Compliance with the Closure Performance Standards Required by Coal Combustion Residuals (CCR) Rule
Plant Scherer Ash Pond 1 (AP-1)

This Report supplements the closure permit application submitted to the Georgia Environmental Protection Division (GAEPD) on November 20, 2018. This Report further demonstrates that the closure-in-place method selected for Plant Scherer Ash Pond 1 (AP-1) complies with the closure performance standards of the federal and state Coal Combustion Residual (CCR) rules.

I. Introduction to the regulated unit, closure method, and conceptual site model

A. Regulated unit and site location

Plant Scherer (Site) is located in Juliette, Georgia, which is situated at the northeast edge of Monroe County, approximately 30 miles north of Macon, Georgia and approximately 60 miles southeast of Atlanta, Georgia. The regulated unit at Plant Scherer is the 550-acre AP-1 located northwest of the main Plant Scherer facilities. AP-1 is a valley-filled impoundment that was commissioned in 1980 and has been in operation since Plant Scherer became operational in 1982. CCR, primarily bottom and fly ash, and other process water generated by the plant has been conveyed to AP-1 since its inception. Sluicing of CCR into AP-1 has ceased with the conversion to dry ash handling systems. The present inventory of CCR stored within AP-1 is approximately 15.3 million cubic yards. Further details as it pertains to AP-1 site-specific information and its location and physical setting are provided in Section 1 – Introduction of Part A of the November 2018 Permit Application (Permit Application).

B. Summary of closure method

AP-1 is proposed to be closed by consolidating the CCR within the 550-acre impoundment into a reduced closure-in-place, approximate 300-acre footprint and closing the unit in accordance with the provisions of 391-3-4-.10 and 40 CFR 257.102(b)(1)(iii) (incorporated by reference in 391-3-4-.10(7)(b)). The proposed closure involves the following areas within the AP-1: 1) a closure-by-removal area located in the northern portion of the current AP-1, and 2) a consolidated closure-in-place area essentially encompassing the footprint of the current AP-1 CCR delta (closure-in-place footprint). The two proposed closure areas within the AP-1 unit limits will be separated by a proposed northern embankment berm (referenced herein as the North Berm) that will buttress the consolidated CCR materials within the closure-in-place footprint and form the northern limit of the final closure-in-place cover system.

In order to effectively manage stormwater, AP-1's closure-in-place design involves grading the closure-in-place surface into a ridge and valley "herringbone" configuration, which enables stormwater to drain efficiently off the final cover system, from the topographically higher ridges to the lower valley channels and subsequently off of the closure-in-place surface via engineered swales and ditches. In this manner, the closure-in-place footprint will be graded to promote positive drainage to the cover system stormwater drainage conveyances consisting of a series of swales and perimeter ditches. The stormwater drainage swales and ditches will discharge to outlet structures that will ultimately convey post-closure surface water runoff from the cover system to either the Recycle Pond (west area) or to Berry Creek (east area).

As part of the closure, Georgia Power will implement an advanced engineering measure (AEM). The AEM consists of expanding the reach of the closure-in-place cover system to include a topographic high area (referred to as the "knob area"). The knob area is a 54-acre, undeveloped, high topographic, peninsula area along the west perimeter of AP-1. Under current conditions, the knob area is an upgradient area of infiltration. Capping the knob area will help control and minimize lateral groundwater flow in the vicinity of AP-1 by controlling, minimizing, or eliminating that infiltration to the maximum extent feasible. More specifically, the knob area will be graded and covered with the same cover system as the closure-in-place footprint (ClosureTurf® cover system) to achieve an effective, continuous barrier to minimize infiltration and groundwater recharge. As the knob area does not contain CCR, it is not considered to be part of the cover system required under 391-3-4-.10 and 40 CFR. § 257.102(d)(3). Nevertheless, this area is included within the overall closure design, as described herein and in the Permit Application.

C. Conceptual site model

A conceptual site model (CSM) has been developed and this CSM is discussed in the Permit Application and the Geologic and Hydrogeologic Report, Plant Scherer – Ash Pond 1 (AP-1), 2020 (HAR Rev-September 2020). The following is a summary of the CSM as it is relevant to the closure methods proposed for AP-1.

The site is typical of the Piedmont Physiographic Province and the CSM is consistent with the conceptual models described for the Piedmont of Georgia[1].

The site is directly underlain by a variably thick blanket of overburden, which is comprised of residual and saprolitic soils, saprolitic rock (also referred to as partially weathered rock (PWR)), and transitionally weathered rock (TWR). The upper 30 feet of the TWR/Bedrock is generally considered fractured bedrock in the Groundwater Modeling Summary Report (HAR Rev-September 2020 Appendix A). The geology beneath the site is generally consistent across the site (i.e., feldspathic biotite gneiss) with isolated granitic, mafic, and ultramafic bodies. Lineaments identified around the site are consistent in orientation with structural features observed during geologic mapping, indicating that development of surface lineation is likely controlled by preferential weathering related to discontinuities in bedrock. The top of rock surface generally mimics site topography.

The uppermost aquifer occurs within the overburden which includes the TWR (fractured bedrock). Based on the site data presented in the HAR Rev-September 2020, the overburden aquifer and the bedrock are hydraulically connected (though limited) and their connectivity varies based on the topographic location, storage capacity of the overburden, and the occurrence of interconnected fractures to the bedrock aquifer.

