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Comprehensive Alternative Evaluation of Ash and Coal Fines Waste Units at the Savannah River Site

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EXECUTIVE SUMMARY

The purpose of this document is to develop a comprehensive strategy and identify viable alternatives for ash basin, ash pile, and coal pile runoff basin waste units at the Savannah River Site (SRS) that have not been closed (see Figure ES-1 for a list and location of waste units). Several ash waste units and coal pile runoff basins have already been closed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Although the human health risks for these closed ash/coal fines waste units were determined to be above acceptable risk thresholds, the risks were due to slightly elevated concentrations of naturally-occurring radioactive materials (NORM) and arsenic.

Recent United States Environmental Protection Agency (USEPA) regulations for coal combustion residuals (CCR) apply to byproducts from active coal burning power generation facilities. The CCR regulations were developed after several significant releases from active ash ponds resulted in environmental insult and costly remediations (e.g., 2008 TVA Kingston ash release, 2014 Duke Energy's Dan River ash release). The remaining ash waste units at SRS are all inactive, have no likelihood of similar releases as from operating commercial operations, and have been determined to be relatively low human health risks. However, the CCR regulations are potential applicable or relevant and appropriate requirements (ARARs) for any future remedial/removal actions (RA).

As a result of the CCR regulations, technology for commercial beneficial reuse has expanded, based partially on costs of placing material in landfills, as well as the potential to use the material in place of other natural resources. Advancements in beneficial reuse technology, the potential for CCR regulations to be considered as ARARs for future ash remediation projects, and lessons learned from previous RAs at SRS ash waste units are the primary drivers for developing an overall strategy for the disposition of the remaining ash and coal fines waste units at SRS.

This strategy was developed by reviewing lessons learned from past RAs at ash waste units, canvassing current commercial practices, collecting data to refine ash/coal fine volume estimates and screen contaminant concentrations against thresholds, identifying a suite of regulatory acceptable alternatives, and performing a weighted evaluation of alternatives using relevant criteria. Using the score from the weighted evaluation, a ranking of the alternatives was then used to make recommendations for each ash/coal fine waste unit. Figure ES-1 provides a list of the waste units evaluated with the ash/coal fines volume estimates and the current Federal Facility Agreement RA start dates. A chart of the alternatives considered for each waste unit is provided in Table ES-1. Not all alternatives were considered for each waste unit because of implementation constraints or previous regulatory documentation.

The beneficial reuse alternatives were ranked as the highest in evaluated alternatives partially due to the emphasis placed on the weighting factors. Recent commercial and government investment in beneficial research and technology (see Appendix D of this report) were factored into the beneficial reuse ranking values. Beneficial reuse includes implementing interim actions such as Land Use Controls (LUCs), entombment in the SRS reactor areas' 186 basins, offsite encapsulated beneficial reuse, or consolidation of ash at one or more locations with a South Carolina Department of Health and Environmental Control (SCDHEC) Class II cover system, and the eventual (calendar year 2064) reuse of the ash as a lower backfill material beneath the F-Area and H-Area Tank Farm cover system for final closure. Unencapsulated reuse bodes well for the remaining ash waste units due to the low human health risks and low risk of unintended release of ash at all the remaining units. Alternatives under this reuse scenario would be considered interim actions and LUCs would be implemented until the material was excavated for beneficial use. Preliminary designs for the final cover systems over the F and H Area Tank Farms call for >2 million cubic yards (yd^3) of lower backfill to bring the areas to grade. Preliminary designs for the cover system include a multilayer cover system greater than 7-feet thick above the lower backfill material. Storing the ash in place or beneath a soil cover would provide a cost avoidance for obtaining the lower fill material and provide a cost effective, environmentally sound interim action. Soil used in the SCDHEC Class II cover system also be used as backfill.

Another alternative that ranked high in the evaluation was the beneficial reuse of an existing structure - entombment of ash in the 186 basins. Due to the volume limitations of the 186 basins, however, this alternative would only apply to a subset of the waste sites.

Encapsulated beneficial reuse ranked lowest of the beneficial reuse alternatives because of its high transportation costs and due to the uncertainty of a viable market for all the SRS coal ash sources.

Samples of surface ash in the basins were found to have a loss on ignition (LOI) greater than 30%. This value is much higher than the LOI values of the material currently being processed in one market source, thermal beneficiation of fly ash using the Staged Turbulent Air Reactor technology developed by the South Eastern Fly Ash organization. Only a portion of the ash would be acceptable for this reuse technology. Other markets may exist for use of SRS ash encapsulated construction materials (e.g., cinder blocks) but were not investigated as part of this evaluation. Encapsulated beneficial reuse could be combined with another alternative to reduce the amount of ash that would need to be dispositioned beneath a cover system or permitted landfill.

Among the alternatives that do not include beneficial reuse, the alternative to consolidate in one location and cover with a SCDHEC Class III Landfill ARAR cover system as a final action ranked the highest. This alternative would use an existing ash basin, L-Area Ash Basin (LAB) or K-Area Ash Basin (KAB), as the consolidation site. LUCs would be implemented at the consolidation site only.

For all the consolidation options (186 basins, LAB, KAB, etc.) described in this strategy, successful implementation will require the regulatory agencies to accept the regulatory provision provided under CERCLA to consider the various ash units as "one site" for purposes of remedy application. The consolidation options would serve to reduce the footprint of restricted future land use and minimize overall long-term maintenance of these closed units.

This document provides a ranking of alternatives; however, within the context of all alternatives there are multiple variations that are acceptable. Recommended alternatives for each waste unit based on the rankings are provided in Table ES-2. Cost estimates for each alternative are provided in Appendix E of this document. The selection of the alternatives is dependent on resources, regulatory schedules, and commercial availability (if off-site beneficial reuse is selected). Ash could be an asset to SRS. Cost benefits, or cost avoidance, associated with future use is difficult to quantify because of market and technology evolution. The need for fly ash as a supplemental cementitious material or as a backfill material is a known future need at SRS.

Efficiencies in regulatory document preparation, design, and disposal costs could be gained by planning the RAs for the remaining ash/coal fines waste units ahead of the FFA milestones. One pathway in gaining regulatory document efficiency is to develop a single early action decision document for the remaining ash and coal fines waste units similar to the early action decision remedial alternative selection document that was prepared for the in-situ decommissioning of the reactor building complexes.

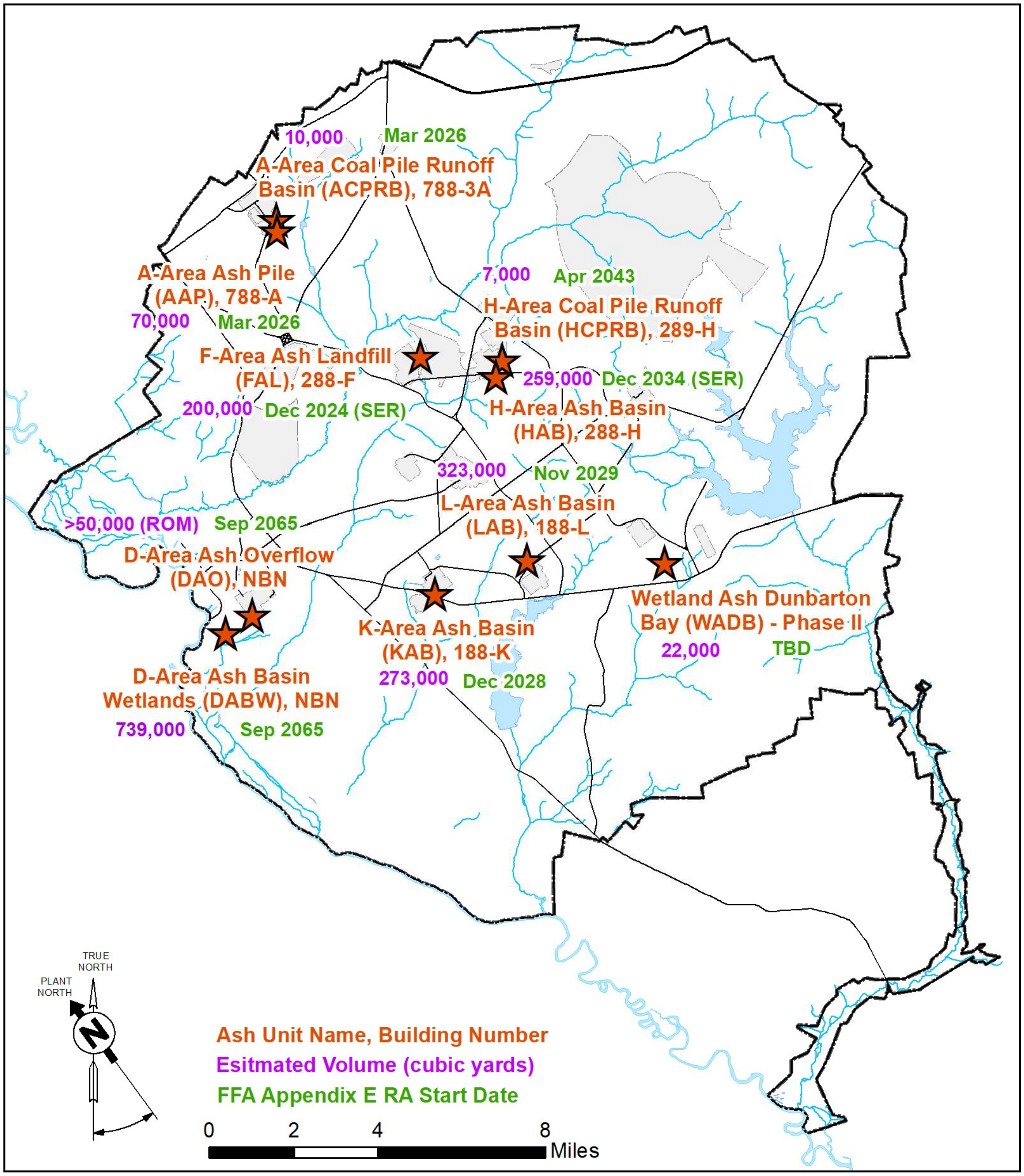

Figure ES-1. Ash and Coal Fines Waste Units at SRS

Table ES-1. Alternatives Evaluated by Waste Unit

#	Ash/Coal Fines Unit Alternative	ACPRB 788-3A	AAP 788-A	DAO	DABW	KAB 188-K	LAB 188-L	WADB	HAB 288-H	HCPRB 289-H	FAL 288-F
<u>IN-SITU ALTERNATIVES</u>											
1	Land Use Controls			✓	✓	✓	✓	✓	✓	✓	
2	Individual Cover in Place with a SCDHEC Class II Landfill Cover System for Eventual Beneficial Reuse					✓	✓		✓		✓
3	In-situ Stabilization with Soil Cover						✓	✓	✓		
4	Individual Cover in Place with SCDHEC Class III Cover System					✓	✓		✓		
<u>EXCAVATE & HAUL ALTERNATIVES</u>											
5	Consolidation at Multiple Locations with SCDHEC Class II Landfill ARAR Cover System Until Eventual Beneficial Reuse	✓ (red)	✓			✓ (red)	✓ (red)	✓	✓ (red)	✓	
6	Consolidation at One Location and Closure with a SCDHEC Class III Landfill ARAR Cover System	✓	✓			✓ (red)	✓ (red)	✓	✓	✓	
7	Construct Onsite SCDHEC Permitted Landfill for Ash Disposal	✓	✓			✓	✓	✓	✓	✓	
8	Excavate and ship for Encapsulated Beneficial Reuse	✓	✓			✓	✓	✓	✓	✓	
9	Excavate and Store / Entomb in 186 Basins	✓	✓			✓	✓	✓	✓	✓	
10	Excavate and Dispose at Three Rivers Landfill	✓	✓			✓	✓	✓	✓	✓	

✓- Evaluated alternative
✓ (red)- Evaluated as a potential consolidation site

Table ES-2. Recommended Alternatives at Each Ash Site Based on Rankings

Site	1st Alternative	2nd Alternative	Description
DO, DABW	1		Land Use Controls Only as a Final Action.
FAL	2		Individual Cover in Place w/ a minimum SCDHEC Class II Cover System as a Final Action.
AAP, ACPRB	9	5a	Entombment in the 186 Basins as a Final Action. Alternate: Consolidate at A-CPRB and Cover w/ SCDHEC Class II Landfill ARAR Cover System as an Interim Action Until Eventual Beneficial Reuse.
HAB, HCPRB, KAB, LAB, WADB	1	8, 9	LUCs as an Interim Action Until Eventual Beneficial Reuse. Alternate: Encapsulated Beneficial Reuse with Unusable Residuals Being Entombed in the 186 Basins as a Final Action.

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximately, approximate
>	greater than
<	less than
%	percent
AAP	A-Area Ash Pile
ac	acre
ACPRB	A-Area Coal Pile Runoff Basin
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
bgs	below ground surface
BRA	Baseline Risk Assessment
CA	Cost Analysis
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CCR	coal combustion residuals
COC	constituent of concern
cm	centimeter
CM	contaminant migration
CMI/RAIP	Corrective Measures Implementation/Remedial Action Implementation Plan
CMIR/RACR	Corrective Measures Implementation Report/Remedial Action Completion Report
CMS/FS	Corrective Measures Study/Feasibility Study
DABW	D-Area Ash Basin Wetland Area
DAO	D-Area Ash Overflow
EA	Early Action
EE	Engineering Evaluation
ERD	Environmental Restoration Department
FA	Final Action
FAL	F-Area Landfill
FFA	Federal Facility Agreement
ft	feet, foot
GCL	Geosynthetic Clay Liner
ha	hectare
HAB	H-Area Ash Basin
HCPRB	H-Area Coal Pile Runoff Basin
IA	Interim Action
IC	institutional control
in.	inch
IOU	Integrated Operable Unit
IWT	Industrial wastewater treatment
KAB	K-Area Ash Basin

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued/End)*

LAB	L-Area Ash Basin
LOI	loss on ignition
LUCIP	Land Use Control Implementation Plan
LUC	Land Use Controls
M	million
mi	mile
NBN	no building number
NORM	Naturally Occurring Radioactive Material
NTC	non time critical
O&M	operation and maintenance
OU	Operable Unit
PAB	P-Area Ash Basin
PCR	Post-Construction Report
PRG	Preliminary Remediation Goal
RA	remedial action or removal action
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	remedial goals
RI	Remedial Investigation
ROD	Record of Decision
ROM	Rough Order of Magnitude
RSER	Removal Site Evaluation Report
SARA	South ash remediation area
SEFA	South Eastern Fly Ash Organization
SEMS	Superfund Enterprise Management System
SER	Site Evaluation Report
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCM	Supplemental Cementitious Material
SRFP	Savannah River Flood Plain
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
STAR	Staged Turbulent Air Reactor
TBD	to be determined
TRL	Three Rives Landfill
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
WADB	Wetland Area at Dunbarton Bay
WSRC	Washington Savannah River Company, LLC
yd^3	cubic yard

1.0 INTRODUCTION

The purpose of this document is to present the results of a comprehensive strategy developed for the ash and coal fine waste units at the Savannah River Site (SRS) that have not been closed. The intent of the strategy is to propose a single or a range of potential alternatives for individual or groups of ash and coal fines waste units. A weighted evaluation of alternatives based on factors such as effectiveness, regulatory acceptability, footprint reduction, design issues, schedule implications, beneficial reuse potential and costs provides the opportunity to select remedial alternatives that could result in positive results such as:

- Cost effective schedule of ash basin waste site disposition;
- Reduction in regulatory document preparation;
- Consistent strategy for wastewater/stormwater disposition;
- Design cost reduction;
- Footprint reduction;
- Construction cost reduction; and
- Procurement process efficiency.

1.1 Scope of the Alternative Evaluation

The scope of the alternative evaluation includes ten ash/coal fines waste units at the SRS that have not yet been closed. These units are:

- A-Area Ash Pile (AAP), 788-A;
- A-Area Coal Pile Runoff Basin (ACPRB), 788-3A;
- D-Area Ash Overflow (DAO), No Building Number (NBN);
- D-Area Ash Basin Wetland (DABW), (NBN);
- F-Area Ash Landfill (FAL), 288-F;
- H-Area Ash Basin (HAB), 288-H;
- H-Area Coal Pile Runoff Basin (HCPRB), 289-H;
- K-Area Ash Basin (KAB), 188-K;
- L-Area Ash Basin (LAB), 188-L; and
- Wetland Area at Dunbarton Bay (WADB) – Phase II.

The location of each of these waste units is shown on Figure 1-1. Table 1-1 provides key attributes of each of the waste units above. Additional details and photos of each of the waste units are provided in Appendix A. The estimated volume of ash/coal fines for some units were updated based on lessons learned from the remedial/removal activities (RAs) of other ash basins and overflow areas, a review of historical verses recent topography, and through the recent collection of data at several of the units listed above. A summary of the data collection performed in support of this document is provided in Appendix B. Appendix C provides the basis for the volume estimates.

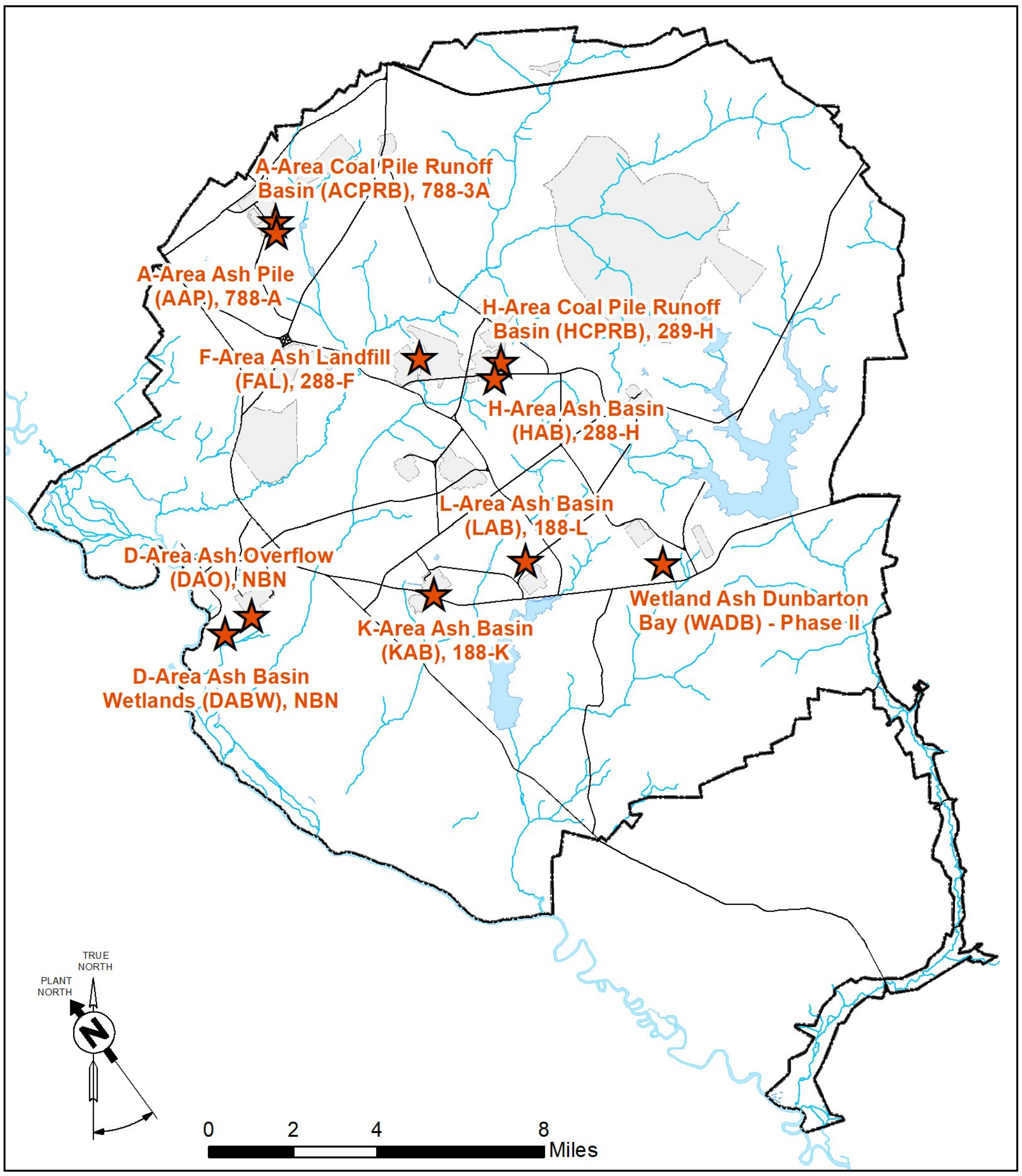

Figure 1-1. Map of Ash/Coal Fines Waste Units Located on the SRS

Table 1-1. Ash and Coal Fines Waste Units Included in Evaluation

Ash/Coal Fine Unit	Depth to Groundwater (ft)	Area (ac)	Estimated Volume (yd^3)	FFA Appendix E RA START	Comments
A-Area Coal Pile Runoff Basin, 788-3A	100-110	2.62	10,000[a]	Mar 2026	Inactive. Coal fines present – not ash.
A-Area Ash Pile 788-A	100-110	2.55	70,000[b]	Mar 2026	Ash was trucked from the power plant and piled from 1950-1980 (approx.). Draft Proposed Plan to consolidate in Coal Pile Runoff Basins (CPRB).
D-Area Ash Overflow (DAO) Savannah River Floodplain Swamp Integrated Operable Unit (IOU) (D-Area SRFP IOU)	0-15	33	>50,000 (ROM)	Sep 2065	Part of IOU. Overflow from previous operations prior to ash basin closure (probably >25 % moisture content).
D-Area Ash Basin Wetlands (DABW) D-Area SRFP IOU	0-15	90	739,000	Sep 2065	Ash was sluiced from powerhouse. Overflow from previous operations prior to ash basin closure.
K-Area Ash Basin, 188-K	61	11.16	273,000	Dec 2028	Ash was sluiced into this basin from 1950-1990. Currently, the basin is heavily vegetated with no standing water. Potential Consolidation location. Active IWT.
L-Area Ash Basin, 188-L	17-50	18	323,000	Nov 2029	Ash was sluiced into this basin from 1950-1968. Currently, the basin is heavily vegetated and holds some standing water in the north east portion of the basin. Potential Consolidation location.
Wetland Area at Dunbarton Bay (WADB) – Phase II	17	4.5	22,000	TBD	Phase II includes the South Ash Remediation Area, south of the powerline road. WADB Phase I included excavate and haul to TRL for non-wetlands and LUCs for Dunbarton Bay wetlands and buffer area. The SARA was >30% moisture and exceeded the capacity of the TRL ash cell.
H-Area Ash Basin, 288-H	22	13	259,000	Dec 2034 (SER)[d]	Ash was sluiced into this basin from 1950-1990. Some standing water on the east and south sides of the basin. Active IWT.
H-Area Coal Pile Runoff Basin, 289-H	10	1.27	7,000[c]	Apr 2043	Coal fines present – not ash. Currently active industrial stormwater permit.
F-Area Ash Landfill, 288-F	70-80	7	213,000	Dec 2024 (SER)[d]	Basin is currently being consolidated into an unlined basin. Active SCDHEC Solid Waste Landfill.

Notes:
a) Ash volume calculated from preliminary design (drawings: C-CG-A-00063, -00064, -00066, -00068) – is slightly higher than volume calculated in Appendix C.
b) SRNS 2012b (AAP/ACPRB RI/BRA)
c) Assumed based on ratio of operating times and volume in ACPRB as calculated in SRNS 2012b
d) SER – Site Evaluation Report – will determine if this site is moved to Appendix E in the FFA

The ash and coal fines waste units were from the nine coal burning powerhouses that operated at the SRS. These powerhouses operated for varying durations at the SRS from the 1950s to the early 2000s. During operation, boilers in the powerhouses generated course bottom ash from the hearth and a fine fly ash from the off-gas system. These combustion byproducts were deposited together by wet sluicing into basins or by trucking the dry material and placing it into piles or basins. SRS powerhouses used bituminous coal to produce steam and electricity. Pulverized coal was only used in two powerhouses, in D-Area and later in A-Area. These two powerhouses were the only areas to generate coal rejects. Powerhouses in A-Area (early operations), H-Area, K-Area and P-Area used stoker coal.

The coal pile runoff basins were installed at SRS between 1978 and 1981 to collect surface runoff from the coal stockpiles near the powerhouses (WSRC 1989). These units consist of coal fines.

The ash basins and the coal pile runoff basins were permitted as Industrial Wastewater Treatment (IWT) facilities if they were operating after the late 1980s. The FAL operates under a South Carolina Department of Health and Environmental Control (SCDHEC) solid waste landfill permit.

1.2 History of Remedial Actions

Several SRS ash basins and one ash pile have been remediated/certified closed in four areas (A, D, P and R). The remediation activities were performed under a variety of regulatory programs including IWT Closure Plans, Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and CERCLA/Non-Time Critical (NTC) Removal Actions (RAs). Six of the coal pile runoff basins at SRS have been remediated. RAs for ash related waste units and coal pile runoff basins include SCDHEC Class II Landfill soil covers, SCDHEC Class III Landfill geosynthetic cover systems, excavation and backfill, and Land Use Controls (LUCs). The RAs were implemented to meet regulatory requirements due to elevated levels of metals and natural radionuclides that result in unacceptable long-term risks to a future resident or industrial worker. In general, they do not pose a contamination risk to groundwater. Table 1-2 identifies the RAs for each of the ash related waste units and coal pile runoff basins.

Table 1-2. Previous Remedial/Removal Actions at SRS Waste Units

Remedial/Removal Activity	Waste Unit	Regulatory Program
SCDHEC Class II Landfill Soil Cover with LUCs	P-Area Ash Basin, (188-P)	NTC Removal Action, ROD
SCDHEC Class II Landfill Soil Cover with LUCs	R-Area Ash Basin, (188-R)	Early Action (EA) ROD
SCDHEC Class II Landfill Soil Cover with LUCs	A-Ash Pile (788-2A)	ROD
SCDHEC Class III Landfill Geosynthetic Cover System with LUCs	D-Area Ash Basins, (488-D, 488-1D, 488-2D, 488-4D)	IWT/SCDHEC Solid Waste Landfill/NTC Removal Action
Excavate and Haul	CPRBs (C-, K-, L-, P- and F-Areas),	ROD
Excavate and Haul	WADB (Phase I - North Ash Remediation Area),	ROD
Excavate and Haul	C-Area Ash Piles	NTC Removal Action
LUCs	WADB (Dunbarton Bay Wetland Area and Buffer Area)	ROD
Class II Soil Cover with LUCs and Excavate and Haul	D-Area Coal Pile Runoff Basin	NTC Removal Action

1.3 Alternatives Evaluated for Consolidation Strategy

A range of alternatives for analysis was selected based on previous RAs performed at ash/coal fines waste units, a review of commercial coal power generation facility practices, a review of regulations, and input from commercial entities that are developing beneficial reuse option. The alternatives selected for evaluation include cover systems, excavation and disposal, LUCs, and beneficial reuse. Beneficial reuse of coal combustion byproducts has been on the rise in recent years due to the recent regulations of coal combustion byproducts, the scarcity and cost of landfills, and the environmental benefits of replacing limited natural resources with ash in encapsulated (e.g., concrete) and non-encapsulated (e.g., backfill) construction materials.

Beneficiation transforms ash from a byproduct to a product. A common beneficial reuse, the use of fly ash as an additive or replacement of cement in concrete mixes, improves the durability and strength of concrete products. Beneficiation of the waste units' ash would be required in order to meet the American Society for Testing and Materials (ASTM) standards for concrete additives. One option evaluated involved making the ash marketable for use in concrete by processing it at the McMeekin Facility Staged Turbulent Air Reactor (STAR) that is operated by the South Eastern Fly Ash (SEFA) Group in Lexington, SC. Appendix D provides details about this beneficial reuse option. Although current test results are inconclusive for use at the SEFA McMeekin Facility, additional processing technologies or other commercial applications may be applicable for SRS fly ash, bottom ash, and coal fines. For purposes of comparison, the SEFA McMeekin Facility is considered the "receiver" facility for the offsite beneficial reuse evaluations.

Regulatory acceptance of unencapsulated uses of fly ash require demonstration that there will be no unacceptable environmental releases of contaminants to the environment. The future need for backfill required to construct the final cover system over the F-Area and H-Area Tank farms (SRNL 2007, 2008), gives credence to considering the use of the ash as backfill material in this beneficial reuse option. Pre-conceptual design plans for the final cover system of the tank farms in F and H areas at the SRS call for >2 million cubic yard (yd^3) of "lower backfill" that will be required to evenly grade the area prior to placing a cover system that includes six layers with a total design thickness of more than 7 feet (ft) (SRR 2010, 2012a, 2012b, 2017). The schedule for the tank farm final closure, calendar year 2064, allows time for designing the cover system with this material as a lower backfill in a way that will be protective of the groundwater.

All evaluated alternatives, including beneficial reuse, are generally described in two main categories: in-situ and excavate and haul. The alternatives are briefly described in the following sections.

1.3.1 In-Situ Alternatives

In-situ alternatives considered for this evaluation include actions that would be performed at an individual waste unit. The actions include LUCs only (both as an interim action [IA] and/or final action [FA]) and some type of cover system, coupled with LUCs. Using LUCs only alternative as a FA would permanently prevent access via deed restrictions and warning signs. This alternative may be appropriate for ash waste units that reside in wetland areas where a construction activity (e.g., excavation or cover construction) would result in additional damage or injury to sensitive ecosystems and future development is highly unlikely. LUCs as an IA would prohibit access via warning signs and other SRS controls until a beneficial reuse option (e.g., backfill beneath cover systems) is available. This alternative may be appropriate for ash waste sites that have large volumes of ash and are "stable" in that they pose no risk to groundwater contamination and no risk of surface migration due to slope/berm failure.

Individual soil covers were also considered for in-situ alternatives. The soil covers would be considered an IA until beneficial reuse options are available. LUCs would be implemented until the ash was excavated for reuse. SCDHEC Class II Landfill cover systems were evaluated as FAs for FAL, consistent with the approved closure plan.

Based on lessons learned with the recent remediation near the WADB, and knowledge of a recent technology used by Duke Energy for remediation of a ponded ash basin, in-situ stabilization was also considered as an alternative where wet/unstable conditions prohibit the use of traditional construction equipment. In this alternative, a soil cover would be placed over the stabilized material and LUCs would be implemented.

In-situ alternatives allow for implementation, as required by the Federal Facility Agreement (FFA) milestones, without coordination with other waste unit schedules. Table 1-3 provides a list of the in-situ alternatives that were evaluated for the consolidation strategy.

Table 1-3. In-situ Alternatives

Evaluated Alternative	Description
1) Land Use Controls (LUCs)	Implement land use controls (i.e., warning signs and access controls through site use/site clearance restrictions) as well as engineering controls (i.e., signs) to limit inadvertent human exposure and access to contaminated areas. LUCs for ash that remains in the Dunbarton Bay wetland has been accepted as a final remedy. This alternative could be a final action (FA) for some units (i.e. areas in or near a jurisdictional wetlands) or an interim action (IA) to allow for future beneficial reuse of the ash.
2) Individual Cover in Place with SCDHEC Class II Landfill ARAR Cover System for Eventual Beneficial Reuse	Place a SCDHEC Class II Landfill ARAR soil cover over existing ash/coal residual waste sites as an IA for future beneficial reuse. This delay would allow advancements in beneficial reuse technologies and/or would provide fill material at the time of need for tank farm closures. In addition, the soil cover would also serve as fill material. This alternative requires dewatering and drying of ash to achieve compaction requirements. This alternative would be an IA. LUCs would be implemented until the FA.
3) In-situ Stabilization with Soil Cover	Use cementitious material at units with wet conditions to increase material strength and decrease permeability of the bottom and side slopes of the basins. This alternative may be suitable for sites with saturated conditions that prevents operation of conventional construction equipment. A soil cover would be placed over the stabilized material. This alternative would be a FA. LUCs would be implemented.
4) Individual Cover in Place with SCDHEC Class III Landfill Cover System	Place a SCDHEC Class III Landfill (geosynthetic) cover over existing waste sites as a FA. This alternative requires dewatering and drying of ash to achieve compaction requirements. This alternative would be a FA. LUCs would be implemented.

