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April 29, 2016

Mr. Charles Smith, P.E.
Duke Energy Carolinas, LLC
400 South Tryon Street – ST06J
Charlotte, NC 28202

RE: Potential Closure Options Evaluation
Buck Steam Station CCR Basins
Salisbury, Rowan County, North Carolina

Dear Mr. Smith,

HDR is pleased to provide this draft letter report to present the Potential Closure Options Evaluation for the ash basins located at Duke Energy Carolinas, LLC's (Duke Energy's) Buck Steam Station (Buck), located at 1555 Dukeville Road in Salisbury, North Carolina.

The Potential Closure Options Evaluation included development of conceptual level designs for five different potential ash basin closure options identified through discussions between Duke Energy and HDR. The conceptual designs enabled HDR to compile rough order of magnitude (ROM) construction cost estimates and preliminary construction schedules for each option along with evaluation of the feasibility of each option. This information was used to score the options relative to each other. This scoring will assist Duke Energy in determining which closure option will be advanced to detailed design.

Primary sources of information used in development of this report, ROM construction cost estimates, and the scoring matrix include:

- Buck Steam Station Ash Basin Closure – Conceptual Design Data Report, HDR, February 2013.
- Comprehensive Site Assessment Report, Buck Steam Station Ash Basin, HDR, August 23, 2015.
- Corrective Action Plan Part 1, Buck Steam Station Ash Basin, HDR, November 20, 2015.
- Corrective Action Plan Part 2, Buck Steam Station Ash Basin, HDR, February 19, 2016.

This letter report provides a summary of the potential closure options, the ROM construction cost estimates, and the scoring criteria used to evaluate the options.

Site Background

Buck began operation as a coal-fired generating station in 1926 and was taken offline in April 2013. The Buck Combined Cycle Station (BCCS) natural gas generating facility was constructed at the site and began operations in late 2011. Historically, coal combustion residuals (CCR) from Buck's

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coal combustion process were disposed in ash basins located adjacent to the station to the south and east, near the Yadkin River. Discharge from the ash basin system is currently permitted by the North Carolina Department of Environmental Quality (NCDEQ) Division of Water Resources (DWR) under the National Pollutant Discharge Elimination System (NPDES) Permit NC0004774.

The ash basin system at Buck consists of three cells, associated earthen dikes, discharge structures, and two canals. The cells are designated as Additional Primary Pond (Cell 1), Primary Pond (Cell 2), and Secondary Pond (Cell 3). The ash basins are located to the south (Cell 1) and southeast (Cells 2 and 3) of the retired Buck Steam Station, with a final NPDES permitted outfall that discharges into the Yadkin River on the northeast side of Buck. The original ash basin at Buck began operation in 1957 and was formed by constructing a dam across a tributary of the Yadkin River. The original ash basin impounded the approximate combined footprint of what is now Cells 2 and 3 and was eventually divided into the two cells in 1977 by construction of a separate divider dam and raising of the western portion of the original dam. In 1982, additional storage was created by building a new dam upgradient from Cell 2 and constructing Cell 1, separate from the other cells.

An unlined dry ash storage area is located on the eastern side of Cell 1 and contains dewatered ash that was excavated from Cell 1 in 2009 to provide additional volume for sluiced ash. The ash storage area is located within the waste boundary of Cell 1 and has a soil cover that is vegetated.

There are five dams regulated by the NCDEQ Dam Safety Program that are associated with the Buck ash basins. These include:

- Cells 2/3 Main Dam (ROWAN-047)
- Cell 1 Additional Primary Dam (ROWAN-068)
- Cell 1 to Cell 2 Dam (ROWAN-069)
- Cell 2 to Cell 3 Dam (ROWAN-070)
- Cell 2/3 Divider Dam (ROWAN-071)

The locations of potential influencing factors of closure, including identified water supply wells and environmental resources are shown in Figures A1 and A2 provided in Attachment A. Estimated pre-development topography for the site is provided in Figure B1-1 of Attachment B. Existing site topography, ash basin dam locations, and potential soil resources for closure are provided in Figure B1-2 of Attachment B. Estimated impounded CCR thicknesses within the ash basins are provided in Figure B1-3 of Attachment B.

Regulatory Considerations

Federal CCR Rule

The U. S. Environmental Protection Agency's *Disposal of Coal Combustion Residuals from Electric Utilities* final rule (Federal CCR Rule) was published in the Federal Register on April 17, 2015. This rule regulates CCR as a nonhazardous waste under Subtitle D of the Resource Conservation and

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Recovery Act (RCRA). The effective date of the rule is October 19, 2015. Most of the regulatory deadlines are set from the date the rule was published.

Written Closure Plan requirements are defined in Federal CCR Rule §257.102(b)(1)(i-vi). This written Closure Plan must be prepared and uploaded to Duke Energy's website for public viewing within 18 months of the rule publication date, or on or before October 19, 2016.

North Carolina Rules

In August of 2014, the North Carolina General Assembly passed Senate Bill 729 known as the Coal Ash Management Act, or CAMA, which includes specific regulatory requirements for ash basin closure. The bill requires the assessment, ranking, and closure of ash basins (also referred to as surface impoundments in CAMA) with CCR basins ranked into three classifications: Low-Risk, Intermediate-Risk, and High-Risk impoundments. Closure pathway options and timelines are limited based on the risk classification assigned by the Coal Ash Management Commission (CAMC).

A closure plan will be required for each CCR surface impoundment regardless of risk classification. Regulatory requirements for these closure plans are defined in CAMA Section §130A-309.212(a)(4). In addition to providing a hazard ranking for each of the sites, the CAMC will be responsible for reviewing the closure plans and providing comments.

Potential Closure Options

HDR developed five conceptual potential closure options for Buck that are in accordance with all applicable federal, state, and local regulations and the Duke Energy Closure Programmatic Document, as summarized below.

- Closure Option 1, Hybrid Closure – Consolidate CCR in Cell 1
- Closure Option #1A, Hybrid Closure – Consolidate CCR Away From the Yadkin River within Cell 1 and the southern portion of Cell 2
- Closure Option 2, Closure by Removal and Construction of New On-site Landfill within the Cell 1 Footprint
- Closure Option 3, Closure in Place (CIP) with Limited Footprint Reduction
- Closure Option 4, Closure by Removal and Disposal of Excavated CCR in an Off-site Landfill

Option 1 consists of excavating CCR from Cell 2 and Cell 3 to fill and regrade Cell 1 and the ash storage area. In addition, CCR from the southern portion of Cell 1 closest to the property line would be used to fill and regrade Cell 1 and the ash storage area and this area would be graded to drain. Following these excavation and placement activities, the remainder of Cell 1 and the ash storage area would be capped with an infiltration barrier/cap system meeting the requirements of the Federal CCR Rule. This option would result in complete removal of four out of the five regulated ash basin dams with only the Cell 1 Additional Primary Dam (ROWAN-068) remaining in place. Proposed CCR excavation and closure by removal areas, CCR relocation and regrade areas, and quantity estimates for Option 1 are shown in Figure B2-1 of Attachment B. Cross sections showing

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estimated pre-basin grades, existing grades, estimated proposed final grades, and estimated groundwater surfaces for Option 1 are provided in Figure B2-2 of Attachment B.

Option 1A consists of excavating CCR from the northern portion of Cell 2 and all of Cell 3, which are near the Yadkin River, to fill and regrade the southern portion of Cell 2, Cell 1, and the ash storage area. In addition, CCR from the southern portion of Cell 1 closest to the property line would be used to fill and regrade Cell 1 and the ash storage area and this area would be graded to drain. Following these excavation and placement activities, the remainder of Cell 1 and Cell 2, and the ash storage area would be capped with an infiltration barrier/cap system meeting the requirements of the Federal CCR Rule. This option would result in complete removal of four out of the five regulated ash basin dams with only the Cell 1 Additional Primary Dam (ROWAN-068) remaining in place. Proposed CCR excavation and closure by removal areas, CCR relocation and regrade areas, and quantity estimates for Option 1A are shown in Figure B2-3 of Attachment B. Cross sections showing estimated pre-basin grades, existing grades, estimated proposed final grades, and estimated groundwater surfaces for Option 1A are provided in Figure B2-4 of Attachment B.

Option 2 consists of excavating CCR out of Cell 1, constructing a lined landfill within the Cell 1 footprint, then placing the excavated Cell 1 CCR in the newly constructed landfill. CCR would also be excavated from Cell 2, Cell 3, and the ash storage area and placed in the lined landfill. Following these excavation and placement activities, the lined landfill would be capped with an infiltration barrier/cap system meeting the requirements of the Federal CCR Rule. This option would result in complete removal of four out of the five regulated ash basin dams with only the Cell 1 Additional Primary Dam (ROWAN-068) remaining in place although removal of this dam from the dam safety requirements is considered likely since the saturated ash upstream of the dam will be removed and replaced with compacted unsaturated ash within a lined facility. Proposed CCR excavation and closure by removal areas, new on-site landfill footprint, and quantity estimates for Option 2 are shown in Figure B3-1 of Attachment B. Cross sections showing estimated pre-basin grades, existing grades, estimated proposed final grades, and estimated groundwater surfaces for Option 2 are provided in Figure B3-2 of Attachment B.

Option 3 consists of regrading CCR within Cells 1, 2, and 3 to allow free drainage and provide a suitable base for cap construction. Following these regrading activities, Cells 1, 2, and 3, and the ash storage area would be capped with an infiltration barrier/cap system meeting the requirements of the Federal CCR Rule. This option would result in complete removal of three out of the five regulated ash basin dams with only the Cells 2/3 Main Dam (ROWAN-047) and Cell 1 Additional Primary Dam (ROWAN-068) remaining in place. Proposed CCR relocation and regrade areas and quantity estimates for Option 3 are shown in Figure B4-1 of Attachment B. Cross sections showing estimated pre-basin grades, existing grades, estimated proposed final grades, and estimated groundwater surfaces for Option 3 are provided in Figure B4-2 of Attachment B.

Option 4 consists of the excavation of CCR from Cells 1, 2, and 3, and the ash storage area and the disposal of these materials in an existing off-site lined landfill. This option would result in complete removal of all five regulated ash basin dams. Proposed CCR excavation and closure by

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removal areas and quantity estimates for Option 4 are shown in Figure B5-1 of Attachment B. Cross sections showing estimated pre-basin grades, existing grades, and estimated groundwater surfaces for Option 4 are provided in Figure B5-2 of Attachment B.

Figure B6-1 of Attachment B shows a proposed standard (soil components only) ash basin closure cap system and a proposed alternate (with geosynthetic components) closure cap system. The ROM cost estimates provided in Attachment C (excluding Option 4) assume the alternate closure cap system will be used.

Figure B6-1 of Attachment B also shows a proposed standard landfill liner system for Option 2 with a compacted soil layer and a proposed alternate landfill liner system which substitutes a geosynthetic clay liner (GCL) and prepared subgrade for the compacted soil layer. The ROM cost estimate for Option 2 provided in Attachment C assumes the alternate landfill liner system will be used.

This report includes a tabulated summary of each evaluated closure option, estimated quantities of CCR and soil materials associated with each closure option and a detailed overview of each closure option. The tables and attachments provided are as follows:

- Table 1 – Potential Closure Options Summary
- Table 2 – Quantity Summary
- Table 3 – Option Overview

- Attachment A – GIS maps of the site depicting the location of potential influencing factors for closure, such as water supply wells, streams, wetlands, protected species, etc.
- Attachment B – figures depicting the pre-development topography and existing site conditions and topography in the vicinity of the ash basins, CCR volume estimates, and conceptual level plan drawings and cross sections for each closure option.
- Attachment C – detailed ROM cost estimates for each of the potential closure options evaluated.
- Attachment D – scoring matrix

Option Evaluation

Duke Energy has prepared a scoring matrix to provide a consistent evaluation of the closure options for their various site locations. This scoring evaluation tool considers the following primary criteria:

- Environmental Protection and Impacts
- Cost
- Schedule
- Regional Factors
- Constructability

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Evaluation Criteria

The scoring matrix provided in Attachment D ranks options and criteria on a weighted scale from 0 (least favorable) to 10 (most favorable). Extreme outliers under the criterion Cost and Constructability were assigned a value of "0" in order to eliminate skewing of the scores for the remaining options. The results of the evaluation for Buck are summarized below:

Criterion	Option 1 Hybrid – Consolidate CCR in Cell 1	Option 1A Hybrid – Consolidate CCR Away from Yadkin River	Option 2 New On-Site Landfill	Option 3 Closure in Place	Option 4 Off-Site Landfill
Environmental Protection and Impacts	2.5	2.4	2.5	2.1	1.8
Cost	2.6	3.0	1.6	2.8	0.7
Schedule	0.6	0.7	0	0.6	0.3
Regional Factors	1.2	1.3	1.1	1.2	0.2
Constructability	0.2	0.1	0	0.5	0.2
Total Score	7.0	7.4	5.1	7.1	3.1

The scoring matrix evaluation identifies hybrid closure Option 1A, Consolidate CCR Away from Yadkin River, as the highest scoring among the options considered at Buck although closure Option 3, Closure in Place, is close behind followed by hybrid Option 1, Consolidate CCR in Cell 1.