II. CCR Rule performance standards.

Rule 391-3-4-.10 of the Rules and Regulations for the State of Georgia contains requirements for the closure of CCR surface impoundments. These regulations (in 391-3-4-.10(7)(b)) reference the closure design requirements of 40 CFR 257.102. For closures in place, 40 CFR 257.102(b)(iii) requires a final cover system designed to achieve the performance standards of 40 CFR 257.102(d). These provisions require the CCR unit to be closed in manner that will:

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[1] Robinson, J. L., Journey, C. A., Atkins, J B, Ground-Water Resources of the Coosa River Basin in Georgia and Alabama - Subarea 6 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins, USGS Report 96-177 - 1996

Legrand, Sr., H. E., Master Conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina: A Guidance Manual - 2004

- Control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere (40 CFR 257.102(d)(1)(i));
- Preclude the probability of future impoundment of water, sediment, or slurry (40 CFR 257.102(d)(1)(ii));
- Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period (40 CFR 257.102(d)(1)(iii));
- Minimize the need for further maintenance of the CCR unit (40 CFR 257.102(d)(1)(iv);
- Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices (40 CFR 257.102(d)(1)(v));
- Stabilizing the CCR unit for closure by eliminating free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues and stabilizing remaining wastes sufficient to support the final cover system (40 CFR 257.102(d)(2)).

Each of these design performance standards referenced by 40 CFR 257.102(b)(iii) are addressed in the following sections.

A. Post-closure infiltration of liquids performance standard [40 C.F.R. § 257.102(d)(1)(i)]

This provision requires the closure cover system to control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere. In the preamble to the federal CCR Rule, EPA states that the performance standards for the final cover system, including the infiltration standard, require owners and operators to ensure the integrity of the final cover system in selecting the final design, including accounting for any conditions that may cause the cover system not to perform as designed [80 Fed Reg. at 21413].

1. Post-closure infiltration will be controlled, minimized, or eliminated, to the maximum extent feasible.

The final cover system design identified in the Permit Application will control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste. From a technical standpoint, infiltration is the movement of water from the land surface into the subsurface. Infiltration is defined by the U.S Geologic Survey as the flow of water from the land surface into the subsurface. *See* USGS Dictionary of Water Terms.[2] Additionally, Freeze and Cherry[3] define infiltration as "the entry into soil of water made available at ground surface, together with the associated flow away from the ground surface within the unsaturated zone." EPA also says that infiltration is how "water applied to the soil surface through rainfall and irrigation events subsequently enters the soil" and that "this term can be used in the estimation of water available for downward percolation…"[4]. This performance standard does not address lateral movement of water in the subsurface because lateral movement is not infiltration.

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[2] https://www.usgs.gov/special-topic/water-science-school/science/dictionary-water-terms?qt-science_center_objects=0#qt-science_center_objects

[3] Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Englewood Cliffs, NJ, Prentice-Hall. 197

[4] https://www.epa.gov/water-research/infiltration-models

Based on the engineering design and planned construction of the closure-in-place cover system (including grading, materials, etc.), the closure method will "control, minimize, or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste." Available lines of evidence that demonstrate compliance with the post-closure infiltration of liquids performance standard include the following:

a. **Section 257.102(d)(3) Final cover system.** Section 2 – Engineering Report of Part B of the Permit Application provides the design methodology and engineering demonstration of the closure cover system criteria. The Permit Application presents an engineered geomembrane-synthetic turf composite (ETC) system Final Cover System and a traditional engineered Final Cover System as an alternative cover design that both meet or exceed the requirements of 257.102(d)(3), as described in Section II.G below. In accordance with these provisions, the AP-1 closure-in-place footprint has been engineered and designed to minimize infiltration and erosion via either cover system. These items are further discussed in the following sections.

   i. **Final Cover System.** The proposed Final Cover System consists of an ETC system with sand infill in lieu of the "traditional" geomembrane and soil cover. Such ETC systems have been successfully utilized at other impoundment closures and other closure applications. As demonstrated by the HELP (Hydrologic Evaluation of Landfill Performance) modeling, the proposed Final Cover System significantly exceeds the infiltration performance cover system described in 40 CFR 257.102(d)(3)(i), meeting and exceeding the requirements of a non-traditional final cover system per 40 CFR 257.102(d)(3)(ii) as documented in Appendix B of Section 2 – Engineering Report of Part B of the Permit Application.

   ii. **Alternative Final Cover System.** The proposed Alternative Final Cover System per the CCR closure permit application consists of a traditional geomembrane barrier layer installed on a prepared CCR surface subgrade that is finish-graded in accordance with the closure-in-place design criteria. The cover system geomembrane would be overlain by a drainage geocomposite, an 18-inch thick compacted soil infiltration/protective cover layer, and a 6-in. thick erosion layer consisting of vegetative cover soil. As demonstrated by the HELP modeling, the proposed Alternative Final Cover System also significantly exceeds the infiltration performance of the minimum cover system, meeting and exceeding the requirements described in 40 CFR 257.102(d)(3)(i), as documented in Appendix B of Section 2 – Engineering Report of Part B of the Permit Application.