1.3.2 Excavate and Haul Alternatives

Excavate and haul alternatives can be applied to either a single waste unit, e.g., excavate and dispose of in an existing permitted landfill or offsite beneficial reuse (e.g., SEFA), or can include a combination of waste units where ash is consolidated from one or more waste units into a single ash basin or newly constructed/permitted landfill at SRS. Consolidation alternatives also included multiple consolidation sites. Multiple sites may be applicable for ash basins/coal pile runoff basins that are near each other, or where reuse of an existing structure (e.g., 186 basins) provides sufficient volume and robust structural features to prevent contaminant migration (CM).

Final cover systems for the consolidated ash sites are assumed to require SCDHEC Class III Landfill closure (geosynthetic) minimum standards. This is a design assumption for alternatives that were considered to be FAs as described in Section 2.1.1 of this document. LUCs would be required at the consolidation sites where waste is left in place beneath the cover system.

Construction of an on-SRS landfill was considered to minimize transportation and to allow the scheduling of disposal to be spread over several years. Although the initial design and permitting requirements would be robust, the implementation costs for each waste unit could be planned and levelized to meet annual budgetary constraints. The Three Rives Landfill (TRL) is currently permitted to receive ash, however, based on discussions held with the TRL project manager in 2019, a dedicated cell would need to be designed and constructed. Funding for the capital costs associated with the design and construction of a mono cell at TRL would require public bonds and could be a risky investment if there was a shortfall in government funding for future ash disposal.

Table 1-4 provides a brief description of the excavate and haul alternatives evaluated.

Table 1-4. Excavate and Haul Alternatives

Evaluated Alternative	Description
5) Consolidation at Multiple Locations with SCDHEC Class II Landfill ARAR Cover System Until Eventual Beneficial Reuse	Excavate ash from several of the units and haul to one or multiple locations for temporary storage. Place a SCDHEC Class II Landfill ARAR cover system over the consolidated ash as an interim action (IA) for future beneficial reuse. This alternative would require dewatering and drying of ash prior to transporting. Implementation could span over several years allowing costs to be spread out. This alternative would be an IA. LUCs would be implemented at the consolidation site only until the final action (FA).
6) Consolidation at One Location and Closure with a SCDHEC Class III Landfill ARAR cover system.	Select one site (e.g., K- or L-Area Ash Basin) as part of a final ROD as a location to construct a landfill type closure to accept ash from other units. Implementation could span several years allowing the costs to be spread out. Dewatering and drying of ash would be required prior to transporting. This alternative would be a FA. LUCs would be implemented at the consolidation site only.
7) Construction of Onsite SCDHEC Permitted Landfill for Ash Disposal	Select a new centralized onsite location to construct a SCDHEC permitted landfill to accept ash from SRS ash/coal fines waste units. Implementation could span several years to spread out costs. Dewatering and drying of ash would be required prior to transporting. Intensive design and construction requirements along with lengthy permitting requirement are anticipated for this alternative. Offsite Disposal Approval would be required by USEPA to place CERCLA waste within the SCDHEC permitted landfill. This alternative would be a FA.
8) Excavation and Shipment for Encapsulated Beneficial Reuse	Excavate waste units and segregate ash, bottom ash, and coal residuals. Materials would then be dried and sieved before shipment to a facility (e.g., SEFA) for beneficial reuse. This alternative would be a FA.
9) Excavation and Entombment in 186 Basins	Excavate coal residuals and place in the 186 basins. This alternative provides a beneficial reuse of an existing structure. The robust facility could meet the design requirements of a SCDHEC Class III permitted landfill. The 186 basins are central to SRS, so transportation costs could be less. This alternative would only be available for small volume ash/coal fines waste sites as each basin (186-C, 186-L, 186-P, and 186-R) has storage capacity for approximately (~) 129,000 yd^3. The 186 basins are in various states of condition. Dewatering and vegetation removal and repairs/rebuild of several of the walls would be required. LUCs would be applicable to the 186 basins, however, these basins are already in area OUs that require LUCs. This alternative would be a FA.
10) Excavation and Disposal at TRL	Excavate coal residuals and dispose at TRL. This alternative eliminates all long-term O&M costs. Currently, TRL is not prepared to receive the amount of ash contained within the waste units at SRS. TRL would have to secure funding to design and build a dedicated cell for the ash. The uncertainty of yearly SRS funding and closure schedule of waste units makes a capital investment by TRL risky. This alternative would be a FA.

1.4 Alternative Evaluation Factors Considered

Each of the proposed alternatives were evaluated using a project risk-based analysis. A list of relevant factors, considerations and assumptions were developed from discussions with project engineers and scientists. The factors used in the evaluation of each alternative are:

- Effectiveness
- Regulatory Issues
- Footprint Reductions
- Beneficial Reuse
- Project Risks (Funding Uncertainty)
- Cost
- Schedule Issues (Urgency)

The following sections describe the considerations and assumptions of each factor used in the evaluation.

1.4.1 Effectiveness

Effectiveness of each alternative was considered. All evaluated alternatives are effective with respect to long-term and short-term protection of human health and the environment. For purposes of this evaluation, effectiveness is defined as the level of long-term isolation of the ash from the environment. Effectiveness ranged from (most to least) complete ash removal, stabilization of the ash, covering the ash, and LUCs only.

1.4.2 Regulatory Issues

Regulatory issues were considered for each alternative. Determination of regulatory approvals is required as follows:

- Regulatory Documentation: Each alternative will require regulatory documentation to implement. (e.g., Record of Decision [ROD], Interim ROD, Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis [RSER/EE/CA], Closure Plan, Land Use Control Implementation Plan [LUCIP] and Five-Year Remedy Review Report).

- Permitting: Active permits of existing units (Waste Treatment Permit, Solid Waste Landfill Permit) will need to be complied with independent of the remedial decision. As a result, the remedial decision of these permitted units will need to be consistent with the Applicable or Relevant and Appropriate Requirements (ARAR) of the permit. For unpermitted facilities, no new permits will be necessary for remedies completed under CERCLA, but those remedies will be required to comply with ARARs specified within the remedial documentation.

- Offsite Disposal: The regulatory provisions afforded by CERCLA (March 8, 1990, Preamble to the National Contingency Plan – Page 8690) will need to be exercised by the regulatory agencies to consider the various ash units as "one site" for purposes of remedy implementation. This flexibility will allow the needed movement and placement of ash from one ash site to another site (e.g., consolidation to KAB or movement of ash into the 186 basins). These units are reasonably related on the basis of geography, on the basis of the stability, and on the potential threat to public health or the environment. Once the decision is made to treat two or more units as one site, wastes from the several units could be managed in a coordinated effort at one of the units and still be an 'on-site' action. This will allow the remedy to proceed expeditiously and cost-effectively.

- Regulatory Acceptability: Long-term ash storage and using a SCDHEC Class II Landfill cover system over the ash while waiting for beneficial use (e.g., use of ash as fill material for the F- Area and H-Area Tank Farm cover systems) will require United States Environmental Protection Agency (USEPA) and SCDHEC acceptance. Discussions during the ash consolidation alternative presentation indicated that USEPA would not accept a SCDHEC Class II Landfill cover as a FA. (NOTE: improvements to the Class III cover system designs has resulted in systems that are comparable in cost to the installation of a Class II cover system. A cost comparison between the two at the time of implementation may result in the installation of a more protective and cost-effective Class III cover.)

1.4.3 Footprint Reductions

Spatial footprint reductions were accounted for wherever possible. Footprint reduction can be achieved in the excavation and haul alternatives by removing all ash to another location and in the in-situ alternatives by consolidating ash into a more compact footprint within the ash unit boundary.

Carbon footprint issues were also considered. Carbon emissions generated during cover installation, excavating, and hauling are considered as well as any offset that could be achieved through beneficial reuse (Appendix D).

1.4.4 Beneficial Reuse

Beneficial reuse was considered for many of the alternatives. Types of beneficial reuse considered included:

- Encapsulated ash reuse;
- Unencapsulated ash reuse; and
- Reuse of an existing structure for disposal

Encapsulated ash reuse alternatives included transport to SEFA for producing fly ash as an additive or replacement of cement in concrete mixes, commonly referred to as supplemental cementitious material (SCM). See Appendix D for further details.

Unencapsulated ash reuse alternatives included use as fill material beneath the F-Area and H-Area Tank Farm cover systems.

Reuse of an existing structure included using the 186-C, -P and -R Cooling Water Basins (referred to in this document as the 186 basins).

1.4.5 Project Risks (aka Funding Uncertainty)

Some alternatives require firm upfront funding certainty to implement (e.g., excavate and haul to TRL). Uncertainty adds to a higher capital cost to cover contingencies for changes to project design or execution as well as delays in construction.

1.4.6 Costs

The estimated costs are provided for comparing alternatives. Actual final costs for completing the alternative will vary based on actual site conditions encountered and timing of the installation/action. The cost assumptions used to evaluate the alternatives include direct and indirect costs (e.g., Engineering & Design Support, Project Construction Management, Health & Safety, Overhead, Contingency). The estimated unit costs are based on previous SRS experience in constructing similar projects. See Appendix E for a table of estimated alternative costs for each alternative.

Site preparation costs included clearing and grubbing, site dewatering and ash consolidation (50% was assumed). Ash processing included ash cleaning, drying and sorting costs.

The construction costs for ash cover systems were estimated to range from \$75,000 to \$200,000 per acre (ac). The cover system design includes (from bottom to top):

SCDHEC Class II Landfill – Soil Cover System

- a grading common fill layer
- 2-ft layer of low permeability soil
- 18-inch (in.) common fill
- topsoil
- sod

SCDHEC Class III Landfill – Geosynthetic Cover

- a grading structural fill layer
- geosynthetic layer which includes a flexible membrane liner, drainage layer, riprap drainage
- 18-in. common fill
- topsoil
- sod

The maintenance costs for cover systems was derived from actual SRS operations and maintenance average costs reported in the Five-Year Remedy Review Reports fiscal year 2015-2019. The average value was:

- \$1,000 access controls per site;
- \$181 annual inspection cost/ac;
- \$382 annual mowing & maintenance cost/ac; and
- \$722 annual mobilization cost/unit.

The average hauling costs were based on previous SRS experience in similar transport projects. Assuming a roundtrip distance using a 13 yd^3 dump truck, average rate was \$5 per cubic yard per mile (\$5 yd^3/mi). For long distance hauling, rail transport costs were also estimated. These costs included ash truck transport from the site to the rail loading station and rail packaging (e.g., lift liner). The average rail transport costs were \$0.11 per cubic yard per mile (\$0.11 yd^3/mi) once loaded in the railcars.

Site restoration costs were included at sites where all ash was excavated and hauled to a different location. The costs included:

- Contour Basin After Sediment / Coal Removal
- Common Backfill (4 in.)
- Topsoil 4 in.
- Fertilizer, Lime, Seed & Mulch
- Backfill Sampling / Analysis

Each alternative will require some type of regulatory document (e.g., ROD, RSER/EE/CA, Permit-specific Closure Plan) to implement. These document costs would vary based on the ash site and were not included in the alternative costs. However, it was assumed that all sites that require long-term maintenance would require a LUCIP at \$5,000 and a five-year remedy review at \$15,000 per review. These document costs were based on average costs reported in the Five-Year Remedy Review Reports FY15-FY19.

The present value of the operating & maintenance (O&M) cost estimates was calculated using a discount rate of 0.9% for activities with a less than 3-year duration and 2.7% for activities with a 30-year duration. These rates are based on Savannah River Nuclear Solutions (SRNS) Technical Memorandum (SRNS 2009b). The present value for the cover system maintenance cost for each alternative was calculated over a 30-year period. Maintenance costs continue beyond 30 years; however, the effect of the present value is relatively small beyond this 30-year time period. If the analysis is carried out for 100 years, the values only increased about 15% over those given for the 30-year period.

1.4.7 Schedule Issues

Schedule issues were considered for each alternative and included:

FFA Appendix E includes RA start dates ranging from near-term March 2026 (AAP/ACPRB) to long-term June 2065 (DAO/DABW). The early RA start date creates the issue of whether the ash is available for other alternatives with later RA start dates.

F-Area and H-Area Tank Farm RA start date of 2064. This date creates the issue of whether ash can be stored in-place while waiting for reuse as fill material for the cover system.

2.0 ALTERNATIVE TECHNOLOGIES

2.1 Design Assumptions

In order to provide a comparison of alternatives, some assumptions regarding the RAs are required. Specifically, design assumptions regarding cover systems, beneficial reuse, and hauling greatly impact the cost of the alternative. These design and other assumptions are described in the following subsections.

2.1.1 Cover System Design

A soil cover meeting the SCDHEC requirements for the closure of a Class II Landfill (SC regulations Chapter 61, Article 107, Sub article 19, Part IV) was considered as an IA that would serve to safely store the ash material until a future beneficial reuse option is available. For FAL, this type of soil cover is considered as a FA in accordance with the approved closure plan. The soil cover alternative would include a 2-ft soil cover that would be seeded with native grasses or other suitable ground cover. The soil cover would be designed to have a functional life of 30 years but will be maintained to have a much longer effective life. Details for the individual ash units are provided in Section 2.2 of this document.

Geosynthetic cover systems that meet the permeability requirements of the SCDHEC Class III Landfill regulations were considered as a FA alternative for applicable individual ash basins and ash basins where consolidation was considered. The cover system would include a geosynthetic clay liner (GCL) with a permeability no greater than $1x10^{-5}$ cm/sec and a functional life of 30 years but will be maintained to have a much longer effective life and have a storm water conveyance system designed for a 25-year, 24-hour storm event. The cover system would consist of an initial layer of common fill (if necessary), a GCL, a geosynthetic drainage layer, common fill layer, topsoil and vegetation (sod). After construction of the cover system, the FA would also include LUCs.

2.1.2 Encapsulated Beneficial Reuse

Offsite encapsulated beneficial reuse was assumed to be a viable option using the STAR technology in use at the McMeekin facility in Lexington, SC, ~76 miles from SRS. This facility is owned and operated by the SEFA group. SEFA representatives visited SRS and expressed interest in processing ash from the waste sites. Samples from HAB, KAB, and LAB were sent to the SEFA group for evaluation. One parameter, loss on ignition (LOI), was above 30% in all three samples. Processing the ash reduces the LOI values to acceptable ranges required for SCM. High LOI values can reduce the strength of concrete. LOI values for material processed at the McMeekin STAR are between 5% and 24%. Samples collected from the 0- to 1-ft depth may not be representative of the ash at all depths. Lighter bottom ash may be at the surface, while finer grained fly ash may be deposited at the bottom of the basins. Additionally, more organic matter may be associated with the upper portion of the ash where the samples were collected since these basins are heavily vegetated. Further characterization of the ash may be required to determine whether the McMeekin STAR technology is viable for the SRS.

Representatives from RPM Solutions also visited SRS ash basins and reviewed the results from the ash sample testing. RPM Solutions is an ash management and environmental services company that uses proprietary equipment to excavate, sort, and dry ash for shipment to beneficial reuse markets. Based on the site visit and the sample results, RPM Solutions was confident that a significant portion of the material in the ash basins/pile could be economically processed to provide usable construction materials in the local market. RPM Solutions personnel have proposed additional sampling for depth discrete analyses to determine the variation in LOI values, grain size distribution, and mineral composition.

For purposes of the evaluation, the assumptions associated with the encapsulated beneficial reuse alternative include processing at the SEFA owned facility in Lexington, SC. All material will not be acceptable, so a portion of the unused material (estimated at 20%) will require disposal or alternate disposition. Costs for additional characterization to identify alternate markets were not included in the evaluation.

2.1.3 Hauling Design

Excavate and hauling alternatives evaluated both truck and rail transportation. Although rail costs appear to be competitive with truck costs, rail transport was not considered feasible due to the multiple locations of the ash waste units and lack of adequate rail infrastructure at SRS and at the receiving end of the haul options (e.g., SEFA STAR facility in Lexington, SC) required to ship by rail. Individual truck capacity was assumed to be 13 yd^3, which is the maximum safe size allowed at SRS.

Hauling costs were not considered in the in-situ alternatives that include future beneficial re-use. Future beneficial reuse for in-situ alternatives included the use of ash as backfill material beneath the F-Area and H-Area Tank Farms cover systems which will require hauling of ash material from the individual waste units to F-Area or H-Area in calendar year 2064.

2.1.4 Regulatory Documents and Design Approval

For purposes of comparison, the cost estimates only considered the development of LUCIP, where required, with respect to regulatory document and design approval. The decision documents required to implement the alternatives, e.g., Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI)/Remedial Investigation (RI)/Baseline Risk Assessment (BRA), Statement of Basis/Proposed Plan (SB/PP), ROD, Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP), Removal Action Design Plan, Post Construction Reports , etc., were not considered in the alternative estimates. It should be noted that combining RAs for multiple waste units could result in significant cost savings with respect to the preparation of regulatory documents, however, due to the uncertainty of the type of regulatory documents that would be required, this efficiency is not quantified in the cost estimate.

2.1.5 Impacts to Groundwater

For this evaluation, impacts to groundwater were not considered. This aspect of the remediation would be addressed in the regulatory documents for implementing the final or interim RAs. The basis for the decision not to include groundwater impacts in the alternative evaluation is that the current or future potential for groundwater impact has been demonstrated to not exist for most of the ash/coal fines waste units. For example, the RI/RFI Workplan with BRA and Corrective Measures Study/Feasibility Study (CMS/FS) for the AAP and ACPRB (SRNS 2012b) identified no CM constituents of concern (COCs) where the depth to groundwater is ~100-ft below ground surface (bgs). No CM COCs were found for the WADB as documented in the Focused CMS/FS Report for the WADB (SRNS 2013a) where depth to groundwater is ~17-ft bgs. Additionally, the LAB is above the L-Area Northern Groundwater Operable Unit (OU) which has been identified as a no-further action OU.

Alternatives that include consolidation of ash/coal fines only included consolidation sites where the vadose zone thicknesses were considered to be protective of groundwater as well as at locations that were not adjacent to surface water bodies. Although groundwater monitoring may be required for alternatives that include permanent storage of ash at SRS (e.g., LUCs, final cover systems, etc.), it is anticipated that the groundwater monitoring will be conducted as part of the larger OU groundwater monitoring programs. Therefore, groundwater monitoring is not included in the cost evaluation of the ash disposition alternatives.

2.2 Alternative Descriptions Evaluated for Waste Units

Multiple in-situ and excavate and haul proposed alternatives were evaluated. The in-situ options are listed in Table 1-3. The excavate and haul alternatives are listed in Table 1-4. Each site has a unique set of applicable alternatives due to physical properties of waste at each ash/coal fine waste unit; therefore, not all alternatives were evaluated for each waste unit. Tables 2.2-1 and 2.2-2 identify the alternatives that were evaluated for each waste site. Pros and cons of each alternative are also provided in these tables. The descriptions below discuss and identify the evaluated alternatives by waste unit.

Table 2.2-1. In-Situ Alternatives and Candidate Waste Sites

Alternative #	Alternatives In-Situ	Candidate Sites	Description	Pros	Cons
1	Land Use Control (LUC) only	DAO (FA) WADB (IA) LAB (IA) HAB (IA) KAB (IA) DABW (IA) HCPRB (IA)	This alternative was evaluated as a final action (FA) for ash in wetland areas (DAO and WADB) because of precedence with Dunbarton Bay which was closed under LUCs only. LUCs for the other waste sites is considered an interim action (IA) until beneficial reuse options are available.	• Most ash/coal fines units are adjacent to industrial complexes, so the addition of LUCs may not be a significant cost to the overall Area OU. • This alternative also allows for future beneficial reuse of ash as fill material.	• Does not reduce near term ash footprint at SRS. • As an IA (all waste units except DAO and DABW) this alternative delays FA.
2	Individual cap in place with SCDHEC Class II Cover System	FAL (FA) LAB (IA) KAB (IA) HAB (IA)	This alternative would put a soil cover over existing ash/ waste sites as an IA. Fly ash, bottom ash and coal fines would be available for beneficial reuse in the future (i.e., tank farm closure fill material, new technologies). For FAL this alternative is considered a FA in accordance with the approved closure plan for this permitted landfill.	• This would allow for future use as fill material or other uses as technology for beneficial reuse develops. • Reduces transportation.	• This is an IA and delays FA. • Requires dewatering and drying of ash (for LAB, HAB) to achieve compaction. • Cannot be used as a FA per regulators.
3	In-situ stabilization with soil cover	LAB (FA) HAB (FA) WADB (FA)	This alternative would allow the use of cementitious material to increase material strength and lower permeability of bottom and side slopes. It provides an alternative to dewatering the basins prior to closure. The added strength of material would make equipment operation easier.	• Reduces transportation. • Reduces/eliminates dewatering. • Stabilizes saturated sediments for equipment operation.	• New technology may have uncertain costs.
4	Cap in place with SCDHEC Class III Cover System/ Individual	LAB (FA) KAB (FA) HAB (FA)	This alternative would place a SCDHEC Class III cover over existing waste sites as a FA. (Some consolidation from other units could be considered).	• Reduces transportation costs. • Eliminates offsite disposal costs.	• Long-term maintenance costs. • Requires dewatering and drying of ash for compaction design. • Does not reduce ash footprint at SRS.

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Table 2.2-2. Excavate and Haul Alternatives and Candidate Waste Sites

Alternative #	Alternatives Excavation & Haul	Candidate Sites	Description	Pros	Cons
5	Consolidate at multiple locations and cover in place with SCDHEC Class II Landfill Cover ARAR for eventual beneficial reuse (IA)	F-Tank Farm, stage @ A-CPRB A-Ash H-Tank Farm, stage @ H-Ash Basin K/L, H-CPRB, WADB Ash H-Tank Farm, stage @ K-Ash Basin L-Ash, WADB Ash Farm, stage @ L-Ash Basin, K-Ash, WADB Ash	This alternative would excavate ash from several of the units and haul to one or multiple locations for “temporary” storage. A soil cover (meeting the requirements of a SCDHEC Class II Landfill closure) over the consolidated ash would act as an interim action (IA). Fly ash, bottom ash, and coal fines would be available for beneficial reuse in the future (i.e., F-Area and H-Area Tank Farm closure fill material, new technologies, etc.). This alternative would be similar to what is being done at FAL with the added expectation of future beneficial reuse.	• Could be implemented over several years allowing the costs to spread out. • This alternative also allows for future beneficial reuse of ash a fill material. • Future cost savings for obtaining tank farms closure fill material (over 2M cubic yards [yd^3] fill will be required). • Reduces future detrimental environmental impact from using virgin resources for backfill material.	• LUCs. • Dewatering and drying of ash for compaction would be required for several of the sites. • Ash/coal fines are "handled" twice, increasing transportation costs.
5a	Consolidation at one location and close with SCDHEC Class II Landfill ARAR Cover (IA)	ACPRB AAP	The AAP and ACPRB have been investigated/ evaluated under the RCRA/CERCLA process. This alternative was the preferred final action (FA) alternative in the SB/PP for the AAP and ACPRB (SRNS 2014). No CM COCs were identified during the BRA. Since the depth to groundwater is approximately 100-ft bgs, a soil cover was considered protective. This alternative is being proposed as an IA for eventual beneficial reuse of the ash as backfill material.	• This alternative could be implemented relatively quickly because the AAP and ACPRB are further along in the regulatory process. • The close proximity of AAP to ACPRB would reduce transportation costs.	• LUCs. • Uncertain regulatory acceptance.

Table 2.2-2. Excavate and Haul Alternatives and Candidate Waste Sites *(Continued)*

Alternative #	Alternatives Excavation & Haul	Candidate Sites	Description	Pros	Cons
6	Consolidate at one location and close with SCDHEC Class III Landfill ARAR Cover (FA)	ACPRB, AAP, KAB, LAB, WADB, HAB, HCPRB	This alternative would select one site (KAB, LAB) as a location to construct a landfill type closure to accept ash from other locations at SRS.	• Could be implemented over several years allowing the costs to spread out. • Reduces ash footprint at SRS. • Very flexible in acceptance of ash	• LUCs • Dewatering and drying of ash for compaction would be required for several of the sites • Uncertain if regulators would require a basin bottom liner.
7	Construct Onsite SCDHEC Permitted Landfill for Ash Disposal (FA)	N-Area (to receive ash/coal fines from: AAP, ACPRB, HAB, HCPRB, LAB, KAB, WADB)	This alternative would select a new centralized onsite location to construct a SCDHEC Permitted landfill to accept ash from other locations at SRS. Offsite-Rule approval would be required from USEPA to dispose of CERCLA ash into this permitted landfill.	• Could be implemented over several years allowing the costs to spread out. • Reduces ash footprint at SRS. • Very flexible in acceptance of ash.	• LUCs. • Landfill permit design and approval. • Long-term O&M costs for cover maintenance and possibly 5-year reporting. • Need offsite approval for CERCLA waste. • Dewatering and drying of ash for compaction would be required for several of the sites.
8	Excavate and ship for encapsulated beneficial reuse (FA)	Truck Transport to SEFA (from AAP, ACPRB, HAB, HCPRB, KAB, LAB, WADB)	This alternative would require excavation of waste units and segregation of ash, bottom ash, and coal residuals. The materials would need to be dried, sorted, crushed, and then shipped to a facility (e.g., SEFA) for beneficial reuse. Some unusable material would likely need to be disposed of at TRL or consolidated and covered in a small footprint with a cover system.	• Eliminates all costs of long-term O&M. • Positive public perception of re-using material vs burying waste. • Provides environmental benefits by removing ash from the environment and reducing use of natural resources. • Lowers future material costs.	• High transportation costs. • There is a risk for sending SRS waste for use in commercial products. • Unusable material will require disposal/disposition.

Table 2.2-2. Excavate and Haul Alternatives and Candidate Waste Sites *(Continued/End)*

Alternative #	Alternatives Excavation & Haul	Candidate Sites	Description	Pros	Cons
9	Excavate and entomb in 186 basins (FA)	186-C, -L, -P, -R (receive from AAP, ACPRB, HAB, HCPRB, KAB, LAB, WADB)	This alternative would excavate ash/coal fines and place it in the 186 basins. The basins would be capped to entomb the ash.	• Beneficial reuse of an existing structure. • Robust facility can meet the permitted facility design equivalency. • Central to SRS. • Minimize transportation costs. • Eliminates O&M costs at excavation site.	• Reconstruction of some walls required. • Clearing and dewatering (rain) of some 186 basins required. • Uncertain permitting process. • Post closure care. • Need offsite approval for CERCLA waste. • Not enough volume to accommodate all SRS remaining ash
10	Excavate and Dispose at TRL (FA)	Three Rivers Landfill (receive from receive from AAP, ACPRB, HAB, HCPRB, KAB, LAB, WADB)	This alternative would excavate ash/coal fines and dispose of at TRL.	• Eliminates all costs of long-term O&M. • Transportation costs are less than many other haul alternatives.	• Currently, TRL is not prepared to receive the amount of ash contained within SRS ash units. • TRL would have to secure funding to design and build a dedicated cell for the ash. • The uncertainty of the SRS funding for waste disposal makes an investment by TRL risky. • SRS would run risk of increased disposal cost by having no other disposal options.

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2.2.1 A-Area Coal Pile Runoff Basin

The proposed alternatives applicable to the ACPRB include all excavate and haul alternatives. Only excavate and haul alternatives were considered for this waste unit because the relatively small volume of coal fines at this unit would result in a relatively low short-term (capital) costs as compared to the long-term (O&M) costs for an in-situ alternative. ACPRB was selected as the "receiver" site for consolidation of AAP in the excavate and haul alternatives due to its proximity to AAP. Groundwater is not currently impacted by the coal fines in the basin, and there are no CM COCs identified for the ACPRB in the RI/RFI/BRA (SRNS 2012b), so delaying action would not be detrimental to the environment. Although the ACPRB is not heavily vegetated and the current water volume is low, some clearing, grubbing, basin content treatment, and dewatering and drying of waste would be required prior to implementation of any alternative.

The alternatives evaluated for the ACPRB include the following:

In-situ

- None.

Excavate and Haul:

- 5a: Ash from AAP would be placed into ACPRB and closed in place with a cover system meeting SCDHEC Class II Landfill ARARs as an IA until beneficial reuse options were available.
- 5: Coal fines would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs for eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse).
- 6: Coal fines would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA.
- 7: Coal fines would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be in N-Area of the SRS) for ash as a FA.

- 8: Coal fines would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility. Although coal fines may not be suitable for fly ash in concrete mixes there is a potential to use the fines as a fuel source in the thermal beneficiation process.
- 9: Coal fines would be disposed of within the 186-C basin and entombed with ash from other waste units.
- 10: Coal fines would be disposed of at TRL.

2.2.2 A-Area Ash Pile

The proposed alternatives applicable to the AAP include all excavate and haul alternatives. Only excavate and haul alternatives are applicable to this waste unit because the location of the AAP, adjacent to Tims Branch Tributary, makes placement of a soil cover unfeasible. The excavation alternatives described in this section for the AAP require clearing and grubbing prior to implementation of any alternative. Due to the proximity of the pile to Tims Branch Tributary, specific sequencing and increased sediment and erosion control measures will be required during excavation. Soil sampling will be required prior to final grading and stabilization to ensure that the site can be released for unrestricted use.

The alternatives evaluated for the AAP include the following:

In-situ

- None, due to proximity to Tims Branch Tributary.

Excavate and Haul:

- 5a: Ash from AAP would be placed into ACPRB with a cover system meeting SCDHEC Class II Landfill ARARs as an IA until eventual beneficial reuse.
- 5: AAP ash would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs for eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse).

- 6: AAP ash would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA.
- 7: AAP ash would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be in N-Area of the SRS) for ash as a FA.
- 8: AAP ash would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility.
- 9: AAP ash would be disposed of within the 186-C basin and entombed with ash from other waste units. The total volume of the AAP ash (70,000 yd^3) could fit in the 186-C basins which have a capacity of 129,000 yd^3.
- 10 AAP ash would be disposed of at TRL.

2.2.3 D-Area Ash Overflow

Due to the extent of ash, the presence of ash within a wetland area and precedence set by the RA of LUCs for the ash within the wetland and buffer area of WADB, the only proposed alternative for the ash at the DAO waste unit within this alternative evaluation is LUCs. This alternative would implement LUCs such as warning signs, access controls through site use/site clearance restrictions, deed restrictions, as well as engineering controls like signs to limit inadvertent human exposure and access to contaminated areas. LUCs would be implemented at the DAO by posting warning and no trespassing signs at access points.

2.2.4 D-Area Ash Basin Wetlands

Due to the extent of ash, the presence of ash within a wetland area and precedence set by the RA of LUCs for the ash within the wetland and buffer area of the WADB, the only proposed alternative for the ash at the DABW waste unit is LUCs. This alternative would implement LUCs such as warning and no trespassing signs, access controls through site use/site clearance restrictions, deed restrictions, as well as engineering controls like signs to limit inadvertent human exposure and access to contaminated areas.

2.2.5 K-Area Ash Basin

The proposed alternatives applicable to the KAB include both in-situ alternatives and excavate and haul alternatives because of its large area, large volume of ash, and stable conditions (e.g., not adjacent to wetlands or a surface water body). The KAB is heavily vegetated and would require vegetation removal prior to implementation of any alternative. The large area, ~ 11 ac, of this waste unit makes it a candidate for receiving ash from other waste units for the consolidation alternatives. KAB is estimated to contain ~273,000 yd^3 of ash, so costs associated with transporting the ash off unit will be high. The large volume of ash within KAB is much greater than the capacity of the 186 basins and the nearby 186-K basins are still in use by K-Area Operations, therefore the alternative to entomb the KAB ash within the 186 basins was not evaluated.

