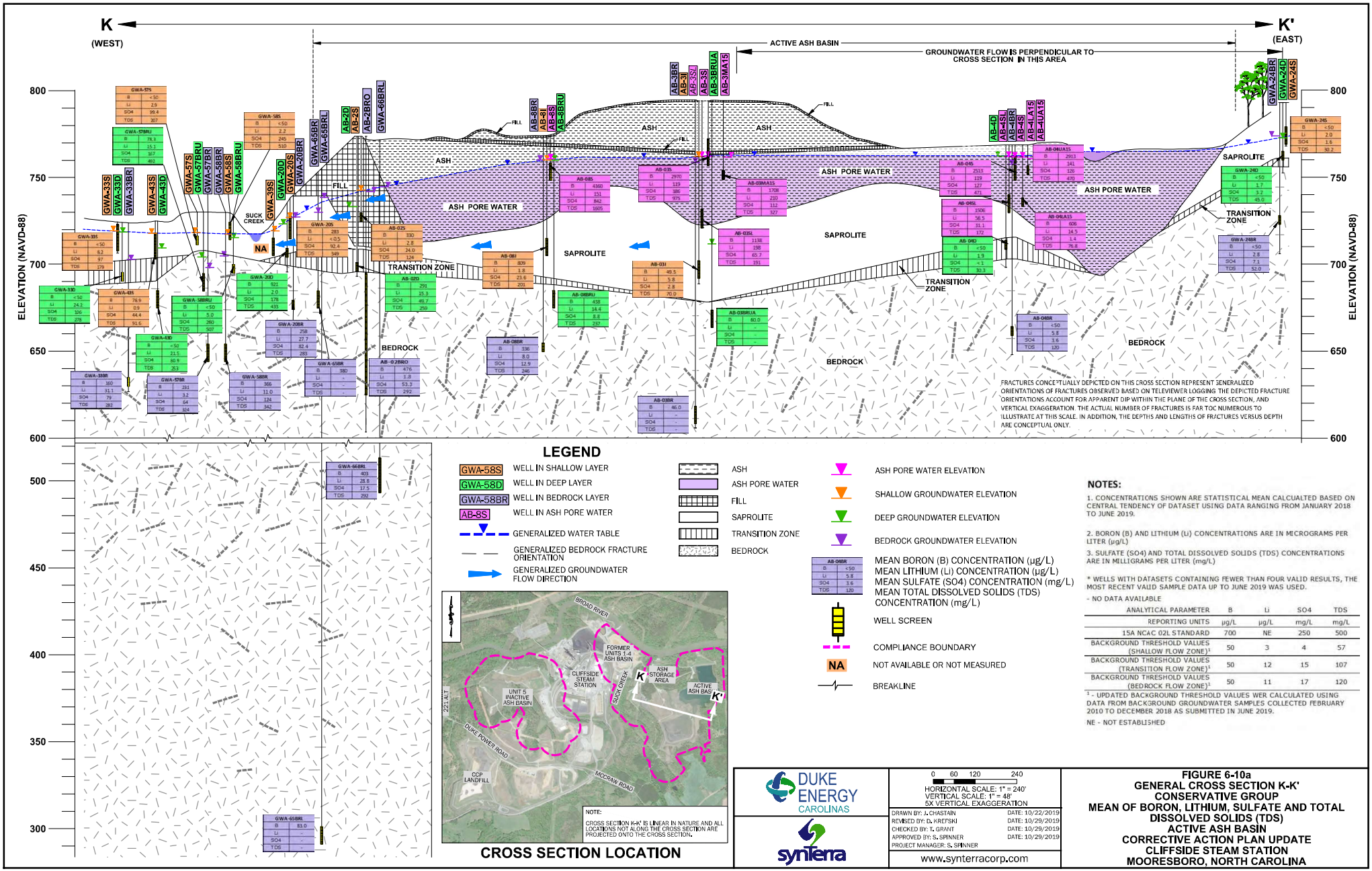
0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/3/2019
REVISED BY: D. KREFSKI	DATE: 10/30/2019
CHECKED BY: T. GRANT	DATE: 10/30/2019
APPROVED BY: S. SPINNER	DATE: 10/30/2019
PROJECT MANAGER: S. SPINNER	

FIGURE 6-9c
GENERAL CROSS SECTION J-J'
VARIABLE GROUP
MEAN OF COBALT, IRON, MANGANESE AND THALLIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- GWA-58S — WELL IN SHALLOW LAYER
- GWA-58D — WELL IN DEEP LAYER
- GWA-58BR — WELL IN BEDROCK LAYER
- AB-8S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- MEAN BORON (B) CONCENTRATION (µg/L)
- MEAN LITHIUM (Li) CONCENTRATION (µg/L)
- MEAN SULFATE (SO4) CONCENTRATION (mg/L)
- MEAN TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION (mg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY
- NA — NOT AVAILABLE OR NOT MEASURED
- BREAKLINE

CROSS SECTION LOCATION

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. BORON (B) AND LITHIUM (Li) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)
3. SULFATE (SO4) AND TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATIONS ARE IN MILLIGRAMS PER LITER (mg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	B	Li	SO4	TDS
REPORTING UNITS	µg/L	µg/L	mg/L	mg/L
15A NCAC 02L STANDARD	700	NE	250	500
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	50	3	4	57
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	50	12	15	107
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	50	11	17	120

[1] - UPDATED BACKGROUND THRESHOLD VALUES WER CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

NE - NOT ESTABLISHED

DUKE ENERGY CAROLINAS

synterra

0 60 120 240
HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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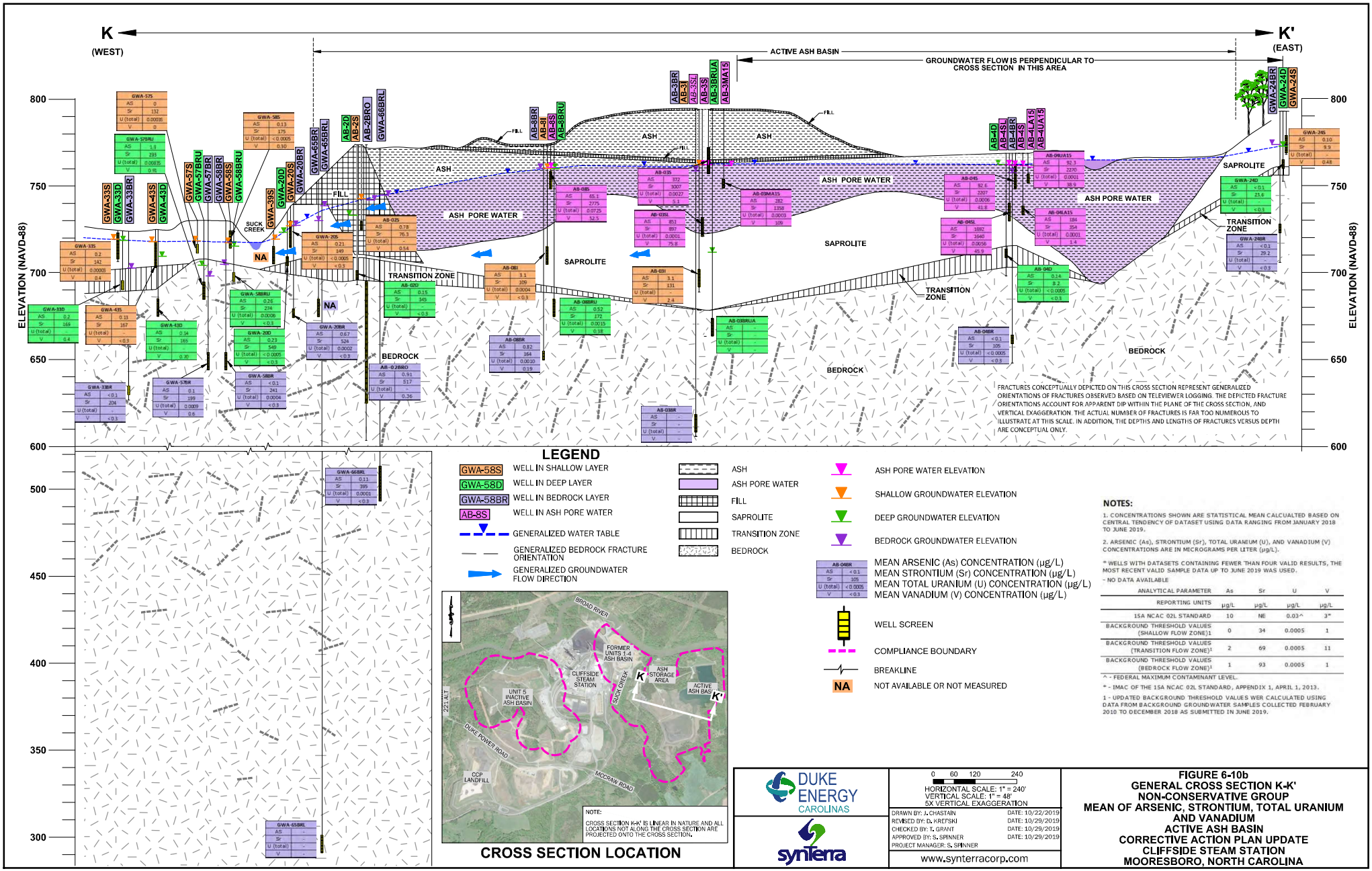
FIGURE 6-10a
GENERAL CROSS SECTION K-K'
CONSERVATIVE GROUP
MEAN OF BORON, LITHIUM, SULFATE AND TOTAL DISSOLVED SOLIDS (TDS)
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- GWA-58S — WELL IN SHALLOW LAYER
- GWA-58D — WELL IN DEEP LAYER
- GWA-58BR — WELL IN BEDROCK LAYER
- AB-8S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- MEAN ARSENIC (As) CONCENTRATION (µg/L)
- MEAN STRONTIUM (Sr) CONCENTRATION (µg/L)
- MEAN TOTAL URANIUM (U) CONCENTRATION (µg/L)
- MEAN VANADIUM (V) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY
- BREAKLINE
- NA — NOT AVAILABLE OR NOT MEASURED