   iii. **Engineering of Alternative Cover System infiltration/protective cover layer.** As part of the Construction Quality Assurance (CQA) program included in Section 5, Part A of the Permit Application, any borrow sources for constructing the Alternative Cover System will be subject to prequalification screening and acceptance criteria based on properties defined by a prescribed geotechnical laboratory testing program. Furthermore, the Alternative Cover System would be comprised of both soil and geosynthetics subjected to "best practice" materials performance testing to demonstrate that the maximum permeability requirement of 40 CFR 257.102(d)(3)(i)(A) will be satisfied. The infiltration/protective cover layer would be constructed from soils meeting the CQA requirements and would be placed in well-compacted, controlled engineering layers. Once in-place, the infiltration/protective cover layer would protect the underlying cover geomembrane while providing a stable sub-base for the overlying vegetative erosion protective soil layer. The proposed infiltration/protective cover layer would thus provide for added performance benefit and protection of the cover system and closure-in-place footprint.

b. **Surface grading plans**. The closure design surface grading plans are presented in Section 9 – Closure Drawings of Part A of the Permit Application. Methodology for the closure configuration and surface grading is provided in Section 7 – Closure Plan of Part A of the Permit Application. The Closure Drawings were generated using AutoCAD Civil 3D (version 2017) and all slopes and grades were engineered to meet minimum/maximum slope guidelines established by GAEPD. As described in these documents, the grades are designed to shed stormwater in a manner that precludes the probability of future impoundment of water, sediment, or slurry, and controls, minimizes, or eliminates, to the maximum extent feasible, the potential for infiltration.

c. **Surface water conveyance design/management controls**. The closure design includes a series of engineered drainage conveyances (swales and ditches) that will serve to capture and convey stormwater out of the closure-in-place footprint to prevent ponding or impoundment of surface water and control, minimize, or eliminate, to the maximum extent feasible, the potential for infiltration through the proposed final (or alternative) cover system.

In addition to controlling and/or minimizing infiltration as required by the performance standards, the selected closure method and implementation of the AEM, will control and minimize lateral migration to the maximum extent feasible, as demonstrated by the following lines of evidence.

a. **Closure-in-place footprint grading/design.** The AP-1 closure-in-place footprint has been engineered/designed to prevent ponding and to shed surface water across the low-permeability proposed Final Cover System (or Alternative Final Cover System) primarily west to the Recycle Pond. The remaining portion of the closure-in-place footprint will shed surface water to the east across the low permeability proposed Final Cover System (or Alternative Cover System) to the downgradient Berry Creek watershed. The proposed Final Cover System (or Alternative Final Cover System) will contribute to the control and minimization of lateral groundwater migration below the AP-1 closure footprint by preventing surface water infiltration and conveying surface water downgradient of AP-1 rather than allowing surface water to infiltrate.

b. **Construction of North Berm.** The North Berm divides the southern closure-in-place footprint from the northern closure-by-removal area. The closure-by-removal area has been engineered with stormwater control systems that divert and attenuate stormwater east to the downgradient Berry Creek watershed. These engineered stormwater control systems have been designed to promote drainage away from the closure-in-place footprint and closure-by-removal area. These designs have been incorporated into the groundwater modeling, which shows these stormwater control features support control and minimization of groundwater flow into the closure-in-place footprint and closure-by-removal area. For additional information on the groundwater model, see the HAR Rev-01, Appendix A.

c. **Knob Area included in cover design.** The AP-1 closure plan includes the AEM of a cover system over a topographic high, peninsula area (knob area) along the west perimeter of AP-1. Three-dimensional groundwater flow modeling predicts that precipitation onto the knob area would be a significant source of post-closure infiltration, which influences the hydraulic gradient across AP-1. However, grading the knob area and extending the AP-1 low-permeability cover system will greatly reduce infiltration at the knob area, thus resulting in a gentler hydraulic gradient. This element of the overall closure strategy enhances the control and minimization of lateral migration of groundwater towards AP-1 otherwise achieved by the closure plan because covering the knob area will further reduce hydraulic head and gradient.

d. **Groundwater modeling.** A steady-state groundwater model was developed for the site and calibrated to observed potentiometric head conditions for use in designing the AP-1 closure. There have been refinements to the AP-1 closure design presented in the Permit Application with the on-going advancement of the AP-1 closure detailed engineering and design work. The currently planned AP-1 closure design is similar to that presented in the Permit Application with the following changes:
   - North Berm Location. The North Berm was shifted south roughly 500 ft, reducing the closure-in-place footprint and increasing the closure-by-removal area size by 30 acres.
   - Closure-By-Removal Area Stormwater Control Systems. Advancement in the closure-by-removal area design identified the need for additional detention basins to attenuate flows and discharge to the Berry Creek watershed.

   These AP-1 closure design changes were incorporated into the groundwater model to support the HAR Rev-September 2020 Appendix A, and updated groundwater contour (hydraulic head) mapping was developed to model the current refined AP-1 closure design. Based on the simulated post-closure model, the AP-1 closure will result in gentler horizontal gradients and an overall significant reduction in hydraulic head after reaching long term groundwater elevations as compared to pre-closure conditions. The modeling is subject to review and refinement, including based on any closure design refinements and as additional site data is collected.

2. Post-closure releases of CCR, leachate, or contaminated run-off [40 C.F.R. § 257.102(d)(1)(i)]

As described in Section 7 of Part A of the Permit Application and above, the consolidated CCR materials will be completely covered with the proposed Final Cover System (or Alternative Final Cover System), which will control, minimize or eliminate, to the maximum extent feasible, releases of CCR, leachate, or contaminated run-off to the ground, surface waters, or to the atmosphere, as required by 40 C.F.R. 257.102(d)(1)(i). The term “groundwater” is not included among the media listed in this performance standard. Matters related to potential CCR groundwater impacts are instead regulated by other parts of the CCR Rule. Thus, the basis for evaluating compliance with this performance standard is the degree to which the closure design for the Final Cover System (or Alternative Cover System) controls, minimizes, or eliminates post-closure releases of CCR, leachate, or contaminated run-off to the ground, surface waters, and the atmosphere.