Rough Order of Magnitude Costs

An ROM cost estimate was prepared for each of the potential closure options based on information and quantities developed during the conceptual design activities. The estimated costs include construction, permitting, engineering design, post-construction O&M, and ground water monitoring. The following is a tabulated summary of the preliminary closure cost estimates.

Cost Category	Option 1	Option 1A	Option 2	Option 3	Option 4
Construction	$131,000,000	$71,000,000	$221,000,000	$57,000,000	$593,000,000
O&M (30 yrs)	$15,000,000	$17,000,000	$20,000,000	$22,000,000	$9,000,000
Total Cost	$146,000,000	$88,000,000	$241,000,000	$79,000,000	$602,000,000

These results show Option 3, Closure in Place, having the lowest total cost at approximately $79,000,000, but the largest O&M cost of approximately $22,000,000. Option 3 has the lowest construction cost largely due to minimal CCR handling required for implementation and the second shortest construction duration. The high O&M costs are a result of the large area of closure cap (163.5 acres) that must be maintained. The second lowest total cost is associated with hybrid Option 1A, Consolidate CCR Away from Yadkin River at $88,000,000.

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The highest total cost occurs with Option 4, Off-Site Landfill, at $602,000,000 due to the large quantity of CCR that must be excavated and hauled to an off-site landfill. Option 4 however, has the lowest estimated O&M costs due to the absence of an on-site closure cap to be maintained.

Detailed tabulated ROM cost estimates are included in Attachment C.

CAMA Risk Classification

As noted earlier, CAMA sets forth classification standards for CCR surface impoundments through which CCR units will be designated as low, intermediate, or high risk. The risk classifications were based upon potential risk to public health and the environment.

On December 31, 2015, NCDEQ released draft proposed risk classifications for Duke Energy's coal ash impoundments in North Carolina. The three Buck ash basins were classified as low-to-intermediate. NCDEQ staff identified a need for additional information from Duke Energy before making definitive determination for the Buck impoundments. Once NCDEQ completes review of all data submitted by Duke Energy, it will modify the classifications to either low or intermediate. According to CAMA, NCDEQ will submit its final proposed risk classifications to the CAMC for final review. The final risk classifications assigned for the impoundments by the CAMC will determine which of the potential closure options presented in this report are feasible based on regulatory considerations.

CAMA Risk Classification	Closure Plan Due Date	Closure Required By	Closure Options
High	12/31/2016	12/31/2019	Closure by removal
Intermediate	12/31/2017	12/31/2024	Closure by removal
Low	12/31/2018	12/31/2029	Closure in place Hybrid closure Closure by removal

As shown above, facilities designated as high or intermediate risk are to be closed by removal of CCR, which includes removal to a new on-site lined landfill (Option 2) or an off-site landfill (Option 4). In addition to closure by removal, low risk facilities can close via hybrid options or closure in place, which include Options 1, 1A, and 3 being considered for Buck. The projected schedules that correspond with the potential closure options with the highest intermediate and low risk rankings are provided below:

Schedule

If Intermediate Risk: Option 2 (New On-Site Landfill)

- Likelihood of meeting Intermediate Risk regulatory deadlines: Low
- Design and permitting: 24 months
- Construction: Begin 7/2/18, End 4/20/26 (95 months)
- Post closure period: 30 years

If Low Risk: Option 1A (Consolidate CCR Away From Yadkin River)

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- Likelihood of meeting Low Risk regulatory deadlines: High
- Design and permitting: 15 months
- Construction: Begin 10/2/17, End 3/6/21 (42 months)
- Post closure period: 30 years

Conclusion

HDR conducted conceptual level design activities in order to evaluate five potential closure option scenarios for the three CCR surface impoundments and the ash storage area located at the Buck Steam Station. Based on an evaluation of the criteria established by Duke Energy (environmental protection/impacts, cost, schedule, regional factors and constructability), hybrid closure Option 1A, Consolidate CCR Away from Yadkin River, scored the highest followed closely by Option 3, Closure in Place, and then Option 1, Consolidate CCR in Cell 1.

North Carolina CAMA regulations provide additional restrictions on the acceptable closure method based on risk criteria. Risk classification at Buck Station is currently ongoing and will dictate which of the five potential closure options are acceptable for consideration under CAMA. Neither closure Option 1 nor Option 1A would be acceptable if the impoundments receive an intermediate risk classification. Under an intermediate risk classification, the scoring matrix places closure Option 2, New On-Site Landfill, ahead of closure Option 4, Off-Site Landfill, which is the only other option that can be considered for impoundments with that classification.

If you have any questions related to the content of this Potential Closure Options Evaluation, please do not hesitate to contact the undersigned.

Sincerely,
HDR Engineering, Inc. of the Carolinas

Thomas M. Yanoschak, P.E.
Senior Project Manager

Joseph C. Readling, P.E.
Section Manager

TABLES
Table 1 – Potential Closure Options Summary
Table 2 – Estimated Quantity Summary
Table 3 – Option Overviews

ATTACHMENTS
Attachment A – GIS Maps
Attachment B – Conceptual Drawings
Attachment C – ROM Cost Estimates
Attachment D – Scoring Matrix

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Table 1 – Potential Closure Options Summary

Option	Description
1. Hybrid Closure – Consolidate CCR in Cell 1	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 3. Excavate CCR from Cells 2 and 3 and use the material to fill and regrade Cell 1 and the ash storage area. Excavate CCR from the southern portion of Cell 1 and use the material to fill and regrade the remainder of Cell 1 and the ash storage area. 4. Over excavate soils beneath excavated CCR (assumed 2-ft) and use the material to fill and regrade Cell 1 and the ash storage area. 5. Backfill excavated areas within Cells 1, 2, and 3 to promote positive surface water drainage. 6. Construct a closure cap over the fill area within Cell 1 and the ash storage area. 7. Perform dam removal (ROWAN-047, -069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 8. Conduct groundwater remediation and/or monitoring, if/as needed.
1A. Hybrid Closure – Consolidate CCR Away From Yadkin River	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 3. Construct a stabilized slope wedge as needed within Cell 2 at the limit of CCR excavation using deep mixing columns or other appropriate stabilization methods. Assume wedge 600' long, between 10' and 40' high, and width of 2/3 height. 4. Excavate CCR from the northern portion of Cell 2 and entire Cell 3 and use the material to fill and regrade the southern portion of Cell 2, Cell 1, and the ash storage area. Excavate CCR from the southern portion of Cell 1 and use the material to fill and regrade the remainder of Cell 1 and the ash storage area. 5. Over excavate soils beneath excavated CCR (assumed 2-ft) and use the material to fill and regrade Cell 1 and the ash storage area. 6. Backfill excavated areas within Cells 1, 2, and 3 to promote positive surface water drainage. 7. Construct a closure cap over the fill areas within Cell 1, Cell 2, and the ash storage area. 8. Perform dam removal (ROWAN-047, -069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 9. Conduct groundwater remediation and/or monitoring, if/as needed.

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Table 1 – Potential Closure Options Summary (continued)

Option	Description
2. New On-Site Landfill	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Excavate CCR and over excavate soils (assumed 2-ft) from the southernmost approximately 15 acres of Cell 1 and temporarily stockpile within the northern portion of Cell 1. Construct Phase 1 of landfill liner system. 3. Excavate CCR and over excavate soils (assumed 2-ft) from the next approximately 15 acres of Cell 1 and place within the Phase 1 landfill. Construct Phase 2 of the landfill liner system. 4. Similarly, excavate and construct Phase 3 and Phase 4 of the landfill until all CCR and over excavated soils have been removed from Cell 1 and placed within the lined landfill. Install underdrain system beneath the landfill liner to maintain minimum 5-ft buffer between the seasonal high groundwater table and the bottom of the liner system. 5. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct landfill closure cap and regrade excavated areas. 6. Excavate CCR from Cells 2, 3 and the ash storage area and place within the lined landfill. 7. Over excavate soils beneath excavated CCR (assumed 2-ft) and place within the lined landfill. 8. Backfill excavated areas within Cells 2, 3, and the ash storage area to promote positive surface water drainage. 9. Construct a closure cap over the landfill. 10. Perform dam removal (ROWAN-047, -069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 11. Petition to remove Cell 1 Additional Primary Dam (ROWAN-068) from dam safety requirements through demonstration that no flowable materials or impounded liquid is maintained behind the dam. 12. Conduct groundwater remediation and/or monitoring, if/as needed.
3. Closure in Place	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap. 3. Regrade Cells 1, 2, 3, and the ash storage area to promote positive surface water drainage. 4. Construct a closure cap over Cells 1, 2, 3, and the ash storage area. 5. Perform dam removal (ROWAN-069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 6. Conduct groundwater remediation and/or monitoring, if/as needed.

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Table 1 – Potential Closure Options Summary (continued)

Option	Description
4. Off-site Landfill	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to regrade excavated areas. 3. Excavate CCR from Cells 1, 2, 3, and the ash storage area to dispose in an approved off-site landfill. 4. Over excavate soils beneath excavated CCR (assumed 2-ft) and dispose in an approved off-site landfill. 5. Backfill excavated areas within Cells 1, 2, and 3 to promote positive surface water drainage. 6. Perform dam removal (ROWAN-047, -068, -069, and -070) through complete removal or breaching and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to regrade excavated areas. 7. Conduct groundwater remediation and/or monitoring, if/as needed.

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Table 2 – Estimated Quantity Summary

Item	Volume (CY)	2D Surface Area (Acres)
Existing CCR		
Cell 1 CCR Footprint	NA	71
Cell 1 CCR Volume	2,591,000	NA
Cell 1 Dam Borrow Area Volume[1]	368,000	NA
Cell 1 Over Excavated Soil (2-ft)	229,000	NA
Cell 2 CCR Footprint	NA	57.5
Cell 2 CCR Volume	1,548,000	NA
Cell 2 Dam Borrow Area Volume[1]	117,000	NA
Cell 2 Over Excavated Soil (2-ft)	186,000	NA
Cell 3 CCR Footprint	NA	21.5
Cell 3 CCR Volume	615,000	NA
Cell 3 Dam Borrow Area Volume[1]	105,000	NA
Cell 3 Over Excavated Soil (2-ft)	69,000	NA
Ash Storage Area Footprint	NA	13.5
Ash Storage Area CCR Volume	196,000	NA
Ash Storage Area Over Excavated Soil (2-ft)	44,000	NA
TOTAL	**6,068,000**	**163.5**
Free Water (Based on Water Elevations Obtained June 25 and 26, 2015)[4]		
Cell 1 (below el. 700.34)	3,249,000 gal	5.0
Cell 2 (below el 681.70)	43,728,000 gal	15.7
Cell 3 Main Pond (below el. 672.74)	29,818,000 gal	11.4
Cell 3 Isolated Pond (below el. 673.03)	1,965,000 gal	1.8
TOTAL	**78,760,000 gal**	**33.9**
Proposed On-site Borrow Areas and Existing Soil Stockpiles		
Soil Stockpile 1	85,000	4.0
Soil Stockpile 2	30,000	2.4
Borrow Area 1 (assume 10' deep)	287,000	17.8
Borrow Area 2 (assume 10' deep)	54,000	3.5
Borrow Area 3 (assume 10' deep)	60,000	3.7
Borrow Area 4 (assume 10' deep)	70,000	4.7
Borrow Area 5 (assume 10' deep)	69,000	4.3
TOTAL	**655,000**	**40.4**

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Table 2 – Estimated Quantity Summary (continued)

Item	Volume (CY)	2D Surface Area (Acres)
Option 1, Hybrid Closure – Consolidate CCR in Cell 1		
Cell 2 CCR Volume	1,548,000	NA
Cell 2 Dam Borrow Area Volume[1]	117,000	NA
Cell 2 Over Excavated Soil (2 ft)	186,000	NA
Cell 3 CCR Volume	615,000	NA
Cell 3 Dam Borrow Area Volume[1]	105,000	NA
Cell 3 Over Excavated Soil (2 ft)	69,000	NA
TOTAL CCR AND OVER EXCAVATED SOIL EXCAVATION	**2,640,000**	**NA**
Cell 2 Dam Excavation	117,000	NA
Cell 3 Dam Excavation	105,000	NA
Divider Dam Excavation	39,000	NA
TOTAL DAM EXCAVATION	**261,000**	**NA**
Cell 1/Ash Storage Area Cap Volume (2')	268,000	83
ADDITIONAL VOLUME AVAILABLE IN CELL 1	**2,123,000**	**NA**
COMPACTED VOLUME REQUIRED[2]	**2,676,000**	**NA**
CAPACITY DEFICIT	**553,000**	**NA**
Option 1A , Hybrid Closure – Consolidate CCR Away From Yadkin River		
Cell 2 CCR Volume Excavated	586,000	NA
Cell 2 Dam Borrow Area Volume[1]	117,000	NA
Cell 2 Over Excavated Soil (2 ft)	66,000	NA
Cell 3 CCR Volume	615,000	NA
Cell 3 Dam Borrow Area Volume[1]	105,000	NA
Cell 3 Over Excavated Soil (2 ft)	69,000	NA
TOTAL CCR AND OVER EXCAVATED SOIL EXCAVATION	**1,558,000**	**NA**
Cell 2 Dam Excavation	117,000	NA
Cell 3 Dam Excavation	105,000	NA
Divider Dam Excavation	39,000	NA
TOTAL DAM EXCAVATION	**261,000**	**NA**
Cell 1/Ash Storage Area Cap Volume (2 ft)	273,000	84.5
Cell 2 Cap Volume (2 ft)	119,000	37
TOTAL CAP VOLUME	**392,000**	**121.5**
ADDITIONAL VOLUME AVAILABLE IN CELL 1	**1,333,000**	**NA**
ADDITIONAL VOLUME AVAILABLE IN CELL 2	**301,000**	**NA**
COMPACTED VOLUME REQUIRED[2]	**1,395,000**	**NA**
CAPACITY SURPLUS	**239,000**	**NA**