CROSS SECTION LOCATION

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. ARSENIC (As), STRONTIUM (Sr), TOTAL URANIUM (U), AND VANADIUM (V) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L).

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	As	Sr	U	V
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	10	NE	0.03^	3*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)1	0	34	0.0005	1
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)1	2	69	0.0005	11
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)1	1	93	0.0005	1

^ - FEDERAL MAXIMUM CONTAMINANT LEVEL.

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WER CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

DUKE ENERGY CAROLINAS

synterra

0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
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APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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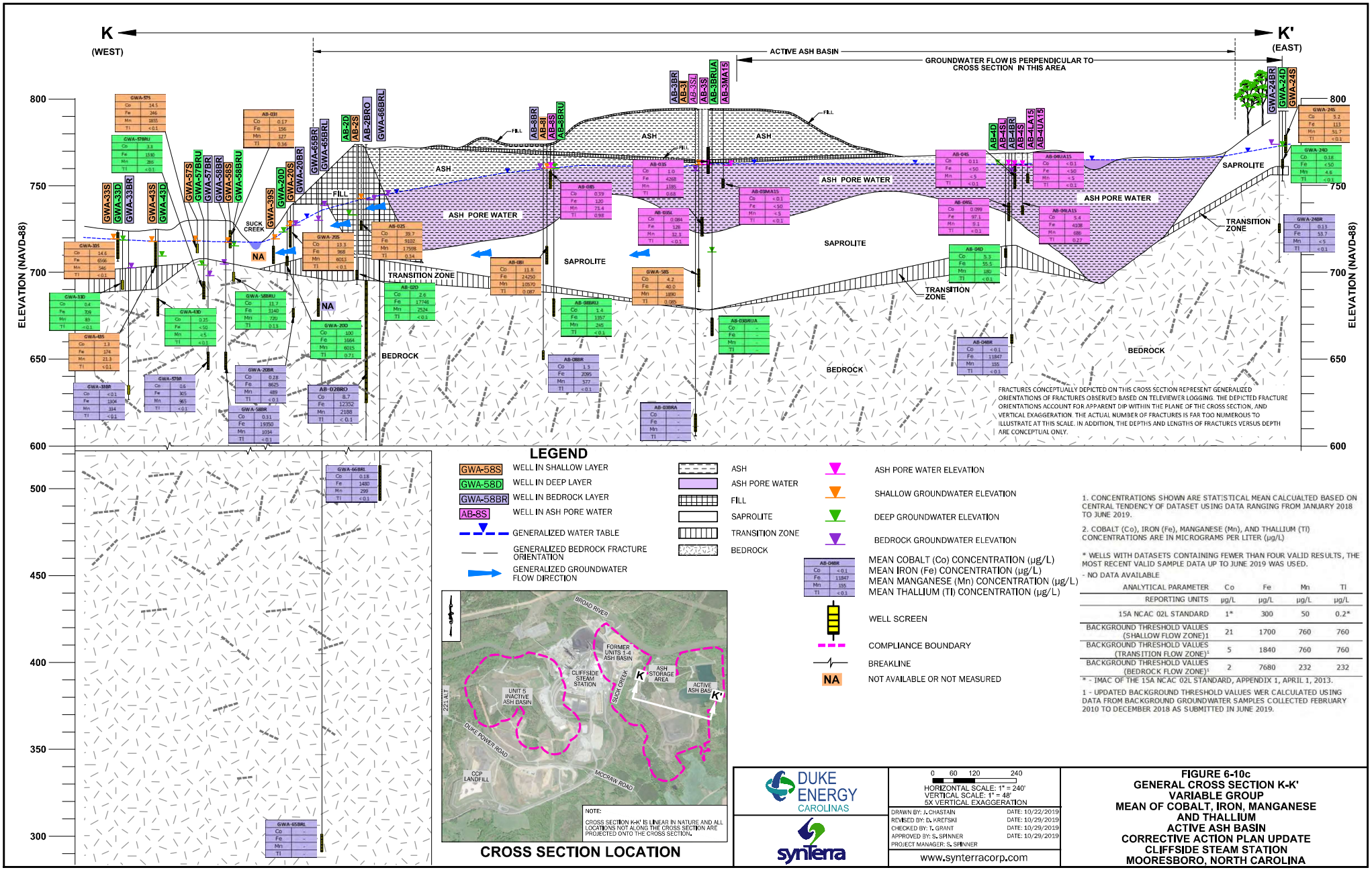
FIGURE 6-10b
GENERAL CROSS SECTION K-K'
NON-CONSERVATIVE GROUP
MEAN OF ARSENIC, STRONTIUM, TOTAL URANIUM AND VANADIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- GWA-58S — WELL IN SHALLOW LAYER
- GWA-58D — WELL IN DEEP LAYER
- GWA-58BR — WELL IN BEDROCK LAYER
- AB-8S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED BEDROCK FRACTURE ORIENTATION
- GENERALIZED GROUNDWATER FLOW DIRECTION
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- TRANSITION ZONE
- BEDROCK
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- MEAN COBALT (Co) CONCENTRATION (µg/L)
- MEAN IRON (Fe) CONCENTRATION (µg/L)
- MEAN MANGANESE (Mn) CONCENTRATION (µg/L)
- MEAN THALLIUM (Tl) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY
- BREAKLINE
- NA — NOT AVAILABLE OR NOT MEASURED

CROSS SECTION LOCATION

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.