The proposed Final Cover System (or Alternative Final Cover System) in the closure-in-place footprint will be virtually impermeable and has been designed to resist erosion and to efficiently shed stormwater off of the cover area to effectively enclose the capped CCR in-place. The Final Cover System (or Alternative Final Cover System) will thereby help to prevent releases of CCR and contaminated run-off from within the closure-in-place footprint to the atmosphere, ground, or surface waters.

As highlighted here, and as further detailed in the GAEPD Permit Application, the closure design for AP-1 will include measures that control, minimize or eliminate, to the maximum extent feasible, the post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground, surface waters, or to the atmosphere, as required by 40 C.F.R. 257.102(d)(1)(i).

B. Future impoundment of water, sediment, or slurry [40 C.F.R. § 257.102(d)(1)(ii)]

Technical and regulatory references show that the term "impoundment" means a surface accumulation. As defined in 40 C.F.R. § 257.53, a CCR surface impoundment or impoundment is "a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR".

The closure cover system must be designed to "preclude the probability of future impoundment of water, sediment, or slurry." See 40 C.F.R. § 257.102(d)(1)(ii). The standard is based on existing Mine Safety and Health Administration (MSHA) regulations for closures of impoundments under MSHA jurisdiction [75 Fed. Reg. 35128, 35208 (June 21, 2010)]. Specifically, the CCR Rule performance standard uses the same language as the MSHA regulation [30 C.F.R. § 77.216]. Both require closure plans to "preclude the probability of future impoundment of water, sediment, or slurry." According to MSHA's Coal Mine Impoundment Inspection and Plan Review Handbook p. 51 (October 2007), precluding surface accumulations through capping satisfies this standard because meeting this standard is "typically done by breaching and/or capping," which eliminate surface accumulations. EPA also indicates that the impoundment performance standard is met by precluding future surface accumulations through final cover system grades that promote surface water runoff [80 Fed. Reg. 21302, 21411 (Apr. 17, 2015)].

Future impoundment of water, sediment, or slurry at AP-1 will be eliminated within the closure-in-place footprint once the closure is completed, by installing the proposed Final Closure System (or Alternative Final Cover System) and constructing finish grades and drainage conveyances that preclude the future surface accumulation of water, sediment, or slurry as outlined below:

a. CCR in AP-1 will be consolidated to the south into the closure-in-place footprint and capped with the proposed Final Cover System (or Alternative Final Cover System), leaving no exposed CCR.

b. HydroCAD version 10.00 was used to model the post-closure stormwater conditions at the AP-1 site. This modeling confirms that the proposed closure designs and included stormwater conveyance features can safely pass flows expected from regulatory design storms for both proposed cover system designs, thus precluding the probability of future impoundment of water. HydroCAD is an industry-accepted modeling software that is used to calculate hydrologic inflows for a variety of design storms. The HydroCAD model generated for the planned AP-1 closure was used to estimate the peak inflows to Berry Creek and to the Recycle Pond, and the expected peak flows along the various stormwater conveyance channels associated with both the proposed Final Cover System and the Alternative Final Cover System. Further description on this methodology and results is provided in Appendix C of Section 2 – Engineering Report of Part B of the Permit Application.

c. As described above, AP-1's closure-in-place footprint has been designed to be graded to promote positive drainage out of the closure area without impoundment within or along the cover area once closure construction is completed. The proposed Final Cover System and Alternative Final Cover System have been designed to resist sloughing or movement and with swales and ditches that will extend across the closure-in-place footprint (swales) and its perimeters (ditches) specifically for stormwater control, conveyance, and discharge away from the closure area.

d. As described above, the proposed Final Cover System (or Alternative Final Cover System) stormwater drainage swales and ditches will flow and discharge to outlet structures that will convey post-closure surface water runoff from the cover area primarily west to the Recycle Pond and partly east to the Berry Creek watershed. The closure-in-place footprint final grades and cover system drainage conveyances and outlet structures designs were developed using AutoCAD Civil 3D. The AP-1 closure-in-place footprint cover system drainage and conveyance features were sized and designed using HydroCAD 10, AutoCAD Civil 3D, and Hydraulic Toolbox 4.4.

e. As described above, the proposed Final Cover System and Alternative Cover system have been designed specifically for the site climatic conditions and expected hydrologic and hydraulic flows for the design storm event (100 yr/24 hr storm). Both systems include a geomembrane liner that is erosion resistant and drainage conveyances designed for the expected surface water flows/velocities. Additional details on the design of channel lining materials are provided in Appendix C of Section 2 – Engineering Report of Part B of the Permit Application.

f. The potential for ponding as a result of settlement beneath both the proposed Final Cover System and the Alternative Cover System were analyzed. Because of the material properties of the CCR and the construction schedule anticipated, any potential settlement the closure-in-place footprint is predicted to occur during the construction period such that it can be appropriately addressed before construction is complete. Therefore, settlement of the proposed cover systems is not expected to be a concern and, as a result, ponding on the surface following closure is not anticipated. As part of the closure construction monitoring and construction instrumentation planning, settlement of the closure-in-place footprint will be monitored and addressed as needed leading up to the phase of cover system installation/construction.

g. The topographic high knob area to the west of AP-1 is being regraded and covered as an AEM. Finish grades across the knob area, closure-in-place footprint, and closure-by-removal area have been designed to collect and effectively and efficiently convey stormwater away from the knob and closure-in-place cover areas without ponding across the knob area or the AP-1 cover system.

