Compliance with the Closure Performance Standards Required by Coal Combustion Residuals (CCR) Rule Plant McDonough-Atkinson CCR Surface Impoundment Ash Pond 1 (CCR Unit AP-1)

This Report supplements the closure Permit Application submitted to the Georgia Environmental Protection Division (GA EPD) by Georgia Power Company. The report further demonstrates that the closure in place methods selected for Plant McDonough-Atkinson (Plant McDonough) CCR Unit Ash Pond 1 (AP-1) comply with the closure performance standards of the federal and state CCR regulations (i.e., CCR rules).

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

A. Regulated Unit and Site Location

Plant McDonough is a power generating facility, owned and operated by Georgia Power, located in Cobb County, GA. Plant McDonough historically operated as a coal fired facility, and four on-site CCR surface impoundments were utilized for CCR material over the duration of Plant McDonough's coal fired operations: Ash Pond 1 (AP-1), Ash Pond 2 (AP-2), Ash Pond 3 (AP-3) and Ash Pond 4 (AP-4). In 2011, Plant McDonough ceased coal-fired electric generating activities, and subsequently ceased placing CCR in the units.

AP-1 was commissioned in 1964 for use in sluicing operations for CCR and was in service until 1968 when Georgia Power ceased placing CCR in AP-1 for capacity reasons. AP-1 was then covered with an intermediate soil cover system, and the area was utilized for several interim land uses, such as lay down, recreation area, and administrative buildings. Historical details for Plant McDonough AP-1, including location coordinates and physical and engineering properties, are presented in the AP-1 History of Construction document submitted to EPD and located on Georgia Power's CCR Rule Compliance Information website for Plant McDonough.

B. Summary of Closure Method

Closure activities in accordance with Federal Regulation 40 CFR 257.100 were initiated in January 2016 for AP-1, before Georgia promulgated its state CCR program. Installation of the final cover system for AP-1 has been substantially completed and closure construction activities are ongoing as closure in place in accordance with 40 CFR 257.102(d), and AP-1 no longer receives CCR or other waste streams. Additionally, AP-1 was originally subject to the Federal CCR Rule timelines for sites with early closures, which were described in 81 Fed. Reg. 51802 (Aug. 5, 2016).

Overall, AP-1 closure activities consist of consolidating CCR from AP-1 and closing in place with a reduced footprint. Additionally, CCR material from the closure by removal of adjacent AP-2 and a portion of the excavated CCR from AP-3 was consolidated into the final limits of CCR in AP-1. This additional consolidation supported AP-1 closure grades such that the final closed geometry provides for gravity drainage of surface water runoff (e.g., precipitation) from the unit in a controlled manner. The CCR Unit AP-1 Solid Waste Permit Application (Permit Application), Part A, Section 7 Closure Plan presents details for the closure of AP-1. Installation of the final cover system at AP-1 was substantially completed in 2017. AP-1 is undergoing additional closure construction in the near term including the installation of a fully encompassing subsurface perimeter barrier wall and comprehensive stormwater management system. Final closure activities, including the subsurface perimeter barrier wall, will be completed in accordance with the Closure Plan.

The closure design and Permit Application for AP-1 include a ClosureTurf® cover system. As described in the Permit Application, that system consists of the following features, from the bottom layer to the top layer:

- 18-inch thick (min.) layer of compacted CCR or earthen subgrade material
- 40-mil minimum thickness linear low-density polyethylene (LLDPE) FML geomembrane
- ClosureTurf® (combined geotextile and engineered turf layer)
- Turf Infill or Overlying Protective Layer Options. Examples include:
  - Sand infill for general areas
  - Sand infill with a tackifier (Armorfill™ E)
  - Concrete infill (Hydrobinder®)
  - Drainage stone (riprap, gravel, etc.) overlying a geosynthetic separation / protection layer
  - Roadway stone overlying a geosynthetic separation / protection layer

To further enhance the in-place closure of AP-1, a subsurface perimeter barrier wall has been designed and will be constructed as an advanced engineering method (AEM). The barrier wall is presented in the Closure Plan, Construction Quality Assurance (CQA) Plan, and Closure Drawings, as well as in the supporting documents including Hydrogeologic Assessment Report (HAR) and Engineering Report as part of the Permit Application. Following closure completion, AP-1 will enter post-closure care for a minimum period of thirty (30) years. Post-closure care is detailed in the Permit Application, Part A, Section 8.