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Table 2 – Estimated Quantity Summary (continued)

Item	Volume (CY)	2D Surface Area (Acres)
Option 2, New On-Site Landfill		
Cell 1 CCR Volume Excavated	2,591,000	NA
Cell 1 Dam Borrow Area Volume[1]	368,000	NA
Cell 1 Over Excavated Soil (2 ft)	229,000	NA
Cell 2 CCR Volume	1,548,000	NA
Cell 2 Dam Borrow Area Volume[1]	117,000	NA
Cell 2 Over Excavated Soil (2 ft)	186,000	NA
Cell 3 CCR Volume	615,000	NA
Cell 3 Dam Borrow Area Volume[1]	105,000	NA
Cell 3 Over Excavated Soil (2 ft)	69,000	NA
Ash Storage Area Volume Excavated	195,000	NA
Ash Storage Area Over Excavated Soil (2 ft)	45,000	NA
TOTAL CCR AND OVER EXCAVATED SOIL EXCAVATION	**6,068,000**	**NA**
Cell 2 Dam Excavation	117,000	NA
Cell 3 Dam Excavation	105,000	NA
Divider Dam Excavation	39,000	NA
TOTAL DAM EXCAVATION	**261,000**	**NA**
TOTAL LANDFILL CAP VOLUME	164,000	50.9
BACKFILL FOR GROUNDWATER BUFFER	68,000	NA
DOUBLE-HANDLED CCR DURING LANDFILL CONSTRUCTION	500,000	NA
ADDITIONAL VOLUME AVAILABLE IN LANDFILL	5,362,000	NA
COMPACTED VOLUME REQUIRED[3]	5,362,000	NA
CAPACITY DEFICIT	0	NA
Option 3 , Closure in Place		
Cell 1 Regrading - Cut	253,000	NA
Cell 1 Regrading - Fill	351,000	NA
DIFFERENCE	**98,000**	**NA**
Cell 2/3 Regrading - Cut	419,000	NA
Cell 2/3 Regrading - Fill	499,000	NA
DIFFERENCE	**80,000**	**NA**
Divider Dam Excavation	39,000	NA
Cell 1/Ash Storage Area Cap Volume (2 ft)	273,000	84.5
Cell 2 Cap Volume (2 ft)	186,000	57.5
Cell 3 Cap Volume (2 ft)	69,000	21.5
TOTAL CAP VOLUME	**528,000**	**163.5**

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Table 2 – Estimated Quantity Summary (continued)

Item	Volume (CY)	2D Surface Area (Acres)
Option 4 , Off-site Landfill		
Cell 1 CCR Volume	2,591,000	NA
Cell 1 Dam Borrow Area Volume[1]	368,000	NA
Cell 1 Over Excavated Soil (2 ft)	229,000	NA
Cell 2 CCR Volume	1,548,000	NA
Cell 2 Dam Borrow Area Volume[1]	117,000	NA
Cell 2 Over Excavated Soil (2 ft)	186,000	NA
Cell 3 CCR Volume	615,000	NA
Cell 3 Dam Borrow Area Volume[1]	105,000	NA
Cell 3 Over Excavated Soil (2 ft)	69,000	NA
Ash Storage Area CCR Volume	196,000	NA
Ash Storage Area Over Excavated Soil (2-ft)	44,000	NA
TOTAL CCR AND OVER EXCAVATED SOIL EXCAVATION	**6,068,000**	**NA**
Cell 1 Dam Excavation	368,000	NA
Cell 2 Dam Excavation	117,000	NA
Cell 3 Dam Excavation	105,000	NA
Divider Dam Excavation	39,000	NA
TOTAL DAM EXCAVATION	**629,000**	**NA**

Notes:

[1] Soil for dam construction assumed to be obtained from within respective cell. Dam fill volume added to CCR quantity.

[2] Includes compaction factor of 6% for CCR excavated from Cells 2 and 3 (based on standard Proctor test results for CCR excavated from Cell 2) and settlement of CCR within Cell 1 of 3% by volume.

[3]Includes compaction factor of 6% for CCR excavated from Cells 2 and 3 (based on standard Proctor test results on CCR samples obtained from Cell 2) and 15% for CCR excavated from Cell 1 (based on standard Proctor test results on CCR samples obtained from Cell 1).

[4]Free water elevations from topographic survey performed by WSP as part of the CSA field activities.

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Table 3 – Option Overviews: Option 1

Option 1, Hybrid Closure – Consolidate CCR in Cell 1	
Subject	**Description**
Description	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 3. Excavate CCR from Cells 2 and 3 and use the material to fill and regrade Cell 1 and the ash storage area. Excavate CCR from the southern portion of Cell 1 and use the material to fill and regrade the remainder of Cell 1 and the ash storage area. 4. Over Excavate soils beneath excavated CCR (assumed 2-ft) and use the material to fill and regrade Cell 1 and the ash storage area. 5. Backfill excavated areas within Cells 1, 2, and 3 to promote positive surface water drainage. 6. Construct a closure cap over the fill area within Cell 1 and the ash storage area. 7. Perform dam removal (ROWAN-047, -069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 8. Conduct groundwater remediation and/or monitoring, if/as needed.
Details	1. Lower the free water levels within Cells 1, 2, and 3 using the existing discharge structures to the extent possible. It is believed that this lowering can be done under the existing NPDES permit. Estimated free water volumes within Cells 1, 2, and 3 as of June 25 and 26, 2015 are 3,249,000 gal, 43,728,000 gal, and 31,783,000 gal, respectively. 2. Remove remaining free water by using floating pumps and screened intakes and pumping through the existing discharge structures. Consider effluent bypass forcemain from Cell 1 to Cell 3 to avoid introducing additional water into Cell 2 which will require double pumping. Install temporary wastewater treatment system near Cell 3 NPDES outfall to treat all water pumped from Cells 1, 2, and 3 in accordance with NPDES permit prior to discharge to the Yadkin River. It is assumed that process water flowing into the ash basins will be stopped by this time. Additional stormwater generated within the ash basin drainage areas will still need to be pumped and treated. 3. Abandon wells and piezometers within ash basins and ash storage area footprints. 4. Perform Divider Dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 5. Dewater CCR in Cells 2 and 3 and the areas in the southern portion of Cell 1 that are to be excavated by constructing trenches within the CCR and by allowing the seepage water to drain by gravity, or by pumping, to Cell 3 for treatment. Saturated CCR can also be stockpiled to allow drainage.

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Option 1, Hybrid Closure – Consolidate CCR in Cell 1	
Subject	**Description**
	6. Lower water table within southern portion of Cell 1 as needed to provide firm working surface for CCR placement. Water table can be lowered by excavating trenches to collect seepage water for gravity drainage or by pumping to Cell 3 for treatment or by installing well points. 7. Excavate dewatered CCR from Cells 2 and 3, and the areas in the southern portion of Cell 1 that are to be excavated, and place and compact within Cell 1. Maintain minimum setbacks during nesting periods for eagle's nest and heron rookery and schedule work in these areas accordingly. After CCR is removed, continue soil over excavation (assumed 2 ft depth) and place and compact within Cell 1. CQA to certify when areas have been adequately excavated to remove sources of contamination. Total estimated excavation 2,640,000 cy. 8. Remove discharge structures and associated dams in Cell 1 (ROWAN-069) and Cell 2 (ROWAN-070) when these structures are no longer needed to facilitate drainage. 9. As areas within Cell 1 and the ash storage area reach final CCR design grade, prepare surface for cap construction. Install cap including associated drainage structures in accordance with approved drawings, specifications, and CQA Plan. Use soil from decommissioned dams for cap construction. Estimated soil required for cap construction 268,000 cy. Estimated soil available from dam deconstruction 261,000 cy. Obtain additional soil for closure from on site or off site borrow areas. Establish vegetation on completed cap. 10. As areas within Cells 2 and 3, and the areas in the southern portion of Cell 1 that are to be excavated are certified to have all CCR removed, grade to drain and to establish a stabilized surface for vegetation. Use soil from decommissioned dams for grading. Establish vegetation and construct lined drainage channels along valley floors. 11. Deconstruct Main Dam (ROWAN-047) as CCR is removed from Cells 2 and 3. Use soil to grade excavated areas and to construct cap within Cell 1 and the ash storage area. Remove remainder of dam after all CCR has been excavated and placed in Cell 1 and capped. Decommission temporary wastewater treatment plant and establish new NPDES outfall location. 12. Monitor Cell 1 cap, ash storage area cap, and restored areas within Cells 1, 2, and 3 for erosion, sedimentation, or other signs of distress. Make repairs promptly. 13. Conduct groundwater remediation and/or monitoring, if/as needed.
Environmental Protections and Impacts	1. Four of five regulated impoundment dams will be decommissioned and removed leaving only the Cell 1 Additional Primary Dam (ROWAN-068) in place. Preliminary groundwater monitoring indicates total dewatering of CCR within Cell 1 after cap construction will not occur, resulting in minimal risk of breach/failure. 2. Current groundwater conditions do not involve significant exceedances or

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Option 1, Hybrid Closure – Consolidate CCR in Cell 1	
Subject	**Description**
	risk to receptors. 3. Groundwater contamination source is not fully eliminated by Hybrid Closure Option 1; however, the unlined CCR footprint is reduced to 83 acres, which is the smallest unlined area of Options 1, 1A, and 3. 4. Proximity to River Bank or Shoreline – Removal of CCR from Cells 2 and 3 significantly reduces proximity to Yadkin River and allows removal of Main Dam (Rowan-047). Option 1 is approximately equivalent to Option 2 with respect to this criterion but is not as protective as Option 4 (assuming off-site landfill is not located adjacent to a river). 5. Proximity to Public Drinking Water Intakes – No downstream public drinking water intakes identified in the Buck Comprehensive Site Assessment (CSA). 6. Proximity to Downgradient Potable Well – No downgradient potable wells identified in the Buck CSA. 7. Restoration of Habitat, Streams, or Wetlands – Removal of CCR from Cells 2 and 3 will enable approximately 80.5 acres of habitat and wetlands to be restored. This is the third greatest amount of habitat restoration after Options 4 and 2. 8. Air Emissions Off-site (based on miles driven) – The available CCR volume within Cell 1 assuming 5 percent closure slopes is estimated to be 553,000 cy short of what is required. This quantity of CCR will therefore have to be hauled to an off-site landfill which will generate off-site air emissions but to a significantly lesser extent than Option 4. 9. Air Emissions On-site (based on gallons of fuel consumed) from Closure Implementation – On-site air emissions would be the third least after Options 3 and 1A. 10. Avoidance of Greenfield Disturbance – Little to no greenfield disturbance assuming CCR hauled to off-site landfill is placed within an existing landfill. 11. Stormwater Impacts - All contact water will be routed to Cell 3 where a temporary treatment plant will be installed to treat all drainage from ash basins prior to discharge to the Yadkin River. Temporary erosion and sediment controls will remain in-place until excavated and capped areas are stabilized. 12. Effects on Eagle Nest and Heron Rookery – Nest and rookery remain intact but option is essentially tied with Options 2 and 4 for most excavation in this area.
Cost	1. Capital costs ≈ $131,000,000 2. Long-term operations, maintenance, and monitoring ≈ $500,000 per year. 3. Avoided costs – Off-site hauling of CCR (except for 553,000 cy on-site capacity deficit), lined landfill. 4. Additional groundwater remediation costs (capital and O&M).
Schedule	1. High likelihood of meeting regulatory deadlines. 2. Design and permitting - 15 months