As highlighted above, and further detailed in the GAEPD Permit Application, the closure design for AP-1 will include measures that were designed for the requirement to preclude the probability of future impoundment of water, sediment, or slurry are met, as required by 40 C.F.R. § 257.102(d)(1)(ii).

C. Slope stability of the final cover system [40 C.F.R. § 257.102(d)(1)(iii)] and minimizing the need for further maintenance [40 C.F.R. § 257.102(d)(1)(iv)]

Available lines of evidence demonstrating that the closure method provides for major slope stability and, through the design of the cover system, minimizes the need for maintenance after placement include the following:

a. The AP-1 closure was designed using AutoCAD Civil 3D with relatively controlled slopes (i.e. 3%) to obtain reasonable cross-grades and maintain stable slopes across the entire completed closure-in-place footprint. As described above, the slopes also meet maximum and minimum slope guidelines set by GAEPD. The closure-in-place footprint slopes have been designed to be stable long-term as demonstrated by the stability analyses provided in Appendix A of Section 2 – Engineering Report of Part B of the Permit Application, and the gentler 3% slopes will aide in minimizing maintenance or need for repairs by reducing stormwater runoff velocities across the cover system. Additionally, the closure-in-place footprint has been designed with a series of conveyance channels that include cross swales and perimeter ditches located and sized to efficiently and effectively convey stormwater out of the cover area to the designed discharge points. All conveyance channels have been designed to be armored with aggregate that is sized for the design storm, and thus these features will have minimal long-term maintenance needs.

b. A comprehensive site investigation and geotechnical investigation program was executed to establish key engineering parameters for the slope stability analyses. The geotechnical investigation included drilling, cone penetration test (CPT) soundings, and laboratory testing to support the closure engineering and design.

c. The AP-1 closure design finished slopes were evaluated for stability using limit equilibrium analysis and Spencer's method to confirm suitable factors of safety would be achieved. These evaluations included interior slopes, the North Berm, and existing perimeter dike slopes. Analyses were performed using the industry-accepted SLOPE/W 2016 computer modeling software**.** The stability analyses were completed to evaluate the planned finish closure-in-place footprint grades and slopes and compare those results against the CCR Rule criteria. Results of the analyses for both the static (local, global, and temporary loading conditions) and the seismic (pseudostatic) indicate that the AP-1 design closure geometry meets or exceeds the required safety factors. The stability analyses also evaluated the AP-1 closure-in-place footprint for the post-earthquake condition, which assigned residual strengths to CCR to model liquefaction. Seismic slope stability analysis performed for the post-earthquake condition indicated that the design closure geometry meets or exceeds required post-liquefaction factors of safety. Further description on methodology and results of the stability analyses is provided in Appendix A of Section 2 – Engineering Report of Part B of the Permit Application. The achieved stabilities will also minimize the need for further maintenance.

d. Post-closure settlement potential of the AP-1 proposed Final Cover System and proposed Alternative Final Cover System was evaluated for static settlement. Static settlement was evaluated using AECOM-developed spreadsheets that support the calculation of immediate or elastic compression, primary consolidation, and secondary compression. The static settlement analyses found that elastic compression is expected to occur over the period of the construction schedule and cease before completion of the cover system installation/construction. Primary consolidation and secondary compression are expected to be minimal (1 ft or less) and will be mitigated by preloading (i.e. overbuilding) areas found to be settling during construction as a result of time-induced settlements. Since it is predicted that settlements will cease prior to construction completion of the cover system, structural issues after installation of the cover system due to static settlement are not expected, and settlement-related maintenance should be minimal. Further description on methodology and results of the settlement analyses is provided in Appendix A of Section 2 – Engineering Report of Part B of the Permit Application. This minimal expected settlement will also minimize the need for further maintenance.

e. A detailed construction instrumentation plan for the AP-1 closure will be implemented to provide for settlement monitoring. Procedures will be followed, if needed, for addressing time-induced settlement to prevent displacement of the closure-in-place footprint cover system. Instrumentation to monitor potential construction settlements and displacements will also be used.

f. Although not required to satisfy stability or maintenance requirements, the knob area AEM cover will support both the stability and maintenance minimization of the closure design. The knob area will be regraded, and doing so will support the AP-1 cover system and enhance slope stability along the western portion of the AP-1 cover. By including the knob area, there is less perimeter length along the western side of the cover area, thus improving upon and bolstering the overall cover system stability and minimizing the need for further maintenance. The perimeter reduction simplifies the cover system by shortening the closure perimeter and providing simpler lines and edges rather than an otherwise heavily curved western boundary, which also reduces the extent of trench needed to anchor the cover system. Also, the management of post-closure stormwater flows is optimized by allowing for straighter/shorter, more functional drainage conveyances that tie-in better with the closure-in-place stormwater channels and ditches.