2. COBALT (Co), IRON (Fe), MANGANESE (Mn), AND THALLIUM (Tl) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)

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- NO DATA AVAILABLE

ANALYTICAL PARAMETER	Co	Fe	Mn	Tl
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	1*	300	50	0.2*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	21	1700	760	760
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BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	2	7680	232	232

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1 - UPDATED BACKGROUND THRESHOLD VALUES WER CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

DUKE ENERGY CAROLINAS

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0 60 120 240

HORIZONTAL SCALE: 1" = 240'
VERTICAL SCALE: 1" = 48'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
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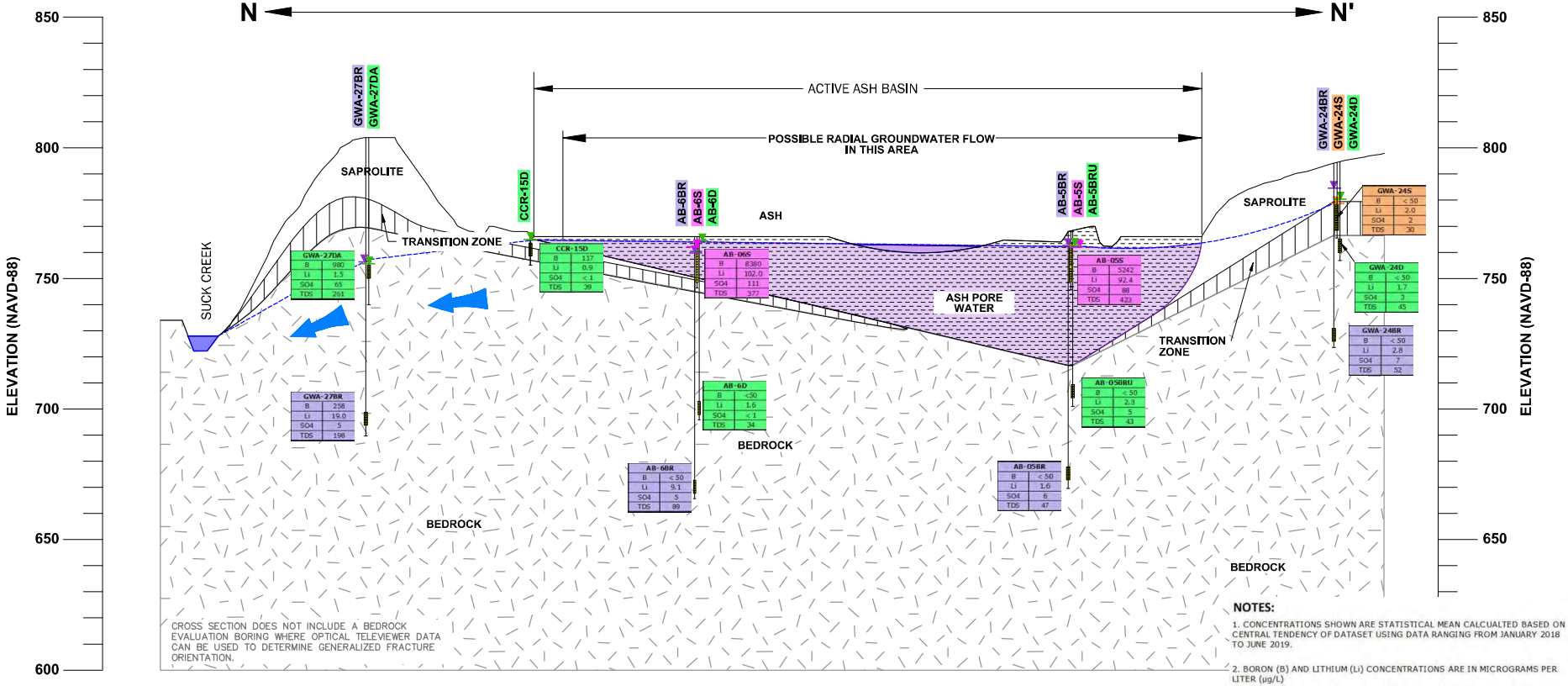
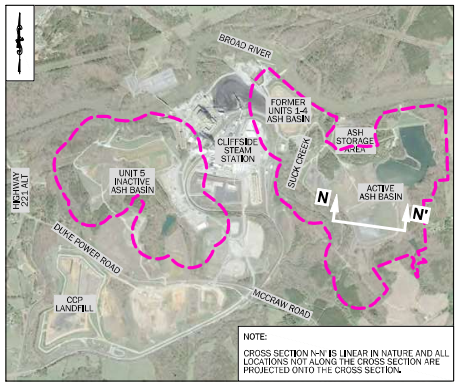
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

FIGURE 6-10c
GENERAL CROSS SECTION K-K'
VARIABLE GROUP
MEAN OF COBALT, IRON, MANGANESE AND THALLIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM
- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- AB-05BRU: B < 50, Li 2.3, SO4 5.3, TDS 42.6 — MEAN BORON (B) CONCENTRATION (µg/L); MEAN LITHIUM (Li) CONCENTRATION (µg/L); MEAN SULFATE (SO4) CONCENTRATION (mg/L); MEAN TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION (mg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. BORON (B) AND LITHIUM (Li) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)
3. SULFATE (SO4) AND TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATIONS ARE IN MILLIGRAMS PER LITER (mg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	B	Li	SO4	TDS
REPORTING UNITS	µg/L	µg/L	mg/L	mg/L
15A NCAC 02L STANDARD	700	NE	250	500
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)[1]	50	3	4	57
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	50	12	15	107
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	50	11	17	120

1 - UPDATED BACKGROUND THRESHOLD VALUES WERE CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

NE - NOT ESTABLISHED

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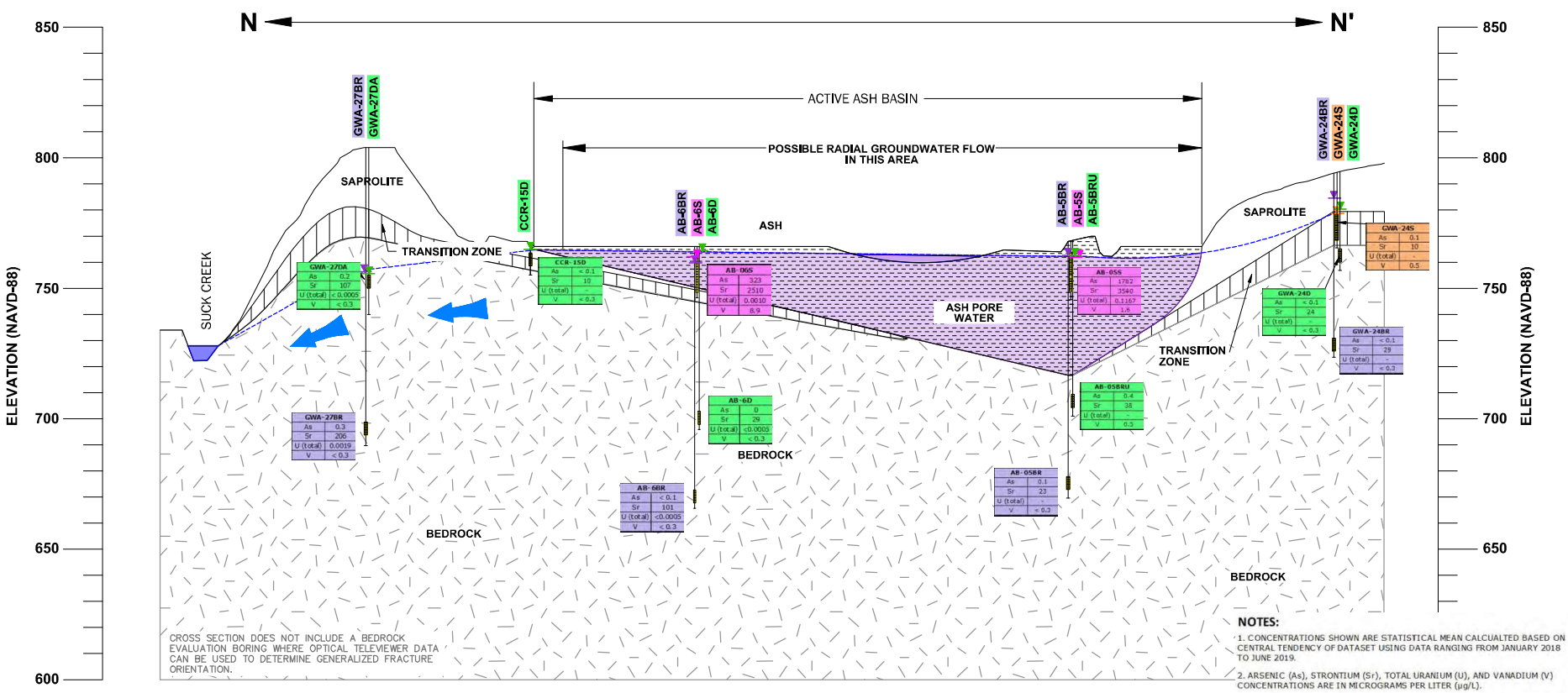
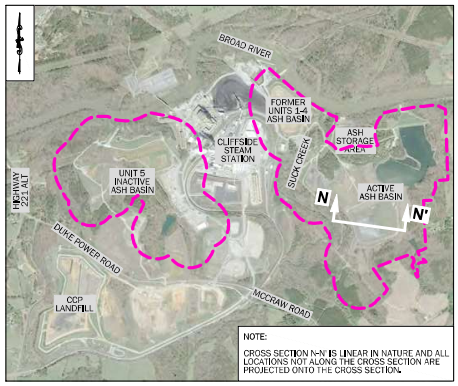
0 50 100 200
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 40'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

FIGURE 6-11a
GENERAL CROSS SECTION N-N'
CONSERVATIVE GROUP
MEAN OF BORON, LITHIUM, SULFATE AND TOTAL DISSOLVED SOLIDS (TDS)
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM

- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION
- MEAN ARSENIC (As) CONCENTRATION (µg/L)
- MEAN STRONTIUM (Sr) CONCENTRATION (µg/L)
- MEAN TOTAL URANIUM (U) CONCENTRATION (µg/L)
- MEAN VANADIUM (V) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.