C. Conceptual Site Model

This section presents a summary of the conceptual site model (CSM) provided in full in the HAR Revision 04 submitted to GA EPD in February 2022, supporting Section 1 of Part B of the Permit Application. A regional, unconfined aquifer system is present at Plant McDonough, consisting of residual soils and transitionally weathered rock. Interconnected fractures in the transition zone transmit groundwater stored in the overburden soils to underlying bedrock. Localized groundwater flow directions within this aquifer are influenced by topographic and top of rock variations on site, which are consistent with the slope-aquifer conceptual model for groundwater flow in the Piedmont (Robinson et al., 1996[1]; LeGrand, 2004[2]).

Other attributes of the site-specific CSM include:

- The site is directly underlain by a variably thick blanket of overburden (typically observed between 9 to 61-feet thick), which is comprised of residual and saprolitic soils, saprolitic rock, partially weathered rock (PWR), and transitionally weathered rock.

- Bedrock in the northwestern part of the site is primarily characterized by Ordovician-age Long Island Creek Gneiss described as felsic sphene-epidote-biotite-quartz-feldspar gneiss with well-developed foliation and an augen texture.

- Bedrock in the southeastern portion of the site is primarily characterized by interlayered Ordovician age phyllonite, button schist with well-developed shear foliation, fine-grained mylonite with poorly developed foliation, and very fine-grained mylonitic biotite gneiss with well-developed shear foliation.

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[1] Robinson, J. L., Journey, C. A., Atkins, J B, 1996, 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.

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

- The uppermost aquifer occurs within the overburden and upper bedrock at the site. Although the degree of connection between the overburden and underlying bedrock aquifer systems is not fully understood, the bedrock is generally massive with few joints available to receive groundwater from the overlying overburden. In general, the majority of groundwater flow across the site occurs laterally in the overburden zone generally towards the southeast and/or south. Based on site-specific hydrogeologic characteristics, groundwater is expected to move laterally more than vertically within the PWR strata within the overburden unit and it is likely that there is limited groundwater movement from the PWR strata to the aquifer occurring in the bedrock unit.

II. CCR Rule Performance Standards

A. Post-Closure Infiltration of Liquids and Releases – CCR Performance Standard 40 C.F.R. § 257.102(d)(1)(i)

Section 257.102(d)(1)(i) requires the final cover system to 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.

1 Infiltration is controlled, minimized, or eliminated, to the maximum extent feasible.

Infiltration is the process by which surface water enters the subsurface. Infiltration is further defined in the text titled *Groundwater*[3] (Freeze and Cherry) as "the entry into soil of water made available at the ground surface, together with the associated flow away from the ground surface within the unsaturated zone." EPA additionally states 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]

Based on these and other technical definitions of infiltration, to meet the performance standard, the engineered final cover system must control, minimize, or eliminate, to the maximum extent feasible, the vertical migration of water from the surface into the underlying CCR. This performance standard does not address lateral movement of water in the subsurface, as that lateral movement is not considered infiltration.

The control and minimization of infiltration in the post-closure state of the unit is achieved by the final grading configuration and the installation of the final cover system. The closure method for AP-1 consists of consolidation and closure in place of CCR, and will be enhanced by the installation of the subsurface perimeter barrier wall as an AEM. The design of the final cover system of AP-1 was prepared following the requirements outlined in §257.102(d), including the final cover system requirements of §257.102(d)(3), as summarized above in Section I.B.