g. The proposed Final and Alternative Final Cover Systems would include erosion control design features to safely convey runoff from the peak design storm event through the stormwater features (TRM and riprap lined channels, culverts with riprap outlet protection, and stilling basins) and from the closure-in-place footprint. To accomplish this, a hydraulic analysis of the post-closure conditions was performed to determine peak depth and velocities. Resulting erosion control evaluations were performed to confirm protection against erosive forces during the design storm. These erosion control features will promote post-closure stability and minimize the need for post-closure maintenance. Additional details on the design of channel lining materials are provided in Appendix C of Section 2 – Engineering Report of Part B of the Permit Application. The existing perimeter dikes and the North Berm will bolster the closure area and help in supporting the long-term stability of the closure-in-place footprint. The existing dikes have been in-place and have remained structurally stable with minimal maintenance needed since AP-1's inception in the early 1980s. The existing dikes were analyzed for both long-term global and local maintenance stability as a part of the closure and were found to meet the requirements of the rule. The North Berm has been analyzed and designed for the planned closure and is also expected to remain structurally stable and require little to no post-closure maintenance. The 30-year post-closure care period provides sufficient time to ensure that the final cover system is properly maintained [80 Fed. Reg at 21426]. Further description on methodology and results of the stability analyses of the existing dikes and North Berm is provided in Appendix A of Section 2 – Engineering Report of Part B of the Permit Application.

h. AP-1 is formed by valley filled dikes, and the east dike segment is currently classified as a Category I High Hazard dam by the GAEPD Safe Dams Program. The east dike was engineered and constructed as a dam and has functioned without performance or dam safety issues since its construction and inception of AP-1 in the early 1980s. The AP-1 east dike structural integrity has been confirmed and continues to be routinely assessed. The east dike is planned to be lowered as part of the closure process to tie-in with the closure cover system. The east dike has also been evaluated for stability in regard to the proposed post-closure conditions and found to be stable. Once AP-1 is closed, the east dike will no longer be regulated under the Safe Dams Program. All activities involving the Category I dam will be completed in compliance with and in coordination with Georgia's Safe Dam Program.

As highlighted above and presented in more detail in the GAEPD permit application, the AP-1 closure design includes measures that provide for major slope stability to prevent sloughing or movement of the final cover system as required by 40 C.F.R. § 257.102(d)(1)(iii) and minimizes the need for future maintenance as required by 40 C.F.R. § 257.102(d)(1)(iv).

D. Completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices [40 C.F.R. § 257.102(d)(1)(v)]

The closure method selected for AP-1 will allow for its closure to be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices. Available lines of evidence demonstrating that the AP-1 closure design and planning is being completed in that manner include the following:

a. Consolidating areas of thin CCR deposits into a reduced closure footprint as planned/designed for AP-1 is a proven means to minimize the CCR footprint and more quickly close CCR impoundments. For example, closure in-place without consolidation would involve a much longer construction schedule.

b. A detailed closure sequence has been developed for AP-1 that will help in promoting and successfully achieving the shortest possible closure construction period. The proposed closure construction sequence is provided in Appendix A of Section 9 –

Closure Drawings of Part B of the Permit Application. Construction sequencing will continue to be refined as closure construction planning progresses.

c. Considering that AP-1 includes dike segments that classify as High Hazard dams, the closure sequencing and schedule has been developed in alignment with the requirements of the GAEPD Safe Dams regulations, including parameters outlined by that regulatory staff. The planned AP-1 closure approach, phasing, and schedule promote dam safety through the entire construction period and up until closure, at which point the AP-1 dikes will no longer be considered dams.

d. The AP-1 closure will minimize the construction time by utilizing good engineering and construction practices, which include:
   - Planning for use of on-site and locally sourced materials and resources.
   - Designing and planning for standardized materials and implementation of methods accepted widely by the engineering, solid waste, and construction industries.
   - Using accepted materials or systems that will help in simplifying and/or expediting construction (e.g., Final Cover System).

The AP-1 closure construction schedule is discussed in Part A of the Permit Application. The schedule milestones are presented here along with current estimated timeframes following Georgia Power's notification to GAEPD of final receipt of non-CCR waste streams.

Activity	Year										
	1	2	3	4	5	6	7	8	9	10	11
Project Start	■										
Liquid Removal	■	■	■								
Place, Grade & Compact CCR within Consolidated Closure-In-Place Footprint		■	■	■	■	■	■				
Excavate CCR from Closure-By-Removal Areas				■	■	■	■				
Complete Final Grading and Install Final Cover System (ClosureTurf®)			■	■	■	■	■	■			
Prepare Accurate Boundary Survey and Legal Description for Final CCR Mgmt. Boundary									■		
Provide Closure Construction Report to GAEPD										■	
Submit Property Deed Confirmation to GAEPD											■

As highlighted above, and presented in more detail in the GAEPD permit application, the AP-1 closure will be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices as required by 40 C.F.R. § 257.102(d)(1)(v).

E. Stability for the final cover system [40 C.F.R. § 257.102(d)(2)]

40 C.F.R. § 257.102(d)(2) provides that the owner or operator of a CCR surface impoundment must meet the drainage and stabilization requirements of paragraphs (d)(2)(i) and (ii) prior to installing the closure cover system. The drainage and stabilization work required under 102(d)(2) is to provide a stable subgrade for the final cover system. Specifically, the performance standard calls for the elimination of free liquids by removing liquid waste and solidifying/stabilizing the remaining wastes and waste residues to a sufficient degree to support the final cover system. Subsection (d)(2)(i) addresses stability through the elimination of free liquids by removing liquid wastes, and Subsection (d)(2)(ii) calls for other stabilization if needed to sufficiently support the cover system. These provisions are satisfied if standing water and sufficient additional liquids are removed under (d)(2)(i) as needed, in conjunction with any other stabilization efforts under (d)(2)(ii), to provide stability for the cover system. Prior to installing the final cover system, in accordance with [40 C.F.R. § 257.102(d)(2)], free liquids will be eliminated by removing liquid wastes. The remaining wastes will be stabilized as may be necessary to support the final cover system. These actions together will provide for both construction as well as long-term stability of the closure cover system.