2. ARSENIC (As), STRONTIUM (Sr), TOTAL URANIUM (U), AND VANADIUM (V) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L).

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	As	Sr	U	V
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	10	NE	NE	3*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)1	0.2	34	0.0005	1
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)1	2	69	0.0005	11
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)1	1	93	0.0005	1

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WERE CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

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0 50 100 200
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 40'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

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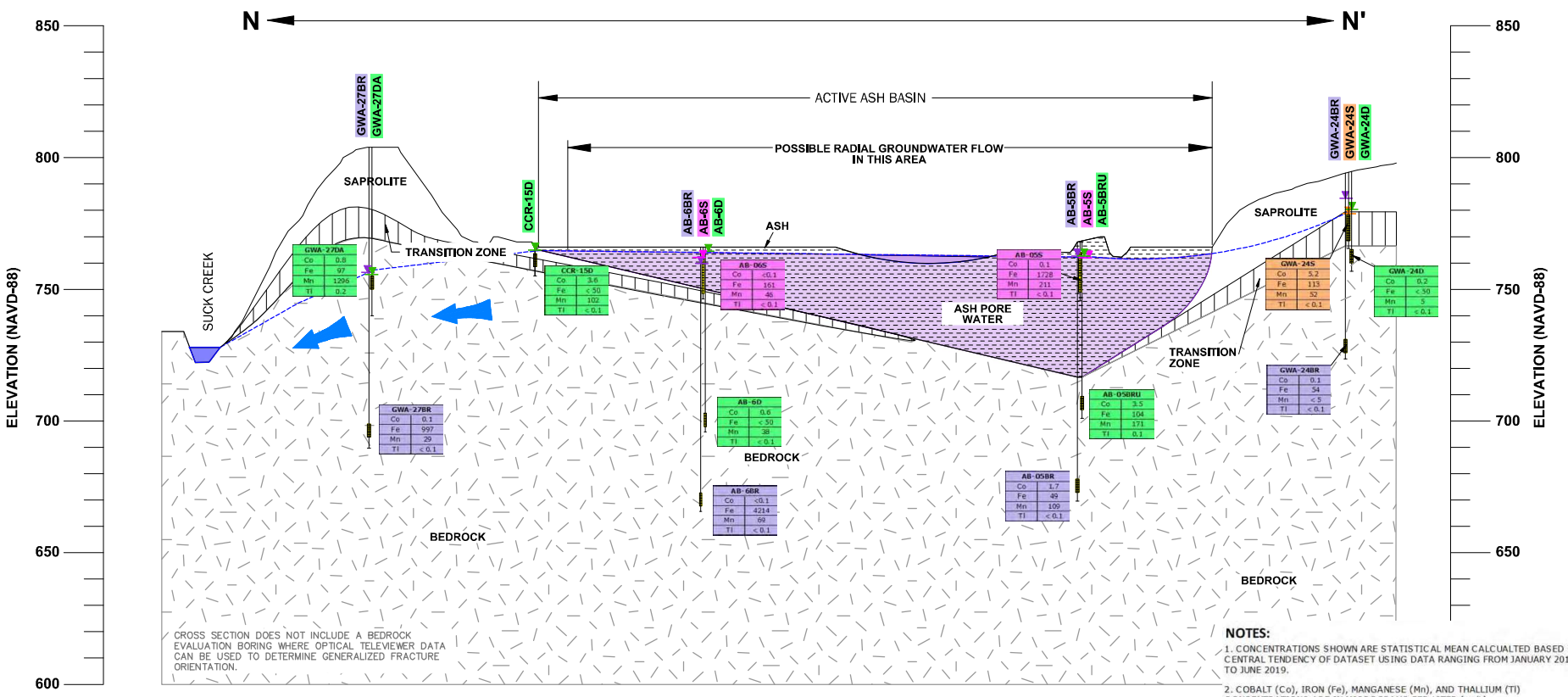
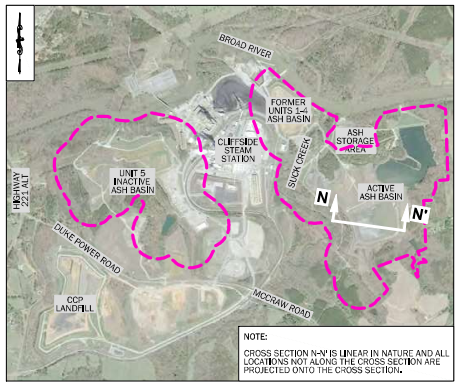
FIGURE 6-11b
GENERAL CROSS SECTION N-N'
NON-CONSERVATIVE GROUP
MEAN OF ARSENIC, STRONTIUM, TOTAL URANIUM AND VANADIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA





CROSS SECTION LOCATION

LEGEND

- GWA-25S — WELL IN SHALLOW LAYER
- GWA-25D — WELL IN DEEP LAYER
- GWA-21BR — WELL IN BEDROCK LAYER
- AB-6S — WELL IN ASH PORE WATER
- GENERALIZED WATER TABLE
- GENERALIZED GROUNDWATER FLOW DIRECTION
- ASH
- ASH PORE WATER
- FILL
- SAPROLITE
- TRANSITION ZONE
- BEDROCK
- ALLUVIUM

- ASH PORE WATER ELEVATION
- SHALLOW GROUNDWATER ELEVATION
- DEEP GROUNDWATER ELEVATION
- BEDROCK GROUNDWATER ELEVATION

AB-05BR	
Co	1.7
Fe	48.7
Mn	109
Tl	< 0.1

- MEAN COBALT (Co) CONCENTRATION (µg/L)
- MEAN IRON (Fe) CONCENTRATION (µg/L)
- MEAN MANGANESE (Mn) CONCENTRATION (µg/L)
- MEAN THALLIUM (Tl) CONCENTRATION (µg/L)
- WELL SCREEN
- COMPLIANCE BOUNDARY

NOTES:

1. CONCENTRATIONS SHOWN ARE STATISTICAL MEAN CALCUALTED BASED ON CENTRAL TENDENCY OF DATASET USING DATA RANGING FROM JANUARY 2018 TO JUNE 2019.
2. COBALT (Co), IRON (Fe), MANGANESE (Mn), AND THALLIUM (Tl) CONCENTRATIONS ARE IN MICROGRAMS PER LITER (µg/L)

* WELLS WITH DATASETS CONTAINING FEWER THAN FOUR VALID RESULTS, THE MOST RECENT VALID SAMPLE DATA UP TO JUNE 2019 WAS USED.

- NO DATA AVAILABLE

ANALYTICAL PARAMETER	Co	Fe	Mn	Tl
REPORTING UNITS	µg/L	µg/L	µg/L	µg/L
15A NCAC 02L STANDARD	1*	300	50	0.2*
BACKGROUND THRESHOLD VALUES (SHALLOW FLOW ZONE)1	21	1700	760	760
BACKGROUND THRESHOLD VALUES (TRANSITION FLOW ZONE)[1]	5	1840	760	760
BACKGROUND THRESHOLD VALUES (BEDROCK FLOW ZONE)[1]	2	7680	232	232

* - IMAC OF THE 15A NCAC 02L STANDARD, APPENDIX 1, APRIL 1, 2013.