The alternatives evaluated for the KAB include the following:

In-situ

- 1: LUCs as an IA until eventual beneficial reuse.
- 2: Construct a soil cover (meeting SCDHEC Class II Landfill ARARs) over the KAB as an interim measure until eventual beneficial reuse. LUCs would be implemented until the ash is removed for beneficial reuse.
- 4: Construct a cover system meeting SCDHEC Class III Landfill ARARs (geosynthetic cover system) as a FA with LUCs.

Excavate and Haul:

- 5: KAB ash would be consolidated with ash from other waste units at HAB, KAB or LAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs for eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse). LUCs would be implemented at the consolidation site until the ash is removed for beneficial reuse.

- 6: KAB ash would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA. LUCs would be implemented at the consolidation site.
- 7: KAB ash would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be located in N-Area of the SRS) for ash as a FA. LUCs would be implemented at the landfill site.
- 8: KAB ash would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility.
- 10: KAB ash would be disposed of at TRL.

2.2.6 L-Area Ash Basin

All proposed alternatives, both in-situ and excavate and haul, are applicable to the LAB because of the large area and centralized remote location of the LAB. All proposed in-situ alternatives would reduce transportation costs and both proposed cover system alternatives would eliminate offsite disposal costs. The LAB is heavily vegetated, and all alternatives require the removal of vegetation prior to implementation. The large area, ~18 ac, of this waste unit makes it a candidate for receiving ash from other waste units for the consolidation alternatives. LAB is estimated to contain ~323,000 yd^3 of ash, so costs associated with transporting the ash will be high.

The alternatives evaluated for the LAB include the following:

In-situ

- 1: LUCs as an IA until eventual beneficial reuse.
- 2: Construct a soil cover (meeting SCDHEC Class II Landfill ARARs) over the LAB as an interim measure until eventual beneficial reuse. LUCs would be implemented until the ash is removed for beneficial reuse.
- 3: Stabilize ash with an in-situ grout mixture and place a soil cover over the stabilized ash as a FA. This alternative was evaluated for LAB because the wet conditions within the basin are

assumed to prohibit the use of traditional construction equipment. LUCs would be implemented at LAB.

- 4: Construct a cover system meeting SCDHEC Class III Landfill ARARs (geosynthetic cover system) as a FA with LUCs.

Excavate and Haul:

- 5: LAB ash would be consolidated with ash from other waste units at HAB, KAB or LAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs for eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse). LUCs would be implemented at the consolidation site until the ash is removed for beneficial reuse.
- 6: LAB ash would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA. LUCs would be implemented at the consolidation site.
- 7: LAB ash would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be located in N-Area of the SRS) for ash as a FA. LUCs would be implemented at the landfill site.
- 8: LAB ash would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility.
- 9: LAB ash would be entombed in the 186-L, 186-P, and 186-C Basins. This alternative was evaluated due to the proximity of the 186-L basins to the LAB, however, the capacity of the 186-L basins, 129,000 yd^3 is much less than the volume of ash estimated within LAB. The 186 basins in P-Area and C-Area would also be used for LAB ash.
- 10: LAB ash would be disposed of at TRL.

2.2.7 Wetland Area at Dunbarton Bay Phase II

The proposed alternatives applicable to the Phase II WADB include both in-situ alternatives and excavate and haul alternatives. All proposed excavate and haul alternatives are applicable to the

WADB and require clearing and grubbing prior to implementation of any of these alternatives. Special excavation equipment or stabilization of the subsurface would be required due to the wet conditions that were experienced during implementation of Phase I in the South Ash Remediation Area (SARA) of WADB.

The alternatives evaluated for the WADB include the following:

In-situ

- 1: LUCs as an IA until eventual beneficial reuse.
- 3: Stabilize ash with an in-situ grout mixture and place a soil cover over the stabilized ash as a FA. This alternative was evaluated for WADB because the wet conditions experienced during Phase I excavation at WADB prohibited the use of traditional construction equipment. LUCs for the Dunbarton Bay wetland area and buffer area would be expanded to include the stabilized ash and soil cover.

Excavate and Haul:

- 5: WADB ash would be consolidated with ash from other waste units at HAB, KAB or LAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs for eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse). LUCs would be implemented at the consolidation site until the ash is removed for beneficial reuse.
- 6: WADB ash would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA. LUCs would be implemented at the consolidation site.
- 7: WADB ash would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be located in N-Area of the SRS) for ash as a FA. LUCs would be implemented at the landfill site.
- 8: WADB ash would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility.

- 9: WADB ash would be entombed in the 186-P basins. This alternative was evaluated due to the proximity of the 186-P basins to the WADB. The capacity of the 186-P basins, 129,000 yd^3 is more than sufficient to store the estimated 22,000 yd^3 from the WADB Phase II overflow area.
- 10: WADB ash would be disposed of at TRL.

2.2.8 H-Area Coal Pile Runoff Basin

The proposed alternatives applicable to the HCPRB includes one in-situ alternative and all excavate and haul alternatives. The HCPRB is active and receives stormwater. In-situ capping alternatives were not evaluated for the HCPRB because the relatively small size and small volume of ash fines.

The alternatives evaluated for the HCPRB include the following:

In-situ

- 1-LUCs as an IA until eventual beneficial reuse.

Excavate and Haul:

- 5: Coal fines would be placed into HAB and closed in place with cover system meeting SCDHEC Class II Landfill ARARs as an IA until eventual beneficial reuse. The coal fines would need to be segregated from the fly ash, as the beneficial reuse options for coal fines will be different than the reuse options for fly ash.
- 5: Coal fines would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs until eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse).
- 6: Coal fines would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA.
- 7: Coal fines would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be located in N-Area of the SRS) for ash as a FA.

- 8: Coal fines would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility. Although coal fines may not be suitable for fly ash in concrete mixes there is a potential to use the fines as a fuel source in the thermal beneficiation process.
- 9: Coal fines would be disposed of within the 186-R basin and entombed with ash from other waste units.
- 10: Coal fines would be disposed of at TRL.

2.2.9 H-Area Ash Basin

All proposed alternatives were evaluated for the HAB. All proposed in-situ alternatives would reduce transportation costs and both proposed cover system alternatives would eliminate offsite disposal costs. In-situ cover systems would require a significant amount of dewatering because the basin and much of the surrounding area is wet and frequently covered in water. There is a large amount of ash outside of the basin berms that would need to be consolidated under the alternatives that involve cover systems. All excavate and haul alternatives would require clearing, grubbing within the basin berms and in a large area (~11.5-ac) outside of the basin berms. HAB was evaluated as a "receiver" basin for Alternative 5, consolidate and cover in place for beneficial reuse, because of its location. The assumed beneficial reuse for Alternative 5 is for backfill material beneath the eventual cover systems over F-Area and H-Area Tank Farms. Because HAB is close to the tank farms, it was evaluated as a potential staging area for the consolidated ash. Although the location is ideal, the wet conditions could pose potential issues with using HAB as a staging area to receive ash from other units.

The alternatives evaluated for the HAB include the following:

In-situ

- 1: LUCs as an IA until eventual beneficial reuse.
- 2: Construct a soil cover (meeting SCDHEC Class II Landfill ARARs) over the HAB as an interim measure for eventual beneficial reuse. LUCs would be implemented until the ash is removed for beneficial reuse.

- 3: Stabilize ash with an in-situ grout mixture and place a soil cover over the stabilized ash as a FA. This alternative was evaluated for HAB because the wet conditions within the basin are assumed to prohibit the use of traditional construction equipment. LUCs would be implemented at HAB.
- 4: Construct a cover system meeting SCDHEC Class III Landfill cover ARAR (geosynthetic cover system) as a FA with LUCs.

Excavate and Haul:

- 5: HAB ash would be consolidated with ash from other waste units at HAB and covered in place with a cover system meeting SCDHEC Class II Landfill ARARs for eventual beneficial reuse (F-Area and H-Area Tank Farm final cover system is the assumed beneficial reuse). LUCs would be implemented at the consolidation site until the ash is removed for beneficial reuse.
- 6: HAB ash would be consolidated with ash from other waste units at KAB or LAB and covered in place with a cover system meeting SCDHEC Class III Landfill ARARs as a FA. LUCs would be implemented at the consolidation site.
- 7: HAB ash would be disposed of at a newly constructed onsite SCDHEC permitted landfill (assumed to be in N-Area of the SRS) for ash as a FA. LUCs would be implemented at the landfill site.
- 8: HAB ash would be shipped for encapsulated beneficial reuse. For this alternative, SEFA (McMeekin STAR Plant in Lexington, SC) is the assumed beneficial reuse facility.
- 9: HAB ash would be entombed in the 186 basins. This alternative was evaluated due to the proximity of the 186-R basins to the HAB, however, the capacity of the 186-R basins, 129,000 yd^3 is much less than the volume of ash within HAB. The 186 basins in P-Area and C-Area would also be used for HAB ash.
- 10: HAB ash would be disposed of at TRL.

2.2.10 F-Area Ash Landfill

The only proposed alternative applicable to the FAL is the placement of an individual SCDHEC Class II Landfill cover over the waste unit in accordance with the approved closure plan. The FAL is an active SCDHEC Class II permitted solid waste landfill. The cover system, in accordance with the approved closure plan, would be considered as a FA, however, due to the proximity of FAL to the F-Area Tank Farm, eventual beneficial reuse of the ash as lower backfill material would still be an option. Proposed excavate and haul alternatives are not applicable to this waste unit as ash from outside of this unit is currently being reconsolidated. The unit is also in a congested area making implementation of any excavate and haul alternative difficult.

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3.0 EVALUATION CRITERIA

The evaluation of alternatives presented in this document is not intended to replace the CERCLA feasibility study process. However, many of the CERCLA nine criteria are directly or indirectly considered as part of this evaluation. These include long-term effectiveness, short-term effectiveness, regulatory acceptance, and cost. The intent of the evaluation of ash disposition alternatives is to consider factors that are important in a broad context when evaluating disposition of multiple units. In addition to capital costs, other factors of varying significance include footprint reduction, beneficial reuse, long-term effectiveness, project risks, short- and long-term O&M costs, hauling costs, regulatory acceptability, and schedule impacts.

The methodology used for comparing and ranking alternatives in this document is based on Weight Ratios using an Analytic Hierarchy Process. A team of SRNS subject matter experts was formed to develop viable alternatives. The alternatives for 10 ash/coal fines sites were evaluated by several criteria (i.e., factors). To adjust the criteria by level of significance, a weighting factor is assigned to each criterion and are described in the following paragraphs. The weighting factors ranged in value between 0 and 10, where greater weighting factors signify more relative importance. The weighting factors were established through engineering principals and best professional judgment based on the relative importance of each criterion. Each alternative was rated for each criterion ranging from a 10 signifying it fully meets the criterion to a 0 where it fails to meet the criterion. The total score is the sum of the products derived by multiplying the weighting factors with each criterion ratings. The total scores are then ranked to determine the preferred alternatives.

3.1. Long-Term Effectiveness Criterion

Long-term Effectiveness is defined as how the alternative will perform in the distant future. The effectiveness ranges from completely effective when ash is completely removed offsite to the least, but sufficiently effective, when ash remains uncovered and ICs are implemented.

Weighting Factor of 2 has been assigned to long-term effectiveness since all alternatives are effective.

Table 3.1. Long-Term Effectiveness *(In-Situ)*

Weighting Factor of 2

Alternative	Rating
Complete ash removal	10
In-situ Stabilization	8
In-situ Cover	6
In-situ ICs	3

3.2 Regulatory Acceptability Criterion

Each alternative has a likelihood of regulatory acceptability. Regulatory acceptance ranges from high, when ash is removed and is beneficially reused, to low, when a large volume of ash is left-in-place with ICs.

Weighting Factor of 2 has been assigned to regulatory acceptability since all alternatives have the potential of gaining regulatory approval.

Table 3.2. Regulatory Acceptance Criterion *(In-Situ)*

Weighting Factor of 2

Alternative	Rating
High	10
Medium	5
Low	0

3.3 Footprint Reductions (via Consolidation and Beneficial Reuse) Criterion

Reducing the footprint of SRS facilities is a United States Department of Energy (USDOE) objective. Footprint reduction ranges from a high of 100%, when all ash is removed and hauled offsite and the site can be restored to unrestricted use, to a low of 0%, when ash is left-in-place with ICs. Other actions taken to reduce the footprint include ash consolidation within the same ash site (rating = 2), ash consolidation at another ash site (rating = 8), or construction of a new landfill (rating = 6).

Weighting Factor of 5 has been assigned to footprint reduction since reducing the ash footprint supports a USDOE objective.

Table 3.3. Footprint Reduction *(In-Situ)*

Weighting Factor of 5

Alternative	Rating
100%	10
50%-100%	8
10-50%	6
0-10%	2
0%	0

3.4 Project Risks Criterion

Project Risk is defined as the likelihood that an alternative would be adversely affected by circumstances outside the control of SRS project management. All alternatives have low project risk except for excavate and haul for beneficial reuse and excavate and dispose at TRL. As examples: SEFA cannot accept all or most of the ash due to unanticipated ash characteristics (rating = 5) or, funding issues for a new disposal cell at TRL (rating = 0). Project risk for the use of ash as backfill material beneath the F-Area and H-Area Tank Farm cover systems was considered low because the material would be used within the SRS boundaries and beneficial reuse decisions would be managed by USDOE.

Weighting Factor of 5 has been assigned to project risks that can adversely impact completion of an alternative.

Table 3.4. Project Risks *(In-Situ)*

Weighting Factor of 5

Alternative	Rating
Low	10
Medium	5
High	0

3.5 Total Project (Life-Cycle) Costs Criterion

Determining the most cost-effective ash strategy is a prime objective of this study. Total project costs include Capital Costs and O&M long- and short-term costs which vary greatly across the alternatives. Capital Costs of an alternative include some combination of site clearing, basin dewatering, ash drying, ash excavation and hauling, cover system, access controls, regulatory documentation and site restoration.

3.5.1 Capital Costs

Capital Costs are compared on a per ash site basis; costs are divided by the number of ash sites when alternatives involving multiple ash sites. Generally, the less hauling of ash, the lower the total capital costs. The lower cost alternatives are the in-situ alternatives – ICs (rating = 10), in-situ cover systems (rating = 8). The higher cost alternatives are the excavate and haul alternatives – consolidate at one or multiple ash sites and transport to SEFA (rating = 2) and consolidate at an ash landfill (a new or TRL) (rating = 0). Appendix E provides a complete listing of estimated capital costs of each alternative.

A Weighting Factor of 10 has been assigned to capital costs since determining the most cost-effective strategy is a prime objective of this study.

Table 3.5.1 Capital Costs per Ash Site *(In-Situ)*

Weighting Factor of 10

Alternative	Rating
<$1M	10
<$10M	8
<$20M	6
<$50M	4
<$100M	2
>$100M	0

3.5.2 Operations and Maintenance Costs Criterion

O&M Costs include long- and short-term costs. Short-term costs of an alternative include some combination of sign placement/maintenance, establishment of vegetation for site restoration, cover maintenance and landfill O&M.

Short-term O&M Costs are compared on a per ash site basis (i.e., alternatives involving multiple ash sites, the costs are divided by the number of ash sites). The level of maintenance required determined the level of cost. The lower cost alternatives are the ICs (rating = 10), site restoration (rating = 8) and cover systems (rating = 6). The highest cost alternative is operating and maintaining a new landfill (rating = 2). Appendix E provides a complete listing of estimated O&M costs of each alternative.

A Weighting Factor of 2 has been assigned to short-term O&M costs since short-term O&M costs are significantly less than capital costs and therefore, not as significant.

Table 3.5.2. Short-Term O&M Costs per Ash Site *(In-Situ)*

Weighting Factor of 2

Alternative	Rating
Signs	10
Site Restoration	7
Cover Maintenance	5
Landfill O&M	2

3.5.3 Long-Term O&M Costs

Long-term costs of an alternative include some combination of sign maintenance, cover maintenance and landfill closure. Long-term O&M costs are alternatives with cover systems are compared on a per ash site basis (i.e., alternatives involving multiple ash sites, the costs are divided by the number of ash sites). The level of maintenance required determined the level of cost. The lower cost alternatives are no long-term O&M (rating = 10), maintain signs and inspections (rating = 8), cover systems (rating = 5). The highest cost alternative is closing a new landfill (rating = 0). Appendix E provides a complete listing of estimated long-term O&M costs of each alternative.

A Weighting Factor of 2 has been assigned to short-term O&M costs since long-term O&M costs are significantly less than capital costs and therefore, not as significant.

Table 3.5.3 Long-Term O&M Costs per Ash Site *(In-Situ)*

Weighting Factor of 2

Alternative	Rating
None	10
Maintain Signs	8
Cover Maintenance	5
Landfill Closure	0

3.5.4 Transport, Handling and Disposal Costs

Transport, handling and disposal costs of an alternative include some type of relocation of the ash. Generally, the less hauling of ash, the lower the cost. The lower cost alternatives are the no relocation (rating = 10) and consolidation within as ash site (rating = 8), The higher cost alternatives are consolidation by hauling to different locations (rating = 4), hauling twice – a first time for consolidation within SRS and a second time for beneficial reuse as fill material on site (rating = 2) and hauling offsite plus a disposal fee (rating = 0). Appendix E provides a complete listing of estimated transport, hauling, and disposal costs of each alternative.

A Weighting Factor of 2 has been assigned to transport, handling and disposal.

Table 3.5.4 Transport, Handling and Disposal Costs per Ash Site *(In-Situ)*

Weighting Factor of 2

Alternative	Rating
No	10
Consolidation	8
Yes	4
Haul Twice	2
Haul & Disposal Fee	0

3.6 Schedule Impacts Criterion

Scheduling the implementation of an SRS ash management strategy will not be impacted by the FFA Appendix E RA Start Dates. The RA start dates range from March 2026 (AAP and ACPRB) to September 2065 (DAO and DABW). However, some alternatives that include A-Area ash may not be ready for implementation early enough to meet the AAP/ACPRB RA start date. Conversely, those alternatives planning to use ash for beneficial reuse as fill material for the F-Area and H-Area Tank Farm cover systems would be needed by calendar year 2064 for implementation.

A Weighting Factor of 2 has been assigned to schedule impacts since scheduling impacts can be managed.

Table 3.6 Schedule Impacts *(In-Situ)*

Weighting Factor of 2

Alternative	Rating
No Schedule Impacts	10
Early RA Schedule Impacts	5
Late RA Schedule Impacts	5

3.7 Beneficial Reuse Criterion

Determining whether beneficial reuse can be cost-effectively incorporated into the SRS ash management strategy is an important consideration in this study. Due to recent coal combustion residuals (CCR) regulations, significant advancements have been made in beneficial reuse of coal ash. Commercial power plants are investing in beneficiation facilities (Fedorka, et. al.) and the USDOE is providing funds for research into beneficial use technologies for coal combustion products (USDOE 2020). These technology investments and advancements, along with the environmental benefits of reducing landfill space provide justification for considering this criterion to be important.

Beneficial reuse in this study includes encapsulated reuse (e.g., conversion into a marketable fly ash), unencapsulated (e.g., fill material for the F-Area and H-Area Tank Farm covers) and reuse of an existing facility for disposal of the ash (e.g., disposal in the 186 basins). Difficulty in reusing the material is also considered. Mixing the coal fines within the ash may require segregation in the future depending on the beneficial reuse option.

Weighting Factor of 8 has been assigned to beneficial reuse since incorporating beneficial reuse into the ash strategy is a sound environmental stewardship alternative.

Table 3.7. Beneficial Reuse *(In-Situ)*

Weighting Factor of 8

Alternative	Rating
Encapsulated Reuse	10
Unencapsulated Reuse	8
Reuse of Existing Structures	6
Material Low Grade for Reuse	2
No Beneficial Reuse	0

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4.0 RESULTS

The detailed cost analysis of all alternatives and of each individual ash site is provided in Appendix E. The alternative ranking, including the weighting factors, score values and total scores of all alternatives are provided on an individual and a combined ash site basis in Appendix F.

4.1 Alternative Rankings

Table 4-0 summarizes the results of the alternative evaluation in Appendix F.

Table 4-0. Ranking of Alternatives

Rank	Average Score*	Alternative	Description
1	296	1	LUCs only.
2	282	2	Individual cover in-place with SCDHEC Class II Landfill Cover System for beneficial reuse as interim action (IA).
3	275	9	Excavate and store/entomb for beneficial reuse in 186 basins.
4	235	5	Consolidate at multiple locations with SCDHEC Class II Landfill Cover System as IA for beneficial reuse.
	222	2a	Individual cover in-place w/SCDHEC Class II Landfill Cover System as final action (FA) (*this alternative is applicable to FAL only*).
5	216	4	Individual cover in-place with SCDHEC Class III Landfill Cover system as FA
	210	5a	Consolidate at existing ash basin and close with SCDHEC Class II Landfill Cover System as an IA until beneficial reuse (*this alternative is applicable to AAP/ACPRB only*).
	206	3a	In-situ stabilization with soil cover (*WADB only due to size*)
6	193	6	Consolidate at existing ash basin and close with SCDHEC Class III Landfill Cover System as a FA.
7	183	8	Excavate and ship for encapsulated beneficial reuse.
8	152	7	Construct onsite SCDHEC permitted landfill for ash disposal.
9	136	3	In-situ stabilization with soil cover.
10	114	10	Excavate and dispose at TRL.

*Average Score based on units evaluated for that alternative

Table 4-1 summarizes the results of the alternative evaluation by waste unit. The top three alternatives for each waste unit are provided except where an alternative is presumed (e.g., DO, DABW, and FAL).

Table 4-1. Top Rankings of Alternatives at Each Site

Site	Score	Alter*	Description
AAP	280	C-9	Excavation and Storage/Entombment in 186 Basins. (FA)
	228	AC-5	Consolidation at ACPRB with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA)
	218	AC-6	Consolidation at one location and closure with SCDHEC Class III Landfill (Geosynthetic) Cover System. (FA)
ACPRB	280	C-9	Excavation and storage/entombment in 186 Basins. (FA)
	228	AC-5	Consolidation of AAP ash at ACPRB with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA)
	218	AC-6	Consolidation at one location and closure with SCDHEC Class III Landfill (Geosynthetic) Cover System. (FA)
DAO	242	DO-1	LUCs only (FA).
DABW	242	D-1	LUCs only (FA).
FAL	222	F-2	Individual cover in place with SCDHEC Class II Landfill Cover System per permitted closure plan (FA).
HAB	296	H-1	LUCs only (Interim action [IA] until beneficial reuse).
	282	H-2	Individual cover in place with SCDHEC Class II Landfill Cover System (IA).
	280	R-9	Excavation and storage/entombment in 186 basins (FA).
	238	H-5	Consolidation at one location with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA).
HCPRB	296	HC-1	LUCs only (IA until beneficial reuse).
	280	R-9	Excavation and storage/entombment in 186 basins (FA).
	238	H-5	Consolidation at one location with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA).
KAB	296	K-1	LUCs only (IA until beneficial reuse).
	282	K-2	Individual cover in place with SCDHEC Class II Landfill Cover System (IA)
	280	K-9	Excavation and storage/entombment in 186 basins (FA).
	238	H-5	Consolidation at one location with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA).
LAB	296	L-1	LUCs only (IA until beneficial reuse).
	282	L-2	Individual cover in place with SCDHEC Class II Landfill Cover System (IA)
	280	L-9	Excavation and storage/entombment in 186 basins (FA).
	268	H-5	Consolidation at one location with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA).
WADB	296	W-1	LUCs only (IA until beneficial reuse).
	260	P-9	Excavation and storage/entombment in 186 basins (FA).
	238	H-5	Consolidation at one location with SCDHEC Class II Landfill ARAR Cover System for eventual beneficial reuse. (IA).

C = 186-C
AC = ACPRB
DO = DAO
D = DABW
F = FAL
H = HAB
HC = HCPRB
R = 186-R
K = KAB
L = LAB
W = WADB
P = 186-P

Each alternative includes some combination of site clearing, ash processing (e.g., basin dewatering, ash drying and sorting), ash handling (e.g., consolidation, excavation, hauling), cover system (interim or final), site restoration (for unrestricted use), ICs, and regulatory documentation. The alternatives that minimize or eliminates any of these activities are the lowest cost alternatives. The cost estimates are detailed in Appendix E.

This evaluation considers many factors (i.e., footprint reduction, beneficial reuse, long-term effectiveness, project risks, short- and long-term O&M costs, hauling costs, regulatory issues) in developing an ash management strategy. As described in Section 3.0 multiple factors are evaluated in the selection of a recommended alternative. Using a weighted average method, many factors of varying significance can be compared and evaluated. As a result of weighting factors, the lowest cost, regulatorily acceptable alternatives scored favorably, but the alternatives using beneficial reuse scored highest.

4.2 Evaluation of the Top Ranked Alternatives

Alternative 1, LUCs only as an IA until beneficial reuse, is the top ranked alternative for all waste units evaluated. This alternative has the lowest capital costs of all the evaluated alternatives, ~$31,000 per waste unit, and minimal long-term O&M costs. Although there is uncertainty associated with regulatory acceptance, the SRS ash basins and Coal Pile Runoff Basins (CPRBs) are stable and present low human health risks thus supporting LUCs. The ash material would be available for beneficial reuse as backfill beneath the H-Area and F-Area Tank Farm cover systems. The ash material would only require being handled/transported once at the time it is needed for the cover system. Testing of the ash and engineering studies may be needed to evaluate whether any amendments or treatment of the soil would be required in order to use as the lower backfill material beneath the cover systems. AAP was not considered for this alternative due to its proximity to Tims Branch and current regulatory documents that identify a preferred RA to excavate the ash. FAL was not considered for the LUCs only alternative because SCDHEC has approved its closure plan as part of the Class II Landfill Permit.

Alternative 2, in-situ individual cover in place with a SCDHEC Class II Landfill ARAR cover system for eventual beneficial reuse, ranked second among the alternatives. Although USEPA indicated that a Class II Landfill ARAR cover system would not be acceptable as a FA, it is anticipated that it would gain regulatory acceptance as an IA until beneficial reuse. It is important to note that this alternative was evaluated as an in-situ alternative and transportation costs associated with the eventual beneficial reuse (assumed to be used as backfill beneath the F-Area and H-Area Tank Farm cover systems) are not included in the evaluation. As technology evolves, other beneficial reuse options may make the value of the ash high enough to offset the transportation costs. A soil cover over the basins, used to prevent exposure during the IA, could add to the beneficial reuse as additional backfill material but could also hinder other potential reuse options if material segregation was required. This alternative was considered as an IA for HAB, HCPRB, KAB, and LAB. This alternative was not considered for AAP because of its proximity to Tims Branch tributary, nor for ACPRB, because any action involving AAP will likely involve ACPRB due to their proximity and the maturity of their regulatory documentation. The overflow areas (DAO, DABW, and WADB) were not considered for this alternative because placing a soil cover over these areas that are saturated or near saturated areas would result in detrimental impact to wetlands. Alternative 2 is appropriate for the ash basins and the HCPRB and will prevent exposure via a soil cover and LUCs in the short term until a beneficial reuse option (e.g., F-Area and H-Area Tank Farm final cover system) is available.

Alternative 9, excavate and entomb in the 186 basins, ranked high among the alternatives as beneficial reuse of an existing structure. The 186-C, -L, -P, and -R were considered as candidates for entombment of the ash. The capacity of the basins at each location is ~129,000 yd^3, so this alternative can only accept ~60% of all ash from the combined totals of AAP, HAB, KAB, LAB, ACPRB, HCPRB, and WADB. The most efficient use of this limited capacity would be to move LAB ash to 186-L, 186-P and 186-R, move ash from WADB to 186-P, move 50% of the HAB ash and H-CPRB to 186-R and AAP ash and ACPRB coal fines to 186-C. However, 186-K may not be available for use in the near-term. If it becomes available, 186-K could accept about 50% of KAB ash. The remaining ash (50% of HAB and KAB) require being managed via other alternatives. This alternative could also be used in conjunction with another alternative (e.g., encapsulated beneficial reuse), to address all waste units. The proximity of the 186 basins to some waste units (LAB to 186-L, WADB to 186-P), favors this alternative. Capital costs associated with this alternative are moderate, ranging from $8 million (M) to $14M. O&M costs are also moderate and are only applicable at the 186 basins.

Alternative 5, consolidate at one location and cover with a SCDHEC Class II Landfill cover system, as an IA, ranked fourth among the alternatives. Although USEPA indicated that a Class II Landfill ARAR cover system would not be acceptable as a FA, regulatory acceptance of this alternative was ranked as "medium" because it is an IA. Only three ash basins (KAB, LAB, and HAB) potentially have the capacity to consolidate ash from AAP, HAB, KAB, LAB, A-CPRB, H-CPRB, and WADB. LAB is the recommended option based on size, centralized location and overall cost. LAB encompasses the largest area and has a calculated capacity of 1,200,000 yd^3 (See Appendix G). Of these three basins, LAB is the largest and lowest cost alternative. HAB would also be more centralized than LAB and would have a similar cost to LAB, but this alternative was ruled out due to HAB's proximity to wetlands. Similar to Alternative 2, the soil cover could be used as backfill material if the beneficial reuse option includes using the ash as lower backfill beneath the final F-Area and H-Area Tank Farm cover system.

Alternative 8, excavate and ship for encapsulated beneficial reuse, ranked seventh among the alternatives, because of its high cost of transportation to the SEFA facility in Lexington, SC and due to the uncertainty of the acceptability of the material. However, this alternative could be used in conjunction with Alternative 9, entomb in the 186 basins. As discussed earlier, there is not enough storage capacity in the 186 basins for all ash in the basins, AAP, and WADB and the coal fines in the coal pile runoff basins. Only a portion of the ash material is likely to be converted into a marketable product for encapsulated beneficial reuse. Combining Alternatives 8 and 9 would address the shortcomings of each alternative and provide the advantage for both encapsulated beneficial reuse of the ash material as a SCM and beneficial reuse of an existing structure. Ash processing could be performed at a cost-effective continuous rate allowing for funding to be spread over multiple fiscal years. The portion of the ash that cannot be converted into a marketable product would be entombed in the 186 basins. The STAR facility at the McMeekin Plant in Lexington, owned and operated by SEFA, was the assumed market for the ash. There is uncertainty whether the ash is of suitable quality to be processed at this plant, however, other markets likely exist for the bottom ash and higher LOI fly ash. Any encapsulated beneficial reuse will require sorting and drying of the ash prior to shipment.

5.0 DISCUSSION

5.1 Combining Alternatives

Although each alternative was evaluated individually, combining multiple alternatives can provide more cost-effective solutions. Combining alternatives is necessary due to factors such as ash in wetlands, approved regulatory documents and lack of enough storage space. Therefore, one alternative cannot be applied at all sites. Overriding factors that impact some waste units include:

- Ash in Wetlands – clearing and grubbing large areas of wetlands is not environmentally sound practice.
- Approved Regulatory Documents – FAL has an approved closure plan for an Alternative 2 soil cover and AAP/ACPRB has a reviewed SB/PP for an Alternative 5a consolidation with soil cover.
- Insufficient storage space – Beneficial reuse of an existing structure (186 basins) do not have enough storage space for all ash.

5.2 Sequencing of Alternatives

Sequencing the implementation will provide a more cost-effective ash management strategy. The chronological order of ash disposition would be based on urgency either regulatorily or environmentally. For example, the first sites to be addressed would be WADB and AAP. Remedial action at WADB was halted prior to completion. AAP is near a tributary of Tims Branch.

All alternatives or combination of alternatives can be implemented sequentially to provide efficient resource loading and a level funding profile provided a comprehensive regulatory document is approved. One objective of this evaluation is to identify critical elements of the content of such a document. Section 6.0, Recommendations and Path Forward, includes a discussion of the critical elements.