Free liquids are defined as "liquids that readily separate from the solid portion of waste under ambient temperature and pressure". In the CCR Rule, the requirement to eliminate free liquids by removing liquid wastes is focused on eliminating ponded water. Removal of ponded water facilitates the proper installation of the final cover system. EPA has also identified other benefits of removing ponded water.

Specifically, the EPA has stated "[d]uring operations, free liquids that are ponded in the impoundment create a strong hydraulic head that acts to increase infiltration through the base of the impoundment. The removal of free liquids and capping during closure reduces the hydraulic head…." [see EPA, Human and Ecological Risk Assessment of Coal Combustion Residuals, Appendix K at K-1 (Dec. 2014)]. Unlike ponded water, groundwater, for example, is not considered free liquid as it is defined separately from free liquids as "water below the land surface in a zone of saturation" [40 C.F.R. § 257.53].

Stability will be necessary across the entire closure-in-place footprint to implement the planned AP-1 closure as well as provide sufficient stability for the cover system after closure. The planned removal of standing water and additional liquids will substantially improve the stability of the CCR and allow for access of construction equipment/personnel and safe construction of the closure design and cover system. Geotechnical investigations and analyses have been completed to support the anticipated liquid removal and other construction activities and to confirm that the design/closure features of the closure-in-place footprint and the closure-by-removal area can be implemented in the field without the need for additional stabilization efforts. Analyses have also been completed and the closure-in-place footprint is designed to safely support the AP-1 final cover grades and its cover system.

As described in Section 2.7 of the Closure Plan included in the Permit Application, liquid removal will include removing standing water and additional liquids as needed to allow for CCR excavation and consolidation into the final closure footprint and configuration, ultimately providing long-term stability of the closure cover system. Removing these liquids will involve a series of pumps with floatable intakes that will then convey the removed liquids to a water treatment plant for treatment during AP-1 closure activities. Georgia Power will discharge the removed liquids in accordance with NPDES permit requirements. A series of dewatering controls may also be used, and they will convey liquids to the same water treatment plant. A pilot testing program conducted at the site using instruments including tensiometers and pore pressure transducers confirmed that sufficient liquids removal from AP-1 will occur to complete the planned closure construction.

These actions will provide for long-term stability of the closure cover system over the closure and post-closure duration. In addition, some of the dewatering controls will remain in-place and functioning up until the point when the installation/construction of the closure cover system is completed across AP-1, thereby allowing the benefits of the above-described liquid removal to translate directly into post-closure such that the improved stable surface of the covered CCR will remain long-term.

In addition:

a. A detailed instrumentation plan will help confirm that the target liquid removal is achieved such that the planned construction can be completed safely and consistent with the standards and criteria established by the closure design documents. The plan will include a detailed Instrumentation Monitoring System (IMS) to monitor the physical state of the CCR impoundment closure. The IMS data will be an important part of the safety and quality plans. The instrumentation data will allow concerns and potential deficiencies to be detected and addressed to avoid potential construction, safety, and/or quality/performance issues. The IMS will remain in-place and active throughout the entirety of construction and will also include instruments that are monitored after closure to confirm the geotechnical performance and long-term stability and integrity of the AP-1 closure-in-place footprint and its cover system.

b. As described above, geotechnical analyses were completed to support the closure design and to confirm long-term stability of the closure-in-place footprint, including the North Berm and the proposed cover systems. Settlement analysis showed that potential short-term elastic settlements due to liquid removal activities will cease before the closure-in-place footprint cover system installation/construction is completed. Settlement analysis also showed that long-term consolidation settlement and secondary compression is expected to be 1-ft or less, which will not affect the integrity or long-term stability of the closure cover system. These settlement estimates are consistent with engineering expectations for CCR materials and considering limited earthwork fill is needed to reach final grades in the CCR delta/closure-in-place footprint. In areas where potential for long-term settlement exists, the closure construction will include pre-loading to promote the settlements prior to cover system installation.

c. Plant Scherer is located within a low seismic zone as defined by the USGS, which means the risk for earthquake induced post-liquefaction settlement and subsequent instability of the closure cover system is within acceptable limits. Furthermore, the benefit of the above-described liquid removal will remain during and following closure, which will help in mitigating against liquefaction-induced settlement and subsidence of the closure cover system.

d. The North Berm is an integral part of the AP-1 closure plan, and it has been designed to buttress the closure-in-place footprint and form the northern limits of the closure area. The North Berm geometry/shape, alignment, foundation, and slopes were developed for this closure based on site-specific geotechnical investigations (borings, sampling, and field and laboratory testing) and foundation and stability analyses. The installation of the North Berm will further provide for long-term stability of the closure cover system.

As highlighted above, and presented in more detail in the GAEPD permit application, the owner or operator of AP-1 will meet the drainage and stabilization requirements as required by 40 C.F.R. § 257.102(d)(2).