The final cover system engineering design is outlined in detail in the Engineering Report Revision 01 (February 2022) submitted to GA EPD as part of the Permit Application for AP-1. The final cover system includes measures to prevent infiltration, serve as a stable containment system under post-closure conditions, and to prevent releases of CCR. Specifically, ClosureTurf®, a cover system consisting of an engineered combination of a flexible membrane liner and synthetic turf, was designed and is being utilized as the final cover system for AP-1 to control, minimize, or eliminate to the maximum extent feasible infiltration (from, e.g., precipitation) into the unit. In addition, final slopes of the closure are engineered for long term

[3] Freeze and Cherry, *Groundwater* 1979
[4] https://www.epa.gov/water-research/infiltration-models

stability and drainage across the top deck of the unit, and maximum 4H:1V slopes are used in CCR placement areas.

An evaluation of the permeability of the designed final cover system at AP-1 using the Hydrologic Evaluation of Landfill Performance (HELP) model was conducted, comparing the implemented ClosureTurf® cover system to a traditional, unlined earthen cover system that is the baseline requirement under §257.102(d)(3).[5] While the baseline earthen cover system would be permissible, the ClosureTurf® actually results in 99.99% less calculated infiltration potential than the baseline earthen cover system. Appendix F of the Engineering Report Rev 01 (Part B Section 2) presents the detailed HELP evaluations.

The surface water management system for AP-1 further minimizes the potential for infiltration. This system includes several controls for stormwater management at the closed unit. Stormwater runoff from the closed surface is routed over the cover system through a system of perimeter and downslope channels to two attenuation ponds. From there, stormwater is routed to the site's permitted outfall points. Surface water management design was performed using the TR-55 – Urban Hydrology for Small Watersheds method and evaluated with the use of Autodesk Storm and Sanitary Analysis software. The surface water management system evaluation is presented in the Engineering Report Rev 01 (Part B Section 2) and describes the design features that provide for controlled conveyance of stormwater off of the unit cover system through the use of downslope channels, perimeter channels, attenuation ponds, and outfall structures.

As demonstrated above and presented in more detail in the Permit Application, the AP-1 closure design includes measures to establish that the infiltration performance standard is met as required by 40 C.F.R. § 257.102(d)(1)(i).

While controlling or minimizing lateral migration of groundwater is not a requirement of the infiltration performance standard because lateral migration is, by definition, not infiltration, the selected closure methods also provide controls to minimize lateral migration. The Hydrogeological Assessment Report Rev 04 (Golder, 2022) for Plant McDonough (supplementing Part B Section 1 of the Permit Application) presents the details the three-dimensional post-closure numerical groundwater modeling for the site. In addition, the designed AEM for AP-1 and closure activities are predicted to effectively reduce groundwater flows between AP-1 and the surrounding areas. Specifically, the modeling presented in the Hydrogeological Assessment Report Rev 04 predicts that the flow in the overburden across the western and southern side of AP-1 will be substantially reduced as compared to base modeled conditions.

The Three-Dimensional Groundwater Model Summary Addendum (Golder, 2021) was submitted to GA EPD to support the groundwater modeling included in the HAR. This addendum summarizes how the model predicts up to an 84% reduction in flow across the downgradient (western and southern) sides of AP-1 under the proposed barrier wall configuration (presented in the Closure Drawings). Additionally, the barrier wall redirects groundwater flow upgradient of the permitted boundary around the wall or through the partially weathered rock below the bottom of CCR in AP-1. Therefore, the closure of the unit and the designed barrier wall AEM are effective in minimizing potential lateral migration of groundwater to the maximum extent feasible. Additional details regarding groundwater modeling of the barrier wall AEM are presented in Appendix A of the Hydrogeological Assessment Report Rev 04 in Part B Section 1 of the Permit Application and the Three-Dimensional Groundwater Model Summary Addendum, and are subject to review and refinement, including as additional site data are collected.