5.3 SRS Experience

All work activities associated with the alternatives evaluated use proven technologies and that have been successfully deployed at SRS previously (with one notable exception). See Section 1.2 for specific examples. The lone exception is the processing of coal ash to produce a marketable product. Experienced beneficial reuse contractors are available and can be subcontracted to process the ash using proven technologies.

More recent ash RAs have been managed individually without consideration of consolidation of material or resources. From a lesson learned perspective, significant savings may have been realized if WADB and the DAB ash sites were worked concurrently or even in sequence.

6.0 RECOMMENDATIONS AND PATH FORWARD

The ash strategy evaluation using a Weight Ratios Analytic Hierarchy Process presented in this document has multiple recommended alternatives. The ranking of alternatives, the uncertainties in the evaluation, and alternative costs were used to develop preferred recommendations for each site presented in Table 6-0. The selection of the alternatives is dependent on the ash site conditions. To provide a cost-effective solution the selected alternatives would be sequenced for optimum efficiency and level resource loading and funding requirements. Efficiencies can also be gained in regulatory document preparation. One pathway in gaining regulatory document efficiency is to develop an early action decision document for the remaining ash and coal fines waste units similar to the early action ROD remedial selection alternative prepared for the reactor building complexes (SRNS 2009a).

To support this strategy the following recommendations are provided:

- Alternative 2 is recommended for FAL due to its approved Closure Plan.
- For the remaining ash sites – one comprehensive regulatory decision document to coordinate and schedule all ash activities.
- Incorporate beneficial reuse to the extent practical at each ash site (Alternatives 1, 8 and 9).

Table 6-0. Recommended Alternatives at Each Ash Site

Site	1st Alternative	2nd Alternative	Description
DO, DABW	1		LUCs only as Final Action (FA)
FAL	2		Individual cover in place with a minimum SCDHEC Class II Cover System as FA.
AAP, ACPRB	9	5a	Entombment in the 186 basins. Alternate: Consolidate at A-CPRB and cover with SCDHEC Class II Landfill ARAR Cover System as a FA.
HAB, HCPRB, KAB, LAB, WADB	1	8, 9	LUCs as an interim action until eventual beneficial reuse. Alternate: Encapsulated beneficial reuse with unusable residuals being entombed in the 186 basins.

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7.0 REFERENCES

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Fedorka, William; Knowles, Jimmy; and Castleman, John. *Results in Reclaiming and Recycling Coal Combustion Residuals for Encapsulated Beneficial Reuse,* The SEFA Group, 217 Cedar Road, Lexington, SC 29073, 2017 World of Coal Ash (WOCA) Conference in Lexington, KY, May 2017

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APPENDIX A

Ash and Coal Fines Waste Unit Summary Descriptions

A1	A-Area Coal Pile Runoff Basin (ACPRB)/A-Area Ash Pile (AAP)
A2	D-Area Ash Overflow (DAO) and D-Area Ash Basin Wetlands (DABW)
A3	K-Area Ash Basin (KAB)
A4	L-Area Ash Basin (LAB)
A5	Wetland Area at Dunbarton Bay (WADB) Phase II
A6	H-Area Coal Pile Runoff Basin (HCPRB) and H-Area Ash Basin (HAB)
A7	F-Area Ash Landfill (FAL)

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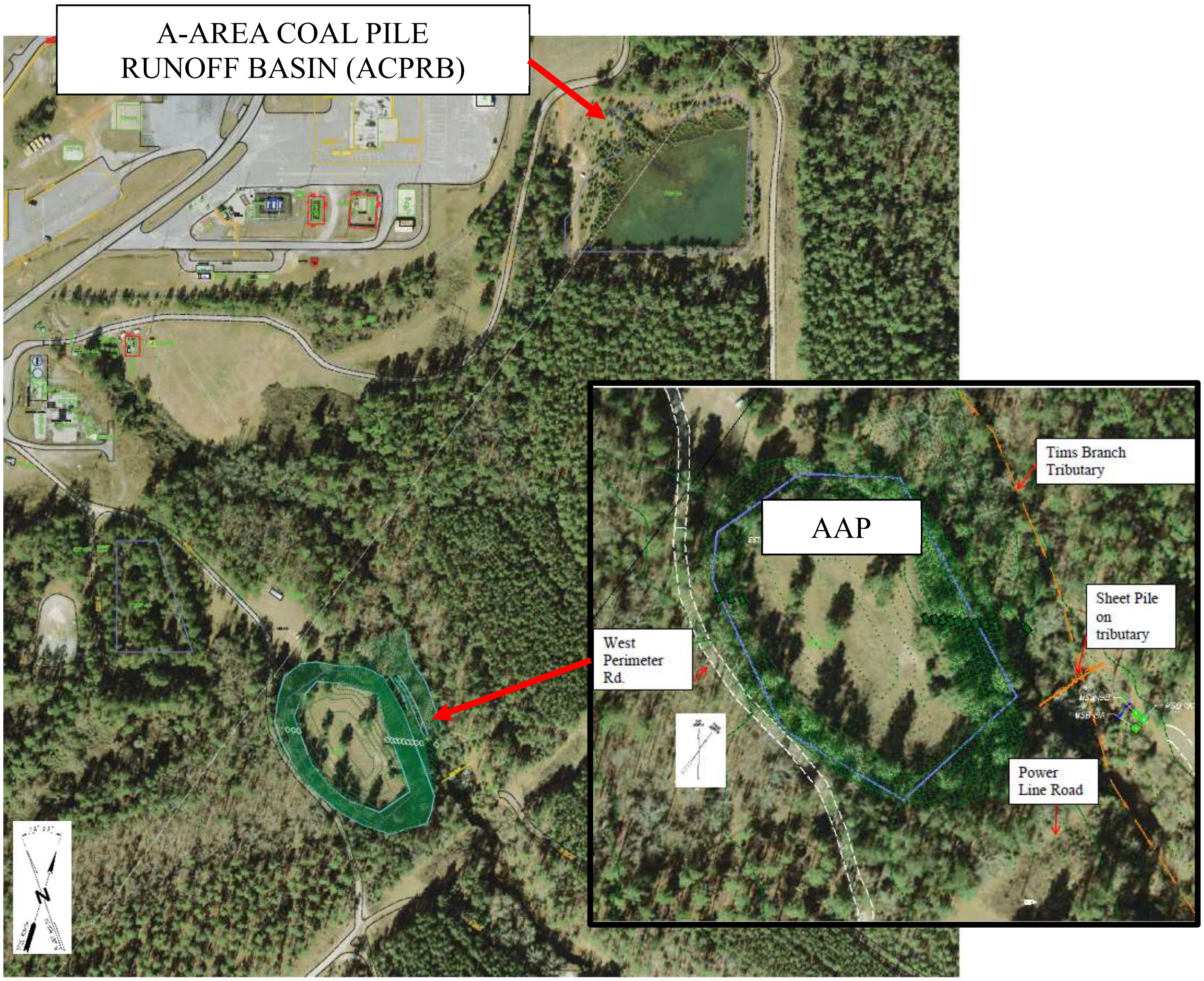
A1
A-Area Coal Pile Runoff Basin (ACPRB)/A-Area Ash Pile (AAP)



Location:

The ACPRB and AAP are located southeast of the A-Area industrial complex.

Operational history:

ACPRB was constructed in 1978 and received stormwater from the A-Area Powerhouse coal pile until closure of coal fired Powerhouse in 2008. Stormwater lines leading to the basin have been plugged.

Bottom ash and fly ash from the A-Area Powerhouse was trucked to the AAP site between 1952 and 1978. The height of the ash pile is approximately 30 ft above natural grade. The side slopes were adjacent to Tims Branch Tributary were benched to prevent erosion and provide stability.

Important Site Conditions:

ACPRB is inactive and only receives water via precipitation. There is usually very little surface water present in the basin. The depth to groundwater in this area is ~100- to 110-ft below natural ground surface as determined by monitoring wells near the basin. The area of the ACPRB is 2.62 ac. The estimated volume of ash fines is 10,000 yd^3 (see Appendix C for volume estimates).

AAP is heavily vegetated with mature pines, hardwoods, and a dense undergrowth. The banks of the adjacent Tims Branch Tributary were significantly scoured, and erosion threatened the stability of the ash pile until sheet piling and other erosion control measures were installed in the tributary in the early 2000's. The depth to groundwater in this area is ~100- to 110-ft below natural ground surface as determined by monitoring wells near the ACPRB. The area and volume of the limits of ash has been conservatively estimated to be 2.55 ac and 70,000 yd^3 (see Appendix C for volume estimates).

Regulatory Status

The ACPRB and the AAP were investigated via the RFI/RI/BRA process in 2008 (SRNS 2012). A summary of the constituents of concern (COCs) is provided in Table A1-1. Based on the contaminant migration analysis performed in the RFI/RI/BRA, no constituents were identified as having the potential to migrate to groundwater above regulatory standards. A Rev. 1.1 Redline Statement of Basis Proposed Plan was issued in March 2014 (SRNS 2014) identifying the consolidation of AAP into the CPRB with a soil cover, LUCs and groundwater monitoring. Finalization and regulatory approval of the SB/PP and preparation of a ROD was delayed due to the uncertainty of the potential for the new CCR regulations being applied to this unit as ARARs. The FFA schedule date for the RA start is March 2026.

AAP COCs

Unit	Human Health COCs	Ecological COCs (sediment/coal fines)	Ecological COCs (surface water)
AAP	Arsenic Potassium-40 Radium-226(+D) Uranium-238(+D)		
ACPRB	Arsenic	Arsenic 2-Methylnaphthalene pH	Aluminum Barium Beryllium Cadmium Cobalt Copper Iron Lead Manganese Nickel Zinc pH

Recent SRNS Actions:

A slope stability assessment was performed to ensure that there is no immediate threat of collapse of the ash pile and migration into the adjacent tributary. The heavily vegetated side slopes prevent migration and slope failure. Annual inspections are made to monitor these conditions. A preliminary design for excavation of the AAP has been prepared. This design examined topography and constructability aspects to determine the area and volume of material (ash and soil) that would require removal to satisfactorily remove the ash and provide the necessary grading. This design estimated that the extent of ash was ~2.5 acres (ac) and the volume of excavated material would be ~70,000 yd^3. Based on lessons learned from finding ash outside of the excavation boundaries at previous ash unit remediations, additional fieldwork was performed in 2020 to examine soil cores along transects. This field work is described in Appendix B of this report.

References:

SRNS, 2012. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan and RFI/RI Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the A-Area Ash Pile (788-A), A-Area Coal Pile Runoff Basin (78-3A), and Stormwater Outfall A-013 (NBN) Operable Unit (U),* Rev. 1, July 2012, SRNS-RP-2010-01457, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

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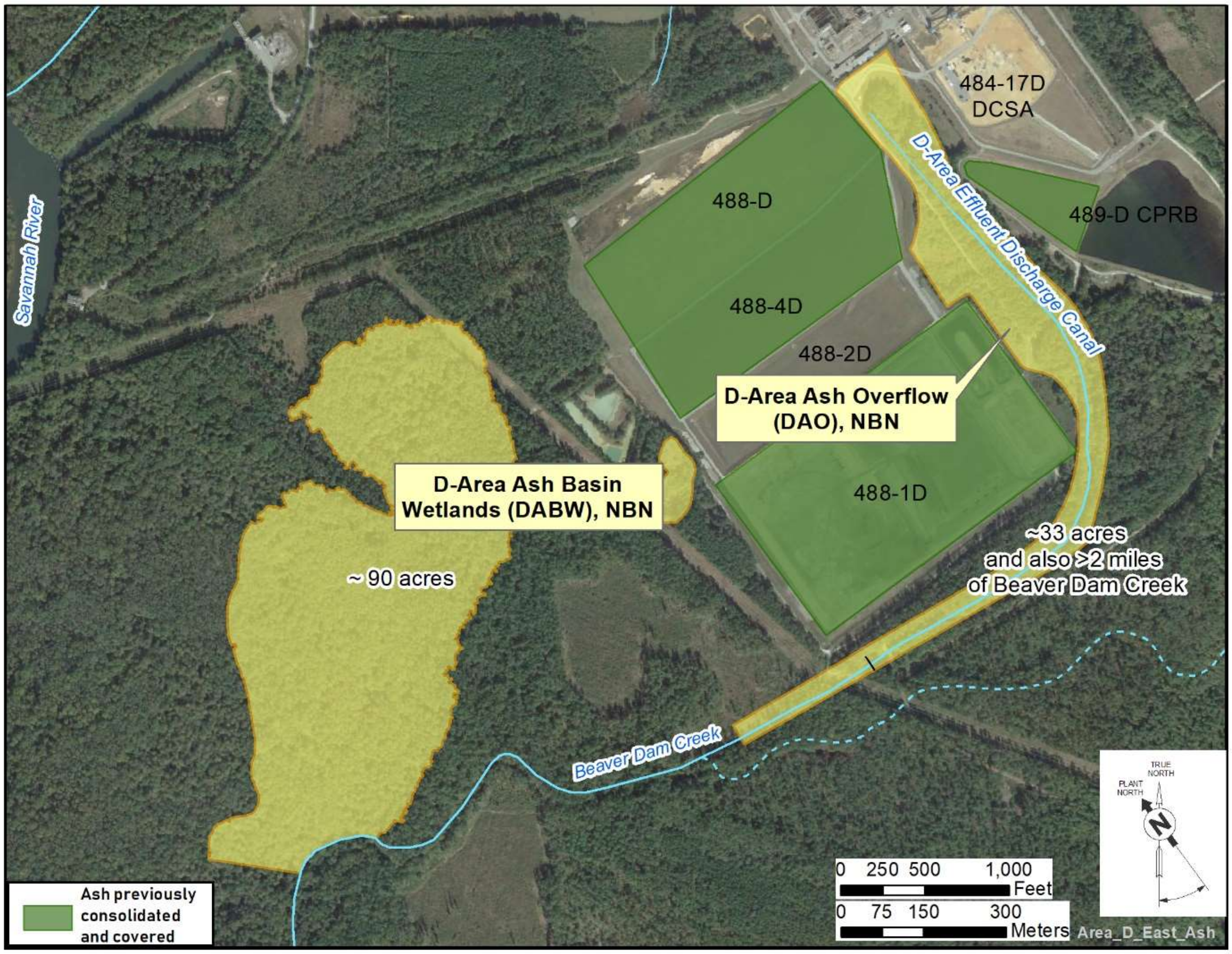
A2
D-Area Ash Overflow (DAO) and D-Area Ash Basin Wetlands (DABW)



Location:
The DAO is located adjacent to the now closed D-Area ash basins. The DABW is located in a wetland area between the closed D-Area Ash Basins and the Savannah River.

Operational history:

The DAO and the DABW are the result of ash overflow from the D-Area ash basins. Ash was believed to be deposited in the DABW via a drainage ditch. The D-Area ash basins received ash from the coal fired D-Area Powerhouse via a wet sluice line. The D-Area Powerhouse was the longest running coal fired powerhouse, operating from 1952 until 2012.

Important Site Conditions:

The DAO extends from the west of closed D-Area ash basins to the D-Area Effluent Discharge Canal and along the floodplain of Beaver Dam Creek to the south of the D-Area ash basins. Although the extent of ash has not been formally evaluated, the area impacted has been estimated to be ~33 ac based on field observations. Based on this area and experience with the WADB overflow area, the volume of ash present is assumed to be greater than 50,000 yd^3. The depth to groundwater over this area ranges from 0 (wetland/floodplain) to 15-ft bgs.

The DABW is a heavily vegetated wetland area with mature cypress and other wetland vegetation. Based on field observations within the wetland and historical knowledge of throughput during electrical generation at the D-Area Powerhouse vs volume of ash in the 488 basins, it is estimated that the volume of ash within the wetland area is ~739,000 yd^3. The area impacted by the ash in the DABW is ~90 ac. The depth to groundwater ranges from ~15 ft in high areas to 0 ft in wetland areas.

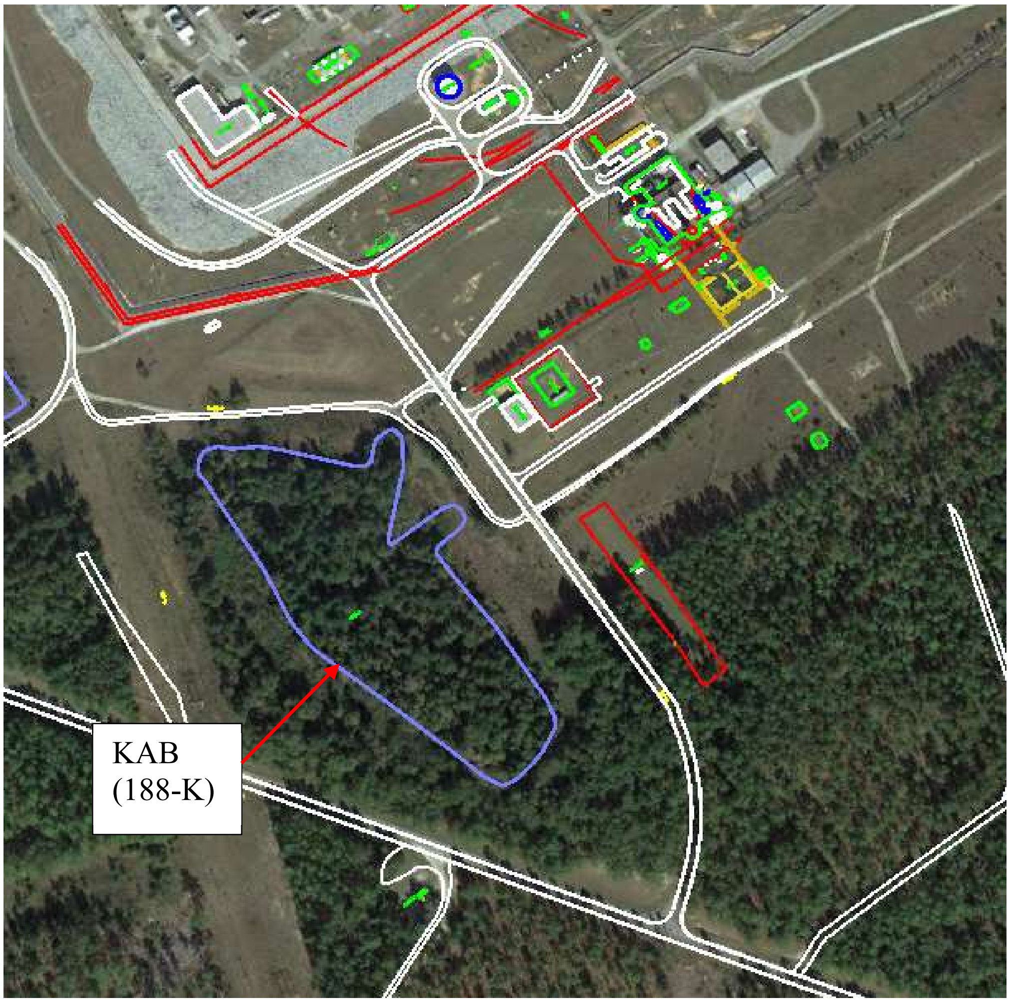
Regulatory Status

Ash in the DAO and DABW was discovered during the removal action performed on the D-Area Ash Basins. These overflow and wetland areas were administratively placed in the Savannah River Floodplain Swamp (SRFS) Integrator Operable Unit (IOU). The RA start date is listed in the FFA as September 2065.

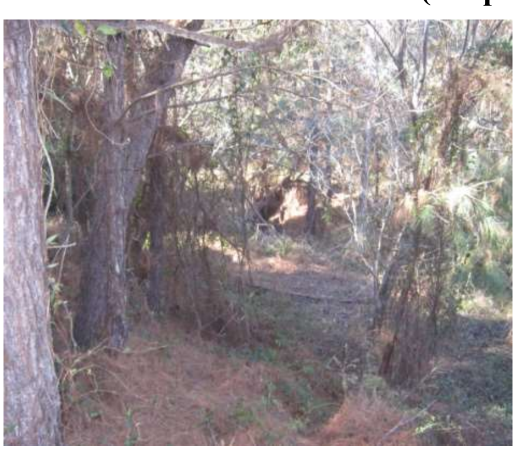
References:

SRNS, 2019. *White Paper 488-D, Wetland Ash Alternate Volume Evaluation*, SRNS-TR-2019-00315, February 2019

A3
K-Area Ash Basin (KAB)



Photos below show the interior (left photo) and berm (right photo) of KAB



Location:

The KAB is located southwest of the K-Reactor Complex and is in the Pen Branch Watershed. Although the KAB is adjacent to an industrial area with active missions, access to the basin can be achieved from SRS Road B which is not heavily used by those supporting K-Area operations.

Operational history:

The KAB received ash from the K-Area coal fired Powerhouse via wet sluice. The Powerhouse operated from 1951 to 1990.

Important Site Conditions:

The KAB is heavily vegetated with mature pines, hardwoods, and a dense undergrowth. The depth to groundwater in this area is ~61-ft bgs. No standing water was observed during multiple field visits to the basin. The area of the basin is ~11.2 ac; however, ash was discovered beyond the basin during recent field investigations (see Appendix B of this report). Earlier estimates of the volume of ash in KAB are assumed to be low. Using older topographic data as compared with recent LIDAR data and based on lessons learned during remediation of other ash basins, the volume of ash anticipated in KAB is ~273,000 yd^3.

Regulatory Status

The KAB has an active IWT permit and receives stormwater from the K-Area Biomass facility. Formal regulatory investigations have not begun at the KAB. In 2012, a scoping meeting for pre-work plan characterization sampling was held with the CORE team (ERD-EN-2012-0011). The sampling has not begun due to funding issues. The FFA provides a RA start date for the KAB of December 2028.

Recent SRNS Actions:

As part of the ash consolidation strategy development, samples were collected from the KAB to compare results to similar waste units. In addition, the extent of ash distribution was evaluated by field observations from multiple transects. The sampling and results are described in Appendix B of this report.

References:

SRNS 2012, *Scoping Summary for the K-Area Ash Basin (188-K) and L-Area Ash Basin (188-L) Pre-Work Plan Characterization Sampling,* March 2012, ERD-EN-2012-0011, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

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A4
L-Area Ash Basin (LAB)

Photo to the left shows standing water in the north east potion of LAB

Location:

The LAB is located northeast of the L-Reactor Complex and is in the Pen Branch Watershed.

Operational history:

The LAB received ash from the L-Area coal fired Powerhouse via wet sluice. The Powerhouse operated from 1951 to 1968.

Important Site Conditions:

The LAB is heavily vegetated with mature pines, hardwoods, and a dense undergrowth. The northern portion of the basin is frequently inundated with water most likely due to perched water conditions. The depth to groundwater in this area is estimated to be about 25- to 40-ft bgs within the basin. The area of the basin is ~18.5 ac, the largest of all the ash basins. The volume of fly ash and bottom ash is estimated to be ~323,000 yd^3. A stormwater diversion berm exists on the eastern side of the basin. Bottom ash was observed floating in the standing water between the basin berm and stormwater berm.

Regulatory Status

Formal regulatory investigations have not begun at the LAB. In 2012, a scoping meeting for pre-work plan characterization sampling was held with the CORE team (ERD-EN-2012-0011). The sampling has not begun due to funding issues. The FFA provides a RA start date for the KAB of November 2029.

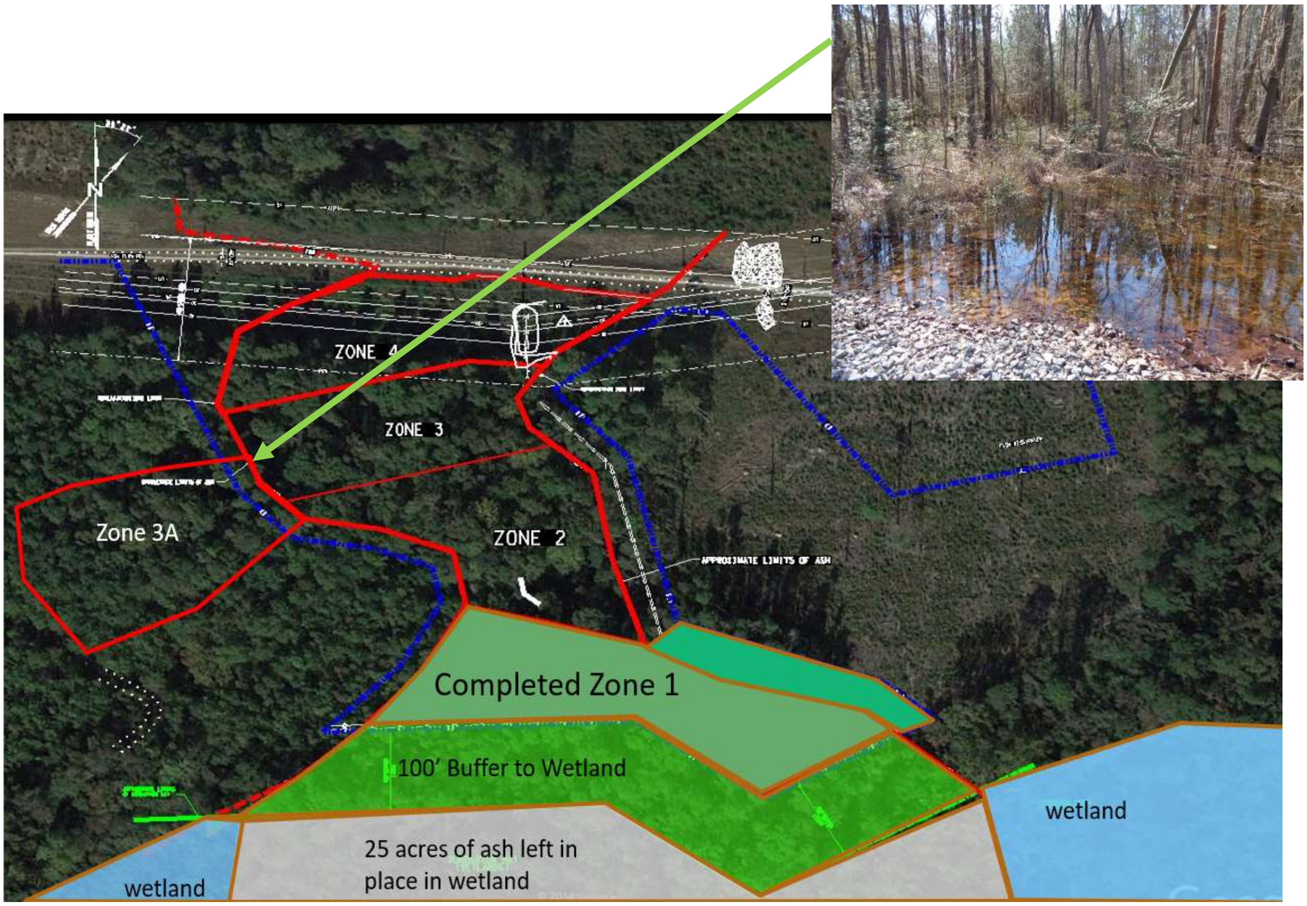
Recent SRNS Actions:

As part of the ash consolidation strategy development, samples were collected from the LAB to compare results to similar waste units. In addition, the extent of ash distribution was evaluated by field observations from multiple transects. The sampling and results are described in Appendix B of this report.

References:

SRNS 2012, *Scoping Summary for the K-Area Ash Basin (188-K) and L-Area Ash Basin (188-L) Pre-Work Plan Characterization Sampling,* March 2012, ERD-EN-2012-0011, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

A5
Wetland Area at Dunbarton Bay (WADB) Phase II



Location:

The WADB Phase II is located south of the P-Area Ash Basin between the powerline road and the Dunbarton Bay. This area is also referred to as the South Ash Remediation Area of WADB. The WADB is part of the Steel Creek Watershed.

Operational history:

Ash contamination in this area is the result of overflow from operation of the P-Area Ash Basin (PAB). The PAB received ash via a wet sluice line from the coal fired Powerhouse in P-Area from 1951 to 1991. In the 1970's ash was removed from the basin and placed along the perimeter and to the north along an access road. Ash was carried to the WADB area (~16 ac) via surface water runoff.

Important Site Conditions:

During Phase I remediation a dense clay layer was found 3- to 4-ft bgs in the South Ash Remediation Area (SARA), south of the powerline road. This clay layer limits infiltration resulting in a perched water table. The depth to groundwater is ~17-ft bgs based on data from nearby monitoring wells. The SARA was divided into four excavation zones. During excavation of the ash in zone 1 of the SARA, the ash was found to be saturated and unstable conditions prohibited the use of conventional construction equipment. Additional ash was found outside of the previously delineated limits of ash. The volume of ash anticipated for project completion exceeded the capacity of the Three Rivers Landfill ash cell that was constructed for the project.

Regulatory Status

The ash overflow was discovered during the removal action associated with the PAB. A ROD was issued for the WADB which included excavation and disposal of the ash from the boundary of the PAB to the edge of a 100-ft buffer at Dunbarton Bay and transporting of ash to an approved ex situ containment facility. LUCs were selected as the RA for the ash in the Dunbarton Bay wetland area and the 100-ft buffer area. Due to unstable/saturated conditions in the SARA and the discovery of additional ash that would have exceeded the landfill’s capacity, remediation of the remaining zones (2-4) was put on hold until an overall strategy was developed for the remaining ash units at SRS.

Recent SRNS Actions:

During remediation of Zone 1 in the SARA, additional ash was discovered outside the previously defined limits of ash. An investigation identified that ~1-acof ash deposits exists to the west of the project area (referred to as zone 3a). This area has been found to be saturated after periods of heavy rain.

References

SRNS, 2018. *Record of Decision Remedial Alternative Selection for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (U),* April 2018, SRNS-RP-2013-00730, Rev. 1

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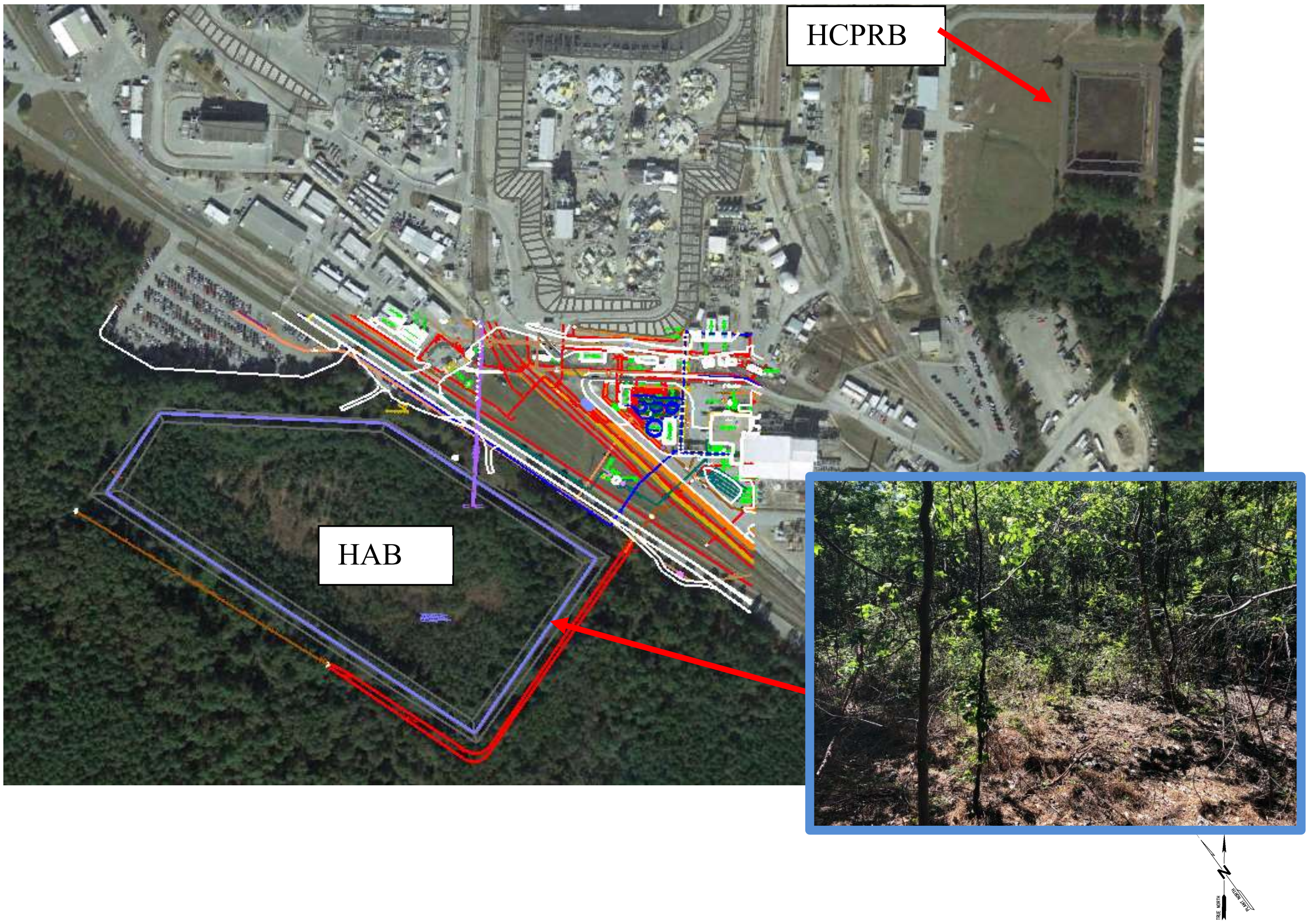
A6
H-Area Coal Pile Runoff Basin (HCPRB) and H-Area Ash Basin (HAB)



Location:

The HCPRB is on the east side and the HAB is on the south side of the H-Area industrial complex. Both units are in congested areas of traffic from operating facilities.