1 - UPDATED BACKGROUND THRESHOLD VALUES WERE CALCULATED USING DATA FROM BACKGROUND GROUNDWATER SAMPLES COLLECTED FEBRUARY 2010 TO DECEMBER 2018 AS SUBMITTED IN JUNE 2019.

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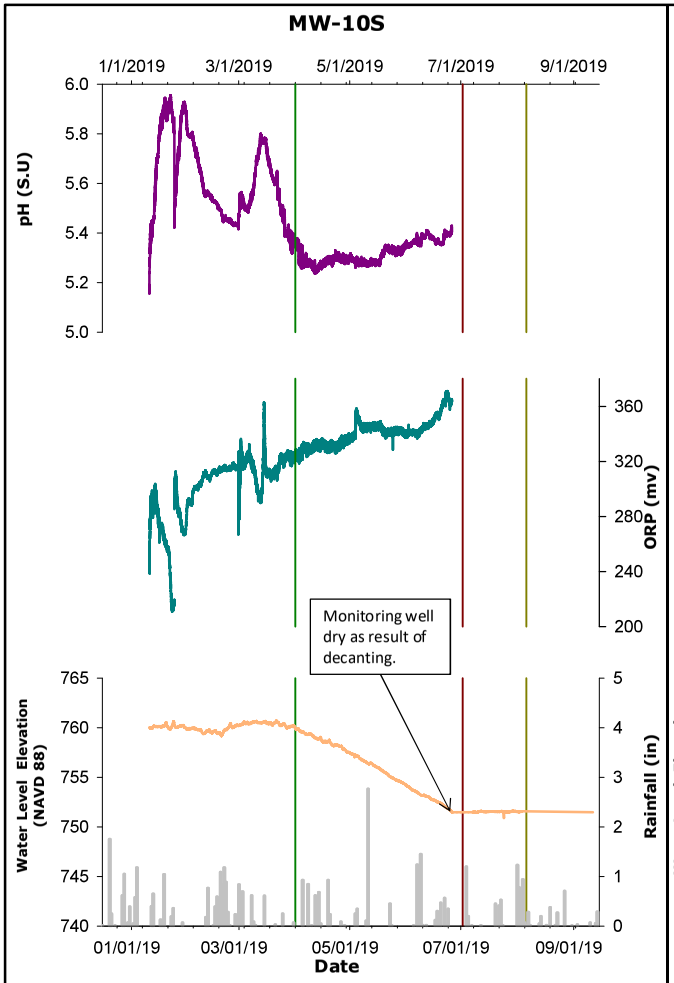
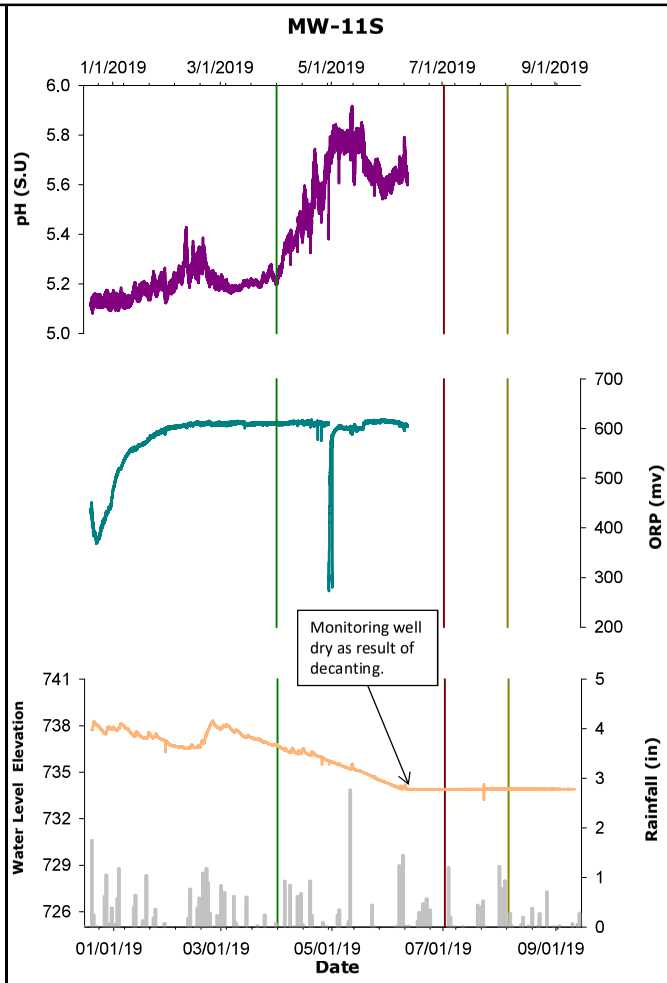
0 50 100 200
HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 40'
5X VERTICAL EXAGGERATION

DRAWN BY: J. CHASTAIN	DATE: 10/22/2019
REVISED BY: D. KREFSKI	DATE: 10/29/2019
CHECKED BY: T. GRANT	DATE: 10/29/2019
APPROVED BY: S. SPINNER	DATE: 10/29/2019
PROJECT MANAGER: S. SPINNER	

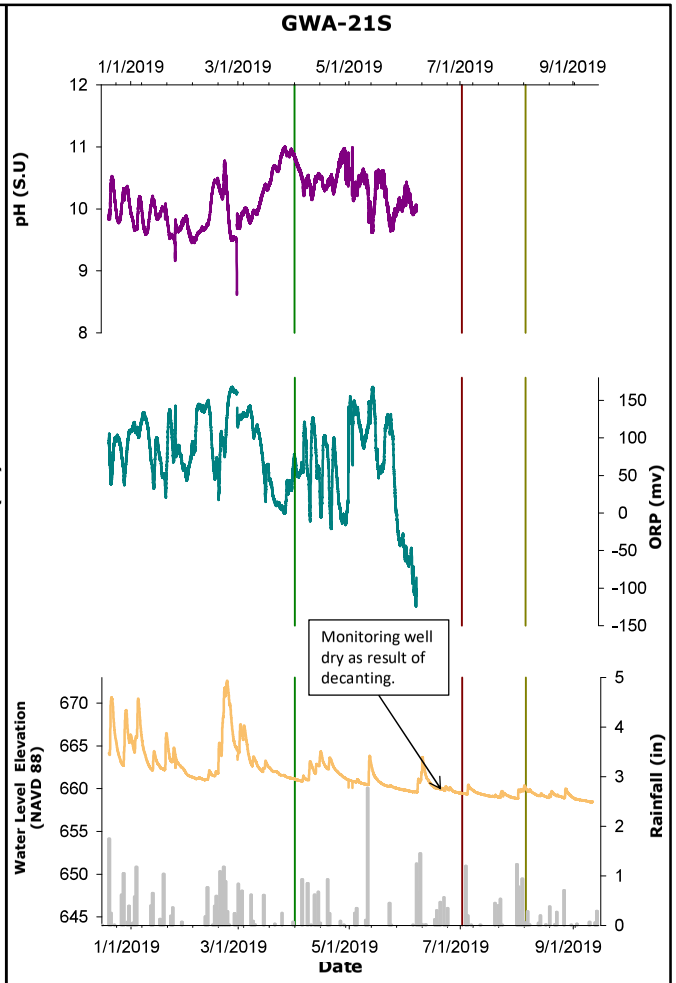
FIGURE 6-11c
GENERAL CROSS SECTION N-N'
VARIABLE GROUP
MEAN OF COBALT, IRON, MANGANESE AND THALLIUM
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



MW-10S: Shallow flow zone monitoring well located west of the active ash basin downstream dam.



MW-11S: Shallow flow zone monitoring well located east of the active ash basin downstream dam.



GWA-21S: Shallow flow zone monitoring well located near the toe of the active ash basin downstream dam.