[5] The HELP model also evaluated the lined vegetated cover system included in the permit application and found that it would also significantly outperform the baseline cover system described at 40 CFR § 257.102(d)(3).

2 Releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere are controlled, minimized, or eliminated to the maximum extent possible.

The selected closure method for AP-1 was designed to control, minimize, or eliminate, to the maximum extent feasible, releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere, as required by the performance standard in 40 C.F.R. § 257.102(d)(1)(i). The defined term "groundwater" is not included among the media listed in this performance standard. Matters related to the 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 controls, minimizes, or eliminates these releases to the ground, surface waters, and the atmosphere.

The final cover system of AP-1 utilizing ClosureTurf® provides a barrier that isolates the CCR closed in place from the surface environment, thereby preventing these types of releases from occurring to the ground, atmosphere, or surface waters. The use of the ClosureTurf® system provides an engineered means to minimize releases of CCR following closure through the use of an FML over engineered slopes to cover CCR and optimize drainage of surface water. Details of the closure design, including details of the ClosureTurf® system, are presented in Section I.B above, as well as the Closure Plan in Part A Section 7 of the Permit Application, Closure Plan Drawings in Part A Section 9 of the Permit Application, and the Engineering Report Rev 01 in Part B Section 2 of the Permit Application. The selected closure method will control, minimize or eliminate, to the maximum extent feasible, releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.

Additionally, a Fugitive Dust Control Plan was prepared in order to identify dust control measures for closure construction. Details on the Fugitive Dust Control Plan are presented in the Closure Plan in Part A Section 7 of the Permit Application, as well as on Georgia Power's CCR website for Plant McDonough. Following closure, the ClosureTurf® system fully separates CCR from exposure to the atmosphere and the liner eliminates, to the maximum extent feasible, release of CCR to the atmosphere.

As demonstrated above and presented in more detail in the Permit Application, the AP-1 closure design includes measures to establish that the post-closure releases performance standard is met as required by 40 C.F.R. § 257.102(d)(1)(i).

B. The closure method precludes the probability of future impoundment of water, sediment, or slurry, per 40 C.F.R. § 257.102(d)(1)(ii).

The final cover system must be designed to "preclude the probability of future impoundment of water, sediment, or slurry" as required by 40 C.F.R. § 257.102(b)(iii); (d)(1)(ii). Technical and regulatory references show that the term, "impoundment" means the surface accumulation of water, sediment, or slurry. Prior to closure, the operation of AP-1 utilized earthen dikes to contain CCR and liquid materials. The CCR Rule closure performance standards follow the Mine Safety and Health Administration (MSHA) regulations for closure of impoundments under MSHA jurisdiction. Specifically, MSHA regulation 30 C.F.R. 77.216-5 uses the same language as the impoundment performance standard, requiring closure plans to "preclude the probability of future impoundment of water, sediment, or slurry." As stated in MSHA's Coal Mine Impoundment Inspection and Plan Review Handbook (October 2007), precluding surface accumulations 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. at 21,411). As such, "future impoundment" refers to potential surface accumulations above the final cover system.

The final cover system will preclude the probability of future impoundment of water, sediment, and slurry because its engineering and construction are designed to prevent the surface accumulation of water, sediment, and slurry. Closure plans for AP-1 include engineered surface grading plans that were prepared using AutoCAD Civil 3D. The grades were designed to eliminate the accumulations of water, sediment, or slurry on the capped surface of AP-1, and the designed perimeter drainage channels were engineered to move runoff away from the closed unit to the designed attenuation ponds at the perimeter of the closed unit, from which the water will be conveyed in a controlled manner until emptied. These closure plans are presented in Part A Section 9 of the Permit Application.