Operational history:

The HCPRB was constructed in 1981. The coal pile runoff basin received storm water containing coal fines from the H-Area Powerhouse coal storage yard and storm water from the railroad-car unloading hopper. The Powerhouse ceased operation in 1990. Currently, the HCPRB receives stormwater. The HAB received fly ash and bottom ash via wet sluice from the H-Area coal fired Powerhouse. It operated from 1950 to 1990. In 1993-1994 a~100,000 yd^3 of ash was removed from the basin and shipped to 288-F and 288-1F. Currently, the HAB receives stormwater from the 284-H facility.

Important Site Conditions:

The area of the HCPRB is 1.3 ac. Based on a comparison of the volume removed from other CPRBs, it is assumed that the volume of ash fines in the HCPRB is ~7,000 yd^3. The depth to groundwater in this area is 22-ft bgs.

The area of the HAB is 13 ac with an estimated volume of 259,000 yd^3 inside and outside of the basin. The basin is heavily vegetated with mature pines, hardwoods, and a dense undergrowth. Standing water is frequently encountered in the southeast side of the basin. The area outside of the basin berm is very wet and indicative of wetlands.

Regulatory Status

Both the HCPRB and the HAB have active IWT permits. The RA start date for the HCPRB is listed as April 2043 in the FFA. The HAB is currently listed in Appendix G of the FFA with a Site Evaluation Report milestone of December 2034.

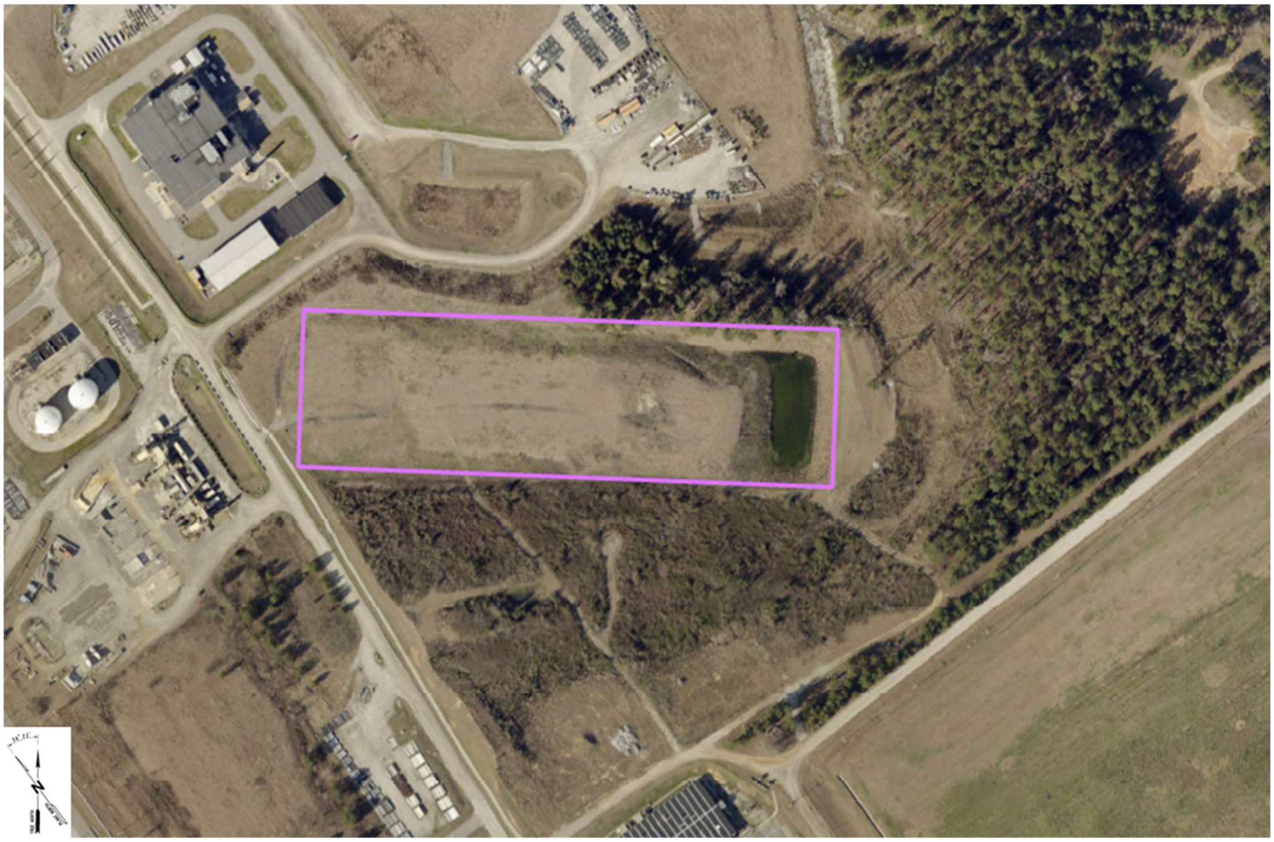
Recent SRNS Actions:

As part of the ash consolidation strategy development, samples were collected from the HAB to compare results to similar waste units. In addition, the extent of ash distribution was evaluated by field observations from multiple transects. The sampling and results are described in Appendix B of this report.

References

Site Drawings:
S5-2-14798 Elevations for H Ash Basin
S5-B-770 Effluent Flume Installation
S5-2-1951B Post Construction Survey for Ash Removal
S5-2-1951A – Pre-Construction Survey for Ash Removal
S5-2-19591 – Ash Removal from 288-H
S5-2-19596 – Design Excavation Plan

A7
F-Area Ash Landfill (FAL)



Location:

The FAL is located southeast of the F-Area Industrial Complex.

Operational history:

The FAL received ash from the F-Area Powerhouse, the HAB, and the A-Area Powerhouse.

Important Site Conditions:

The area of the FAL is 7 ac. The FAL is in a relatively congested area. The area is dry with engineered storm water controls. The depth to the groundwater is ~70- to 80-ft bgs. Ash deposits are known to be outside the footprint of the of the landfill boundary. In 2012 the volume of ash within the basin was calculated to be ~200,000 yd^3 with an additional capacity of 150,000 yd^3 (C-CLC-F-00825).

Regulatory Status

The FAL operates under a SCDHEC Solid Waste Landfill. The closure plan for the FAL includes a SCDHEC Class II cover system, minimum 2-ft soil cover.

Recent SRNS Actions:

As part of the ash consolidation strategy development, the extent of ash distribution outside of the FAL was evaluated by field observations from multiple transects. The sampling and results are described in Appendix B of this report.

References

C-CLC-F-00825, 288-F Ash Basin Volume Calculation, October 2012.

APPENDIX B

Sampling Summary

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1.1 INTRODUCTION

The appendix documents the implementation and results of the sampling and analysis associated with the *Pre-Characterization of the A-Area Ash Pile (188-0A), F-Area Ash Landfill (288-0F), H-Area Ash Basin (288-0H), L-Area Ash Basin (188-0L), K-Area Ash Basin (188-0K), and D-Area Ash Overflow area (DAO)* (SRNS 2020). The activities associated with the sampling effort were primarily performed from May 2020 through July 2020. The intent of the activities was to confirm the aerial extent of ash at the AAP and ash basins and to analyze ash from the basins which have not yet been investigated (HAB, KAB, and LAB). The results of the sampling support a comprehensive strategy to support final deposition, including potential beneficial reuse alternatives, for the remaining ash related units on the Savannah River Site (SRS).

1.1 Purpose of Sampling

The SAP (SRNS 2020) was prepared to direct pre-characterization sampling at the following ash units: A-Area Ash Pile (AAP) (788-A), F-Area Ash Landfill (FAL) (288-F), H-Area Ash Basin (HAB) (288-H), L-Area Ash Basin (LAB) (188-L), K-Area Ash Basin (KAB) (188-K), and the D Ash Overflow area (DAO) [No Building Number (NBN)]. The DAO is referred to in the Federal Facility Agreement (FFA) as the "Easterly of D-Area Ash Basins 488-1D and 488-2D" area which is part of the Savannah River and Floodplain Swamp Integrator Operable Unit, NBN (Including Beaver Dam Creek, D-Area Effluent Discharge Canal, and Ash Area Adjacent to and Easterly of D-Area Ash Basins 488-1D and 488-2D) (FFA 1993).

Although the DAO was initially included in the scope of the pre-characterization sampling and analysis plan (SAP) (SRNS 2020), it was not included in the sampling effort since ash was not found at the locations identified for sample collection for this unit. It was further determined that walk-downs of the area associated with the DAO had already been conducted during the D-Area Operable Unit (DAOU) remediation of the D-Area ash basins and associated units (inlet, outlet, etc.). These walk-downs, to determine the presence/absence of ash, resulted in maps that delineated ash deposits that were used to develop estimates of ash volumes needed to support the comprehensive strategy.

For AAP, the sampling efforts were targeted to confirm the extent of ash that was delineated by the RFI/RI Workplan with BRA and CMS/FS. Recent experience with remediation of ash waste units has shown that original estimates of in-place volumes of ash have been low and that during excavation the extent of ash is commonly found outside the originally delineated boundaries.

The purpose of the sampling was three-fold: 1) determine contaminant levels within basin ash, and therefore representative of SRS ash from remaining ash units, 2) collection of bulk samples for geophysical testing/parameters to support beneficial reuse alternatives, and 3) conduct step-outs along transects radiating from the edge of the ash unit boundaries (presence/absence determinations) for extent and volume estimates.

The location of the units addressed in the SAP (SRNS 2020) is shown in Figure 1. Individual units are discussed in the following sections.

1.2 Ash Unit Locations

The SRS occupies an area of approximately310 square miles {mi^2}]) adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. The ash units associated with the sampling effort included the following (Figure 1):

- A-Area Ash Pile (AAP) (188-A)
- F-Area Ash Landfill (FAL) (288-F)
- H-Area Ash Basin (HAB) (188-H)
- K-Area Ash Basin (KAB) (188-K)
- L-Area Ash Basin (LAB) (188-L)

1.3 Objectives for the Sampling

The objectives of the sampling plan were to : 1) collect ash samples from three of the ash units where existing data were insufficient (HAB, KAB, and LAB), and 2) determine the extent of ash outside five units (AAP, FAL, HAB, KAB, and LAB) based on transect walk-downs to determine the extent of ash outside the basin boundaries, and 3), collect bulk samples for geotechnical analyses from the units where the ash samples were to be collected (HAB, KAB, and LAB) to assess beneficiation alternatives of SRS coal ash/ash fines

2.0 UNIT DESCRIPTIONS

The AAP is located in A-Area in the northwest portion of SRS within the Upper Three Runs watershed. This unit is adjacent to a tributary of Tims Branch that has experienced erosion. Sheet pilings have been installed within the tributary to mitigate further erosion. The AAP has an FFA Appendix E remedial action (RA) start date of March 2026 (FFA 1993). Figure 2 shows the transect locations associated with the AAP.

The FAL is an active Class 2 Landfill (South Carolina Department of Health and Environmental Control [SCDHEC] Permit #025800-1601) (SCDHEC 2004, SCDHEC 2014). The FAL is listed as a Site Evaluation Area (SEA) unit in the FFA and has a Site Evaluation Report (SER) due date of December 2024 (FFA 1993). Figure 3 depicts the transect locations associated with the FAL.

The sampling locations and transects associated with the HAB are shown in Figure 4. This unit is a SEA with a SER submittal date of December 2034 (FFA 1993). This unit is considered active and receives rainwater discharge from an above ground pipeline that accumulates in Abatement Pumps located behind 284-H. All operating systems in 284-H have been shut down. The HAB may include wetlands within and beyond the boundary of the unit. A known/suspected Carolina bay is partially located within the southeastern boundary of the HAB.

The KAB has an FFA RA start date of December 2028 (FFA 1993). The sampling and transect locations are depicted in Figure 5. The KAB currently receives process blowdown water from the Ameresco Biomass Steam Plant during the winter months.

The LAB is an inactive ash basin. The LAB is listed in the FFA as a combined unit OU consisting of Early Construction and Operational Disposal Site (ECODS) L-3 (East of L Area) (no building number [NBN]), L-Area Rubble Pit (131-1L), L-Area Rubble Pit (131-4L), and the L-Area Ash Basin (188-0L). The RA is scheduled for November 2029. Sampling locations and transects associated with the LAB are shown in Figure 6.

2.0 SAMPLING DESIGN

Activities associated with the pre-characterization SAP (SRNS 2020) sampling effort are discussed in the following sections.

2.1 Analytical Samples

Sampling activities included the collection of ash samples to determine analytical constituent levels in order to determine contaminants of concern (COCs) associated with the ash basins (HAB, KAB, and LAB). Ash samples were collected for both the 0- to 1-foot (ft) and 1- to 4-ft depth intervals, collected by hand auger/shovel. Given the results of evaluations at other SRS ash units, the ash was expected to generally have a uniform consistency and chemical composition, with metals, naturally-occurring radioactive materials (NORM), and SVOCs as the primary COCs. Therefore, each sample was analyzed for TCL SVOCs, TAL metals, hexavalent chromium, and radiological indicator parameters (gross alpha and nonvolatile beta). Any samples that exceed the radiological triggers for gross alpha (20 pCi/g) or nonvolatile beta (50 pCi/g) were further analyzed for the radionuclide specific analyses. The sample matrix table for the analytical samples is provided in Table 1.

Preliminary Data Screening was conducted by comparing the detected sample results to the SRS background soil maximum concentrations (WSRC 2006) and the residential and industrial worker regional screening levels (RSLs)/radiological Preliminary Remediation Goals (PRGs) as shown in Attachment 1. Sample results that are greater than the threshold are highlighted in yellow. In general, a constituent must be greater than the SRS background maximum and the risk-based threshold to be considered a COC.

Results of the screening show for non-radiological constituents, arsenic (As) is the only constituent that meets these criteria. For radionuclides, potassium-40 (K-40), Thorium-232 (Th-232), including daughter products in the thorium series, Uranium-238 (U-238), including daughter products in the uranium series, and U-235 (including daughter products in the actinium series) meet these criteria.

As and the NORM (K-40, Ra-228[+D], Th-228 [+D], U-238[+D], Ra-226[+D] and U-235[+D]) have been identified in past Baseline Risk Assessment as refined COCs.

2.2 Bulk Samples

Bulk samples (5-gallon buckets) were collected for geophysical testing conducted by System One (located on the SRS), and other testing to be performed by commercial/research facilities. The bulk samples consisted of 4 buckets of ash from each ash basin (HAB, KAB, and LAB) for a total of 12 buckets. Two buckets from each basin were provided to System One. The test results from the bulk sample testing conducted by System One are provided in Attachment 2.

In addition, three buckets, one from each basin, were shipped to a research lab at the University of North Carolina-Charlotte that is evaluating additives that can be mixed with ash to produce a more impervious surface for road-bed applications. Another three buckets, one from each basin, were provided to the Southeastern Fly Ash (SEFA) Group. The SEFA Group is a technical service provider principally engaged in processing and marketing sustainable products derived from coal combustion byproducts. SEFA operates a Staged Turbulent Air Reactor (STAR®) Process in Lexington, South Carolina that can transform coal ash for beneficial reuse.

2.3 Transects

Results of observations of ash/no ash along the transects for each basin (AAP, FAL, HAB, KAB, and LAB) are shown in Attachment 3. The purpose of the transect step-outs was to laterally delineate the extent of ash outside the basin using visual inspection. The soil/ash borings were advanced vertically up to a maximum depth of 12 in. To perform the inspections, transects began with a boring at a specified distance from the existing ash unit boundary. A limited number of specific boring locations followed, as needed, by additional 10-ft step outs to confirm the ash extent. Longer transects, resulting in a step-out at 100-ft intervals, were also employed until an ash-free location was located. Subsequent to finding an ash-free location, each step-out was one-half the length of the prior step. The step direction was inbound (i.e., toward the basin/landfill) if ash was absent, and outbound if ash was present.

3.0 FIELD IMPLEMENTATION

The following list of activities outlines the field implementation tasks associated with the overall sampling effort. Additional implementing documents, such as the environmental evaluation checklist, automated hazard analysis, radiological work instructions, and site-specific health and safety plan are internal to SRS and detail day-to-day sampling operations and safety requirements.

3.1 Chronology of Sampling Related Efforts:

5/11/2020: Pre-job briefing for sampling H-, K-, L-Area Ash Basins

5/11/2020: Sampling conducted and completed.

5/12/2020: Samples for GEL laboratory analysis were dropped off at SRS Groundwater Receiving for shipping. Bulk samples were provided to System One for analyses and for shipment to UNC-Charlotte and SEFA in South Carolina

5/13/2020: Transect step-out sampling began.

6/8/2020: Transect sampling complete.

6/16/2020: Analytical data from GEL analyses of ash samples was received.

6/23/2020: Bulk samples for UNC-C and SEFA were shipped.

6/24/2020: Bulk samples received by SEFA

3.2 Sample Documentation

The SRS/Savannah River Nuclear Solutions/Area Completion Projects Data Management group has entered the sample collection and laboratory data into the Environment Restoration Data Management System (ERDMS) in accordance with Procedure ER-SOP-43 (SRNS 2014). Properly completed and qualified data are entered into the ERDMS Database. Data records are updated, re-qualified, and continuously corrected for usability based on the results of electronic verification and manual validation evaluations as corrective actions are resolved with the analytical laboratories. The Data Management Project Narrative for the GEL analytical data are provided in Attachment 4.

4.0 REFERENCES

FFA, 1993. *Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF* (Effective Date: August 16, 1993). Fiscal Year 2019

SCDHEC, 2004. SRS 288-F Industrial Waste Landfill, Class I, Final Permit, Facility ID#025800-1601, SRNS-OS-00088, April

SCDHEC, 2014. *Class 2 Landfill Permit # 025800-1601 Modification* February 21, 2014.

WSRC, 2006. *Background Soils Statistical Summary Report for the Savannah River Site, ERD-EN-2005-0223,* Westinghouse Savannah River Company, Savannah River Site, Aiken, SC. October 2006

SRNS, 2014. *Environmental Compliance and Area Completion Projects Geochemical Monitoring Procedures Vol X. Manual: C3 – Obtaining and Managing Environmental Data for Environmental Compliance and Area Completion Projects, ER-SOP-043*, Revision 4, Savannah River Site, Aiken, SC

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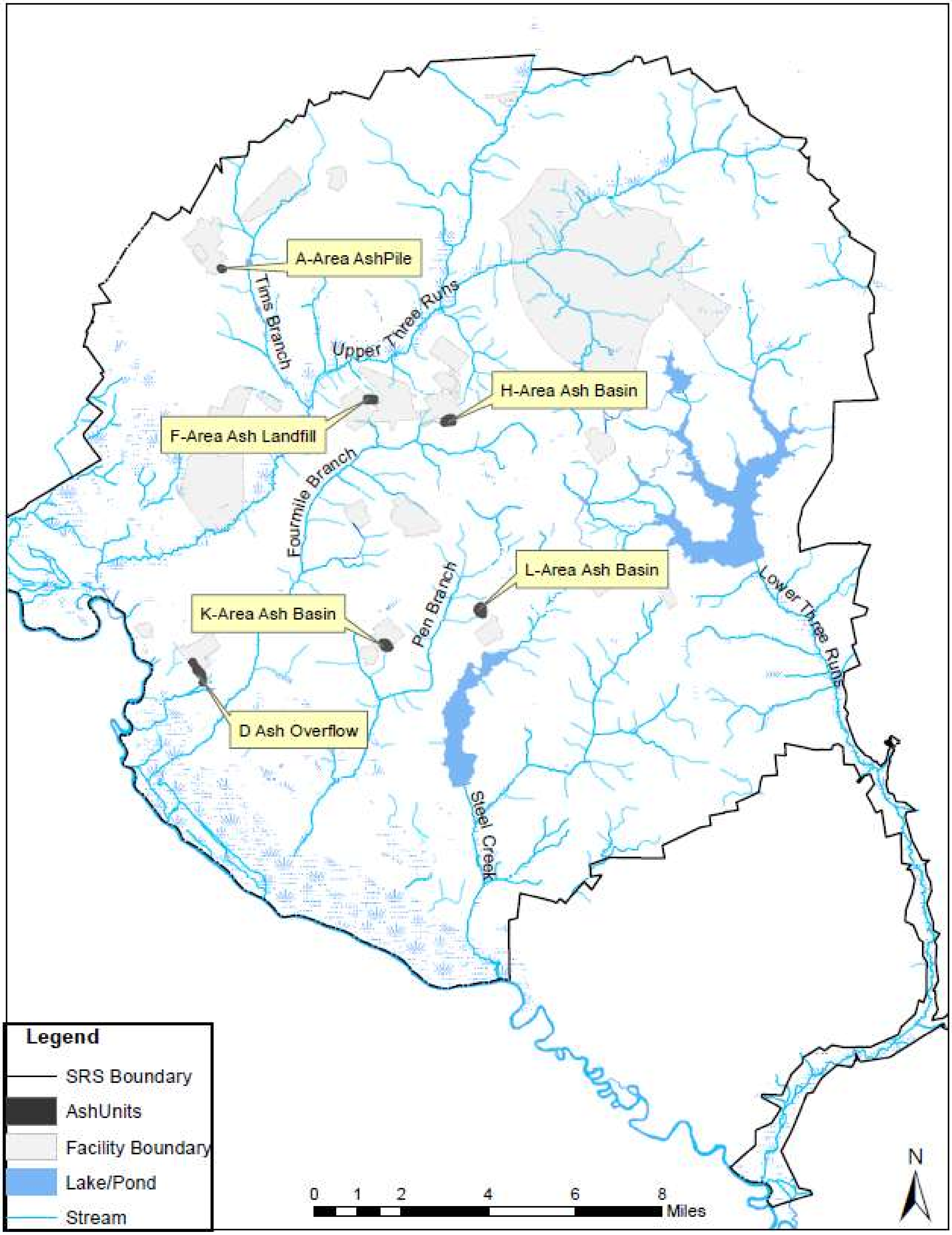

Figure 1. Location of Ash Units

Figure 2. Location of A-Area Ash Pile (788-A)

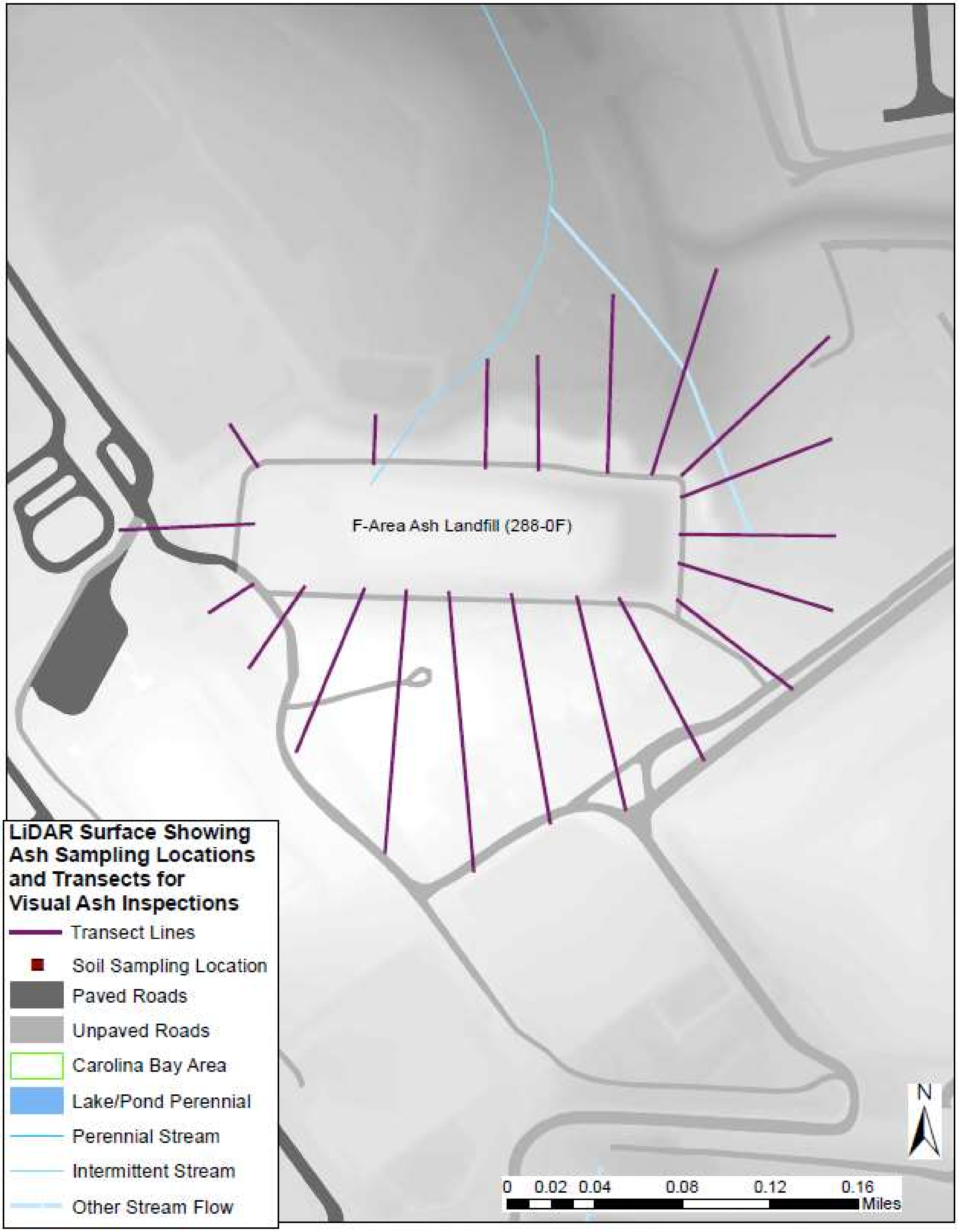

Figure 3. Location of F-Area Ash Landfill (288-F)

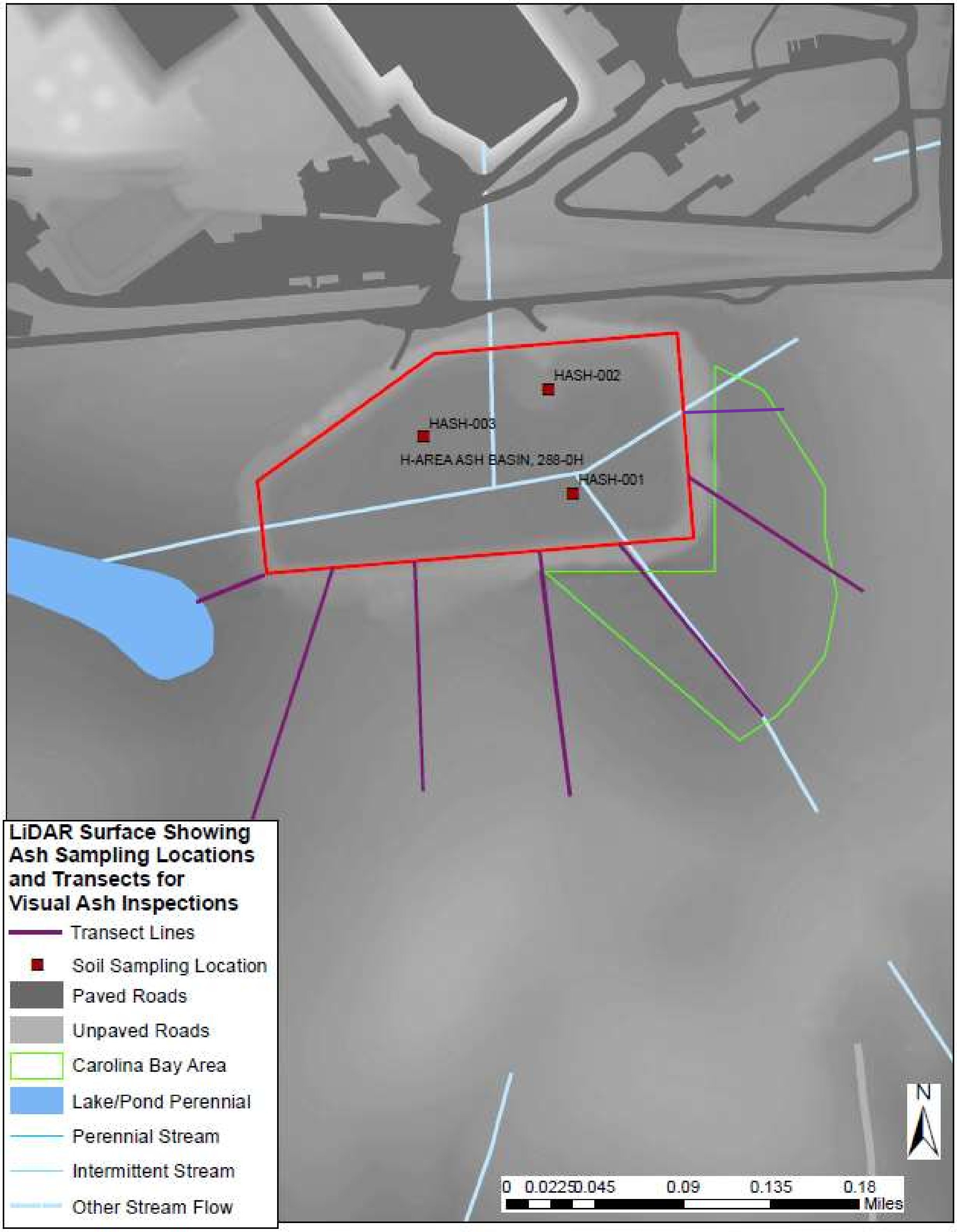

Figure 4. Location of H-Area Ash Basin (288-H)