LEGEND

- pH (SU)
- Oxidation Reduction Potential (ORP) (mV)
- Daily Total Rainfall (inches)
- Decanting Start (03/31/2019)
- Decanting Suspended (07/02/2019)
- Decanting Resumed (08/06/2019)

NOTES:

NAVD 88 – North American Vertical Datum

in – inches

mv – millivolts

SU – standard unit

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DRAWN BY: D. AVARD DATE: 10/31/2019

REVISED BY:

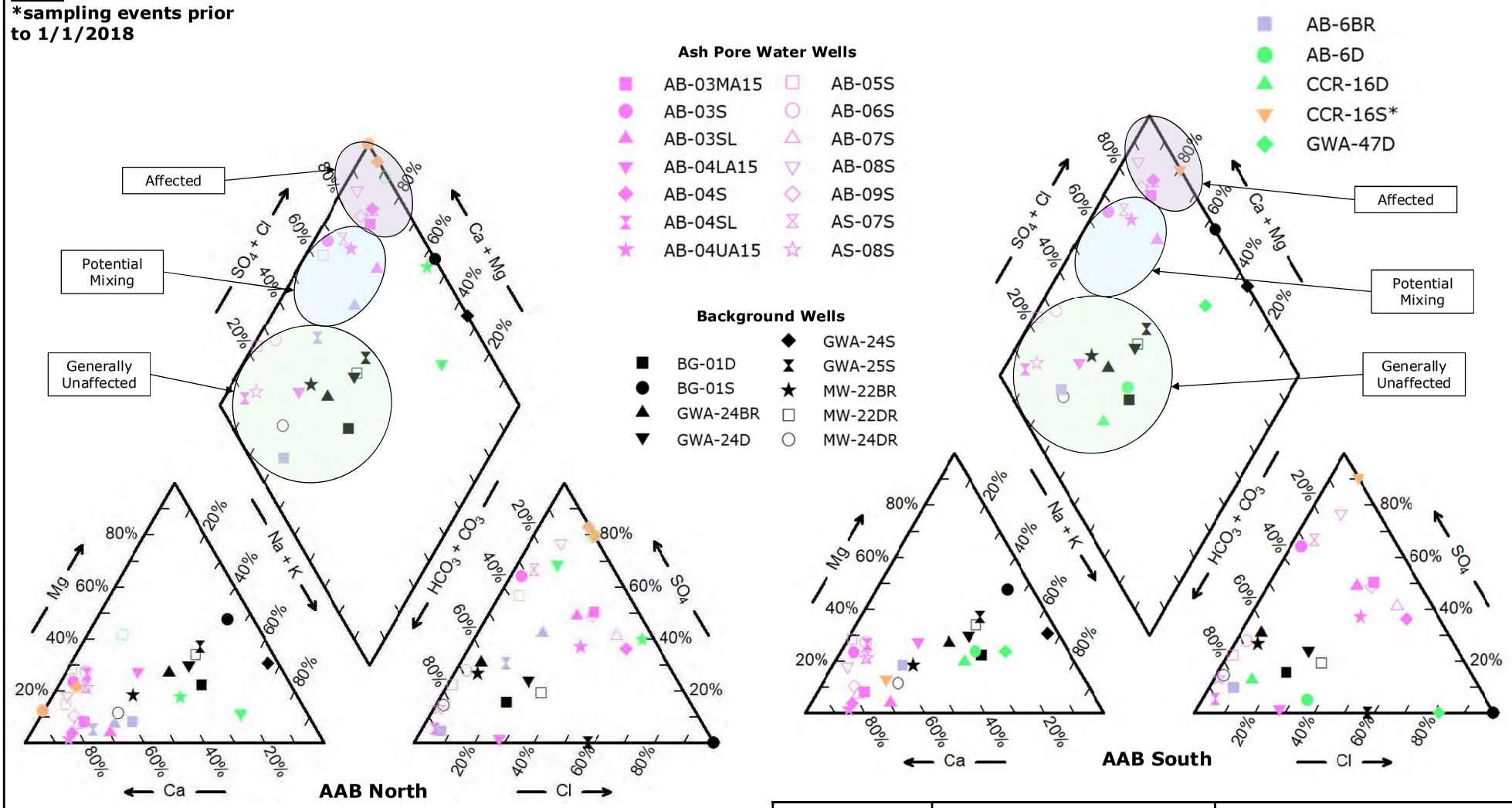
CHECKED BY: T. GRANT

APPROVED BY: T. GRANT

PROJECT MANAGER: S. SPINNER

FIGURE 6-12
GEOCHEMICAL WATER QUALITY PLOTS
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA

Note:
***sampling events prior to 1/1/2018**



DUKE ENERGY CAROLINAS

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REVISED BY:
CHECKED BY: T. Grant
APPROVED BY: T. Grant
PROJECT MANAGER: S. Spinner

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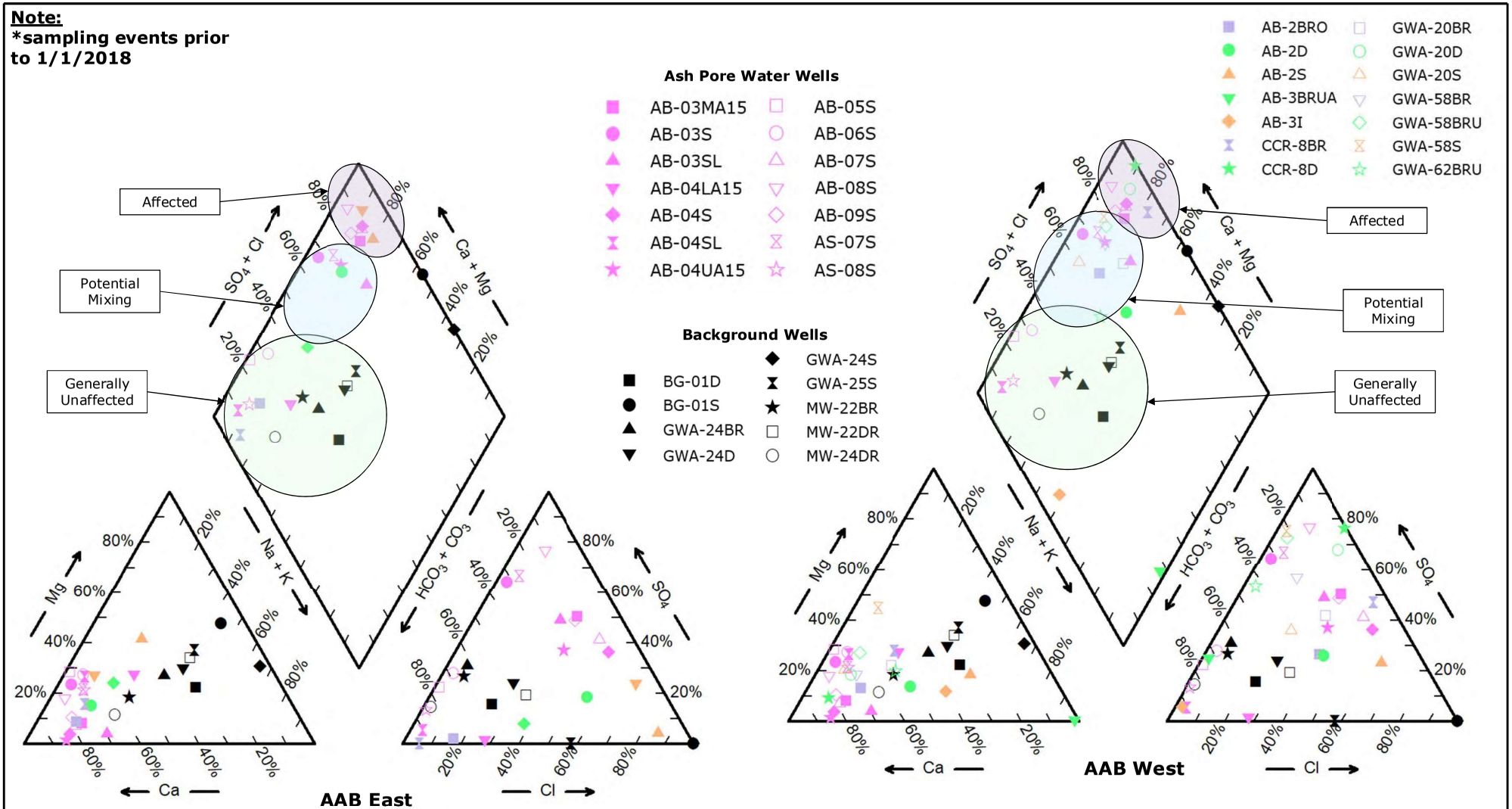
FIGURE 6-13a
ASH PORE WATER AND GROUNDWATER PIPER DIAGRAMS NORTH AND SOUTH TRANSECTS ACTIVE ASH BASIN CORRECTIVE ACTION PLAN UPDATE CLIFFSIDE STEAM STATION MOORESBORO, NORTH CAROLINA