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Option 1, Hybrid Closure – Consolidate CCR in Cell 1	
Subject	**Description**
	3. Construction – 50 months to be completed on 9/9/21 (based on construction start date of 10/2/17) and designed to meet CAMA deadline of 12/31/29 for low risk facilities. Duration requires that 1,000,000 cy of CCR per year is moved and 50 ac of final cover be constructed per year. 4. Post-closure – 30 years.
Regional Factors	1. Remaining CCR footprint is unlined but least unlined footprint except for Options 2 and 4. 2. NPDES permit modification may be required. 3. Plan or potential for beneficial use of site – Restore excavated areas to natural setting although restored area is less than Options 2 and 4. 4. Soil requirements - 268,000 cy soil required for cap construction which can be obtained from existing on-site soil stockpiles and dam removal without borrow area development. 5. CCR beneficial use – None. 6. Transportation impact (based on miles driven) – 553,000 cy of CCR will still need to be transported off-site which is second highest option after Option 4. On-site transportation may need to be routed onto existing plant roads to avoid impacts to eagle nest and blue heron rookery. On-site miles third highest after Options 2 and 4. 7. Noise impact due to on-site activity (based on proximity to neighbors) – High, substantial excavation and fill activity near southern neighbors. Third highest impact after Options 2 and 4. 8. Visual impact (based on final height of storage facility, land uses within the viewshed) – Medium, visible mounding in Cell 1 but Cells 2 and 3 restored to natural setting. Has least visual impact of all options except for Option 4.
Constructability	1. This option has the third greatest quantity of CCR that must be handled after Options 4 and 2 and the third longest construction duration. 2. Will require routing stormwater from Cell 1 through Cells 2 and 3 during CCR excavation within Cells 2 and 3. 3. Stormwater holding/treatment pond can be located within current CCR footprint. 4. Requires no on-site borrow area development. 5. Deep excavations within the CCR are necessary within Cells 2 and 3. 6. No CCR stabilization (e.g. deep soil mixing) required beyond dewatering. 7. Third most dewatering required after Options 2 and 4. Dewatering includes free water removal, drawdown of water table within CCR in southern portion of Cell 1 where close to the surface to allow for CCR excavation/placement, and drawdown of water within CCR in Cells 2 and 3 to allow CCR excavation. 8. Requires arrangements to be made for off-site disposal of 553,000 cy of CCR which can not be placed within Cell 1 with 5% final slope. Would require development of CCR loading infrastructure.
Advantages	1. Significant reduction in unlined CCR footprint. 2. Significant restoration to original habitat.

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Option 1, Hybrid Closure – Consolidate CCR in Cell 1	
Subject	**Description**
	3. Main Dam removal/decommissioning. 4. No on-site borrow areas required. 5. Can be safely executed using typical ash pond closure construction methods. 6. Minimized post-closure requirements. 7. Removal of CCR closest to Yadkin River. 8. Partial removal of CCR closest to neighbors to the south.
Disadvantages	1. Significant construction impact to neighbors. 2. Partial unlined CCR footprint remains. 3. Significant impact to Bald Eagle nest and Blue Heron rookery during CCR excavation. 4. Requires off-site disposal of 553,000 cy of CCR. 5. Need to find available landfill space within a reasonable distance to site. 6. Liabilities associated with transport of large quantities of CCR on public roads. 7. Does not eliminate source of groundwater contamination in Cell 1. 8. Uncertain whether Additional Primary Dam can be decommissioned due to probable saturated CCR remaining behind the dam. 9. Probable that CCR will remain below the water table in lower portion of Cell 1. 10. Deep CCR excavation required in Cells 2 and 3.

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Table 3 – Option Overviews: Option 1A

Option 1A, Hybrid Closure – Consolidate CCR Away From Yadkin River	
Subject	**Description**
Description	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 3. Construct a stabilized slope wedge as needed within Cell 2 at the limit of CCR excavation using deep mixing columns or other appropriate stabilization methods. 4. Excavate CCR from the northern portion of Cell 2 and entire Cell 3 and use the material to fill and regrade the southern portion of Cell 2, Cell 1, and the ash storage area. Excavate CCR from the southern portion of Cell 1 and use the material to fill and regrade the remainder of Cell 1 and the ash storage area. 5. Over Excavate soils beneath excavated CCR (assumed 2-ft) and use the material to fill and regrade Cell 1 and the ash storage area. 6. Backfill excavated areas within Cells 1, 2, and 3 to promote positive surface water drainage. 7. Construct a closure cap over the fill areas within Cell 1, Cell 2, and the ash storage area. 8. Perform dam removal (ROWAN-047, -069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 9. Conduct groundwater remediation and/or monitoring, if/as needed.
Details	1. Lower the free water levels within Cells 1, 2, and 3 using the existing discharge structures to the extent possible. It is believed that this lowering can be done under the existing NPDES permit. Estimated free water volumes within Cells 1, 2, and 3 as of June 25 and 26, 2015 are 3,249,000 gal, 43,728,000 gal, and 31,783,000 gal, respectively. 2. Remove remaining free water by using floating pumps and screened intakes and by pumping through the existing discharge structures. Consider effluent bypass forcemain from Cell 1 to Cell 3 to avoid introducing additional water into Cell 2 which will require double pumping. Install temporary wastewater treatment system near Cell 3 NPDES outfall to treat all water pumped from Cells 1, 2, and 3 in accordance with NPDES permit prior to discharge to the Yadkin River. It is assumed that process water flowing into the ash basins will be stopped by this time. Additional stormwater generated within the ash basin drainage areas will still need to be pumped and treated. 3. Abandon wells and piezometers within ash basins and ash storage area footprints. 4. Perform Divider Dam removal (ROWAN-071) and stockpile excavated soil

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Option 1A, Hybrid Closure – Consolidate CCR Away From Yadkin River	
Subject	**Description**
	to construct closure cap and regrade excavated areas. 5. Implement deep soil mixing or other CCR stabilization technique to provide a stable wedge of CCR within Cell 2 to allow CCR excavation downstream of the wedge. 6. Dewater CCR within the northern portion of Cell 2, Cell 3, and the areas in the southern portion of Cell 1 that are to be excavated by constructing trenches within the CCR and by allowing the seepage water to drain by gravity, or by pumping, to Cell 3 for treatment. Saturated CCR can also be stockpiled to allow drainage. 7. Lower water table within southern portions of Cell 1 and Cell 2 as needed to provide firm working surface for CCR placement. Water table can be lowered by excavating trenches to collect seepage water for gravity drainage or by pumping to Cell 3 for treatment or by installing well points. 8. Excavate dewatered CCR from the northern portion of Cell 2, Cell 3, and the areas in the southern portion of Cell 1 that are to be excavated, and place and compact within the southern portion of Cell 2 and Cell 1. Maintain minimum setbacks during nesting periods for eagle's nest and heron rookery and schedule work in these areas accordingly. After CCR is removed, continue soil over excavation (assumed 2 ft depth) and place and compact within the southern portion of Cell 2 and Cell 1. CQA to certify when areas have been adequately excavated to remove sources of contamination. Total estimated excavation 1,558,000 cy. 9. Remove discharge structures and associated dams in Cell 1 (ROWAN-069) and Cell 2 (ROWAN-070) when these structures are no longer needed to facilitate drainage. 10. As areas within the southern portion of Cell 2, Cell 1, and the ash storage area reach final CCR design grade, prepare surface for cap construction. Install cap including associated drainage structures in accordance with approved drawings, specifications, and CQA Plan. Use soil from decommissioned dams for cap construction. Estimated soil required for cap construction 392,000 cy. Estimated soil available from dam deconstruction 261,000 cy. Obtain additional soil for closure from on site or off site borrow areas. Establish vegetation on completed cap. 11. As areas within the northern portion of Cell 2, Cell 3, and the areas in the southern portion of Cell 1 that are to be excavated are certified to have all CCR removed, grade to drain and to establish a stabilized surface for vegetation. Use soil from decommissioned dams for grading. Establish vegetation and construct lined drainage channels along valley floors. 12. Deconstruct Main Dam (ROWAN-047) as CCR is removed from Cells 2 and 3. Use soil to grade excavated areas and to construct cap within the southern portion of Cell 2, Cell 1, and the ash storage area. Remove remainder of dam after all CCR has been excavated and placed in the northern portion of Cell 2 and Cell 1 and capped. Decommission temporary

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Option 1A, Hybrid Closure – Consolidate CCR Away From Yadkin River	
Subject	**Description**
	wastewater treatment plant and establish new NPDES outfall location. 13. Monitor Cell 1 cap, Cell 2 cap, ash storage area cap, and restored areas within Cells 1, 2, and 3 for erosion, sedimentation, or other signs of distress. Make repairs promptly. 14. Conduct groundwater remediation and/or monitoring, if/as needed.
Environmental Protections and Impacts	1. Four of five regulated impoundment dams will be decommissioned and removed leaving only the Cell1 Additional Primary Dam (ROWAN-068) in place. Preliminary groundwater monitoring indicates total dewatering of CCR within Cell 1 after cap construction will not occur, resulting in minimal risk of breach/failure. 2. Current groundwater conditions do not involve significant exceedances or risk to receptors. 3. Groundwater contamination source is not fully eliminated by Hybrid Closure Option 1A; however, the unlined CCR footprint is reduced to 121.5 acres, which is the second smallest unlined area next to Option 1. 4. Proximity to River Bank or Shoreline – Removal of CCR from the northern portion of Cell 2 and all of Cell 3 significantly reduces proximity to Yadkin River, although to a lesser extent then Options 1, 2, and 4 (assuming off-site landfill is not located adjacent to a river) and allows removal of Main Dam (ROWAN-047). 5. Proximity to Public Drinking Water Intakes – No downstream public drinking water intakes identified in the Buck CSA. 6. Proximity to Downgradient Potable Well – No downgradient potable wells identified in the Buck CSA. 7. Restoration of Habitat, Streams, or Wetlands – Removal of CCR from the northern portion of Cell 2 and all of Cell 3 will enable approximately 42 acres of habitat and wetlands to be restored. This is the fourth greatest amount of habitat restoration after Options 4, 2, and 1. 8. Air Emissions Off-site (based on miles driven) – NA 9. Air Emissions On-site (based on gallons of fuel consumed) from Closure Implementation – On-site air emissions would be the second least after Option 3. 10. Avoidance of Greenfield Disturbance – Construction of final cover will lead to a soil deficit of approximately 131,000 cy beyond which can be obtained from dam decommissioning. This quantity of soil is assumed to be obtained from on site borrow areas located in greenfield areas of the site. 11. Stormwater Impacts - All contact water will be routed to Cell 3 where a temporary treatment plant will be installed to treat all drainage from ash basins prior to discharge to the Yadkin River. Temporary erosion and sediment controls will remain in-place until excavated and capped areas are stabilized. Development of on-site borrow areas; however, will result in additional stormwater impacts beyond those occurring within the ash basins. 12. Effects on Eagle Nest and Heron Rookery – Nest and rookery remain intact

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Option 1A, Hybrid Closure – Consolidate CCR Away From Yadkin River	
Subject	**Description**
	but option includes second least excavation in this area after Option 3.
Cost	1. Capital costs ≈ $71,000,000 2. Long-term operations, maintenance, and monitoring ≈ $600,000 per year. 3. Avoided costs – Off-site hauling of CCR, lined landfill. 4. Additional groundwater remediation costs (capital and O&M).
Schedule	1. High likelihood of meeting regulatory deadlines. 2. Design and permitting - 15 months 3. Construction – 42 months to be completed on 3/6/21 (based on construction start date of10/2/17) and designed to meet CAMA deadline of 12/31/29 for low risk facilities. Duration requires that 1,000,000 cy of CCR per year is moved and 50 ac of final cover be constructed per year. 4. Post-closure – 30 years.
Regional Factors	1. Remaining CCR footprint is unlined. More footprint than all other options except Option 3. 2. NPDES permit modification may be required. 3. Plan or potential for beneficial use of site – Restore excavated areas to natural setting although least amount of restoration of all other options except Option 3. 4. Soil requirements - 392,000 cy soil required for cap construction of which 376,000 cy can be obtained from existing on-site soil stockpiles and dam removal. Remainder would be obtained from on-site borrow areas that would need to be developed. 5. CCR beneficial use – None. 6. Transportation impact (based on miles driven) – No off-site miles. On-site transportation may need to be routed onto existing plant roads to avoid impacts to eagle nest and blue heron rookery but less impact than all other options except for Option 3. 7. Noise impact due to on-site activity (based on proximity to neighbors) – Medium, moderate excavation and fill activity near southern neighbors. 8. Visual impact (based on final height of storage facility, land uses within the viewshed) – Medium, visible mounding in Cell 1 but less than all other options except for Options 3 and 4. Cells 2 and 3 only partially restored to natural setting.
Constructability	1. This option has the second least quantity of CCR that must be handled after Option 3 and the shortest construction duration. 2. Will require routing stormwater from Cell 1 through Cells 2 and 3 during CCR excavation within Cells 2 and 3 and cap construction within Cell 2. 3. Stormwater holding/treatment pond can be located within current CCR footprint. 4. Requires some on-site borrow area development. 5. Deep excavations within the CCR are necessary within Cells 2 and 3 although not as much as Options 1, 2, and 4. 6. CCR stabilization (e.g. deep soil mixing) required within Cell 2 beyond

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Option 1A, Hybrid Closure – Consolidate CCR Away From Yadkin River	
Subject	**Description**
	dewatering. 7. Second least dewatering required after Option 3. Dewatering includes free water removal, drawdown of water table within CCR in southern portions of Cells 1 and 2 where close to the surface to allow for CCR excavation/placement, and drawdown of water within CCR in northern portion of Cell 2 and Cell 3 to allow CCR excavation.
Advantages	1. Partial reduction in unlined CCR footprint. 2. Some restoration to original habitat. 3. Main Dam removal/decommissioning. 4. Removal of CCR closest to Yadkin River. 5. Partial removal of CCR closest to neighbors to the south. 6. Reduced impact to Bald Eagle nest and Blue Heron rookery. 7. Reduced construction impact to neighbors.
Disadvantages	1. Partial unlined CCR footprint remains. 2. Does not eliminate source of groundwater contamination in Cells 1 and 2. 3. Uncertain whether Additional Primary Dam can be decommissioned due to probable saturated CCR remaining behind the dam. 4. Probable that CCR will remain below the water table in lower portion of Cell 1. 5. Deep CCR excavation required in Cells 2 and 3. 6. Some on-site borrow areas will need to be developed. 7. Significant post-closure requirements. 8. CCR stabilization (e.g. deep soil mixing) required in Cell 2.