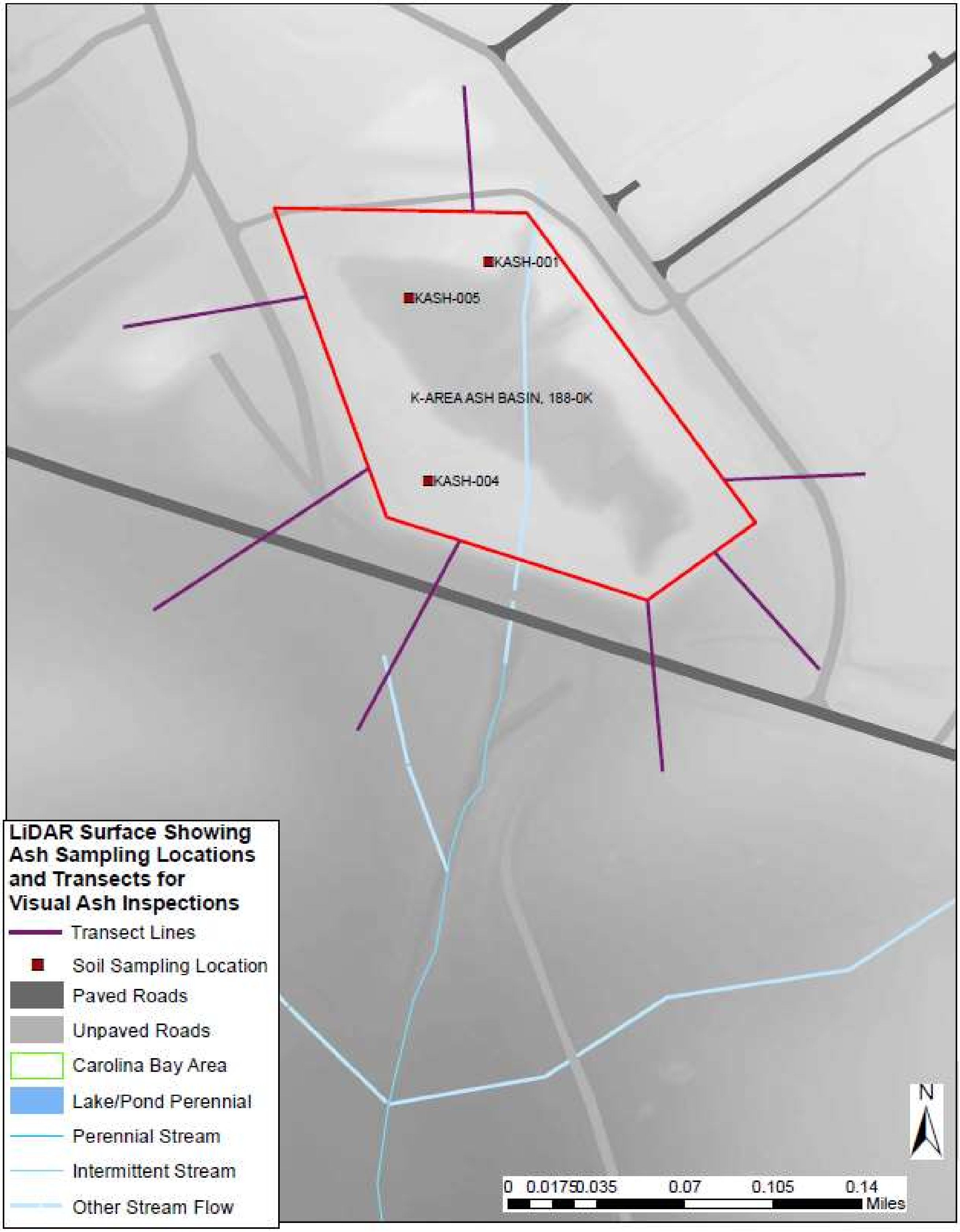

Figure 5. Location of K-Area Ash Basin (188-K)

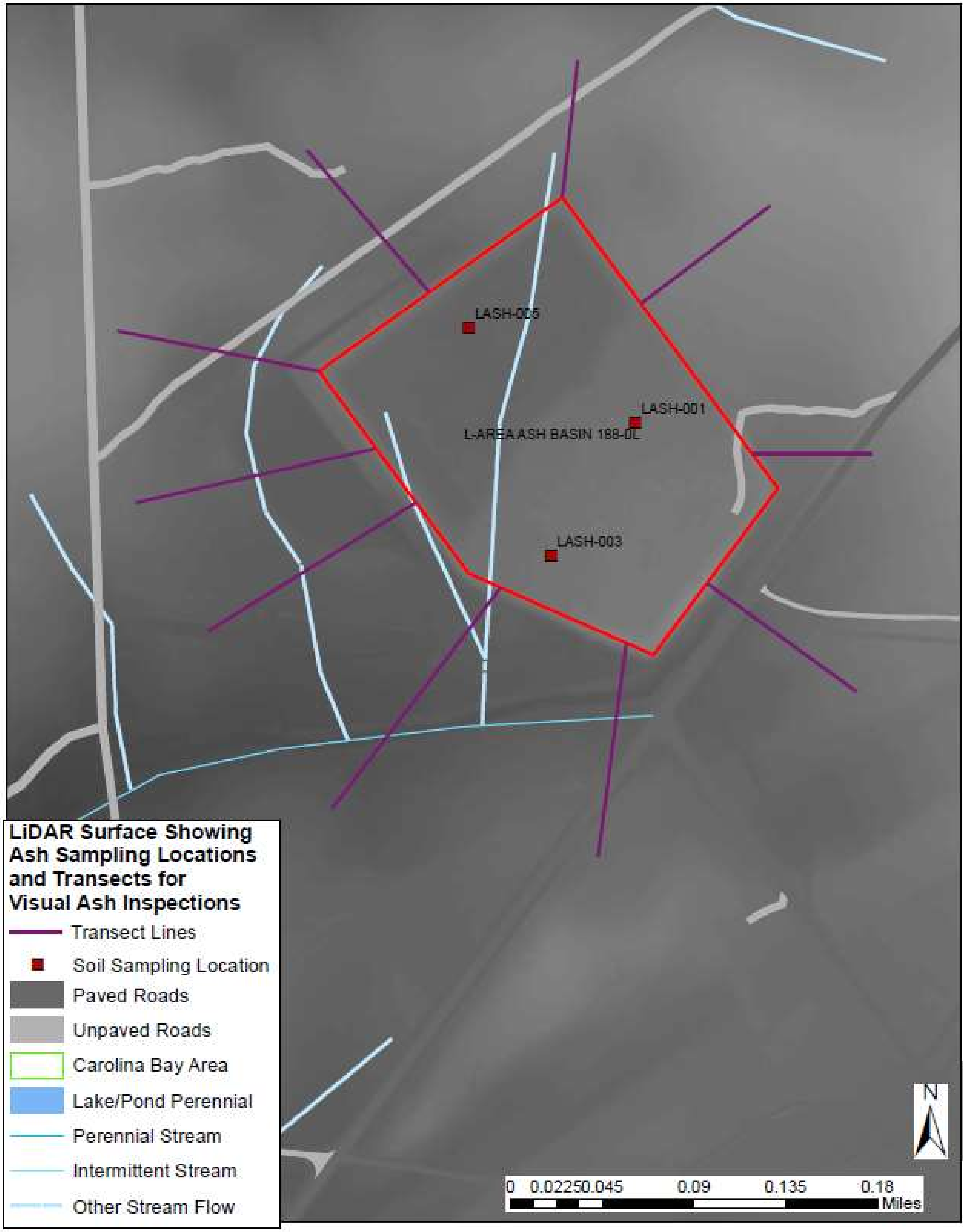

Figure 6. Location of L-Area Ash Basin (188-L)

Table 1. Sample Matrix Table

Sample Type	Subunit	Station	Top Depth *(ft)*	Bottom Depth *(ft)*	Media	Sample Method	Analyses	Lat	Long
REG	188-K	KASH-001	0	1	Soil	Hand Auger	1, 2, 3	3674527.522	438129.5261
REG	188-K	KASH-004	0	1	Soil	Hand Auger	1, 2, 3	3674385.647	438091.208
REG	188-K	KASH-005	0	1	Soil	Hand Auger	1, 2, 3	3674503.573	438078.8738
REG	188-L	LASH-001	0	1	Soil	Hand Auger	1, 2, 3	3675738.909	441726.6692
REG	188-L	LASH-003	0	1	Soil	Hand Auger	1, 2, 3	3675632.616	441660.2695
REG	188-L	LASH-005	0	1	Soil	Hand Auger	1, 2, 3	3675815.546	441595.3292
DUP	188-L	LASH-005	0	1	Soil	Hand Auger	1, 2, 3	3675815.546	441595.3292
REG	188-H	HASH-001	0	1	Soil	Hand Auger	1, 2, 3	3675738.909	441726.6692
REG	188-H	HASH-002	0	1	Soil	Hand Auger	1, 2, 3	3675632.616	441660.2695
REG	188-H	HASH-003	0	1	Soil	Hand Auger	1, 2, 3	3675815.546	441595.3292
REG	DAO	DASH-001	0	1	Soil	Hand Auger	1, 2, 3	3675632.616	441660.2695
REG	DAO	DASH-002	0	1	Soil	Hand Auger	1, 2, 3	3675738.909	441726.6692

Note: If no ash is visually identified at the 0- to 1-ft interval, a 1- to 4-ft sample will be taken.

Analyses
1) TAL metals, and hexavalent chromium
2) TCL SVOCs
3) Gross Alpha / Nonvolatile Beta. Radionuclide specific analyses if gross alpha / nonvolatile beta trigger levels are exceeded.

Field parameter: moisture content

Other required analyses (collection of bulk samples, 5-gallon bucket, from 288-H, 188-K and 188-L)
A) Geotechnical: sieve analysis, standard proctor, specific gravity
B) Mineralogical/Elemental: XSRD (X ray diffraction), XRF (X ray fluorescence)
C) Carbon content

Notes: Sample Count 12
Total Number of Samples: 12
Field Duplications: 1
Regular Samples: 11

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APPENDIX B
Attachment 1

HAB, KAB, and LAB
PRELIMINARY DATA SCREENING

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Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
H-Area Ash Basin													
H	HASH-002	pH	6.27	J	EPA9045D	na		na			na		na
H	HASH-003	pH	5.77	J	EPA9045D	na		na			na		na
H	HASH-001	pH	5.49	J	EPA9045D	na		na			na		na
Inorganics *(mg/kg)*													
H	HASH-003	Aluminum	9,120		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
H	HASH-001	Aluminum	4,180		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
H	HASH-002	Aluminum	1,950		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
H	HASH-002	Arsenic	76.5		EPA6010D	22.9	YES	na	no	6.80E-01	YES	3.00E+00	YES
H	HASH-003	Arsenic	18.8		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
H	HASH-001	Arsenic	15.2		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
H	HASH-003	Barium	227		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
H	HASH-001	Barium	118		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
H	HASH-002	Barium	79.9		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
H	HASH-001	Beryllium	2.2		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
H	HASH-003	Beryllium	1.97		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
H	HASH-002	Beryllium	1.01		EPA6010D	1.15	no	na	no	1.60E+02	no	2.30E+03	no
H	HASH-003	Calcium	2,910		EPA6010D	6020	no	na	no	na	no	na	no
H	HASH-001	Calcium	810		EPA6010D	6020	no	na	no	na	no	na	no
H	HASH-002	Calcium	624		EPA6010D	6020	no	na	no	na	no	na	no
H	HASH-003	Chromium [4]	13.3		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
H	HASH-001	Chromium [4]	8.86		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
H	HASH-002	Chromium [4]	5.9		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
H	HASH-001	Cobalt	8.61		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
H	HASH-003	Cobalt	6.51		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
H	HASH-002	Cobalt	4.52		EPA6010D	5.04	no	na	no	2.30E+01	no	3.50E+02	no
H	HASH-003	Copper	39		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
H	HASH-001	Copper	37		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
H	HASH-002	Copper	16.9		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
H	HASH-003	Iron	9,790		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
H	HASH-002	Iron	5,540		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB

Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
H	HASH-001	Iron	5,310		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
H	HASH-001	Lead	11.9		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
H	HASH-003	Lead	8.07		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
H	HASH-002	Lead	4.17		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
H	HASH-003	Magnesium	675		EPA6010D	1040	no	na	no	na	no	na	no
H	HASH-001	Magnesium	237		EPA6010D	1040	no	na	no	na	no	na	no
H	HASH-002	Magnesium	175		EPA6010D	1040	no	na	no	na	no	na	no
H	HASH-003	Manganese	41.9		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
H	HASH-001	Manganese	27.6		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
H	HASH-002	Manganese	12.9		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
H	HASH-003	Mercury	0.0869		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
H	HASH-001	Mercury	0.0603		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
H	HASH-002	Mercury	0.0146	J	EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
H	HASH-001	Nickel	15.5		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
H	HASH-003	Nickel	14.8		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
H	HASH-002	Nickel	10.1		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
H	HASH-003	Potassium	1,950		EPA6010D	959	YES	na	no	na	no	na	no
H	HASH-001	Potassium	504		EPA6010D	959	no	na	no	na	no	na	no
H	HASH-002	Potassium	254		EPA6010D	959	no	na	no	na	no	na	no
H	HASH-003	Selenium	2.87	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
H	HASH-001	Selenium	2.51	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
H	HASH-002	Selenium	1.32	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
H	HASH-003	Sodium	133		EPA6010D	246	no	na	no	na	no	na	no
H	HASH-001	Sodium	36.2	J	EPA6010D	246	no	na	no	na	no	na	no
H	HASH-002	Sodium	33.7		EPA6010D	246	no	na	no	na	no	na	no
H	HASH-003	Vanadium	28.9		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
H	HASH-001	Vanadium	22.3		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
H	HASH-002	Vanadium	13.1		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
H	HASH-001	Zinc	26.7		EPA6010D	20.7	YES	na	no	2.30E+04	no	3.50E+05	no
H	HASH-003	Zinc	9.68		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
H	HASH-002	Zinc	9.19		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
Organics ***(mg/kg)***													
H	HASH-002	2-Methylnaphthalene	0.0435		EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
H	HASH-003	2-Methylnaphthalene	0.0314	J	EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
H	HASH-001	2-Methylnaphthalene	0.0283	J	EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
H	HASH-002	Bis(2-Ethylhexyl)Phthalate	0.0116	J	EPA8270D	na	no	na	no	3.90E+01	no	1.60E+02	no
H	HASH-002	Naphthalene	0.0312	J	EPA8270D	na	no	na	no	2.00E+00	no	8.60E+00	no
H	HASH-001	Naphthalene	0.0215	J	EPA8270D	na	no	na	no	2.00E+00	no	8.60E+00	no
H	HASH-001	Phenanthrene	0.0336	J	EPA8270D	na	no	na	no	na	no	na	no
H	HASH-002	Phenanthrene	0.0297	J	EPA8270D	na	no	na	no	na	no	na	no
Radionuclides ***(pCi/g)***													
H	HASH-001	Gross Alpha [5]	41.1		RADA-001	20	YES	na	no		na		na
H	HASH-002	Gross Alpha [5]	35.4		RADA-001	20	YES	na	no		na		na
H	HASH-003	Gross Alpha [5]	29.6		RADA-001	20	YES	na	no		na		na
H	HASH-001	Nonvolatile Beta [5]	24.8		RADA-001	50	no	na	no		na		na
H	HASH-003	Nonvolatile Beta [5]	24.8		RADA-001	50	no	na	no		na		na
H	HASH-002	Nonvolatile Beta [5]	21.1		RADA-001	50	no	na	no		na		na
H	HASH-001	Cesium-137 [6]	0.156	J	RADA-013	1	no	na	no	4.55E-02	YES	6.90E-02	YES
H	HASH-003	Potassium-40	11.3		RADA-013	8.53	YES	na	no	1.44E-01	YES	2.19E-01	YES
H	HASH-002	Potassium-40	10.1		RADA-013	8.53	YES	na	no	1.44E-01	YES	2.19E-01	YES
H	HASH-001	Potassium-40	6.97		RADA-013	8.53	no	na	no	1.44E-01	YES	2.19E-01	YES
Thorium Series[7]													
H	HASH-002	Thorium-232	3.39		RADA-038	2.79	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-001	Thorium-232	1.78		RADA-038	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-003	Thorium-232	1.51	J	RADA-038	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-002	Actinium-228	4.15		RADA-013	2.54	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-001	Actinium-228	2.04		RADA-013	2.54	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-003	Actinium-228	2		RADA-013	2.54	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-002	Thorium-228	4.27		RADA-038	4.17	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-001	Thorium-228	2.25		RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-003	Thorium-228	1.49	J	RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
H	HASH-002	Lead-212	3.55		RADA-013	2.79	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-001	Lead-212	2.09		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-003	Lead-212	1.65		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-002	Bismuth-212	4.23		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-001	Bismuth-212	3.8	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-003	Bismuth-212	3.1	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-002	Thallium-208	1.04		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-001	Thallium-208	0.575		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
H	HASH-003	Thallium-208	0.53		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
Uranium Series[8]													
H	HASH-002	Uranium-238	3.59		RADA-011	1.9	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Uranium-238	2.4		RADA-011	1.9	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-003	Uranium-238	1.97		RADA-011	1.9	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-002	Uranium-233/234	3.38	J	RADA-011	1.76	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-003	Uranium-233/234	2.48	J	RADA-011	1.76	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Uranium-233/234	2.11	J	RADA-011	1.76	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Uranium-233/234	2.11	J	RADA-011	1.76	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-002	Thorium-230	5.89		RADA-038	2.78	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-003	Thorium-230	2.29		RADA-038	2.78	no	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Thorium-230	2.14		RADA-038	2.78	no	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-002	Radium-226	4.04		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Radium-226	3.72		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-003	Radium-226	3.39		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-002	Lead-214	4.78		RADA-013	na	no	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Lead-214	2.54		RADA-013	na	no	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-003	Lead-214	2.06		RADA-013	na	no	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-002	Bismuth-214	3.65		RADA-013	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
H	HASH-001	Bismuth-214	2.31		RADA-013	1.74	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
H	HASH-003	Bismuth-214	1.98		RADA-013	1.74	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
K-Area Ash Basin													
K	KASH-005	Ph	6.38	J	EPA9045D	na		na			na		na

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
K	KASH-001	Ph	5.71	J	EPA9045D	na		na			na		na
K	KASH-004	Ph	5.52	J	EPA9045D	na		na			na		na
Inorganics *(mg/kg)*													
K	KASH-005	Aluminum	4,840		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
K	KASH-004	Aluminum	4,480		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
K	KASH-001	Aluminum	3,440		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
K	KASH-001	Arsenic	32.3		EPA6010D	22.9	YES	na	no	6.80E-01	YES	3.00E+00	YES
K	KASH-004	Arsenic	19		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
K	KASH-005	Arsenic	18.1		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
K	KASH-005	Barium	179		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
K	KASH-004	Barium	114		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
K	KASH-001	Barium	79.5		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
K	KASH-005	Beryllium	1.94		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
K	KASH-004	Beryllium	1.76		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
K	KASH-001	Beryllium	1.74		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
K	KASH-005	Calcium	2,420		EPA6010D	6020	no	na	no	na	no	na	no
K	KASH-004	Calcium	2,200		EPA6010D	6020	no	na	no	na	no	na	no
K	KASH-001	Calcium	1,570		EPA6010D	6020	no	na	no	na	no	na	no
K	KASH-005	Chromium [4]	6.6		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
K	KASH-004	Chromium [4]	6.32		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
K	KASH-001	Chromium [4]	5.75		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
K	KASH-004	Cobalt	7.17		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
K	KASH-001	Cobalt	5.57		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
K	KASH-005	Cobalt	5.57		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
K	KASH-005	Copper	29.8		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
K	KASH-004	Copper	26.7		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
K	KASH-001	Copper	24.3		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
K	KASH-001	Iron	10,000		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
K	KASH-005	Iron	8,650		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
K	KASH-004	Iron	5,570		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
K	KASH-005	Lead	7.13		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no

Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
K	KASH-001	Lead	6.7		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
K	KASH-004	Lead	6.43		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
K	KASH-005	Magnesium	461		EPA6010D	1040	no	na	no	na	no	na	no
K	KASH-004	Magnesium	444		EPA6010D	1040	no	na	no	na	no	na	no
K	KASH-001	Magnesium	296		EPA6010D	1040	no	na	no	na	no	na	no
K	KASH-005	Manganese	54		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
K	KASH-001	Manganese	34.1		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
K	KASH-004	Manganese	28.5		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
K	KASH-004	Mercury	0.103		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
K	KASH-005	Mercury	0.0495		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
K	KASH-001	Mercury	0.0428		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
K	KASH-004	Nickel	13.8		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
K	KASH-001	Nickel	11.2		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
K	KASH-005	Nickel	11.1		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
K	KASH-005	Potassium	572		EPA6010D	959	no	na	no	na	no	na	no
K	KASH-004	Potassium	405		EPA6010D	959	no	na	no	na	no	na	no
K	KASH-001	Potassium	252		EPA6010D	959	no	na	no	na	no	na	no
K	KASH-004	Selenium	2.59	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
K	KASH-001	Selenium	2.31	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
K	KASH-005	Selenium	1.5	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
K	KASH-005	Sodium	58.2		EPA6010D	246	no	na	no	na	no	na	no
K	KASH-004	Sodium	51.2		EPA6010D	246	no	na	no	na	no	na	no
K	KASH-001	Sodium	34.2		EPA6010D	246	no	na	no	na	no	na	no
K	KASH-001	Vanadium	18.4		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
K	KASH-004	Vanadium	17.8		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
K	KASH-005	Vanadium	17.7		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
K	KASH-005	Zinc	15.6		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
K	KASH-004	Zinc	12.5		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
K	KASH-001	Zinc	11.5		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
Organics *(mg/kg)*													
K	KASH-005	2-Methylnaphthalene	0.415		EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
K	KASH-001	2-Methylnaphthalene	0.36		EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
K	KASH-004	2-Methylnaphthalene	0.158		EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
K	KASH-001	Benzo(G,H,I)Perylene	0.0297	J	EPA8270D	na	no	na	no	na	no	na	no
K	KASH-001	Benzo[A]Anthracene	0.0326	J	EPA8270D	na	no	na	no	1.10E+01	no	2.10E+01	no
K	KASH-005	Benzo[A]Anthracene	0.025	J	EPA8270D	na	no	na	no	1.10E+01	no	2.10E+01	no
K	KASH-004	Benzo[A]Anthracene	0.0161	J	EPA8270D	na	no	na	no	1.10E+01	no	2.10E+01	no
K	KASH-001	Benzo[A]Pyrene	0.0152	J	EPA8270D	na	no	na	no	1.10E-01	no	2.10E+00	no
K	KASH-001	Benzo[B]Fluoranthene	0.0375		EPA8270D	na	no	na	no	1.10E+00	no	2.10E+01	no
K	KASH-005	Benzo[B]Fluoranthene	0.0194	J	EPA8270D	na	no	na	no	1.10E+00	no	2.10E+01	no
K	KASH-005	Bis(2-Ethylhexyl)Phthalate	0.0165	J	EPA8270D	na	no	na	no	3.90E+01	no	1.60E+02	no
K	KASH-005	Chrysene	0.0351	J	EPA8270D	na	no	na	no	1.10E+02	no	2.10E+03	no
K	KASH-001	Chrysene	0.0341	J	EPA8270D	na	no	na	no	1.10E+02	no	2.10E+03	no
K	KASH-004	Chrysene	0.0148	J	EPA8270D	na	no	na	no	1.10E+02	no	2.10E+03	no
K	KASH-005	Di-N-Butyl Phthalate	0.0246	J	EPA8270D	na	no	na	no	6.30E+03	no	8.20E+04	no
K	KASH-001	Fluoranthene	0.0497		EPA8270D	na	no	na	no	2.40E+03	no	3.00E+04	no
K	KASH-005	Fluoranthene	0.0226	J	EPA8270D	na	no	na	no	2.40E+03	no	3.00E+04	no
K	KASH-004	Fluoranthene	0.0169	J	EPA8270D	na	no	na	no	2.40E+03	no	3.00E+04	no
K	KASH-001	Indeno[1,2,3-Cd]Pyrene	0.013	J	EPA8270D	na	no	na	no	1.10E+00	no	2.10E+01	no
K	KASH-005	Naphthalene	0.26		EPA8270D	na	no	na	no	2.00E+00	no	8.60E+00	no
K	KASH-001	Naphthalene	0.242		EPA8270D	na	no	na	no	2.00E+00	no	8.60E+00	no
K	KASH-004	Naphthalene	0.1		EPA8270D	na	no	na	no	2.00E+00	no	8.60E+00	no
K	KASH-001	Phenanthrene	0.228		EPA8270D	na	no	na	no	na	no	na	no
K	KASH-005	Phenanthrene	0.224		EPA8270D	na	no	na	no	na	no	na	no
K	KASH-004	Phenanthrene	0.112		EPA8270D	na	no	na	no	na	no	na	no
K	KASH-001	Pyrene	0.0642		EPA8270D	na	no	na	no	1.80E+03	no	2.30E+04	no
K	KASH-005	Pyrene	0.0355	J	EPA8270D	na	no	na	no	1.80E+03	no	2.30E+04	no
K	KASH-004	Pyrene	0.0231	J	EPA8270D	na	no	na	no	1.80E+03	no	2.30E+04	no
Radionuclides *(pCi/g)*													
K	KASH-004	Gross Alpha [5]	43.6		RADA-001	20	YES	na	no		na		na
K	KASH-001	Gross Alpha [5]	39.2		RADA-001	20	YES	na	no		na		na

Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
K	KASH-005	Gross Alpha [5]	23		RADA-001	20	YES	na	no		na		na
K	KASH-004	Nonvolatile Beta [5]	30.4		RADA-001	50	no	na	no		na		na
K	KASH-001	Nonvolatile Beta [5]	28.1		RADA-001	50	no	na	no		na		na
K	KASH-005	Nonvolatile Beta [5]	20.1		RADA-001	50	no	na	no		na		na
K	KASH-005	Potassium-40	12.5		RADA-013	8.53	YES	na	no	1.44E-01	YES	2.19E-01	YES
K	KASH-004	Potassium-40	11.7		RADA-013	8.53	YES	na	no	1.44E-01	YES	2.19E-01	YES
K	KASH-001	Potassium-40	9.6		RADA-013	8.53	YES	na	no	1.44E-01	YES	2.19E-01	YES
Thorium Series[6]													
K	KASH-004	Thorium-232	3.9		RADA-038	2.79	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-001	Thorium-232	2.88		RADA-038	2.79	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-005	Thorium-232	2.79		RADA-038	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-001	Actinium-228	2.91		RADA-013	2.54	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-004	Actinium-228	2.69		RADA-013	2.54	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-005	Actinium-228	2.58		RADA-013	2.54	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-004	Thorium-228	3.94		RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-001	Thorium-228	3.07		RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-005	Thorium-228	2.76		RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-001	Lead-212	2.82		RADA-013	2.79	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-004	Lead-212	2.74		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-005	Lead-212	2.39		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-005	Bismuth-212	3.09		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-001	Bismuth-212	2.78	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-004	Bismuth-212	2.59	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-001	Thallium-208	0.893		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-004	Thallium-208	0.779		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
K	KASH-005	Thallium-208	0.688		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
Uranium Series[7]													
K	KASH-004	Uranium-238	3.7		RADA-011	1.9	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-001	Uranium-238	3.25		RADA-011	1.9	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Uranium-238	2.56		RADA-011	1.9	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
K	KASH-004	Uranium-233/234	3.77	J	RADA-011	1.76	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
K	KASH-001	Uranium-233/234	3.15	J	RADA-011	1.76	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Uranium-233/234	2.52	J	RADA-011	1.76	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Uranium-233/234	2.52	J	RADA-011	1.76	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
K	KASH-004	Thorium-230	4.46		RADA-038	2.78	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-001	Thorium-230	3.99		RADA-038	2.78	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Thorium-230	3.17		RADA-038	2.78	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-001	Radium-226	4.12		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-004	Radium-226	3.92		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Radium-226	2.84		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-001	Lead-214	3.76		RADA-013	na	no	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-004	Lead-214	3.39		RADA-013	na	no	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Lead-214	2.74		RADA-013	na	no	2.78	no	1.24E-02	YES	2.00E-02	YES
K	KASH-001	Bismuth-214	3.26		RADA-013	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-004	Bismuth-214	3.07		RADA-013	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
K	KASH-005	Bismuth-214	2.53		RADA-013	1.74	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
L-Area Ash Basin													
L	LASH-001	Ph	8.03	J	EPA9045D	na		na			na		na
L	LASH-005	Ph	7.35	J	EPA9045D	na		na			na		na
L	LASH-005	Ph	7.27	J	EPA9045D	na		na			na		na
L	LASH-003	Ph	7.04	J	EPA9045D	na		na			na		na
Inorganics *(mg/kg)*													
L	LASH-001	Aluminum	21,600		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
L	LASH-005	Aluminum	8,350		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
L	LASH-003	Aluminum	7,400		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
L	LASH-005	Aluminum	6,730		EPA6010D	23700	no	na	no	7.70E+04	no	1.10E+06	no
L	LASH-005	Antimony	0.502	J	EPA6010D	8.83	no	na	no	3.10E+01	no	4.70E+02	no
L	LASH-003	Arsenic	19.1		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
L	LASH-005	Arsenic	16.6		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
L	LASH-005	Arsenic	15.6		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
L	LASH-001	Arsenic	12.1		EPA6010D	22.9	no	na	no	6.80E-01	YES	3.00E+00	YES
L	LASH-001	Barium	479		EPA6010D	252	YES	na	no	1.50E+04	no	2.20E+05	no

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB														
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
L	LASH-003	Barium	246		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
L	LASH-005	Barium	115		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
L	LASH-005	Barium	104		EPA6010D	252	no	na	no	1.50E+04	no	2.20E+05	no
L	LASH-001	Beryllium	5.06		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
L	LASH-003	Beryllium	2.85		EPA6010D	1.15	YES	na	no	1.60E+02	no	2.30E+03	no
L	LASH-005	Beryllium	0.896		EPA6010D	1.15	no	na	no	1.60E+02	no	2.30E+03	no
L	LASH-005	Beryllium	0.835		EPA6010D	1.15	no	na	no	1.60E+02	no	2.30E+03	no
L	LASH-001	Calcium	45,900		EPA6010D	6020	YES	na	no	na	no	na	no
L	LASH-005	Calcium	28,100		EPA6010D	6020	YES	na	no	na	no	na	no
L	LASH-005	Calcium	25,600		EPA6010D	6020	YES	na	no	na	no	na	no
L	LASH-003	Calcium	5,890		EPA6010D	6020	no	na	no	na	no	na	no
L	LASH-005	Chromium [4]	18.8		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
L	LASH-005	Chromium [4]	18.7		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
L	LASH-001	Chromium [4]	14.3		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
L	LASH-003	Chromium [4]	9.94		EPA6010D	54.3	no	na	no	1.20E+05	no	1.80E+06	no
L	LASH-001	Cobalt	10.1		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
L	LASH-003	Cobalt	8.22		EPA6010D	5.04	YES	na	no	2.30E+01	no	3.50E+02	no
L	LASH-005	Cobalt	2.73		EPA6010D	5.04	no	na	no	2.30E+01	no	3.50E+02	no
L	LASH-005	Cobalt	2.42		EPA6010D	5.04	no	na	no	2.30E+01	no	3.50E+02	no
L	LASH-003	Copper	38.4		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
L	LASH-001	Copper	37.1		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
L	LASH-005	Copper	27		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
L	LASH-005	Copper	18.7		EPA6010D	74.2	no	na	no	3.10E+03	no	4.70E+04	no
L	LASH-001	Iron	21,600		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
L	LASH-005	Iron	13,300		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
L	LASH-003	Iron	11,500		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
L	LASH-005	Iron	11,300		EPA6010D	44300	no	na	no	5.50E+04	no	8.20E+05	no
L	LASH-003	Lead	12.5		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
L	LASH-005	Lead	12.5		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
L	LASH-005	Lead	11.7		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no
L	LASH-001	Lead	5.41		EPA6010D	26.6	no	na	no	4.00E+02	no	8.00E+02	no