More specifically, and as already noted above, the AP-1 surface water management system manages stormwater runoff from the closed surface, such that stormwater is routed off of the closure system's engineered turf through a system of downslope and perimeter channels to the two attenuation ponds (North Pond and South Pond) and ultimately through the respective outlet structures identified in the Closure Plans (Part A, Section 9). These two attenuation ponds are designed for the attenuation and controlled management of stormwater. The ponds are designed to attenuate flow from the closed surface and drain within 24 hours for the design 100-year, 24-hour storm event, and outlet to the unnamed tributary to the west and south of AP-1. Design of this surface water management system was performed using the TR-55 – Urban Hydrology for Small Watersheds method for generating rainfall information and was also evaluated with the use of Autodesk Storm and Sanitary Analysis. The detailed surface water management system analysis is presented in the Engineering Report Rev 01 (Part B Section 2), which provides additional details on how the designed AP-1 stormwater management system meets the CCR rule requirements and design objectives of the closure.

In addition, long-term settlement potential for AP-1 was calculated and used to evaluate the potential for future impoundment subject to this performance standard. In general, CCR is much less susceptible to long term settlement than municipal solid waste (MSW) and Construction & Demolition (C&D) waste masses, and as such, cover system components and drainage grades are less prone to settlement induced issues in CCR closures. The settlement evaluations for the closed AP-1 conditions considered settlement following closure, with a maximum calculated post capping settlement predicted to be 0.43 ft in the northwest area of AP-1. Details of the evaluation for settlement potential for AP-1 are presented in Appendix E of the Engineering Report Rev 01 (Part B Section 2 of the Permit Application). This amount of settlement is immaterial from the standpoint of the potential for impoundment; thus, these settlement evaluations confirm that the final cover system will preclude the probability of future impoundment of water, sediment, or slurry.

As demonstrated above and presented in more detail in the Permit Application, the AP-1 closure is designed to preclude the probability of future impoundment of water, sediment, or slurry, as required by 40 C.F.R. § 257.102(d)(1)(ii).

C. The closure method provides for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period, per 40 C.F.R. § 257.102(d)(1)(iii).

As demonstrated in detail in the Engineering Report Rev 01 included in Part B of the Permit Application, AP-1 at Plant McDonough has been evaluated and meets or exceeds requirements across a wide range of global (deep) and veneer (shallow) stability conditions. Slope stability evaluations include a range of short- and long-term conditions, including provision for impacts from design storm events and from the theoretically potential seismic (earthquake) hazard at the site. Stability and integrity were evaluated using common commercial analysis software packages, including: RocScience SLIDE, AutoCAD Civil 3D, and in-house analytical calculation worksheets and procedures. As demonstrated in the Permit Application, the closure of AP-1 exceeds all regulatory requirements for closed unit stability.

As demonstrated above and presented in more detail in the Permit Application, the AP-1 closure is designed to prevent the sloughing or movement of the final cover system during the closure and post-closure care period, as required by 40 C.F.R. § 257.102(d)(1)(iii).

D. The closure method minimizes the need for further maintenance of the CCR unit, per 40 C.F.R. § 257.102(d)(1)(iv).

The maintenance performance standard as required by 40 C.F.R. § 257.102(d)(1)(iv) is met because the final cover system has been designed to need minimal maintenance after placement. The 30-year post-closure care period provides sufficient time to ensure that the final cover system is properly maintained (80 Fed. Reg. at 21,426).

As summarized above, the closure design of AP-1 incorporates a synthetic liner and engineered turf cover system known commercially as ClosureTurf®. The ClosureTurf® cover system consists of a structured geomembrane, overlain by an engineered synthetic turf and a specified sand infill in areas not otherwise overlain by supplemental cover materials (e.g., stone, riprap, etc.). While sand infill for a ClosureTurf® system can warrant replenishment or maintenance, use of an engineered turf closure system does not involve maintenance associated with traditional soil covers related to potential deeper erosion repairs and revegetation. Veneer stability calculations were completed and demonstrate that the selected cover system material is stable; additional details can be found in Appendix G of the Engineering Report Rev 01 (Part B Section 2 of the Permit Application). In addition, manufacturer guidelines for the sand infill on the ClosureTurf® are being followed. Additional details can be found in Appendix I of the Engineering Report Rev 01 (Part B Section 2 of the Permit Application.