Note:
***sampling events prior to 1/1/2018**



DUKE ENERGY CAROLINAS	DRAWN BY: R. Badum	DATE: 12/4/2019
	REVISED BY:	
	CHECKED BY: T. Grant	
	APPROVED BY: T. Grant	
	PROJECT MANAGER: S. Spinner	
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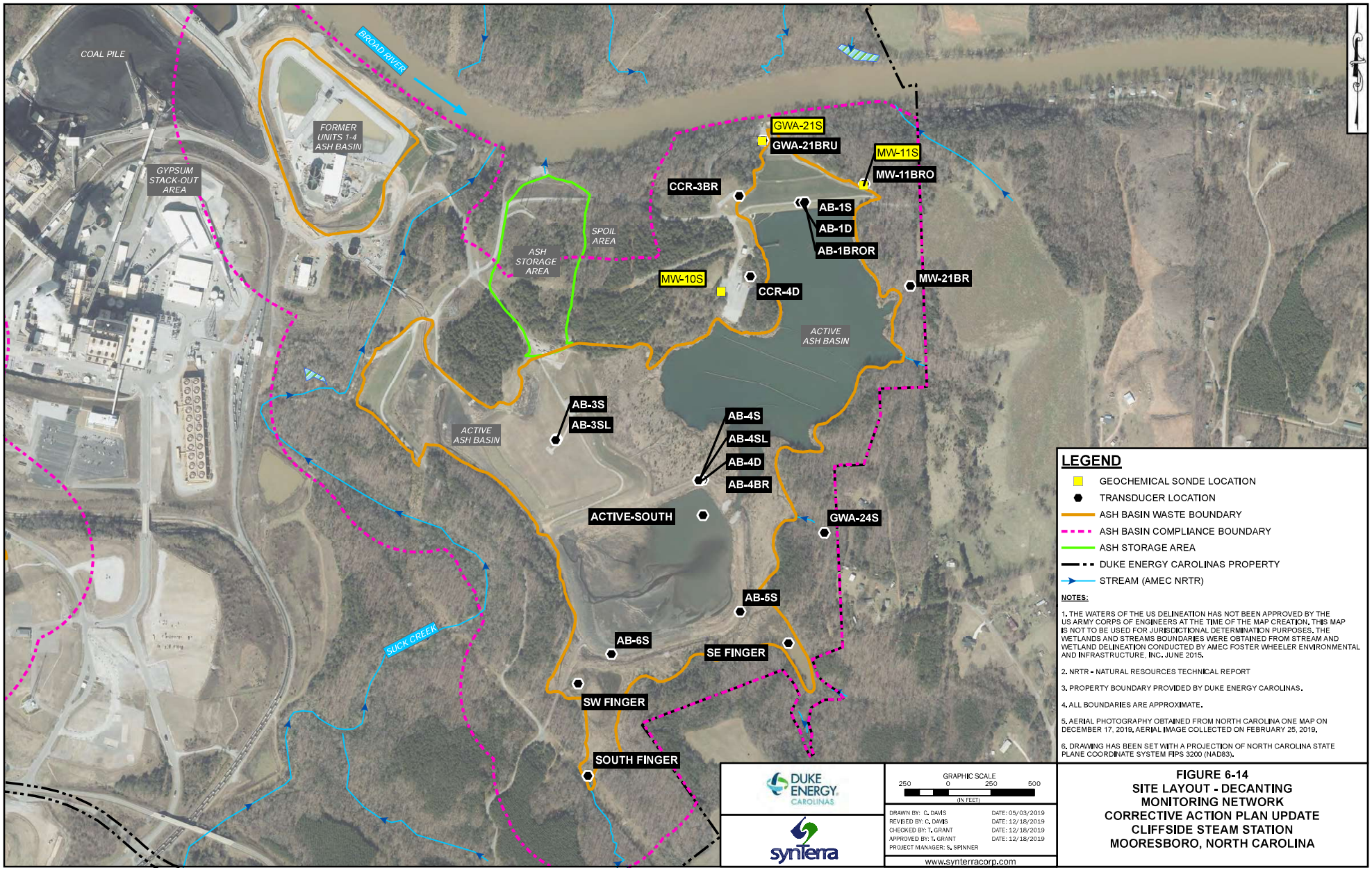
FIGURE 6-13b
ASH PORE WATER AND GROUNDWATER PIPER DIAGRAMS EAST AND WEST TRANSECTS ACTIVE ASH BASIN CORRECTIVE ACTION PLAN UPDATE CLIFFSIDE STEAM STATION MOORESBORO, NORTH CAROLINA


COAL PILE
BROAD RIVER
FORMER UNITS 1-4 ASH BASIN
GYPSUM STACK-OUT AREA
SPOIL AREA
ASH STORAGE AREA
ACTIVE ASH BASIN
ACTIVE ASH BASIN
SUCK CREEK
GWA-21S
GWA-21BRU
MW-11S
MW-11BRO
CCR-3BR
AB-1S
AB-1D
AB-1BROR
MW-10S
CCR-4D
MW-21BR
AB-3S
AB-3SL
AB-4S
AB-4SL
AB-4D
AB-4BR
ACTIVE-SOUTH
GWA-24S
AB-5S
AB-6S
SE FINGER
SW FINGER
SOUTH FINGER
LEGEND
GEOCHEMICAL SONDE LOCATION
TRANSDUCER LOCATION
ASH BASIN WASTE BOUNDARY
ASH BASIN COMPLIANCE BOUNDARY
ASH STORAGE AREA
DUKE ENERGY CAROLINAS PROPERTY
STREAM (AMEC NRTR)
NOTES:
1. THE WATERS OF THE US DELINEATION HAS NOT BEEN APPROVED BY THE US ARMY CORPS OF ENGINEERS AT THE TIME OF THE MAP CREATION. THIS MAP IS NOT TO BE USED FOR JURISDICTIONAL DETERMINATION PURPOSES. THE WETLANDS AND STREAMS BOUNDARIES WERE OBTAINED FROM STREAM AND WETLAND DELINEATION CONDUCTED BY AMEC FOSTER WHEELER ENVIRONMENTAL AND INFRASTRUCTURE, INC. JUNE 2015.
2. NRTR - NATURAL RESOURCES TECHNICAL REPORT
3. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY CAROLINAS.
4. ALL BOUNDARIES ARE APPROXIMATE.
5. AERIAL PHOTOGRAPHY OBTAINED FROM NORTH CAROLINA ONE MAP ON DECEMBER 17, 2019. AERIAL IMAGE COLLECTED ON FEBRUARY 25, 2019.
6. DRAWING HAS BEEN SET WITH A PROJECTION OF NORTH CAROLINA STATE PLANE COORDINATE SYSTEM FIPS 3200 (NAD83).
DUKE ENERGY CAROLINAS
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GRAPHIC SCALE
250 0 250 500
(IN FEET)
DRAWN BY: C. DAVIS DATE: 05/03/2019
REVISED BY: C. DAVIS DATE: 12/18/2019
CHECKED BY: T. GRANT DATE: 12/18/2019
APPROVED BY: T. GRANT DATE: 12/18/2019
PROJECT MANAGER: S. SPINNER
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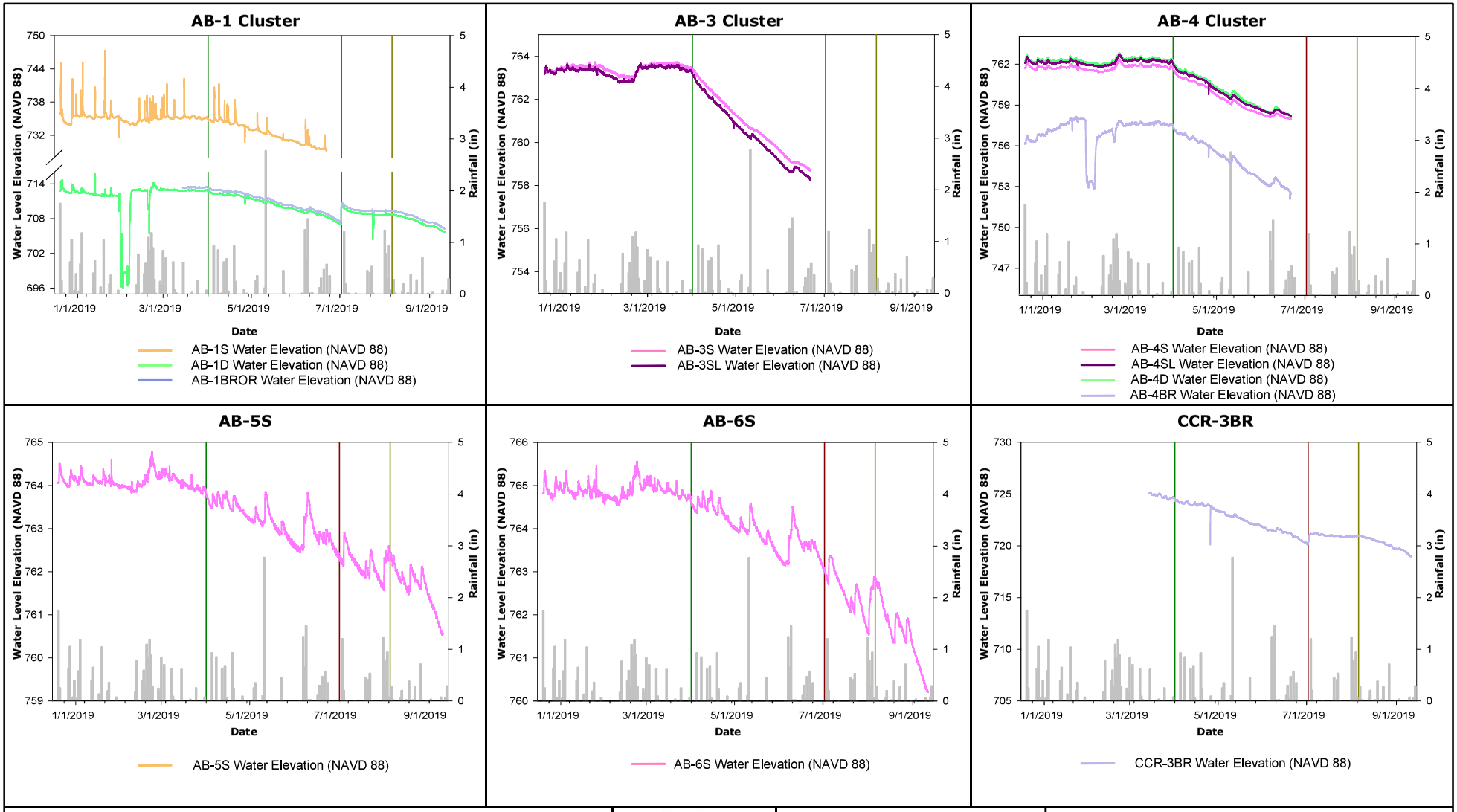
FIGURE 6-14
SITE LAYOUT - DECANTING
MONITORING NETWORK
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NORTH CAROLINA