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Table 3 – Option Overviews: Option 2

Option 2, New On Site Landfill	
Subject	**Description**
Description	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Excavate CCR and over excavate soils (assumed 2-ft) from the southernmost approximately 15 acres of Cell 1 and temporarily stockpile within the northern portion of Cell 1. Construct Phase 1 of landfill liner system. 3. Excavate CCR and over excavate soils (assumed 2-ft) from the next approximately 15 acres of Cell 1 and place within the Phase 1 landfill. Construct Phase 2 of the landfill liner system. 4. Similarly, excavate and construct Phase 3 and Phase 4 of the landfill until all CCR and over excavated soils have been excavated out of Cell 1 and placed within the lined landfill. Install underdrain system beneath the landfill liner to maintain minimum 5-ft buffer between the seasonal high groundwater table and the bottom of the liner system. 5. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct landfill closure cap and regrade excavated areas. 6. Excavate CCR from Cells 2, 3 and the ash storage area and place within the lined landfill. 7. Over excavate soils beneath excavated CCR (assumed 2-ft) and place within the lined landfill. 8. Backfill excavated areas within Cells 2, 3, and the ash storage area to promote positive surface water drainage. 9. Construct a closure cap over the landfill. 10. Perform dam removal (ROWAN-047, -069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 11. Petition to remove Cell 1 Additional Primary Dam (ROWAN-068) from dam safety requirements through demonstration that no flowable materials or impounded liquid is maintained behind the dam. 12. Conduct groundwater remediation and/or monitoring, if/as needed.
Details	1. Lower the free water levels within Cells 1, 2, and 3 using the existing discharge structures to the extent possible. It is believed that this lowering can be done under the existing NPDES permit. Estimated free water volumes within Cells 1, 2, and 3 as of June 25 and 26, 2015 are 3,249,000 gal, 43,728,000 gal, and 31,783,000 gal, respectively. 2. Remove remaining free water by using floating pumps and screened intakes and by pumping through the existing discharge structures. Consider effluent bypass forcemain from Cell 1 to Cell 3 to avoid introducing additional water into Cell 2 which will require double pumping. Install temporary wastewater treatment system near Cell 3 NPDES outfall to treat all water pumped from Cells 1, 2, and 3 in accordance with NPDES permit prior to discharge to the

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Option 2, New On Site Landfill	
Subject	**Description**
	Yadkin River. It is assumed that process water flowing into the ash basins will be stopped by this time. Additional stormwater generated within the ash basin drainage areas will still need to be pumped and treated. 3. Abandon wells and piezometers within ash basins and ash storage area footprints. 4. Perform Divider Dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 5. Dewater CCR within Cells 1, 2 and 3 by constructing trenches within the CCR and by allowing the seepage water to drain by gravity, or by pumping, to Cell 3 for treatment. Saturated CCR can also be stockpiled to allow drainage. 6. Excavate CCR and over excavate soils (assumed 2-ft) from the southernmost approximately 15 acres of Cell 1 and temporarily stockpile within the northern portion of Cell 1. Construct Phase 1 of landfill liner system and perimeter berm. 7. Excavate CCR and over excavate soils (assumed 2-ft) from the next approximately 15 acres of Cell 1 and place within the Phase 1 landfill. Construct Phase 2 of the landfill liner system and perimeter berm. 8. Similarly, excavate and construct Phase 3 and Phase 4 of the landfill until all CCR and over excavated soils have been excavated out of Cell 1 and placed within the lined landfill. Install underdrain system beneath the landfill liner to maintain minimum 5-ft buffer between the seasonal high groundwater table and the bottom of the liner system. 6. Excavate dewatered CCR from Cells 2 and 3, and CCR within the ash storage area, and place and compact within the landfill. Maintain minimum setbacks during nesting periods for eagle's nest and heron rookery and schedule work in these areas accordingly. After CCR is removed, continue soil over excavation (assumed 2 ft depth) and place and compact within the landfill. CQA to certify when areas have been adequately excavated to remove sources of contamination. Total estimated excavation 6,068,000 cy. 7. Remove discharge structures and associated dams in Cell 1 (ROWAN-069) and Cell 2 (ROWAN-070) when these structures are no longer needed to facilitate drainage. 8. As areas within the landfill reach final CCR design grade, prepare surface for cap construction. Install cap including associated drainage structures in accordance with approved drawings, specifications, and CQA Plan. Use soil from decommissioned dams for cap construction. Estimated soil required for cap construction 164,000 cy. Estimated soil available from dam deconstruction 261,000 cy. Establish vegetation on completed cap. 9. As areas within Cells 2 and 3, and the ash storage area are certified to have all CCR removed, grade to drain and to establish a stabilized surface for vegetation. Use soil from decommissioned dams for grading. Establish vegetation and construct lined drainage channels along valley floors.

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Option 2, New On Site Landfill	
Subject	**Description**
	10. Deconstruct Cells 2/3 Main Dam (ROWAN-047) as CCR is removed from Cells 2 and 3, Use soil to grade excavated areas and to construct cap for landfill. Remove remainder of dam after all CCR has been excavated and placed in the landfill and capped. Decommission temporary wastewater treatment plant and establish new NPDES outfall location. 11. Monitor landfill cap and restored areas within Cells 1, 2, and 3 for erosion, sedimentation, or other signs of distress. Make repairs promptly. 12. Petition to remove Cell 1 Additional Primary Dam (ROWAN-068) from dam safety requirements through demonstration that no flowable materials or impounded liquid is maintained behind the dam. 13. Conduct groundwater remediation and/or monitoring, if/as needed.
Environmental Protections and Impacts	1. Four of five regulated impoundment dams will be decommissioned and removed leaving only the Cell1 Additional Primary Dam (ROWAN-068) in place. Total removal of CCR from within Cell 1 prior to landfill liner construction will allow backfilling low areas with compacted soil and the possible installation of an underdrain system to achieve the required five-foot buffer between the seasonal high groundwater table and the liner system. These actions may allow the Primary dam to be decommissioned. 2. Current groundwater conditions do not involve significant exceedances or risk to receptors. 3. Groundwater contamination source is fully eliminated by Closure Option 1 assuming the landfill liner and leachate collection systems are effective. The unlined CCR footprint is entirely eliminated although Option 4 provides a greater degree of protection by removing all CCR to an off-site landfill. 4. Proximity to River Bank or Shoreline – Removal of CCR from Cells 2 and 3 significantly reduces proximity to Yadkin River and allows removal of Main Dam (Rowan-047). Option 2 is approximately equivalent to Option 1 with respect to this criterion but is not as protective as Option 4 (assuming off-site landfill is not located adjacent to a river). 5. Proximity to Public Drinking Water Intakes – No downstream public drinking water intakes identified in the Buck CSA. 6. Proximity to Downgradient Potable Well – No downgradient potable wells identified in the Buck CSA. 7. Restoration of Habitat, Streams, or Wetlands – Removal of CCR from Cells 2 and 3 and consolidation of the Cell 1 and ash storage area CCR within the lined landfill will enable approximately 100.6 acres of habitat and wetlands to be restored. This is the second greatest amount of habitat restoration after Option 4. 8. Air Emissions Off-site (based on miles driven) – NA. 9. Air Emissions On-site (based on gallons of fuel consumed) from Closure Implementation – On-site air emissions would be the greatest of all of the options due to the quantity of CCR excavated and placed within the lined landfill.

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Option 2, New On Site Landfill	
Subject	**Description**
	10. Avoidance of Greenfield Disturbance – Little to no greenfield disturbance. 11. Stormwater Impacts - All contact water will be routed to Cell 3 where a temporary treatment plant will be installed to treat all drainage from ash basins prior to discharge to the Yadkin River. Temporary erosion and sediment controls will remain in-place until excavated and capped areas are stabilized. 12. Effects on Eagle Nest and Heron Rookery – Nest and rookery remain intact but option is essentially tied with Options 1 and 4 for most excavation in this area.
Cost	1. Capital costs ≈ $221,000,000 2. Long-term operations, maintenance, and monitoring ≈ $670,000 per year. 3. Avoided costs – Off-site hauling of CCR, minimized groundwater remediation costs (capital and O&M).
Schedule	1. High likelihood of meeting regulatory deadline of 12/31/29 for low risk facility; low likelihood of meeting regulatory deadline of 12/31/24 for intermediate risk facilities. 2. Design and permitting - 24 months. 3. Construction – 95 months to be completed on 4/20/26 (based on construction start date of 7/2/18. Duration requires that 1,000,000 cy of CCR per year is moved, 50 ac of final cover be constructed per year, and 25 ac of landfill bottom liner be constructed per year. 4. Post-closure – 30 years.
Regional Factors	1. Siting/permitting of new on-site lined landfill. No unlined footprint remaining. 2. NPDES permit modification may be required. 3. Plan or potential for beneficial use of site – Restore excavated areas to natural setting although restored area is less than Options 4. 4. Soil requirements - 164,000 cy soil required for cap construction which can be obtained from existing on-site soil stockpiles and dam removal without borrow area development. 5. CCR beneficial use – None. 6. Transportation impact (based on miles driven) – No off-site miles. On-site transportation may need to be routed onto existing plant roads to avoid impacts to eagle nest and blue heron rookery. On-site miles highest of all options. 7. Noise impact due to on-site activity (based on proximity to neighbors) – High, substantial excavation and fill activity near southern neighbors. Highest impact of all options. 8. Visual impact (based on final height of storage facility, land uses within the viewshed) – High, highest visible mounding within Cell 1 but Cells 2 and 3 restored to natural setting. Has most visual impact along with Option 3.
Constructability	1. Most difficult option to construct due to removal of CCR within Cell 1 in stages to construct bottom liner system. Difficult to characterize post

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Option 2, New On Site Landfill	
Subject	**Description**
	excavation basegrades to meet 5-foot buffer requirement between seasonal high groundwater and liner system. Will require backfilling of deeper portions of Cell 1 with soil to achieve required buffer. Underdrains within Cell 1 may be needed which would penetrate the New Additional Primary Dam. 2. This option has the greatest quantity of CCR that must be handled due to double handling of a portion of the CCR within Cell 1 and the longest construction duration. 3. Will require routing stormwater from Cell 1 through Cells 2 and 3 during CCR excavation within Cells 2 and 3. 4. Will require pumping of large quantities of contact stormwater within Cell 1 during CCR excavation and bottom liner construction. 5. Stormwater holding/treatment pond can be located within current CCR footprint. 6. Requires no on-site borrow area development. 7. Deep excavations within the CCR are necessary within Cells 1, 2 and 3. 8. No CCR stabilization (e.g. deep soil mixing) required beyond dewatering. 9. Most dewatering required off all options due to length of time to construct Cell 1 bottom liner system. Dewatering includes free water removal; drawdown of water table within Cell 1 to allow CCR excavation, backfilling with soil, and bottom liner construction; and drawdown of water within CCR in Cells 2 and 3 to allow CCR excavation.
Advantages	1. Total reduction in unlined CCR footprint. 2. Significant restoration to original habitat. 3. Totally eliminates source of groundwater contamination. 4. Eliminates CCR below the water table. 5. Main Dam removal/decommissioning. 6. Additional Primary Dam decommissioning. 7. No on-site borrow areas required. 8. Minimized post-closure requirements. 9. Removal of CCR closest to Yadkin River. 10. Removal of CCR closest to neighbors to the south.
Disadvantages	1. Significant construction impact to neighbors. 2. Lined landfill increases construction time and complexity. 3. Can be difficult permitting effort. 4. Significant impact to Bald Eagle nest and Blue Heron rookery during CCR excavation. 5. Deep CCR excavation required in Cells 1, 2, and 3. 6. Leachate collection and treatment requirements.