Similarly, the final grades of AP-1 were designed to minimize maintenance by limiting long-term settlement potential of the surface water conveyance system that directs water from the unit to the outlet structures. Details of the evaluation for settlement potential for AP-1 are presented in Appendix E of the Engineering Report Rev 01 (Part B Section 2 of the Permit Application), indicating that for the closed AP-1 conditions there is both minimal potential for post-closure settlement and post-closure inspection and maintenance protocols in place to rectify any settlement that may occur during the post closure care period.

Surface water is routed to the North and South attenuation ponds through a series of flat bottom perimeter channels designed and constructed as concrete infilled turf (HydroTurf®) and drainage stone (riprap and stone) lined channels. The closure configuration and engineered stormwater features are designed to safely manage stormwater while limiting erosion from stormwater flow in the channel and outfalls through channel and pond layout and dissipation and armoring features. Estimates of the anticipated post-closure flow velocities and shear stresses, and selected channel lining's resistance to the shear stresses were calculated and are provided in Appendix I of the Engineering Report Rev 01 (Part B Section 2 of the Permit Application). In addition, the proposed barrier wall AEM would be a permanent system requiring little or no maintenance.

Through this combination of features, and as presented in more detail in the Permit Application, the closure method minimizes the need for further maintenance of the CCR unit, as required by 40 C.F.R. § 257.102(d)(1)(iv). See also the Post-Closure Care Plan presented in Part A Section 8 of the Permit Application.

E. The closure method will be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices, per 40 C.F.R. § 257.102(d)(1)(v).

Closure of AP-1 was initiated in 2016, following the submission of the Notification of Intent to Initiate Closure in December 2015. Closure in place, along with the selection of ClosureTurf® as the final cover system, allowed for an accelerated construction schedule for the substantial completion of closure when compared to, for example, the construction schedules associated with traditional soil and soil-synthetic composite covers. The below schedule reflects expectations as of 1Q22.

Closure Activity	Completion Date																																
	2015	2016				2017				2018				2019				2020				2021				2022				2023			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Notification of Intent to Initiate Closure	■																																
Dewateing Activities		■	■	■																					■	■							
Grading and Final Cover Construction Activities		■	■	■	■	■															■	■			■	■	■	■	■	■	■		
Permit Boundary Survey											■										■												
Permit Submittal to EPD													■																				
Construction Activities for Subsurface Perimeter Barrier Wall													■															■	■	■			
Completion of Final Closure Activities																															■		

At the time of the Permit Application, installation of the final cover system for AP-1 had been substantially completed, and closure construction activities are ongoing (including of the subsurface perimeter barrier wall AEM). As demonstrated in the above schedule and presented in more detail in the Permit Application, the AP-1 closure was designed to be completed expeditiously while consistent with recognized and generally accepted good engineering practices, as required by 40 C.F.R. § 257.102(d)(1)(v).

F. The closure method will provide stability for the final cover system, per 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) of this section prior to installing the final cover system required under paragraph (d)(3). This work is required for the purpose of ensuring that the final cover system subgrade will provide sufficient support for the cover system. Specifically, the performance standard calls for the elimination of free liquids by removing liquid waste or solidifying the remaining wastes and waste residues and stabilizing the remaining wastes to a sufficient degree to support the final cover system. Consistent with standard good engineering practices, the performance standard requires the removal of standing water and additional liquids as needed to accomplish a stable in-place closure, considering other stabilization work that may be performed, if necessary. Prior to substantial completion of cover system installation at AP-1 in 2017, and in accordance with 40 C.F.R. § 257.102(d)(2), free liquids were removed and the remaining wastes stabilized as necessary to support the final cover system.