LEGEND

- Decanting Start (03/31/2019)
- Decanting Suspended (06/02/2019)
- Decanting Resumed (08/06/2019)
- Daily Total Rainfall (inches)

Notes:
Water level elevations are measured in feet
NAVD 88 – North American Vertical Datum 1988
in – inches

DUKE ENERGY CAROLINAS

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REVISED BY: M. ROZIER
CHECKED BY: T. GRANT
APPROVED BY: T. GRANT
PROJECT MANAGER: S. SPINNER
DATE: 10/31/2019

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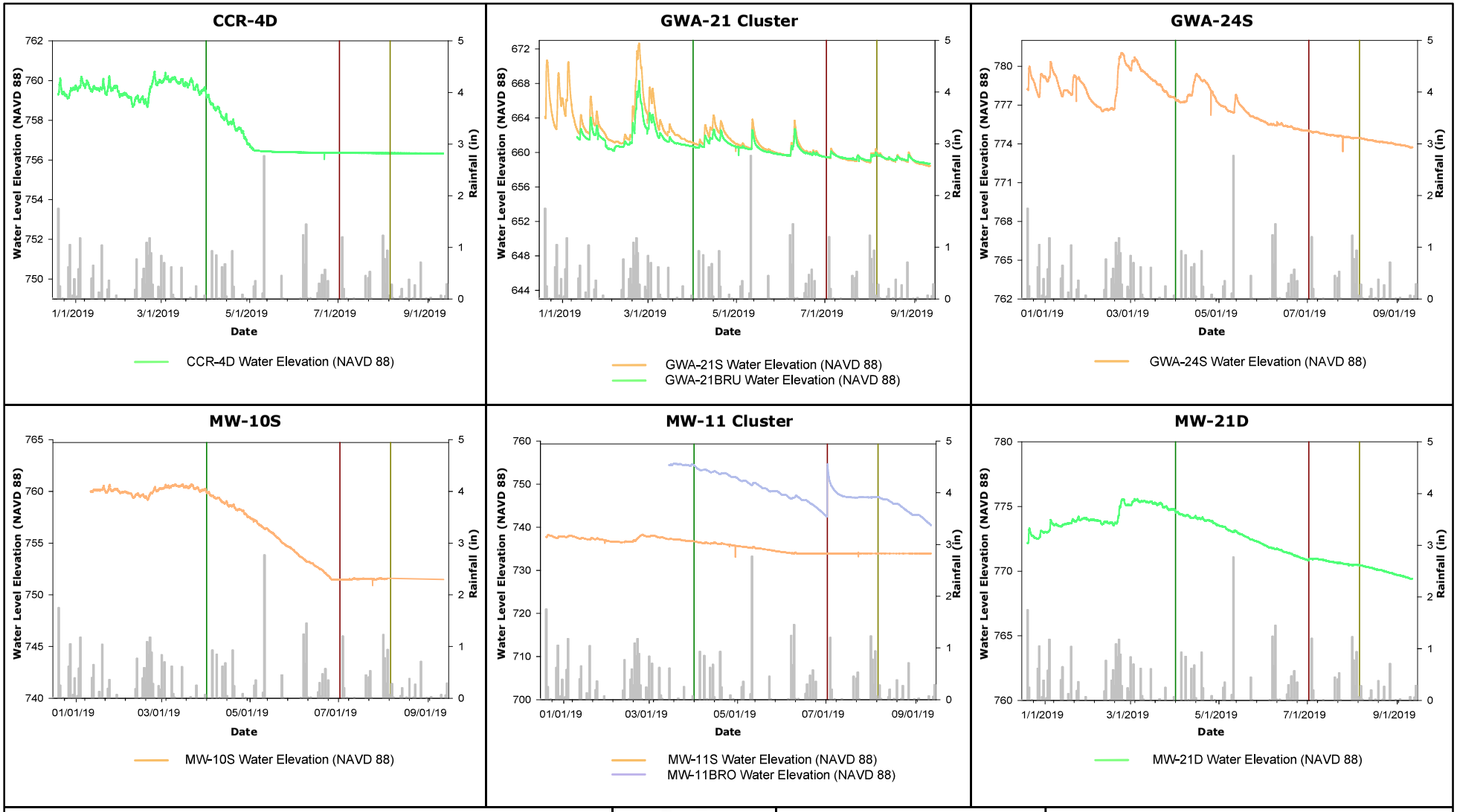
FIGURE 6-15a
HYDROGRAPHS – GROUNDWATER
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NC



LEGEND

- Decanting Start (03/31/2019)
- Decanting Suspended (06/02/2019)
- Decanting Resumed (08/06/2019)
- Daily Total Rainfall (inches)

Notes:
Water level elevations are measured in feet
NAVD 88 – North American Vertical Datum 1988
in – inches

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REVISED BY: M. ROZIER
CHECKED BY: T. GRANT
APPROVED BY: T. GRANT
PROJECT MANAGER: S. SPINNER
DATE: 10/31/2019

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FIGURE 6-15b
HYDROGRAPHS – GROUNDWATER
ACTIVE ASH BASIN
CORRECTIVE ACTION PLAN UPDATE
CLIFFSIDE STEAM STATION
MOORESBORO, NC