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
L	LASH-001	Magnesium	5,440		EPA6010D	1040	YES	na	no	na	no	na	no
L	LASH-003	Magnesium	1,470		EPA6010D	1040	YES	na	no	na	no	na	no
L	LASH-005	Magnesium	355		EPA6010D	1040	no	na	no	na	no	na	no
L	LASH-005	Magnesium	328		EPA6010D	1040	no	na	no	na	no	na	no
L	LASH-001	Manganese	230		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
L	LASH-003	Manganese	96.7		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
L	LASH-005	Manganese	63.7		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
L	LASH-005	Manganese	41.2		EPA6010D	346	no	na	no	1.80E+03	no	2.60E+04	no
L	LASH-003	Mercury	0.0739		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
L	LASH-005	Mercury	0.0619		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
L	LASH-005	Mercury	0.0512		EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
L	LASH-001	Mercury	0.0253	J	EPA7471B	0.3	no	na	no	1.10E+01	no	4.60E+01	no
L	LASH-001	Nickel	14.4		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
L	LASH-003	Nickel	14		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
L	LASH-005	Nickel	5.67		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
L	LASH-005	Nickel	4.59		EPA6010D	27	no	na	no	7.60E-01	YES	3.60E+00	YES
L	LASH-001	Potassium	1,100		EPA6010D	959	YES	na	no	na	no	na	no
L	LASH-003	Potassium	614		EPA6010D	959	no	na	no	na	no	na	no
L	LASH-005	Potassium	176		EPA6010D	959	no	na	no	na	no	na	no
L	LASH-005	Potassium	151		EPA6010D	959	no	na	no	na	no	na	no
L	LASH-005	Selenium	3.09	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-005	Selenium	2.28	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-001	Selenium	1.91	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-003	Selenium	1.81	J	EPA6010D	12.2	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-001	Sodium	592		EPA6010D	246	YES	na	no	na	no	na	no
L	LASH-003	Sodium	150		EPA6010D	246	no	na	no	na	no	na	no
L	LASH-005	Sodium	46.5		EPA6010D	246	no	na	no	na	no	na	no
L	LASH-005	Sodium	27.5	J	EPA6010D	246	no	na	no	na	no	na	no
L	LASH-005	Vanadium	61.3		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-001	Vanadium	48.8		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-005	Vanadium	40.3		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB

Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
L	LASH-003	Vanadium	23.5		EPA6010D	104	no	na	no	3.90E+02	no	5.80E+03	no
L	LASH-005	Zinc	21.2		EPA6010D	20.7	YES	na	no	2.30E+04	no	3.50E+05	no
L	LASH-005	Zinc	17.7		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
L	LASH-003	Zinc	16.5		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
L	LASH-001	Zinc	8.81		EPA6010D	20.7	no	na	no	2.30E+04	no	3.50E+05	no
Organics *(mg/kg)*													
L	LASH-003	2-Methylnaphthalene	0.073		EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
L	LASH-001	2-Methylnaphthalene	0.0162	J	EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
L	LASH-005	2-Methylnaphthalene	0.0154	J	EPA8270D	na	no	na	no	2.40E+02	no	3.00E+03	no
L	LASH-003	Benzo[B]Fluoranthene	0.016	J	EPA8270D	na	no	na	no	1.10E+00	no	2.10E+01	no
L	LASH-003	Chrysene	0.0234	J	EPA8270D	na	no	na	no	1.10E+02	no	2.10E+03	no
L	LASH-005	Di-N-Butyl Phthalate	0.0227	J	EPA8270D	na	no	na	no	6.30E+03	no	8.20E+04	no
L	LASH-003	Naphthalene	0.0467		EPA8270D	na	no	na	no	2.00E+00	no	8.60E+00	no
L	LASH-003	Phenanthrene	0.0959		EPA8270D	na	no	na	no	na	no	na	no
L	LASH-001	Phenanthrene	0.0289	J	EPA8270D	na	no	na	no	na	no	na	no
L	LASH-005	Phenanthrene	0.0145	J	EPA8270D	na	no	na	no	na	no	na	no
L	LASH-003	Pyrene	0.0152	J	EPA8270D	na	no	na	no	1.80E+03	no	2.30E+04	no
Radionuclides *(pCi/g)*													
L	LASH-001	Gross Alpha[5]	50.5		RADA-001	20	YES	na	no		na		na
L	LASH-003	Gross Alpha[5]	48		RADA-001	20	YES	na	no		na		na
L	LASH-005	Gross Alpha[5]	20.7		RADA-001	20	YES	na	no		na		na
L	LASH-005	Gross Alpha[5]	19.7		RADA-001	20	no	na	no		na		na
L	LASH-003	Nonvolatile Beta[5]	36.8		RADA-001	50	no	na	no		na		na
L	LASH-001	Nonvolatile Beta[5]	36.1		RADA-001	50	no	na	no		na		na
L	LASH-005	Nonvolatile Beta[5]	10.2		RADA-001	50	no	na	no		na		na
L	LASH-005	Nonvolatile Beta[5]	9.7		RADA-001	50	no	na	no		na		na
L	LASH-005	Cesium-137 [6]	0.236		RADA-013	1	no	na	no	4.55E-02	YES	6.90E-02	YES
L	LASH-005	Cesium-137 [6]	0.226		RADA-013	1	no	na	no	4.55E-02	YES	6.90E-02	YES
L	LASH-003	Potassium-40	10.8		RADA-013	8.53	YES	na	no	1.44E-01	YES	2.19E-01	YES
L	LASH-001	Potassium-40	7.5		RADA-013	8.53	no	na	no	1.44E-01	YES	2.19E-01	YES
L	LASH-005	Potassium-40	2.3		RADA-013	8.53	no	na	no	1.44E-01	YES	2.19E-01	YES

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB

Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?
L	LASH-005	Potassium-40	1.75	J	RADA-013	8.53	no	na	no	1.44E-01	YES	2.19E-01	YES
Thorium Series[7]													
L	LASH-001	Thorium-232	3.11		RADA-038	2.79	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Thorium-232	2.27		RADA-038	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Thorium-232	1.51	J	RADA-038	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Thorium-232	1.2	J	RADA-038	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Radium-228	1.1	J	RADA-009	6.75	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-001	Actinium-228	2.63		RADA-013	2.54	YES	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Actinium-228	2.28		RADA-013	2.54	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Actinium-228	1.3		RADA-013	2.54	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Actinium-228	1.22		RADA-013	2.54	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-001	Thorium-228	3.18		RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Thorium-228	1.95	J	RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Thorium-228	1.06	J	RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Thorium-228	0.878	J	RADA-038	4.17	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-001	Lead-212	2.5		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Lead-212	2.21		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Lead-212	1.1		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Lead-212	1.06		RADA-013	2.79	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-001	Bismuth-212	3.06	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Bismuth-212	1.76	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Bismuth-212	1.52	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Bismuth-212	1.45	J	RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-001	Thallium-208	0.81		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-003	Thallium-208	0.549		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Thallium-208	0.319		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
L	LASH-005	Thallium-208	0.27		RADA-013	na	no	6.75	no	9.85E-03	YES	1.53E-02	YES
Uranium Series[8]													
L	LASH-001	Uranium-238	5.82		RADA-011	1.9	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-003	Uranium-238	5.58		RADA-011	1.9	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Uranium-238	1.42	J	RADA-011	1.9	no	2.78	no	1.24E-02	YES	2.00E-02	YES

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB													
Area	**Station ID**	**Analyte Name**	**Converted Result**	**Lab Qual**	**Method Code**	**SRS Bkgd Max[1]**	**Result > SRS Bkgd Max?**	**SRS Bkgd Chain Max[2]**	**Result >SRS Chain Max?**	**RES RSL/ PRG[3]**	**Result > RES PRG/RSL?**	**IW RSL/ PRG[3]**	**Result > IW PRG/RSL?**
L	LASH-005	Uranium-238	1.29	J	RADA-011	1.9	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-001	Uranium-233/234	6.72		RADA-011	1.76	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-003	Uranium-233/234	4.77	J	RADA-011	1.76	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Uranium-233/234	1.64	J	RADA-011	1.76	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Uranium-233/234	1.64	J	RADA-011	1.76	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-001	Thorium-230	8.02		RADA-038	2.78	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-003	Thorium-230	6.09		RADA-038	2.78	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Thorium-230	2.11		RADA-038	2.78	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Thorium-230	0.959	J	RADA-038	2.78	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-001	Radium-226	8.63		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-003	Radium-226	6.21		RADA-008	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Radium-226	2.65		RADA-008	1.74	YES	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Radium-226	1.5		RADA-008	1.74	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-001	Lead-214	6.26		RADA-013	na	no	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-003	Lead-214	4.15		RADA-013	na	no	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Lead-214	1.04		RADA-013	na	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Lead-214	1.02		RADA-013	na	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-001	Bismuth-214	5.57		RADA-013	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-003	Bismuth-214	3.58		RADA-013	1.74	YES	2.78	YES	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Bismuth-214	0.807		RADA-013	1.74	no	2.78	no	1.24E-02	YES	2.00E-02	YES
L	LASH-005	Bismuth-214	0.803		RADA-013	1.74	no	2.78	no	1.24E-02	YES	2.00E-02	YES
Actinium Series[9]													
L	LASH-001	Uranium-235	0.561	J	RADA-011	0.17	YES	0.17	YES	4.58E-02	YES	7.31E-02	YES

PRELIMINARY DATA SCREENING FOR HAB, KAB, and LAB

Area	Station ID	Analyte Name	Converted Result	Lab Qual	Method Code	SRS Bkgd Max[1]	Result > SRS Bkgd Max?	SRS Bkgd Chain Max[2]	Result >SRS Chain Max?	RES RSL/ PRG[3]	Result > RES PRG/RSL?	IW RSL/ PRG[3]	Result > IW PRG/RSL?

1. SRS Bkgd Max = Maximum detected concentration from *Background Soils Statistical Summary Report for the Savannah River Site* unless otherwise noted (Appendix B-2) (SRNS 2006)
2. SRS Bkgd Chain Max = Applies to the thorium series and uranium series radionuclides only; maximum detected concentration from *Background Soils Statistical Summary Report for the Savannah River Site* from the entire decay chain (Appendix B-2) (SRNS 2006). For the Thorium Series, Radium-228 has the highest detected concentration (6.75 pCi/g); for the Uranium Series, Thorium-230 has the highest detected concentration (2.78 pCi/g).
3. RES RSL/PRG and IW RSL/PRG = Residential and industrial worker soil screening values from the USEPA websites set at 1E-06 for carcinogens and HQ = 1 for noncarcinogens. Nonradiological Regional Screening Levels (RSLS) are default residential and industrial worker soil values from the *EPA Regional Screening Levels Table*, dated May 2020. Radiological Secular Equilibrium Preliminary Remediation Goal (PRGS) are SRS-specific residential soil values from the *EPA Preliminary Goals for Radionuclides* website obtained by eliminating the fruit and vegetable consumption pathway; all other residential inputs are defaults; for the industrial worker, all inputs are defaults (May 2018).
4. Chromium = Reported result is for total Chromium. All hexavalent chromium results were nondetect; therefore, this screening uses the RSLS for trivalent chromium.
5. Gross Alpha / Nonvolatile Beta = Maximum detected concentrations from *Background Soils Statistical Summary Report for the Savannah River Site* is 32.7 pCi/g and 33.0 pCi/g, respectively. This screening uses the EC&ACP soil screening thresholds of 20 pCi/g gross alpha ND 50 pCi/g nonvolatile Beta.
6. Cesium-137 = Maximum detected concentration from *Background Soils Statistical Summary Report for the Savannah River Site* is 3. pCi/g (2006). This screening uses a more conservative value of 1 pCi/g based on past regulatory agreements (PAOU and RAOU).
7. Thorium Series = Secular Equilibrium PRG for Th-232 entire decay chain used for data screening.
8. Uranium Series = Secular Equilibrium PRG for U-238 entire decay chain used for data screening.
9. Actinium Series = Secular Equilibrium PRG for U-235 entire decay chain used for data screening.

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APPENDIX B
Attachment 2

GEOPHYSICAL RESULTS – SYSTEM ONE

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ASR 18-203 (04/19)

System|One
Savannah River Site - Building 717-5N

Summary Report of Testing Activities

☐ Report ☒ Cover Sheet Page 1 of 5

Approvals (If required)	Work Package No.: 01790212
Senior Civil Technician (Level III): Bradley Carlson - 7-4007	QCIR No.: N/A
	Project No.: 01.29.32.01.09.01.01
Civil Testing & Inspection Superintendent: W. Pope, Jr. - 7-4797	Design Category: N/A
	Report No.: 2020-01790212-0001 Date: 5-11-20
Lab. No.: 2020-SO-0012	Test Method: See Attached Page
Discipline: Civil	Description: Soil
Location: H-Area Ash Basin	Reported to: Susan Blas 2-6904

Summary: Attached are the testing results for the H-Area Ash basin sample obtained on 5-11-2020.

N/A

FILE

M&TE: See Attached Page	Cal. Due Date: See Attached Page	Procedure: C-QCP-003
NCR No.: N/A		Rev.: 0
Test Results: ☐ Conforming ☐ Nonconforming ☒ N/A		PCN(s): 2
Remarks: N/A		Spec.: SRNS-RP-2019-00798
N/A		Rev.: 0
N/A		DCF(s): N/A
N/A		

Technician (Print/Sign): Steven Eppihimer / [signature] Level: II Date: 6-24-20

Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6-24-20

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ASR 18-178 (07/19)

System|One
Savannah River Site
Determination of Water Content

Page 2 of 5

ASTM D 2216-(19) Oven-Dry ASTM D 4643-(N/A) Microwave

Report No.: 2020-01790212-0001 Work Package No.: 01790212
Project No.: 01.29.32.01.09.01.01 QCIR No.: N/A
Lab. No.: 2020-SO-0012 Date Tested: 5-27-20 Acceptance Criteria: N/A
Material Description: Coal Ash
Location: H-Area Ash Basin

Test Number	1						
Elev. / Depth	0-1'						
Sample No./Microwave No.	P2						
A. Weight of Wet Sample + Tare	319.1			N			
B. Weight of Dry Sample + Tare	263.1						
C. Weight of Moisture (A - B)	56.0				A		
D. Tare Weight	98.2						
E. Weight of Dry Sample (B - D)	164.9						
F. Percent Moisture (C / E x 100)	34.0						

Test Number							
Elev. / Depth							
Sample No./Microwave No.							
A. Weight of Wet Sample + Tare			N				
B. Weight of Dry Sample + Tare							
C. Weight of Moisture (A - B)					A		
D. Tare Weight							
E. Weight of Dry Sample (B - D)							
F. Percent Moisture (C / E x 100)							

Minimum Size Sample: ☐ Conforming ☐ Nonconforming Remarks: N/A
More Than One Soil Type: N/A
Drying Method: ☒ 230 + / - 9 Deg. F ☐ Other: N/A Microwave Time Setting: N/A
Material (Size/Amount) Excluded From Test: N/A

M&TE: 1). S-65, 2). BOVEN	Cal. Due Date: 1). 03-15-21, 2). 06-15-21	Procedure: C-QCP-003
		Rev.: 0
NCR No.: N/A		PCN(s): 2
Test Results: ☐ Conforming ☐ Nonconforming ☒* N/A		Spec.: SRNS-RP-2019-00798
		Rev.: 0
Remarks: *For Engineering Evaluation		DCF(s): N/A
N/A		Design Category: N/A

Technician (Print/Sign): Andrew Wilson [signature] Level: II Date: 5-27-20
Reviewer (Print/Sign): Bradley Carlson [signature] Level: III Date: 6-24-20

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ASR 18-172 (07/19)

system | one

ASTM D422-63(07)

Client: SRNS

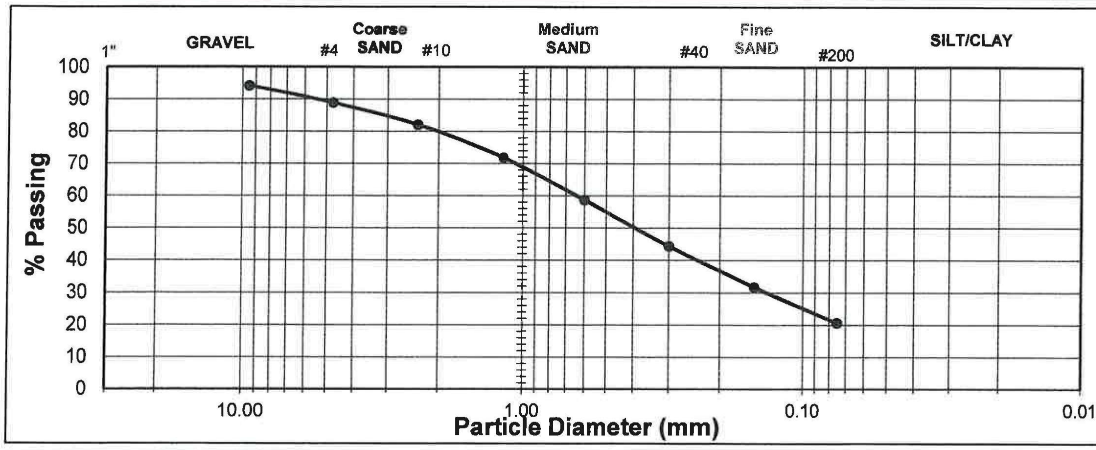
Page: 3 of 5

Particle-Size Analysis

Project No.:	N/A	Work Package No.:	01790212	Report No.:	2020-01790212-0001
Lab No.:	2020-SO-0012	Date Tested:	5/14/2020	Design Category:	N/A
QCIR No.:	N/A				
Description of Material:	Coal Ash	Origin of Material:	H-Area Coal Ash Basin		

Sieve Size	Sieve Diameter [mm]	Cumulative Wt. Retained [g]	Cumulative % Retained	% Passing	Acceptance Criteria
3/8"	9.500	23.3	5.8	94.2	N/A
#4	4.750	44.4	11.1	88.9	N/A
#8	2.360	71.8	17.9	82.1	N/A
#16	1.180	112.7	28.2	71.8	N/A
#30	0.600	165.2	41.3	58.7	N/A
#50	0.300	222.6	55.6	44.4	N/A
#100	0.150	273.5	68.3	31.7	N/A
#200	0.075	317.7	79.4	20.6	N/A
	N/A				
Pan		333.6			

Tare ID & Weight	P22	97.5 g
Original Oven Dry Weight w/Tare[g]		497.8
Oven Dry Weight After Wash w/Tare[g]		431.2
Difference [g]		66.6
Wash Finer Than 200 [%]		16.6



Test Results:	N/A	NCR No.:	N/A
Remarks:	N/A		
N/A			
N/A			
Procedure:	C-QCP-003	Rev.: 0	PCN: 2
Spec.:	SRNS-RP-2019-00798	Rev.: 0	
DCF(s)/Rev(s):	N/A		
Dwg. No(s)./Rev(s):	N/A		
DCF(s)/Rev(s):	N/A		

M&TE	Cal. Due Date	M&TE	Cal. Due Date
BOVEN	06/15/21		
S-65	03/12/21		
WG-S-4	10/10/20	N	
SS-3	03/15/21		A
SL-3	08/06/20		
N/A	N/A		

Technician (Print/Sign): Andrew Wilson / [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6-24-20

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THESE RESULTS RELATE ONLY TO THE ITEMS INSPECTED OR TESTED.

ASR 18-174 (07/19)

system | one

ASTM D1557 - (12e15)
ASTM D698 - (N/A)

Client: SRNS

Page: 4 of 5

Moisture-Density Relationship Test

Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0001

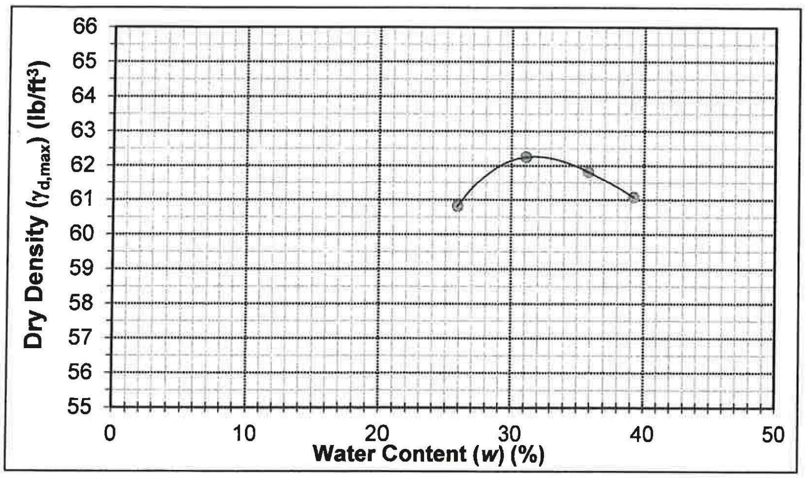
Lab No.: 2020-SO-0012 Date Tested: 5/27/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: H-Area Ash Basin

ASTM: D1557 - 12e15 Preparation Method: Dry Method Used: C Oversize Correction: N/A

Specific Gravity: 1.999 Method of Determining Specifc Gravity: ASTM D854 Rammer: Manual

Soils Classified Using: D2487 As Received Moisture Content: 34 Acceptance Criteria: N/A



	Dry Density	Moisture Content
Point 1	60.8	25.9
Point 2	62.2	31.1
Point 3	61.8	35.8
Point 4	61.1	39.2
Point 5	N/A	N/A

Percent Retained on Sieves	
3/4"	N/A
3/8"	5.8
#4	11.1

Maxium Dry Density: 62.3 PCF Optimum Moisture Percentage: 31.5 %

Test Results: N/A NCR No.: N/A

Remarks: N/A
N/A
N/A

Procedure:	C-QCP-003	Rev.:	0	PCN:	2
Spec.:	SRNS-RP-2019-00798	Rev.:	0		
DCF(s)/Rev(s):	N/A				
Dwg. No(s)./Rev(s):	N/A				
DCF(s)/Rev(s):	N/A				

M&TE	Cal. Due Date	M&TE	Cal. Due Date
S-65	3/12/2021		
M-9	12/9/2020		
SE-4	5/11/2021	N	
R-21	6/5/2021		A
BOVEN	5/15/2021		
N/A	N/A		

Technician (Print/Sign): Steven Eppihimer / [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6-24-20

BC 7/8/20

Savannah River Site
717-5N, 148
Aiken, SC
803-727-4720

INFORMATION ONLY

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system | one

ASR 18-176 (07/19)

system | one

ASTM D4318 - (17e1)

Client: SRNS

Page: 5 of 5

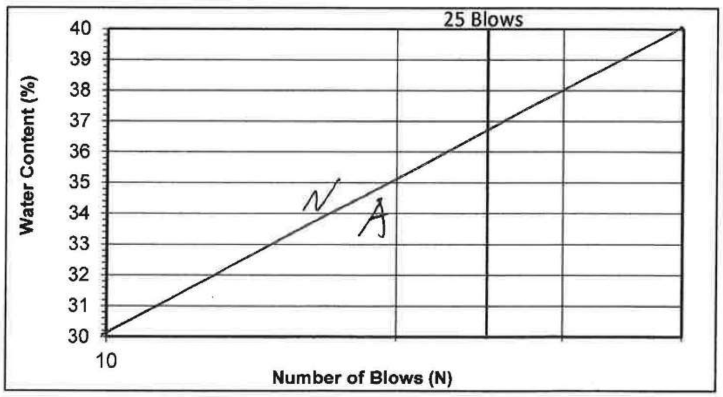
Atterberg Limits

Project No.: 01.29.32.01.09.01.01	Work Package No.: 1790212	Report No.: 2020-1790212-0001	
Lab No.: 2020-so-0012	Date Tested: 5/27/2020	Design Category: N/A	QCIR No.: N/A
Description of Material: Coal Ash		Origin of Material: H-Area Ash Basin	

	Units	PLASTIC LIMIT 1	PLASTIC LIMIT 2	LIQUID LIMIT 1	LIQUID LIMIT 2	LIQUID LIMIT 3
Tare Number	---	N/A	N/A	N/A	N/A	N/A
Mass of Tare	[g]	N/A	N/A	N/A	N/A	N/A
Mass Can & Soil (Wet)	[g]	N/A	N/A	N/A	N/A	N/A
Mass Can & Soil (Dry)	[g]	N/A	N/A	N/A	N/A	N/A
Mass of Soil	[g]	N/A	N/A	N/A	N/A	N/A
Mass of Water	[g]	N/A	N/A	N/A	N/A	N/A
Water Content	[%]	N/A	N/A	N/A	N/A	N/A
Number of Blows	---	Non Plastic	Non-Plastic	N/A	N/A	N/A

Preperation Method:	(Wet/Air Dry/OD)
% Retained on #40:	51
In-Situ Moisture %:	34

Liquid Limit (LL):	NP
Plastic Limit (PL):	NP
Plasticity Index (PI):	NV
USCS Classification	SM



Test Results: N/A		NCR No.: N/A			M&TE	Cal. Due Date	M&TE	Cal. Due Date
Remarks: Sample Slides in cup, exibiting non-plastic behavior								
N/A								
N/A					LL-06	4/1/2020		
Procedure:	C-QCP-003	Rev.:	0	PCN: 2	GT-02	4/1/2020		
Spec.:	SRNS-RP-2019-00798	Rev.:	0		N/A	N/A	N	
DCF(s)/Rev(s):	N/A				N/A	N/A		A
Dwg. No(s)./Rev(s):	N/A				N/A	N/A		
DCF(s)/Rev(s):	N/A				N/A	N/A		

Technician (Print/Sign): Andrew Wilson [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson [signature] Level: III Date: 6-24-20

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ASR 18-203 (04/19)

System|One
Savannah River Site - Building 717-5N

Summary Report of Testing Activities

☐ Report ☒ Cover Sheet Page 1 of 5

Approvals (If required)	Work Package No.: 01790212
Senior Civil Technician (Level III): Bradley Carlson - 7-4007	QCIR No.: N/A Project No.: 01.29.32.01.09.01.01
Civil Testing & Inspection Superintendent: W. Pope, Jr. - 7-4797	Design Category: N/A Report No.: 2020-01790212-0002 Date: 5-11-20
Lab. No.: 2020-SO-0011	Test Method: See Attached Page
Discipline: Civil	Description: Soil
Location: K-Area Ash Basin	Reported to: Susan Blas 2-6904

Summary: Attached are the testing results for the K-Area Ash basin sample obtained on 5-11-2020.

N/A

FILE

M&TE: See Attached Page / Cal. Due Date: See Attached Page	Procedure: C-QCP-003
NCR No.: N/A	Rev.: 0
Test Results: ☐ Conforming ☐ Nonconforming ☒ N/A	PCN(s): 2
Remarks: N/A N/A N/A N/A	Spec.: SRNS-RP-2019-00798 Rev.: 0 DCF(s): N/A
Technician (Print/Sign): Steven Eppihimer / [signature]	Level: II Date: 6-24-20
Reviewer (Print/Sign): Bradley Carlson / [signature]	Level: III Date: 6-24-20

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THESE RESULTS RELATE ONLY TO THE ITEMS INSPECTED OR TESTED

ASR 18-178 (07/19)

System|One
Savannah River Site
Determination of Water Content

Page 2 of 5

ASTM D 2216-(19) Oven-Dry   ASTM D 4643-(N/A) Microwave

Report No.: 2020-01790212-0002   Work Package No.: 01790212
Project No.: 01.29.32.01.09.01.01   QCIR No.: N/A
Lab. No.: 2020-SO-0011   Date Tested: 5-27-20   Acceptance Criteria: N/A
Material Description: Coal Ash
Location: K-Area Ash Basin

Test Number	1						
Elev. / Depth	0-1'						
Sample No./Microwave No.	P11			N/A			
A. Weight of Wet Sample + Tare	424.5						
B. Weight of Dry Sample + Tare	325.1						
C. Weight of Moisture (A - B)	99.4						
D. Tare Weight	0						
E. Weight of Dry Sample (B - D)	325.1						
F. Percent Moisture (C / E x 100)	30.6						

Test Number							
Elev. / Depth							
Sample No./Microwave No.			N/A				
A. Weight of Wet Sample + Tare							
B. Weight of Dry Sample + Tare							
C. Weight of Moisture (A - B)							
D. Tare Weight							
E. Weight of Dry Sample (B - D)							
F. Percent Moisture (C / E x 100)							

Minimum Size Sample: ☐ Conforming ☐ Nonconforming   Remarks: N/A
More Than One Soil Type: N/A
Drying Method: ☒ 230 + / - 9 Deg. F ☐ Other: N/A   Microwave Time Setting: N/A
Material (Size/Amount) Excluded From Test: N/A

M&TE: 1). S-65, 2). BOVEN   Cal. Due Date: 1). 03-15-21, 2). 06-15-21
Procedure: C-QCP-003
Rev.: 0
PCN(s): 2
NCR No.: N/A
Spec.: SRNS-RP-2019-00798
Test Results: ☐ Conforming ☐ Nonconforming *☒ N/A
Rev.: 0
Remarks: *For Engineering Evaluation
N/A
DCF(s): N/A
Design Category: N/A

Technician (Print/Sign): Andrew Wilson / [signature]   Level: II   Date: 5-27-20
Reviewer (Print/Sign): Bradley Carlson / [signature]   Level: III   Date: 6-24-20

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ASR 18-172 (07/19)

system | one

ASTM D422-63(07)

Client: SRNS

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Particle-Size Analysis

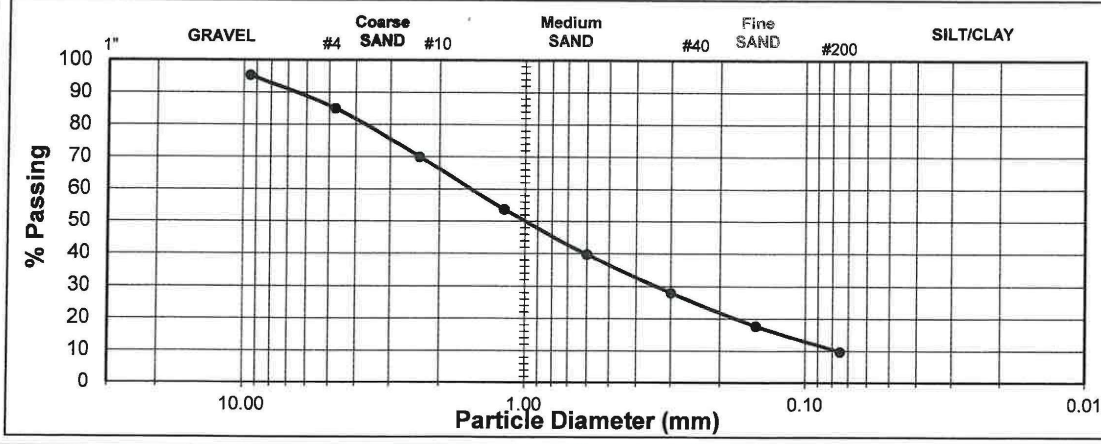
Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0002

Lab No.: 2020-SO-0011 Report Date: 5/27/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: K-Area Ash Basin

Sieve Size	Sieve Diameter [mm]	Cumulative Wt. Retained [g]	Cumulative % Retained	% Passing	Acceptance Criteria
3/8"	9.500	18.8	4.7	95.3	N/A
#4	4.750	60	15.0	85.0	N/A
#8	2.360	119.9	30.0	70.0	N/A
#16	1.180	185.1	46.2	53.8	N/A
#30	0.600	241.1	60.2	39.8	N/A
#50	0.300	288.3	72.0	28.0	N/A
#100	0.150	329.3	82.3	17.7	N/A
#200	0.075	361.2	90.2	9.8	N/A
	N				
					A
Pan		371.8			

Tare ID & Weight: P22	97.5 g
Original Oven Dry Weight w/Tare[g]	497.8
Oven Dry Weight After Wash w/Tare[g]	431.2
Difference [g]	66.6
Wash Finer Than 200 [%]	16.6