Free liquids are defined as "liquids that readily separate from the solid portion of waste under ambient temperature and pressure" (40 C.F.R. § 257.53). Per the CCR Rule, the requirement to eliminate free liquids by removing liquid wastes is focused on eliminating ponded (standing) water. Removal of ponded water facilitates the proper installation of the final cover system. Further benefits of removing ponded water per the EPA have been identified, specifically "during 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…" (EPA, Human and Ecological Risk Assessment of Coal Combustion Residuals, Appendix K (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). Accordingly, the free liquids requirement of the CCR Rule is addressed by removing ponded water and implementing the Ash Pond Dewatering Plan approved by the GAEPD.

Thus, the free liquid requirement of Subsection (d)(2)(i) is satisfied if standing water and sufficient additional liquids are removed as needed to, in conjunction with other stabilization efforts, ensure the stability of the final cover system. Per subsection (d)(2)(i), the closure method eliminated free liquids by removal, and the removed liquids were treated prior to discharge in accordance with the GAEPD-approved Dewatering Plan. Confirmation of adequate subgrade stability was additionally provided by the required compaction and proof-rolling of the final cover system subgrade areas that was performed in the manner documented in the project Construction Quality Assurance Plan. Details of free liquid removal and subgrade preparation performed for AP-1 are presented in the Closure Plan (Part A, Section 7) and satisfy this standard. The GAEPD-approved Ash Pond Dewatering Plan (Dewatering Plan) also provides a summary of previously completed liquid removal activities.

Liquid removal associated with closure activities consisted of removing water using a variety of methods, including but not limited to passive, gravity-based methods (e.g., rim ditches) and active dewatering methods (e.g., pumps and well points) as needed to allow for CCR consolidation. In addition to dewatering, Georgia Power developed and implemented a plan for treating removed CCR contact water at the site during closure to provide treatment and management of discharge of contact water from the units, consisting of a range of treatment technologies, compliance sampling (constituents, frequency, and locations) for compliance with both the site's National Pollutant Discharge Elimination System (NPDES) permit and the CCR Rule.

Subsection (d)(2)(ii) is satisfied because, along with the elimination of free liquids as described above, the closure method will stabilize the remaining CCR sufficiently to support the final cover system. As described above and provided in detail in the Engineering Report Rev 01 included in Part B of the Permit Application, AP-1 at Plant McDonough has been evaluated across a wide range of global (deep) and veneer (shallow) stability conditions. Slope stability evaluations included a range of short- and long-term conditions, including provision for impacts from design storm events and from the theoretically potential seismic (earthquake) hazard based on the site location. Stability and integrity were evaluated using common commercial analysis software packages, including: RocScience SLIDE, AutoCAD Civil 3D, and in-house analytical calculation worksheets and procedures. As demonstrated in the Permit Application, the closure of AP-1 exceeds all regulatory requirements for closed unit stability as reflected in the factors of safety in the Engineering Report Rev 01 contained in Part B of the Permit Application for various cross sections through the unit.

The ClosureTurf® system cover veneer stability analyses for gravel access roads calculated an acceptable factor of safety against veneer failure, as reflected in the Engineering Report Rev 01 contained in Part B of the Permit Application.

As demonstrated above and presented in more detail in the Permit Application, the AP-1 closure is designed to satisfy the performance standard requirement for drainage and stabilization of AP-1 prior to the installation of the final cover system, as required by 40 C.F.R. § 257.102(d)(2).

G. Per 40 C.F.R. § 257.102(d)(3), the closure method includes a final cover system that is designed to minimize infiltration and erosion and meets the criteria specified in 40 C.F.R. § 257.102(d)(3)(ii) and (iii).