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Table 3 – Option Overviews: Option 3

Option 3, Close in Place	
Subject	**Description**
Description	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap. 3. Regrade Cells 1, 2, 3, and the ash storage area to promote positive surface water drainage. 4. Construct a closure cap over Cells 1, 2, 3, and the ash storage area. 5. Perform dam removal (ROWAN-069, and -070) and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to construct closure cap and regrade excavated areas. 6. Conduct groundwater remediation and/or monitoring, if/as needed.
Details	1. Lower the free water levels within Cells 1, 2, and 3 using the existing discharge structures to the extent possible. It is believed that this lowering can be done under the existing NPDES permit. Estimated free water volumes within Cells 1, 2, and 3 as of June 25 and 26, 2015 are 3,249,000 gal, 43,728,000 gal, and 31,783,000 gal, respectively. 2. Remove remaining free water by using floating pumps and screened intakes and by pumping through the existing discharge structures. Consider effluent bypass forcemain from Cell 1 to Cell 3 to avoid introducing additional water into Cell 2 which will require double pumping. Install temporary wastewater treatment system near Cell 3 NPDES outfall to treat all water pumped from Cells 1, 2, and 3 in accordance with NPDES permit prior to discharge to the Yadkin River. It is assumed that process water flowing into the ash basins will be stopped by this time. Additional stormwater generated within the ash basin drainage areas will still need to be pumped and treated. 3. Abandon wells and piezometers within ash basins and ash storage area footprints. 4. Perform Divider Dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap. 5. Dewater CCR within the portions of Cells 1, 2, and 3 that are to be excavated during regrading by constructing trenches within the CCR and by allowing the seepage water to drain by gravity, or by pumping, to Cell 3 for treatment. Saturated CCR can also be stockpiled to allow drainage.

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Option 3, Close in Place	
Subject	**Description**
	6. Lower water table within portions of Cells 1, 2, and 3 as needed to provide firm working surface for CCR placement. Water table can be lowered by excavating trenches to collect seepage water for gravity drainage or by pumping to Cell 3 for treatment or by installing well points. 7. Regrade surface of Cells 1, 2, and 3 to provide drainage according to plans by excavating in high areas and placing compacted material in low areas in an effort to balance cut and fill. Maintain minimum setbacks during nesting periods for eagle's nest and heron rookery and schedule work in these areas accordingly. CQA to certify when areas have been adequately regraded. Total estimated cut to fill 850,000 cy. 8. Remove discharge structures and associated dams in Cell 1 (ROWAN-069) and Cell 2 (ROWAN-070) when these structures are no longer needed to facilitate drainage. 9. As areas within Cells 1, 2, 3, and the ash storage area reach final CCR design grade, prepare surface for cap construction. Install cap including associated drainage structures in accordance with approved drawings, specifications, and CQA Plan. Use soil from decommissioned dams for cap construction. Estimated soil required for cap construction 528,000 cy. Estimated soil available from dam deconstruction 39,000 cy. Obtain additional soil for closure from on site or off site borrow areas. Establish vegetation on completed cap. 10. Decommission temporary wastewater treatment plant and establish new NPDES outfall location. 11. Monitor Cells 1, 2, 3, and ash storage area caps for erosion, sedimentation, or other signs of distress. Make repairs promptly. 12. Conduct groundwater remediation and/or monitoring, if/as needed.
Environmental Protections and Impacts	1. Three of five regulated impoundment dams will be decommissioned and removed leaving only the Cell1 Additional Primary Dam (ROWAN-068) and the Main Dam (ROWAN-047) in place. Preliminary groundwater monitoring indicates total dewatering of CCR within Cells 1, 2, and 3 after cap construction will not occur, resulting in minimal risk of breach/failure. 2. Current groundwater conditions do not involve significant exceedances or risk to receptors. 3. Groundwater contamination source is not fully eliminated by Closure Option 3 as essentially the entire 163.5 acre unlined CCR footprint remains which is the largest unlined CCR

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Option 3, Close in Place	
Subject	**Description**
	footprint remaining of all options. 4. Proximity to River Bank or Shoreline – Since the Main Dam (ROWAN-047) will remain as well as the entire unlined CCR footprints within Cells 2 and 3, this option does not provide any benefit related to proximity to the Yadkin River. 5. Proximity to Public Drinking Water Intakes – No downstream public drinking water intakes identified in the Buck CSA. 6. Proximity to Downgradient Potable Well – No downgradient potable wells identified in the Buck CSA. 7. Restoration of Habitat, Streams, or Wetlands – Since essentially the entire CCR footprint will remain under this option, there will be no opportunity for restoration of habitat, streams, or wetlands. 8. Air Emissions Off-site (based on miles driven) – NA 9. Air Emissions On-site (based on gallons of fuel consumed) from Closure Implementation – On-site air emissions would be the least of all options. 10. Avoidance of Greenfield Disturbance – This option requires the greatest quantity of soils for cap construction (528,000 cy) but only approximately 39,000 cy of soil will be available through deconstruction of the Divider Dam. The remaining soil required for cap construction is assumed to be available through the use of existing on-site soil stockpiles and the development of on-site soil borrow areas. The development of these borrow areas will impact greenfield areas on-site and represents the greatest greenfield impact of all options. 11. Stormwater Impacts - All contact water will be routed to Cell 3 where a temporary treatment plant will be installed to treat all drainage from ash basins prior to discharge to the Yadkin River. Temporary erosion and sediment controls will remain in-place until regraded and capped areas are stabilized. Development of on-site borrow areas; however, will result in additional stormwater impacts beyond those occurring within the ash basins. Because of the quantity of borrow soil require, this option will result in the greatest impact to stormwater of all options. 12. Effects on Eagle Nest and Heron Rookery – Nest and rookery remain intact and option includes least impact in this area of all options.
Cost	1. Capital costs ≈ $57,000,000 2. Long-term operations, maintenance, and monitoring ≈ $730,000 per year. 3. Avoided costs – Off-site hauling of CCR, habitat restoration,

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Option 3, Close in Place	
Subject	**Description**
	lined landfill, costs managed through minimized material handling. 4. Significant additional groundwater remediation costs (capital and O&M).
Schedule	1. High likelihood of meeting regulatory deadlines. 2. Design and permitting - 15 months. 3. Construction – 46 months to be completed on 7/8/21 (based on construction start date of 10/2/17, and designed to meet CAMA deadline of 12/31/29 for low risk facilities. Duration requires that 1,000,000 cy of CCR is moved per year and 50 ac of final cover is constructed per year. 4. Post-closure – 30 years.
Regional Factors	1. Entire unlined CCR footprint remains. Largest footprint of all options. 2. NPDES permit modification may be required. 3. Plan or potential for beneficial use of site – None. 4. Soil requirements - 528,000 cy soil required for cap construction of which 154,000 cy can be obtained from existing on-site soil stockpiles and dam removal. Remainder would be obtained from on-site borrow areas that would need to be developed. Most borrow area development required of all options. 5. CCR beneficial use – None. 6. Transportation impact (based on miles driven) – No off-site miles. On-site transportation may need to be routed onto existing plant roads to avoid impacts to eagle nest and blue heron rookery but less impact than all other options. 7. Noise impact due to on-site activity (based on proximity to neighbors) – Low, least excavation and fill activity near southern neighbors of all options. 8. Visual impact (based on final height of storage facility, land uses within the viewshed) – High, no areas restored to natural setting.
Constructability	1. This option has the least quantity of CCR that must be handled and the second shortest construction duration after Option 1A. 2. Will require routing stormwater from Cell 1 through Cells 2 and 3 during cap construction within Cells 2 and 3. 3. May require stormwater holding/treatment pond outside of current CCR footprint. 4. Requires most on-site borrow area development of all options. 5. No deep excavations within the CCR are necessary. 6. No CCR stabilization (e.g. deep soil mixing) required beyond dewatering. 7. Dewatering mostly limited to free water removal and drawdown

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Option 3, Close in Place	
Subject	**Description**
	of water table within CCR where close to the surface to allow for CCR excavation/placement and cap construction.
Advantages	1. Relatively limited construction compared to other options. 2. Least construction impact to neighbors compared to other options. 3. Least impact to Bald Eagle nest and Blue Heron rookery compared to other options. 4. Most economical option. 5. Can be safely executed using typical ash pond closure construction methods. 6. Less chance for schedule delays. 7. Minimal permitting required compared to other options.
Disadvantages	1. Largest footprint of unlined area. 2. Requires largest on-site borrow area development in greenfield areas. 3. Largest post-closure care requirements of all options. 4. Does not remove or consolidate source of groundwater contamination. 5. Uncertain whether Additional Primary Dam and Main Dam can be decommissioned due to probable saturated CCR remaining behind the dams. 6. Probable that CCR will remain below the water table in lower portions of Cells 1, 2, and 3. 7. No restoration to original habitat. 8. CCR closest to Yadkin River remains. 9. CCR closest to southern neighbors remains.

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Table 3 – Option Overviews: Option 4

Option 4, Off-Site Landfill	
Subject	**Description**
Description	1. Remove free water from Cells 1, 2, and 3 to facilitate stable and safe construction activities. Install temporary wastewater treatment system. 2. Perform dam removal (ROWAN-071) and stockpile excavated soil to regrade excavated areas. 3. Excavate CCR from Cells 1, 2, 3, and the ash storage area to dispose in an approved off-site landfill. 4. Over excavate soils beneath excavated CCR (assumed 2-ft) and dispose in an approved off-site landfill. 5. Backfill excavated areas within Cells 1, 2, and 3 to promote positive surface water drainage. 6. Perform dam removal (ROWAN-047, -068, -069, and -070) through complete removal or breaching and restore excavated areas to stable and non-erodible condition with positive drainage. Use excavated soil to regrade excavated areas. 7. Conduct groundwater remediation and/or monitoring, if/as needed.
Details	1. Lower the free water levels within Cells 1, 2, and 3 using the existing discharge structures to the extent possible. It is believed that this lowering can be done under the existing NPDES permit. Estimated free water volumes within Cells 1, 2, and 3 as of June 25 and 26, 2015 are 3,249,000 gal, 43,728,000 gal, and 31,783,000 gal, respectively. 2. Remove remaining free water by using floating pumps and screened intakes and by pumping through the existing discharge structures. Consider effluent bypass forcemain from Cell 1 to Cell 3 to avoid introducing additional water into Cell 2 which will require double pumping. Install temporary wastewater treatment system near Cell 3 NPDES outfall to treat all water pumped from Cells 1, 2, and 3 in accordance with NPDES permit prior to discharge to the Yadkin River. It is assumed that process water flowing into the ash basins will be stopped by this time. Additional stormwater generated within the ash basin drainage areas will still need to be pumped and treated. 3. Abandon wells and piezometers within ash basins and ash storage area footprints. 4. Perform Divider Dam removal (ROWAN-071) and stockpile excavated soil to construct closure cap and regrade excavated areas. 5. Dewater CCR within Cells 1, 2, and 3 by constructing trenches within the CCR and by allowing the seepage water to drain by

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Option 4, Off-Site Landfill	
Subject	**Description**
	gravity, or by pumping, to Cell 3 for treatment. Saturated CCR can also be stockpiled to allow drainage. 6. Excavate dewatered CCR from Cells 1, 2, 3, and the ash storage area and moisture condition as needed to prepare for off-site transport identified by Duke Energy (landfill or structural fill). Maintain minimum setbacks during nesting periods for eagle's nest and heron rookery and schedule work in these areas accordingly. After CCR is removed, continue soil over excavation (assumed 2 ft depth) and prepare for off-site transport. CQA to certify when areas have been adequately excavated to remove sources of contamination. Total estimated excavation 6,068,000 cy. 7. Remove discharge structures and associated dams in Cell 1 (ROWAN-069) and Cell 2 (ROWAN-070) when these structures are no longer needed to facilitate drainage. 8. As areas within Cells 1, 2, 3, and the ash storage area are certified to have all CCR removed, grade to drain and to establish a stabilized surface for vegetation. Use soil from decommissioned dams for grading. Establish vegetation and construct lined drainage channels along valley floors. 9. Deconstruct Main Dam (ROWAN-047) as CCR is removed from Cells 2 and 3. Deconstruct Additional Primary Dam (ROWAN-068) as CCR is removed from Cell 1. Use soil to grade excavated areas. Remove remainder of main dam after all CCR has been excavated and removed from site. Decommission temporary wastewater treatment plant and establish new NPDES outfall locations. 10. Monitor restored areas within Cells 1, 2, 3, and the ash storage area for erosion, sedimentation, or other signs of distress. Make repairs promptly. 11. Conduct groundwater remediation and/or monitoring, if/as needed.
Environmental Protections and Impacts	1. All five regulated impoundment dams will be decommissioned and removed under this option. 2. Current groundwater conditions do not involve significant exceedances or risk to receptors. 3. Groundwater contamination source is fully eliminated by this option and is the only option to achieve this. 4. Proximity to River Bank or Shoreline – Total removal of CCR from site eliminates proximity of CCR to river bank and is most protective in this aspect of all options (assuming off-site landfill is not located adjacent to a river). 5. Proximity to Public Drinking Water Intakes – No downstream