G. Final cover system and Georgia-registered professional engineer certification [40 C.F.R. § 257.102(d)(3)]

1. The AP-1 proposed engineered geomembrane-synthetic turf composite Final Cover System meets the requirements of paragraph 102(d)(3)(ii) as follows:

a. The proposed Final Cover System satisfies 102(d)(3)(ii)(A) because the synthetic turf composite and sand infill layer overlying a 40-mil linear low density polyethylene layer with a permeability estimated at 4.0×10^{-13} cm/sec that significantly outperforms the 1.0×10^{-5} cm/sec regulatory standard set forth at 102(d)(3)(i)(A). And these system components would provide greater protection against infiltration than the 18-inch, earthen infiltration layer described in 102(d)(3)(i)(B). This performance is confirmed by HELP modeling and liner system analyses.

b. The proposed Final Cover System satisfies 102(d)(3)(ii)(B) because permanently affixed synthetic turf on the Alternative Final Cover System is not susceptible to erosion and the synthetic turf prohibits native plant growth. Thus, the Alternative Cover System would provide greater protection from wind or water erosion than a 6-inch earthen erosion layer capable of sustaining native plant growth.

c. As required by 102(d)(3)(ii)(C), the disruption of the integrity of the proposed Final Cover System would be minimized through a design that accommodates settling and potential for subsidence. Anticipated potential settlement is documented in Part B Section 2 – Engineering Report of the Permit Application and is within the design specifications of the proposed Final Cover System. In addition, leveling fill materials and additional crown filling may be placed across the cover subgrade during construction to accommodate initial and elastic settlement to promote positive drainage and minimize long-term maintenance to the cover system.

2. The AP-1 Alternative Final Cover System meets the requirements of paragraph 102(d)(3)(i) as follows:

a. As documented in Part B – Engineering Report of the Permit Application, the proposed Alternative Final Cover System includes a 40-mil linear low-density polyethylene geomembrane material with a default permeability on the order of 10^{-13} cm/sec. The cover system HELP modeling and liner system analysis demonstrate that the Alternative Final Cover System significantly outperforms the 1.0×10^{-5} cm/sec regulatory standard set forth at 102(d)(3)(i)(A).

b. As required by 102(d)(3)(i)(B), the Alternative Final Cover System would include an infiltration/protective cover layer that contains a minimum of 18 inches of earthen material. Borrow source investigations/soil index testing of the soil protection layer would be performed in accordance with the proposed CQA Plan as provided in Part A Section 5 of the Permit Application, and as identified during closure construction.

c. As required by 102(d)(3)(i)(C), the Alternative Final Cover System would include an erosion layer that contains a minimum of six inches of earthen material capable of sustaining native plant growth. Details regarding establishing and maintaining native plant growth are provided in Part A Section 8 – Post-Closure Plan of the Permit Application.

d. As required by 102(d)(3)(i)(D), the disruption of the integrity of the AP-1 proposed Final Cover System and proposed Alternative Final Cover System would be minimized through a design that accommodates settling and potential for subsidence. Anticipated potential settlement is documented in Part B Section 2 – Engineering Report of the Permit Application. In addition, leveling fill materials and additional crown filling may be placed across the cover subgrade during construction to accommodate initial and elastic settlement to promote positive drainage and minimize long-term maintenance to the cover system.

3. **As required by (d)(3)(iii), a Georgia-registered professional engineer has certified that the design of both the AP-1 proposed Final Cover System and proposed Alternative Final Cover System meets the requirements of 40 CFR 257.102.** ***See the Professional Engineer Certification signed and sealed on November 16, 2018 by Douglas W. Carr, P.E. and included in the Permit Application.*** **In addition, the certification is reaffirmed as provided by the engineer stamp on this report.**

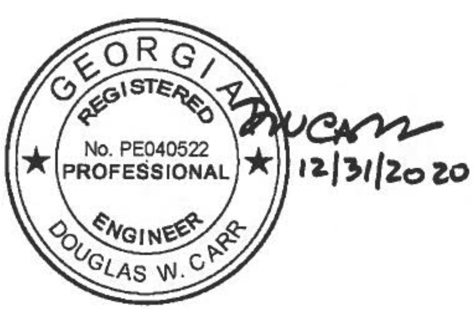
III. Summary and Conclusions

This assessment of the Plant Scherer AP-1 closure has considered the performance standards applicable under 40 CFR 257.102(d). As demonstrated throughout this document without exceptions, both the Final Cover System and the Alternative Final Cover System proposed in the Permit Application would achieve or exceed (in many cases significantly) each of the performance standards applicable to closure-in-place final cover systems as referenced by 40 CFR 257.102(b)(1)(iii) and described in 40 CFR 257.102(d)(1), (2), and (3). In addition to compliance with these performance standards, the proposed design includes an AEM that will provide enhanced protections by further controlling and minimizing lateral migration, as demonstrated by groundwater modeling. Considering the various components of the AP-1 closure design, the proposed closure satisfies the Rules, is consistent with good engineering practices, and is designed to be protective of human health and the environment.

IV. Professional Engineer Certification

As required by 40 C.F.R. § 257.102(b)(4), a Georgia-registered professional engineer has certified that the design in the Permit Application meets the requirements of the CCR Rule. Additionally, the certification is reaffirmed as provided by the engineer stamp on this report.

"I certify that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person who manages the system and those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I do hereby certify that the requirements of the United States Environmental Protection Agency Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (40 C.F.R. Subpart D) and Georgia Environmental Protection Division Solid Waste Rule for Management of Coal Combustion (391-3-4-.10) have been met."



ATTEST:

AECOM
Engineering Firm

Douglas W. Carr, P.E.
Name of Professional Engineer

Signature

December 31, 2020
Date