The final cover system of AP-1 meets the requirements of §257.102(d)(3)(ii)(A) through the design permeability of the final cover system, which will be limited by a flexible geomembrane liner with a permeability less than the maximum allowed permeability of 1 x 10^{-5} cm/sec. The flexible membrane liner of the ClosureTurf® cover system is modeled to have a permeability of 4 x 10^{-12}cm/sec, far below the maximum permissible permeability specified by the CCR Rule for final cover systems.

The final cover system also meets the requirements of §257.102(d)(3)(ii)(A) because the ClosureTurf® cover system designed for AP-1 provides equivalent or superior reduction of infiltration as compared to an infiltration layer that contains a minimum of 18 inches of earthen material. Specifically, the ClosureTurf® system for AP-1 was modeled to result in 99.99% less infiltration than that modeled for the baseline soil cover system that includes an infiltration layer of 18 inches of earthen material. This evaluation is detailed in the Alternative Cover Evaluation (Appendix F) of the Engineering Report Rev 01 (Part B, Section 2 of Permit Application).

The final cover system meets the requirements of §257.102(d)(3)(ii)(B) because it provides equivalent or superior protection from wind and water erosion as compared to a 6-inch vegetated erosion layer due to the fact that the synthetic engineered turf does not have the erosion potential attributable to biological growth cycles and climatic conditions. That is, the ClosureTurf® will retain the synthetic grass strands regardless of rainfall, drought, freeze-thaw cycles, lack of fertilization, soil augmentation, and other factors required to maintain a vegetative cover system. See the Engineering Report Rev 01 for additional detail on the performance of the ClosureTurf® cover system. In addition, as demonstrated in the Permit Application, the closure of AP-1 meets all the regulatory requirements to satisfy the industry standard for closed unit stability, resulting in minimized disruption of the integrity of the final cover system.

The final cover system meets the requirement of §257.102(d)(3)(ii)(C) to accommodate settling and subsidence because it relies on proven materials, design practices and construction techniques (e.g. geosynthetic FMLs, earthen dikes, rock armored stormwater channels, etc.). As discussed in detail in the Engineering Report Rev 01, and as summarized above, the closure method at AP-1 has been evaluated across a range of global (deep) and veneer (shallow) stability conditions and meets or exceeds applicable requirements. Satisfactory slope stability evaluations were completed for both short- and long-term conditions, including provision for impacts from design storm events and from the theoretically potential seismic (earthquake) hazard at the site based on the site location. Also, the modeled potential settlement is well within the specifications for the cover system, and similar cover systems are regularly and successfully used at sites where settlements are typically up to ten or more times higher than those predicted through modeling for the AP-1 closure. As discussed earlier, the AP-1 CCR Unit closure provides for minimal calculated post-closure settlement, low seismic hazard risk, and well known and understood subsurface conditions without a history of subsidence risk. The low calculated potential settlement and subsidence magnitudes and the absence of known geologic subsidence risks at the site, combined with the ability of the cover system materials and design and construction techniques to accommodate much higher displacements and seismic loadings (well above those predicted) show that this regulatory requirement has been met.

As required by §257.102(d)(3)(iii), a Georgia-registered professional engineer has certified that the design of the final cover system meets the requirements of 257.102 (See Professional Engineer Certification in Section 3 of Part A of the Permit Application and the certified Engineering Report Rev 01 in Section 2 of Part B of the Permit Application). In addition, the certification is reaffirmed as provided by the engineer stamp on this report.

III. Professional Engineer Certification

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

"I certify under penalty of law that this document and all attachments were 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 or persons who manage the system or 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 application requirements of the Georgia Environmental Protection Division Solid Waste Rule 391-3-4-.10 for Management of Coal Combustion Residuals have been met."

ATTEST:

Golder Associates USA Inc.
Engineering Firm

Gregory L. Hebeler, P.E.
Name of Professional Engineer

Signature

April 21, 2022
Date