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Option 4, Off-Site Landfill	
Subject	**Description**
	public drinking water intakes identified in the Buck CSA. 6. Proximity to Downgradient Potable Well – No downgradient potable wells identified in the Buck CSA. 7. Restoration of Habitat, Streams, or Wetlands – Removal of CCR from the entire site will enable approximately 163.5 acres of habitat, streams, and wetlands to be restored. This is the greatest amount of habitat restoration of all options. 8. Air Emissions Off-site (based on miles driven) – This option requires the complete removal of on-site CCR to an off-site landfill which will generate the greatest amount of off-site air emissions of any option. 9. Air Emissions On-site (based on gallons of fuel consumed) from Closure Implementation – On-site air emissions would be the second greatest after Option 2. 10. Avoidance of Greenfield Disturbance – Little to no greenfield disturbance assuming CCR hauled to off-site landfill is placed within an existing landfill. 11. Stormwater Impacts - All contact water will be routed to Cell 3 where a temporary treatment plant will be installed to treat all drainage from ash basins prior to discharge to the Yadkin River. Temporary erosion and sediment controls will remain in-place until excavated and capped areas are stabilized. 12. Effects on Eagle Nest and Heron Rookery – Nest and rookery remain intact but option is essentially tied with Options 1 and 2 for most excavation in this area.
Cost	1. Capital costs ≈ $593,000,000 2. Long-term operations, maintenance, and monitoring ≈ $270,000 per year. 3. Avoided costs – On-site monitoring and O&M, lined landfill, minimized groundwater remediation costs (capital and O&M).
Schedule	1. High likelihood of meeting regulatory deadline of 12/31/29 for low risk facility; high likelihood of meeting regulatory deadline of 12/31/24 for intermediate risk facilities. 2. Design and permitting - 15 months (assuming off-site permitted capacity is readily available). 3. Construction – 74 months to be completed on 10/26/23 (based on construction start date of10/2/17), and designed to meet CAMA deadline of 12/31/24 for intermediate risk facilities. Duration requires that 1,000,000 cy of CCR per year is moved. 4. Post-closure – NA (responsibility of off-site landfill).
Regional Factors	1. Off-site disposal location. No unlined footprint remaining. 2. NPDES permit modification may be required. 3. Plan or potential for beneficial use of site – Restore excavated

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Option 4, Off-Site Landfill	
Subject	**Description**
	areas to natural setting. Largest restored area of all options. 4. Soil requirements – No soil required for cap construction. 5. CCR beneficial use – None. 6. Transportation impact (based on miles driven) – Most off-site miles of all options. On-site transportation may need to be routed onto existing plant roads to avoid impacts to eagle nest and blue heron rookery. On-site miles highest after Option 2. 7. Noise impact due to on-site activity (based on proximity to neighbors) – High, substantial excavation and fill activity near southern neighbors. Second highest impact of all options after Option 2. 8. Visual impact (based on final height of storage facility, land uses within the viewshed) – Low, least visual impact of all options since all CCR storage areas will be restored to natural setting.
Constructability	1. This option has the second greatest quantity of CCR that must be handled after Option 2 and therefore second longest construction duration. 2. Will require routing stormwater from Cell 1 through Cells 2 and 3 during CCR excavation within Cells 2 and 3. 3. Stormwater holding/treatment pond can be located within current CCR footprint. 4. Requires no on-site borrow area development. 5. Deep excavations within the CCR are necessary within Cells 1, 2, and 3. 6. No CCR stabilization (e.g. deep soil mixing) required beyond dewatering. 7. Second most dewatering required after Option 2. Dewatering includes free water removal and drawdown of water within CCR in Cells 1, 2, and 3 to allow CCR excavation. 8. Requires arrangements to be made for off-site disposal of 6,068,000 cy of CCR. Would require development of CCR loading infrastructure.
Advantages	1. Total reduction in unlined CCR footprint. 2. Largest restoration to original habitat. 3. Totally eliminates source of groundwater contamination. 4. Eliminates CCR below the water table. 5. Total dam removal/decommissioning. 6. No on-site borrow areas required. 7. Minimized post-closure requirements. 8. Total removal of CCR from site.
Disadvantages	1. Significant construction impact to neighbors. 2. Need to find available landfill space within a reasonable

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Option 4, Off-Site Landfill	
Subject	**Description**
	distance to site. 3. Liabilities associated with transport of large quantities of CCR on public roads. 4. Significant impact to Bald Eagle nest and Blue Heron rookery during CCR excavation. 5. Deep CCR excavation required in Cells 1, 2, and 3. 6. Highest cost option.

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GIS Maps

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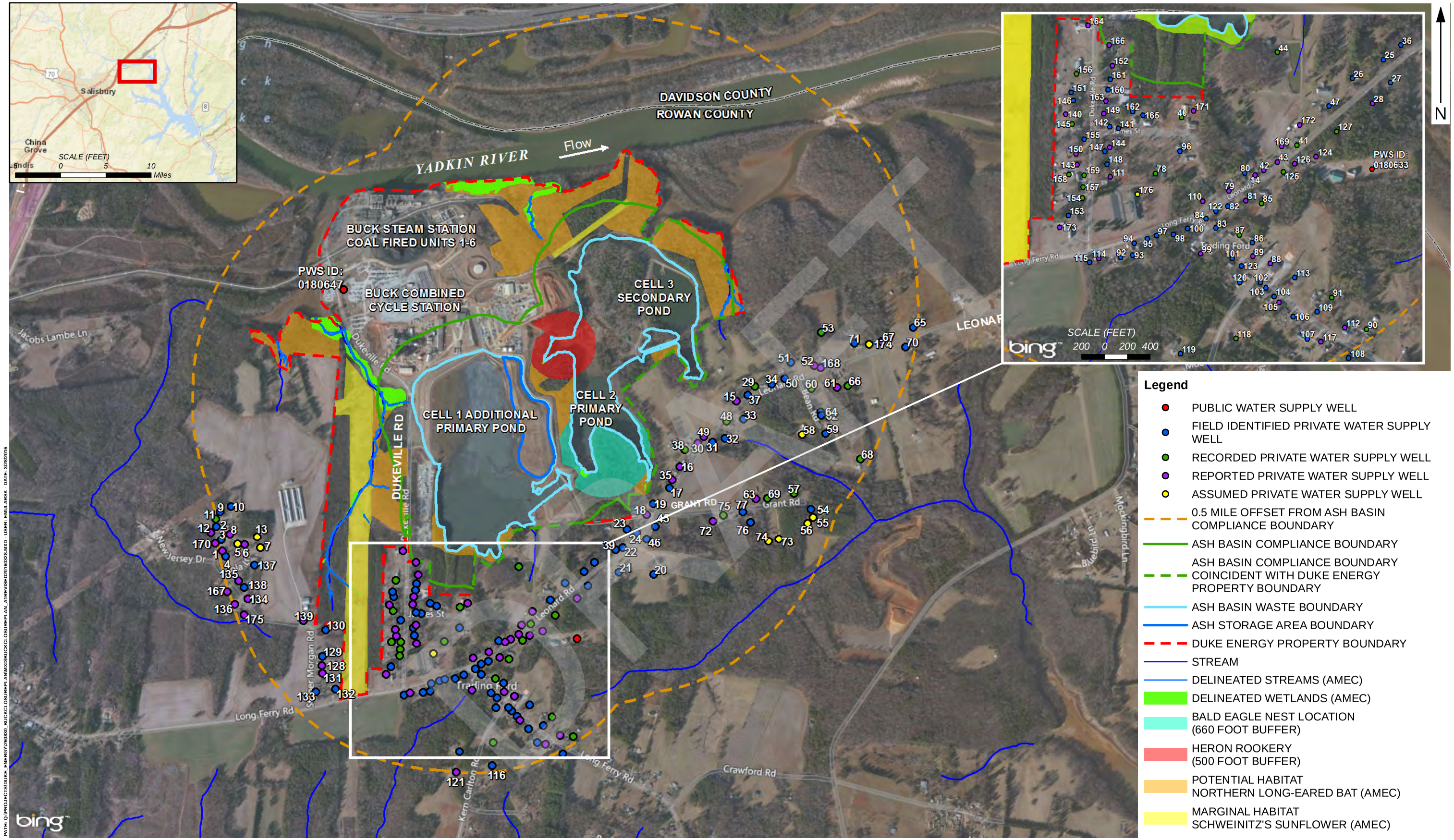

Legend

- PUBLIC WATER SUPPLY WELL
- FIELD IDENTIFIED PRIVATE WATER SUPPLY WELL
- RECORDED PRIVATE WATER SUPPLY WELL
- REPORTED PRIVATE WATER SUPPLY WELL
- ASSUMED PRIVATE WATER SUPPLY WELL
- 0.5 MILE OFFSET FROM ASH BASIN COMPLIANCE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY COINCIDENT WITH DUKE ENERGY PROPERTY BOUNDARY
- ASH BASIN WASTE BOUNDARY
- ASH STORAGE AREA BOUNDARY
- DUKE ENERGY PROPERTY BOUNDARY
- STREAM
- DELINEATED STREAMS (AMEC)
- DELINEATED WETLANDS (AMEC)
- BALD EAGLE NEST LOCATION (660 FOOT BUFFER)
- HERON ROOKERY (500 FOOT BUFFER)
- POTENTIAL HABITAT NORTHERN LONG-EARED BAT (AMEC)
- MARGINAL HABITAT SCHWEINITZ'S SUNFLOWER (AMEC)

PATH: Q:\PROJECTS\DUKE_ENERGY\260830_BUCKCLOSURE\PLANNING\BUCKCLOSURE\PLAN_A1REVISED20160328.MXD - USER: EMULARSK - DATE: 3/28/2016

NOTES:
1. ASH BASIN WASTE BOUNDARIES AND ASH STORAGE AREA BOUNDARIES ARE APPROXIMATE.
2. PRIVATE WELL LOCATIONS ARE APPROXIMATE.
3. ORTHOPHOTOGRAPHY IS FROM NC ONEMAP GIS ONLINE SERVICE.
4. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L.0107(a).
5. HYDROGRAPHY WAS OBTAINED FROM USGS 7.5-MINUTE SERIES TOPOGRAPHIC MAPS SALISBURY, NC
6. DUKE ENERGY PROPERTY BOUNDARY WAS SUPPLIED BY DUKE ENERGY REAL ESTATE.
7. DELINEATED STREAMS AND WETLANDS AND SUITABLE PROTECTED SPECIES HABITAT WITHIN DUKE ENERGY PROPERTY WERE TAKEN FROM THE "NATURAL RESOURCES TECHNICAL REPORT" PREPARED BY AMEC.

SCALE (FEET)
500 0 500 1,000

Service Layer Credits: Image courtesy of USGS © 2016 Microsoft Corporation © 2010 NAVTEQ © AND

DUKE ENERGY

LOCATION OF POTENTIAL INFLUENCING FACTORS OF CLOSURE

DUKE ENERGY CAROLINAS, LLC
BUCK STEAM STATION ASH BASINS
ROWAN COUNTY, NORTH CAROLINA

HDR

DATE
MARCH 2016

FIGURE
A1

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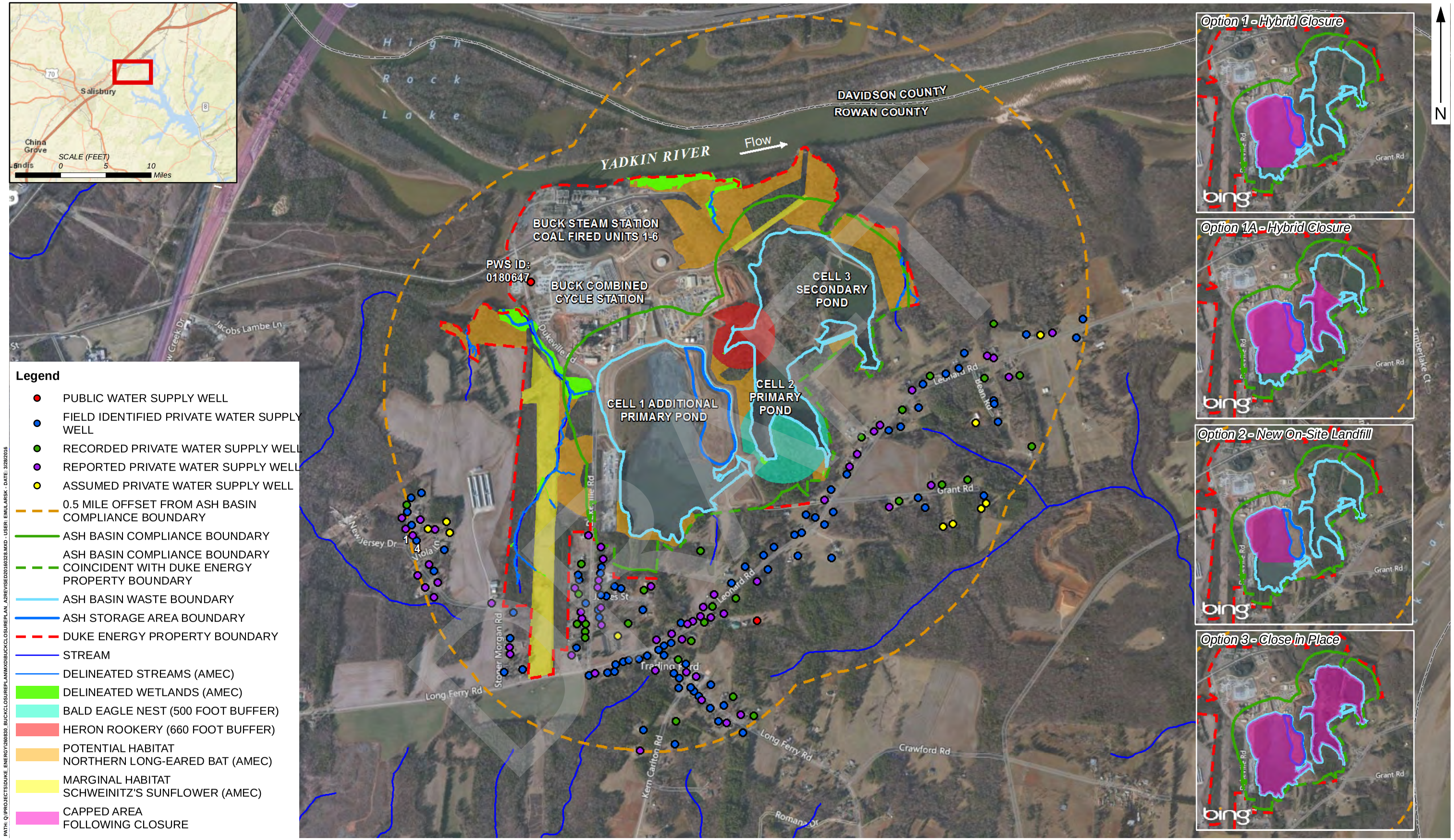

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NOTES:
1. ASH BASIN WASTE BOUNDARIES AND ASH STORAGE AREA BOUNDARIES ARE APPROXIMATE.
2. PRIVATE WELL LOCATIONS ARE APPROXIMATE.
3. ORTHOPHOTOGRAPHY IS FROM NC ONEMAP GIS ONLINE SERVICE.
4. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L.0107(a).
5. HYDROGRAPHY WAS OBTAINED FROM USGS 7.5-MINUTE SERIES TOPOGRAPHIC MAPS SALISBURY, NC
6. DUKE ENERGY PROPERTY BOUNDARY WAS SUPPLIED BY DUKE ENERGY REAL ESTATE.
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SCALE (FEET)
500 0 500 1,000

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DUKE ENERGY

LOCATION OF POTENTIAL INFLUENCING FACTORS OF CLOSURE

DUKE ENERGY CAROLINAS, LLC
BUCK STEAM STATION ASH BASINS
ROWAN COUNTY, NORTH CAROLINA

HDR

DATE
MARCH 2016

FIGURE
A2

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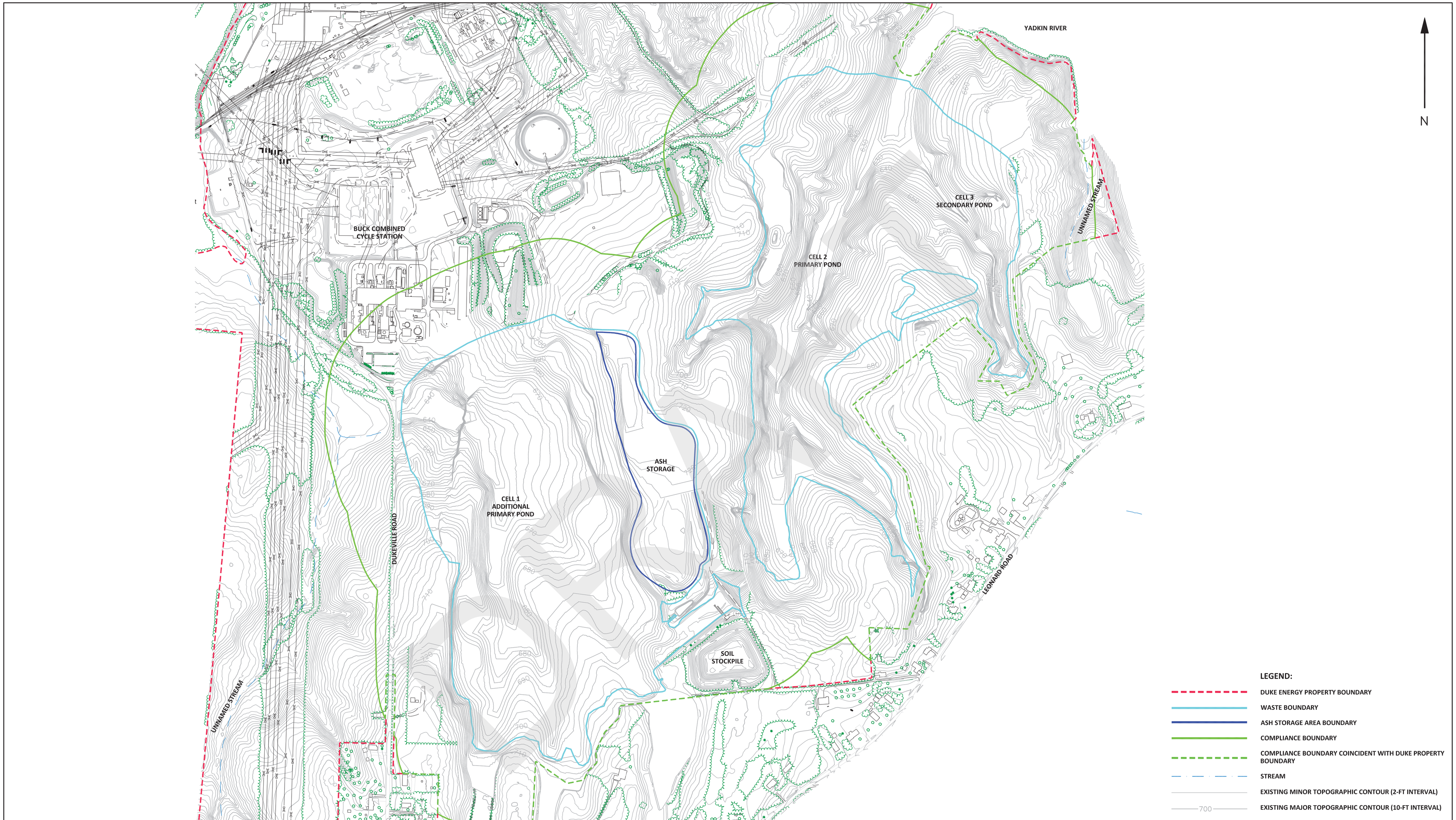
B

Conceptual Drawings

DRAFT



NOTES:
1. WASTE BOUNDARY AND ASH STORAGE AREA BOUNDARY ARE APPROXIMATE.
2. SOURCES OF PRE-DEVELOPMENT TOPOGRAPHY IN CELL 1 ARE DUKE POWER COMPANY DRAWING NO. B-3039-D1, UPDATED AUGUST 14, 1983 AND DRAWING NO. B-3039-D2, UPDATED MARCH 8, 1989.
3. SOURCE OF PRE-DEVELOPMENT TOPOGRAPHY IN CELLS 2 AND 3 IS DUKE POWER COMPANY DRAWING NO. B-3039-D UPDATED FEBRUARY 9, 1982.
4. SOURCE OF PRE-DEVELOPMENT TOPOGRAPHY IN ASH STORAGE AREA IS "CONSTRUCTION PLANS FOR ASH POND CLEANING PROJECT, BUCK STEAM STATION" BY SHIELD ENGINEERING, INC., DATED JUNE 26, 2009.
5. TOPOGRAPHY DATA FOR THE SITE OUTSIDE OF THE ASH BASIN AND ASH STORAGE AREA WAS OBTAINED FROM WSP DATED JULY 21, 2015.
6. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).
7. HYDROGRAPHY WAS OBTAINED FROM USGS 7.5-MINUTE SERIES TOPOGRAPHIC MAPS SALISBURY, NC AND SOUTHMONT, NC.
8. SURVEY BASED ON NC STATE PLANE GRID-NAD 83/NAVD 88.

SCALE (FEET)
150' 0 150' 300'
1" = 300'

PRE-DEVELOPMENT TOPOGRAPHY
DUKE ENERGY CAROLINAS, LLC
BUCK STEAM STATION ASH BASINS

ROWAN COUNTY, NORTH CAROLINA

DATE
MARCH 2016

FIGURE
B1–1

EXHIBIT DJW - 7.3.1
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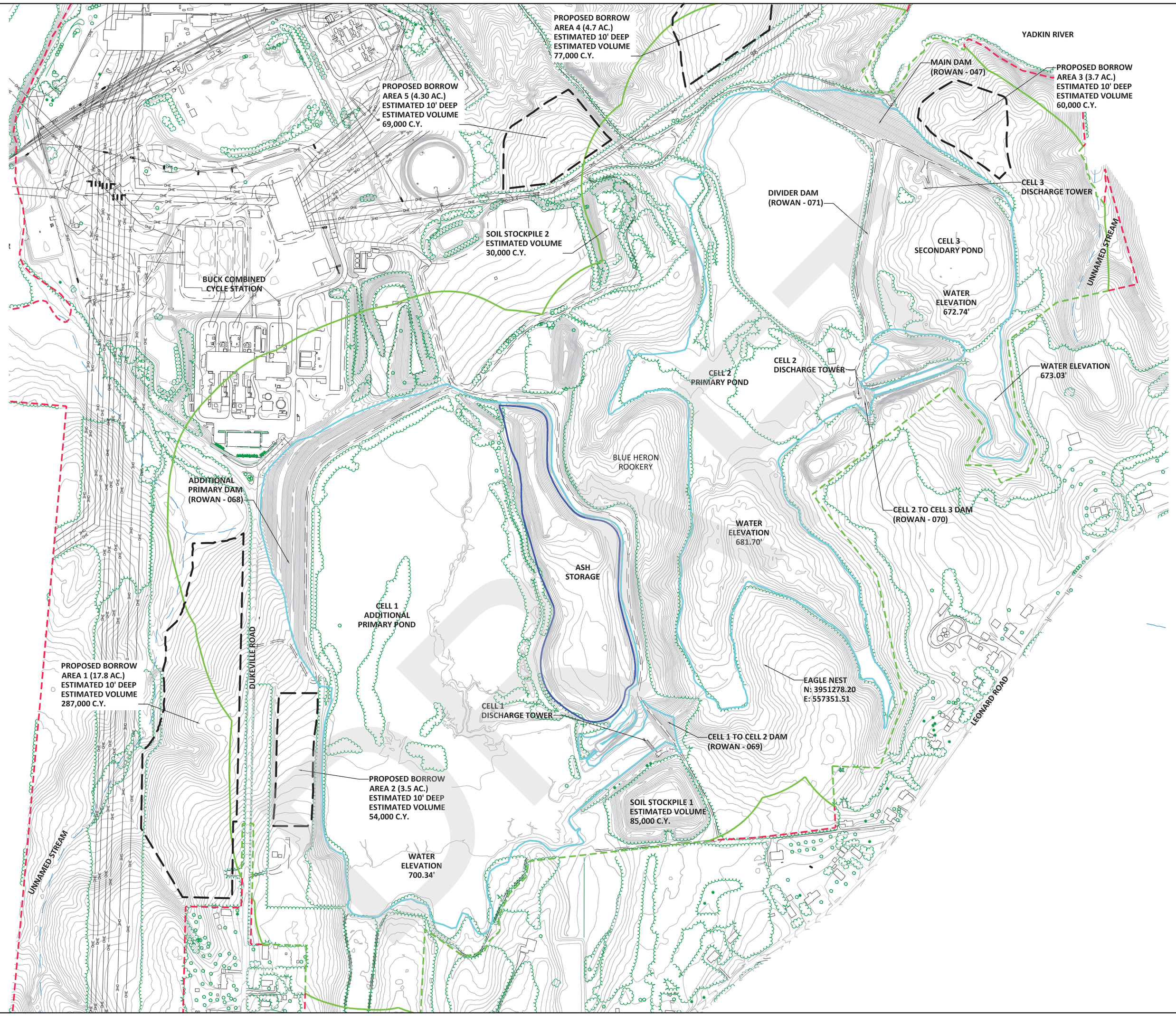

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4. HYDROGRAPHY WAS OBTAINED FROM USGS 7.5-MINUTE SERIES TOPOGRAPHIC MAPS SALISBURY, NC AND SOUTHMONT, NC.
5. SURVEY BASED ON NC STATE PLANE GRID-NAD 83/NAVD 88.

SCALE (FEET)
150' 0 150' 300'
1" = 300'

EXISTING TOPOGRAPHY
DUKE ENERGY CAROLINAS, LLC
BUCK STEAM STATION ASH BASINS

ROWAN COUNTY, NORTH CAROLINA

DATE
MARCH 2016

FIGURE
B1-2

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