Test Results:	N/A	NCR No.:	N/A
Remarks:	N/A		
N/A			
N/A			
Procedure:	C-QCP-003	Rev.: 0	PCN: 2
Spec.:	SRNS-RP-2019-00798	Rev.:	0
DCF(s)/Rev(s):	N/A		
Dwg. No(s)./Rev(s):	N/A		
DCF(s)/Rev(s):	N/A		

M&TE	Cal. Due Date	M&TE	Cal. Due Date
BOVEN	06/15/21		
S-65	03/12/21		
WG-S-4	10/10/20	N	
SS-3	03/15/21		A
SL-3	08/06/20		
N/A	N/A		

Technician (Print/Sign): Andrew Wilson [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson [signature] Level: III Date: 6-24-20

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ASR 18-175 (07/19)

system | one

ASTM D1557 - (12e15)
ASTM D698 - (N/A)

Client: SRNS

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Moisture-Density Relationship Test

Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0002

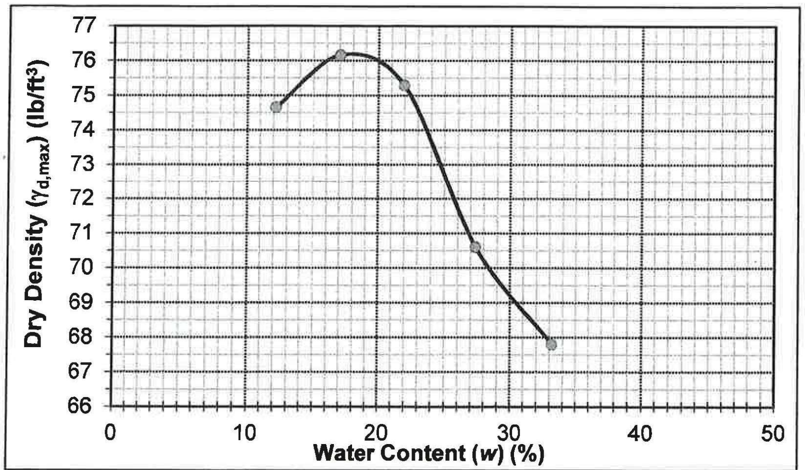
Lab No.: 2020-SO-0011 Report Date: 5/28/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: K-Area Ash Basin

ASTM: D1557 - 12e15 Preparation Method: Dry Method Used: C Oversize Correction: N/A

Specific Gravity: 2.01 Method of Determining Specifc Gravity: ASTM D854 Rammer: Manual

Soils Classified Using: D2487 As Received Moisture Content: 30.6 Acceptance Criteria: N/A



	Dry Density	Moisture Content
Point 1	74.7	12.1
Point 2	76.2	17.0
Point 3	75.3	21.9
Point 4	70.6	27.4
Point 5	67.8	33.2

Percent Retained on Sieves	
3/4"	N/A
3/8"	4.7
#4	15

Maxium Dry Density: 76.2 PCF Optimum Moisture Percentage: 18.0 %

Test Results:	N/A	NCR No.:	N/A
Remarks:	N/A		
N/A			
N/A			
Procedure:	C-QCP-003	Rev.: 0	PCN: 2
Spec.:	SRNS-RP-2019-00798	Rev.: 0	
DCF(s)/Rev(s):	N/A		
Dwg. No(s)./Rev(s):	N/A		
DCF(s)/Rev(s):	N/A		

M&TE	Cal. Due Date	M&TE	Cal. Due Date
S-65	3/12/2021		
M-9	12/9/2020		
SE-4	5/11/2021	N	
R-21	6/5/2021		A
BOVEN	5/15/2021		
N/A	N/A		

Technician (Print/Sign): Steven Eppihimer / [signature] Level: II Date: 5/28/2020

Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6-24-20

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Savannah River Site
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ASR 18-176 (07/19)

system|one

ASTM D4318 - (17e1)

Client: SRNS

Page: 5 of 5

Atterberg Limits

Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0002

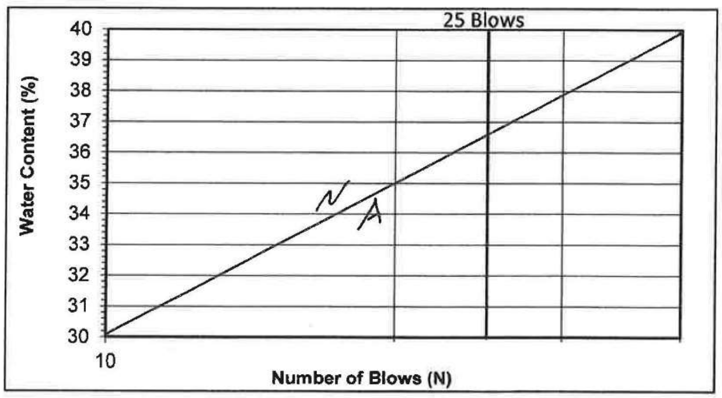
Lab No.: 2020-SO-0011 Report Date: 5/27/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: K-Area Ash Basin

	Units	PLASTIC LIMIT 1	PLASTIC LIMIT 2	LIQUID LIMIT 1	LIQUID LIMIT 2	LIQUID LIMIT 3
Tare Number	---	N/A	N/A	N/A	N/A	N/A
Mass of Tare	[g]	N/A	N/A	N/A	N/A	N/A
Mass Can & Soil (Wet)	[g]	N/A	N/A	N/A	N/A	N/A
Mass Can & Soil (Dry)	[g]	N/A	N/A	N/A	N/A	N/A
Mass of Soil	[g]	N/A	N/A	N/A	N/A	N/A
Mass of Water	[g]	N/A	N/A	N/A	N/A	N/A
Water Content	[%]	N/A	N/A	N/A	N/A	N/A
Number of Blows	---	Non Plastic	Non-Plastic	N/A	N/A	N/A

Preperation Method:	(Wet/Air Dry/OD)
% Retained on #40:	66.1
In-Situ Moisture %:	30.6

Liquid Limit (LL):	NP
Plastic Limit (PL):	NP
Plasticity Index (PI):	NV
USCS Classification	SM



						M&TE	Cal. Due Date	M&TE	Cal. Due Date
Test Results:	N/A	NCR No.:	N/A						
Remarks:	Sample Slides in cup, exibiting non-plastic behavior								
	N/A								
	N/A					LL-06	4/1/2020		
Procedure:	C-QCP-003	Rev.:	0	PCN:	2	GT-02	4/1/2020		
Spec.:	SRNS-RP-2019-00798	Rev.:	0			N/A	N/A	N	
DCF(s)/Rev(s):	N/A					N/A	N/A		A
Dwg. No(s)./Rev(s):	N/A					N/A	N/A		
DCF(s)/Rev(s):	N/A					N/A	N/A		

Technician (Print/Sign): Andrew Wilson [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson [signature] Level: III Date: 6-24-20

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ASR 18-203 (04/19)

System|One
Savannah River Site - Building 717-5N

Summary Report of Testing Activities

☐ Report ☒ Cover Sheet Page 1 of 5

Approvals (If required)	Work Package No.: 01790212
Senior Civil Technician (Level III): Bradley Carlson - 7-4007	QCIR No.: N/A Project No.: 01.29.32.01.09.01.01
Civil Testing & Inspection Superintendent: W. Pope, Jr. - 7-4797	Design Category: N/A Report No.: 2020-01790212-0003 Date: 5-11-20
Lab. No.: 2020-SO-0013	Test Method: See Attached Page
Discipline: Civil	Description: Soil
Location: L-Area Ash Basin	Reported to: Susan Blas 2-6904

Summary: Attached are the testing results for the L-Area Ash basin sample obtained on 5-11-2020.

N/A

FILE

M&TE: See Attached Page	Cal. Due Date: See Attached Page	Procedure:	C-QCP-003
NCR No.: N/A		Rev.:	0
Test Results: ☐ Conforming ☐ Nonconforming ☒ N/A		PCN(s):	2
Remarks: N/A		Spec.:	SRNS-RP-2019-00798
N/A		Rev.:	0
N/A		DCF(s):	N/A
N/A			

Technician (Print/Sign): Steven Eppihimer / [signature] Level: II Date: 6-24-20

Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6-24-20

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ASR 18-178 (07/19)

System|One
Savannah River Site
Determination of Water Content

Page 2 of 5

ASTM D 2216-(19) Oven-Dry ASTM D 4643-(N/A) Microwave

Report No.: 2020-01790212-0003 Work Package No.: 01790212
Project No.: 01.29.32.01.09.01.01 QCIR No.: N/A
Lab. No.: 2020-SO-0013 Date Tested: 5-27-20 Acceptance Criteria: N/A
Material Description: Coal Ash
Location: L-Area Ash Basin

Test Number	1						
Elev. / Depth	0-1'						
Sample No./Microwave No.	PP1						
A. Weight of Wet Sample + Tare	512.2						
B. Weight of Dry Sample + Tare	424.5						
C. Weight of Moisture (A - B)	87.7						
D. Tare Weight	95.0						
E. Weight of Dry Sample (B - D)	329.5						
F. Percent Moisture (C / E x 100)	26.6						

N/A

Test Number							
Elev. / Depth							
Sample No./Microwave No.							
A. Weight of Wet Sample + Tare							
B. Weight of Dry Sample + Tare							
C. Weight of Moisture (A - B)							
D. Tare Weight							
E. Weight of Dry Sample (B - D)							
F. Percent Moisture (C / E x 100)							

N/A

Minimum Size Sample: ☐ Conforming ☐ Nonconforming Remarks: N/A
More Than One Soil Type: N/A
Drying Method: ☒ 230 + / - 9 Deg. F ☐ Other: N/A Microwave Time Setting: N/A
Material (Size/Amount) Excluded From Test: N/A

M&TE: 1). S-65, 2). BOVEN Cal. Due Date: 1). 03-15-21, 2). 06-15-21
NCR No.: N/A
Test Results: ☐ Conforming ☐ Nonconforming *X N/A
Remarks: *For Engineering Evaluation
N/A

Procedure: C-QCP-003
Rev.: 0
PCN(s): 2
Spec.: SRNS-RP-2019-00798
Rev.: 0
DCF(s): N/A
Design Category: N/A

Technician (Print/Sign): Andrew Wilson / [signature] Level: II Date: 5-27-20
Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6-24-20

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ASR 18-172 (07/19)

system | one

ASTM D422-63(07)

Client: SRNS

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Particle-Size Analysis

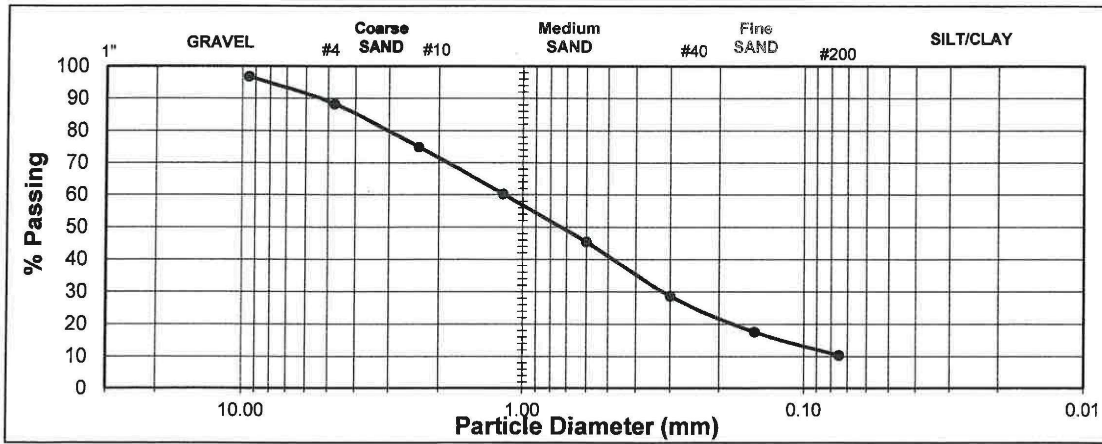
Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0003

Lab No.: 2020-SO-0013 Report Date: 5/27/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: L-Area Ash Basin

Sieve Size	Sieve Diameter [mm]	Cumulative Wt. Retained [g]	Cumulative % Retained	% Passing	Acceptance Criteria
3/8"	9.500	12.5	3.2	96.8	N/A
#4	4.750	46.5	11.7	88.3	N/A
#8	2.360	99.5	25.1	74.9	N/A
#16	1.180	157.3	39.7	60.3	N/A
#30	0.600	216.3	54.5	45.5	N/A
#50	0.300	282.8	71.3	28.7	N/A
#100	0.150	326.9	82.4	17.6	N/A
#200	0.075	355.5	89.6	10.4	N/A
	N				
				A	
Pan		364.9			

Tare ID & Weight	ID# 201	93.4 g
Original Oven Dry Weight w/Tare[g]		490
Oven Dry Weight After Wash w/Tare[g]		455.8
Difference [g]		34.2
Wash Finer Than 200 [%]		8.6



						M&TE	Cal. Due Date	M&TE	Cal. Due Date
Test Results:	N/A	NCR No.:	N/A						
Remarks:	N/A								
N/A									
N/A						BOVEN	06/15/21		
Procedure:	C-QCP-003	Rev.:	0	PCN:	2	S-65	03/12/21		
Spec.:	SRNS-RP-2019-00798	Rev.:	0			WG-S-4	10/10/20	N	
DCF(s)/Rev(s):	N/A					SS-3	03/15/21		A
Dwg. No(s)./Rev(s):	N/A					SL-3	08/06/20		
DCF(s)/Rev(s):	N/A					N/A	N/A		

Technician (Print/Sign): Andrew Wilson [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson [signature] Level: III Date: 6/24/20

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ASR 18-175 (07/19)

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ASTM D1557 - (12e15)
ASTM D698 - (N/A)
Page: 4 of 5

Client: SRNS

Moisture-Density Relationship Test

Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0003

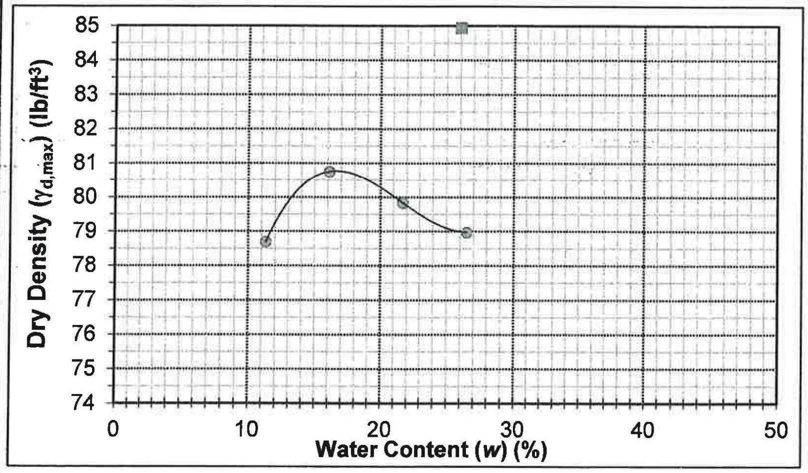
Lab No.: 2020-SO-0013 Report Date: 5/27/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: L-Area Ash Basin

ASTM: D1557 - 12e15 Preparation Method: Dry Method Used: C Oversize Correction: N/A

Specific Gravity: 2.107 Method of Determining Specifc Gravity: ASTM D854 Rammer: Manual

Soils Classified Using: D2487 As Received Moisture Content: 26.6 Acceptance Criteria: N/A



	Dry Density	Moisture Content
Point 1	78.7	11.3
Point 2	80.8	16.1
Point 3	79.8	21.7
Point 4	79.0	26.5
Point 5	N/A	N/A

Percent Retained on Sieves	
3/4"	N/A
3/8"	3.2
#4	11.7

Maxium Dry Density: 80.8 PCF Optimum Moisture Percentage: 16.5 %

Test Results: N/A	NCR No.: N/A				
Remarks: N/A					
N/A					
N/A					
Procedure: C-QCP-003	Rev.: 0	PCN: 2			
Spec.: SRNS-RP-2019-00798	Rev.: 0				
DCF(s)/Rev(s): N/A					
Dwg. No(s)./Rev(s): N/A					
DCF(s)/Rev(s): N/A					

M&TE	Cal. Due Date	M&TE	Cal. Due Date
S-65	3/12/2021		
M-9	12/9/2020		
SE-4	5/11/2021	N	
R-21	6/5/2021		A
BOVEN	5/15/2021		
N/A	N/A		

Technician (Print/Sign): Steven Eppihimer / [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson / [signature] Level: III Date: 6/24/20

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Savannah River Site
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ASR 18-176 (07/19)

system|one

ASTM D4318 - (17e1)

Client: SRNS

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Atterberg Limits

Project No.: 01.29.32.01.09.01.01 Work Package No.: 01790212 Report No.: 2020-01790212-0003

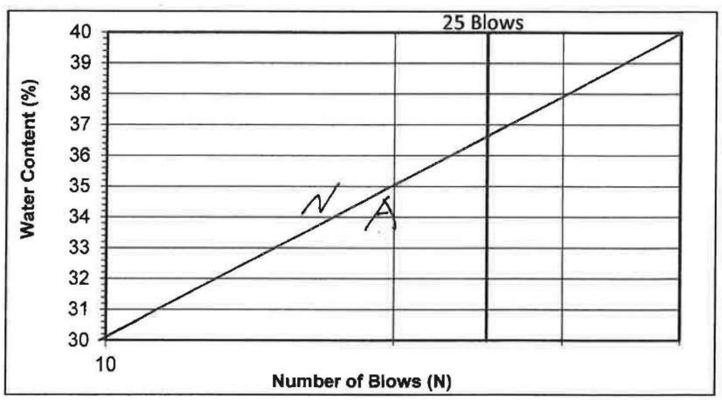
Lab No.: 2020-SO-0013 Report Date: 5/27/2020 Design Category: N/A QCIR No.: N/A

Description of Material: Coal Ash Origin of Material: L-Area Ash Basin

	Units	PLASTIC LIMIT		LIQUID LIMIT		
		1	2	1	2	3
Tare Number	---	N/A	N/A	N/A	N/A	N/A
Mass of Tare	[g]	N/A	N/A	N/A	N/A	N/A
Mass Can & Soil (Wet)	[g]	N/A	N/A	N/A	N/A	N/A
Mass Can & Soil (Dry)	[g]	N/A	N/A	N/A	N/A	N/A
Mass of Soil	[g]	N/A	N/A	N/A	N/A	N/A
Mass of Water	[g]	N/A	N/A	N/A	N/A	N/A
Water Content	[%]	N/A	N/A	N/A	N/A	N/A
Number of Blows	---	Non Plastic	Non-Plastic	N/A	N/A	N/A

Preperation Method:	(Wet/Air Dry/OD)
% Retained on #40:	62.9
In-Situ Moisture %:	26.6

Liquid Limit (LL):	NP
Plastic Limit (PL):	NP
Plasticity Index (PI):	NV
USCS Classification	SM



Test Results: N/A	NCR No.: N/A				M&TE	Cal. Due Date	M&TE	Cal. Due Date
Remarks: Sample Slides in cup, exibiting non-plastic behavior								
N/A								
N/A					LL-06	4/1/2020		
Procedure:	C-QCP-003	Rev.: 0	PCN: 2		GT-02	4/1/2020		
Spec.:	SRNS-RP-2019-00798	Rev.: 0			N/A	N/A	N	
DCF(s)/Rev(s):	N/A				N/A	N/A		A
Dwg. No(s)./Rev(s):	N/A				N/A	N/A		
DCF(s)/Rev(s):	N/A				N/A	N/A		

Technician (Print/Sign): Andrew Wilson [signature] Level: II Date: 5/27/2020

Reviewer (Print/Sign): Bradley Carlson [signature] Level: III Date: 6/24/20

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APPENDIX B
Attachment 3

TRANSECT DATA

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A-AREA ASH PILE					
Unit	**Date**	**Transect No.**	**Distance from Origin** *(ft)*	**Observation**	**Notes**
A-Area Ash Pile	5/14/2020	A-1	0	Ash	Origin is end of transect line as located using GPS.
A-Area Ash Pile	5/14/2020	A-1	30	Ash	
A-Area Ash Pile	5/14/2020	A-1	60	Soil	
A-Area Ash Pile	5/14/2020	A-1	45	Ash	END OF ASH AT 45 FT.
A-Area Ash Pile	5/14/2020	A-1	52	Soil	
A-Area Ash Pile	5/14/2020	A-2	0	Thin (2-3") layer of 50/50 soil / ash	Side of ash pile. Origin is end of transect line as located using GPS.
A-Area Ash Pile	5/14/2020	A-2	30	Surficial ash - 2"	
A-Area Ash Pile	5/14/2020	A-2	60	Soil	
A-Area Ash Pile	5/14/2020	A-2	45	Trace ash.	
A-Area Ash Pile	5/14/2020	A-2	52	Trace ash.	END OF ASH AT 52 FT.
A-Area Ash Pile	5/14/2020	A-3	0	Soil. Ash visible in embankment.	Origin is at base of dike. 432020.53 / 3688378.92 m
A-Area Ash Pile	5/14/2020	A-3	30	Soil.	END OF ASH AT 0 FT.
A-Area Ash Pile	5/14/2020	A-4	0	Ash	Poor GPS signal. Origin relocated to 432139.83 / 3688331.98 m
A-Area Ash Pile	5/14/2020	A-4	30	Trace ash	END OF ASH AT 30 FT.
A-Area Ash Pile	5/14/2020	A-4	60	Soil	
A-Area Ash Pile	5/14/2020	A-4	45	Soil	
A-Area Ash Pile	5/14/2020	A-5	0	Soil	Origin is end of transect line as located using GPS.
A-Area Ash Pile	5/14/2020	A-5	30	Soil	NO ASH
A-Area Ash Pile	5/14/2020	A-6	0	Soil	Origin is end of transect line as located using GPS.
A-Area Ash Pile	5/14/2020	A-6	30	Soil	Poor GPS signal. NO ASH.
A-Area Ash Pile	6/2/2020	A-7	0	Soil	Origin is end of transect line as located using GPS.
A-Area Ash Pile	6/2/2020	A-7	30	Soil	NO ASH
A-Area Ash Pile	6/2/2020	A-8	0	Soil	Origin is end of transect line as located using GPS.
A-Area Ash Pile	6/2/2020	A-8	30	Soil	NO ASH
Total No. Holes: 24					

F-AREA ASH PILE					
Unit	**Date**	**Transect No.**	**Distance from Origin** *(ft)*	**Observation**	**Notes**
F-Area Ash Basin	6/4/2020	F-1	0	Soil	Origin is distal end of transect line as located using GPS.
F-Area Ash Basin	6/4/2020	F-1	30	Soil	
F-Area Ash Basin	6/4/2020	F-1	60	Soil	Impenetrable brush after 60 ft
F-Area Ash Basin	6/4/2020	F-1	0	Soil	Resume line at 437533.35 / 368343.82 m. Brush preventing further advancement.
F-Area Ash Basin	6/8/2020	F-1	-	Ash	Sample at interior end of transect as located using GPS
F-Area Ash Basin	6/4/2020	F-2	0	Ash	Origin is distal end of transect line as located using GPS. 15 ft. from sidewalk.
F-Area Ash Basin	6/4/2020	F-3	0	Soil	Origin is distal end of transect line as located using GPS.
F-Area Ash Basin	6/4/2020	F-3	25	Ash / soil	Brush at 30 ft - inaccessible
F-Area Ash Basin	6/4/2020	F-3	13	Ash / soil	END OF ASH AT 13 FT.
F-Area Ash Basin	6/4/2020	F-4	0	Soil	Origin is distal end of transect line as located using GPS.
F-Area Ash Basin	6/4/2020	F-4	30	Ash	
F-Area Ash Basin	6/4/2020	F-4	15	Ash / soil	
F-Area Ash Basin	6/4/2020	F-4	7.5	Soil with trace ash	END OF ASH AT 7.5 FT.
F-Area Ash Basin	6/4/2020	F-5	0	Ash	Origin is distal end of transect line as located using GPS. Embankment edge is ash limit.
F-Area Ash Basin	6/4/2020	F-6	0	Ash at 10-12"	Origin is distal end of transect line as located using GPS. Embankment edge is ash limit.
F-Area Ash Basin	6/4/2020	F-7	0	Ash	Origin is distal end of transect line as located using GPS. Embankment edge is ash limit.
F-Area Ash Basin	6/4/2020	F-8	0	Soil	
F-Area Ash Basin	6/4/2020	F-8	30	Soil	
F-Area Ash Basin	6/4/2020	F-8	46	Soil	END OF ASH AT APPROX. 55 FT - BASE OF EMBANKMENT

F-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
F-Area Ash Basin	6/4/2020	F-9	0	Soil	
F-Area Ash Basin	6/4/2020	F-9	30	Soil	
F-Area Ash Basin	6/4/2020	F-9	46	Ash	END OF ASH AT 46 FT - BASE OF EMBANKMENT
F-Area Ash Basin	6/4/2020	F-10	0	Soil	
F-Area Ash Basin	6/4/2020	F-10	30	Soil	
F-Area Ash Basin	6/4/2020	F-10	60	Soil	Location by base of metal stairs extending up embankment. Terminated due to poison ivy thicket.
F-Area Ash Basin	6/4/2020	F-11	0	Soil	Line started at 437933.86 / 3683490.48 m. Refusal (hard soils). Soil at surface.
F-Area Ash Basin	6/4/2020	F-11	24	Soil	Thick vegetation preventing further access.
F-Area Ash Basin	6/4/2020	F-12	0	Soil	Line started at 437763.60 / 3683545.86 m. Refusal (hard soils). Soil at surface.
F-Area Ash Basin	6/8/2020	F-12	30	Soil with trace of ash at surface	On graded slope. Possible clean cover over ash.
F-Area Ash Basin	6/8/2020	F-12	60	Soil with trace of ash at surface	On graded slope. Possible clean cover over ash.
F-Area Ash Basin	6/8/2020	F-13	0	Soil	Line started at 437775.32 / 3683517.02 m.
F-Area Ash Basin	6/8/2020	F-13	30	Soil	At edge of suspect ash clean soil cover
F-Area Ash Basin	6/8/2020	F-13	60	Soil with trace of ash	Appears to be fill material
F-Area Ash Basin	6/8/2020	F-13	90	Soil with trace of ash	Appears to be fill material
F-Area Ash Basin	6/8/2020	F-14	0	Soil 0-6" / Ash 6 -12"	Line started at 437724.90 / 3683484.10 m.
F-Area Ash Basin	6/8/2020	F-14	-	Soil	Second hole at 438229.22 / 3683473.59 m due to impassable vegetation thicket
F-Area Ash Basin	6/8/2020	F-15	0	Soil	By edge of dirt road
F-Area Ash Basin	6/8/2020	F-15	30	Soil	
F-Area Ash Basin	6/8/2020	F-15	60	Soil	Heavy thicket preventing advancement

F-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
F-Area Ash Basin	6/8/2020	F-16	0	Soil	
F-Area Ash Basin	6/8/2020	F-16	30	Soil	
F-Area Ash Basin	6/8/2020	F-16	60	Soil	
F-Area Ash Basin	6/8/2020	F-16	90	Soil	ASH AT 122 FT VISIBLE IN SMALL MOUND
F-Area Ash Basin	6/8/2020	F-17	0	Soil with trace ash. Refusal at 3"	By gravel road
F-Area Ash Basin	6/8/2020	F-17	30	Ash	By gravel road leading into basin
F-Area Ash Basin	6/8/2020	F-17	60	Soil	Ash present on opposite side of road
F-Area Ash Basin	6/8/2020	F-17	90	Ash	Switched transect to eastern side of road. END OF ASH AT APPROX. 60 FT FROM ORIGIN
F-Area Ash Basin	6/8/2020	F-18	0	Soil	Line started at 437645.51 / 3683319.26 m.
F-Area Ash Basin	6/8/2020	F-18	30	Soil	
F-Area Ash Basin	6/8/2020	F-18	60	Soil	
F-Area Ash Basin	6/8/2020	F-18	90	Soil	
F-Area Ash Basin	6/8/2020	F-18	120	Soil	
F-Area Ash Basin	6/8/2020	F-18	150	Soil	
F-Area Ash Basin	6/8/2020	F-18	180	Soil	Thick vegetation preventing further access. PRESUMED EXTENT OF ASH AT 210 FT.
F-Area Ash Basin	6/8/2020	F-19	0	Soil	
F-Area Ash Basin	6/8/2020	F-19	30	Soil	
F-Area Ash Basin	6/8/2020	F-19	60	Soil	
F-Area Ash Basin	6/8/2020	F-19	90	Soil	
F-Area Ash Basin	6/8/2020	F-19	120	Soil	
F-Area Ash Basin	6/8/2020	F-19	150	Soil	
F-Area Ash Basin	6/8/2020	F-19	180	Soil	Thick vegetation preventing further access.
F-Area Ash Basin	6/4/2020	F-19	-	Ash	Interior end of transect
Total No. Holes: 62					

H-AREA ASH PILE					
Unit	**Date**	**Transect No.**	**Distance from Origin** *(ft)*	**Observation**	**Notes**
H-Area Ash Basin	6/2/2020	H-1	0	Ash	Start at edge of dike. Origin is end of transect line as located using GPS.
H-Area Ash Basin	6/2/2020	H-1	30	Approx. 30% ash. Dark, wet.	Floodplain
H-Area Ash Basin	6/2/2020	H-1	60	Ash. 0-6"	
H-Area Ash Basin	6/2/2020	H-1	90	Ash. 0-12"	
H-Area Ash Basin	6/2/2020	H-1	120	Ash. 0-6"	
H-Area Ash Basin	6/2/2020	H-1	150	Ash. 0-8"	
H-Area Ash Basin	6/2/2020	H-1	180	Ash. 0-6"	
H-Area Ash Basin	6/2/2020	H-1	210	Ash. 0-10"	
H-Area Ash Basin	6/2/2020	H-1	240	Ash / soil mix (50% ash/50% soil)	
H-Area Ash Basin	6/2/2020	H-1	270	Trace ash. Approx. 90% soil.	Thin ash layer at surface.
H-Area Ash Basin	6/2/2020	H-1	300	Soil	
H-Area Ash Basin	6/2/2020	H-1	285	Trace ash. Approx. 90% soil.	END OF ASH AT 285 FT.
H-Area Ash Basin	6/2/2020	H-2	0	Ash	Start at edge of dike. Origin is end of transect line as located using GPS
H-Area Ash Basin	6/2/2020	H-2	30	Ash. Wet.	
H-Area Ash Basin	6/2/2020	H-2	60	Ash with sediment	
H-Area Ash Basin	6/2/2020	H-2	90	Ash	
H-Area Ash Basin	6/2/2020	H-2	120	Ash	
H-Area Ash Basin	6/2/2020	H-2	150	Ash with 20% sediment	
H-Area Ash Basin	6/2/2020	H-2	180	Ash	
H-Area Ash Basin	6/2/2020	H-2	210	Ash with sediment	
H-Area Ash Basin	6/2/2020	H-2	240	Ash	
H-Area Ash Basin	6/2/2020	H-2	270	Ash with sediment	
H-Area Ash Basin	6/2/2020	H-2	300	Ash with sediment	
H-Area Ash Basin	6/2/2020	H-2	330	Ash / soil mix. 50/50	
H-Area Ash Basin	6/2/2020	H-2	360	Ash / soil mix. 50/50	
H-Area Ash Basin	6/2/2020	H-2	390	Soil	END OF ASH 365-375 FT.

H-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
H-Area Ash Basin	6/3/2020	H-3	0	Ash / soil mix. 50/50	Origin 440483.44 / 3682766.32 m
H-Area Ash Basin	6/3/2020	H-3	30	Ash / soil mix. 60/40	
H-Area Ash Basin	6/3/2020	H-3	60	Ash / soil mix. 60/40	
H-Area Ash Basin	6/3/2020	H-3	90	Ash / soil mix. Black.	
H-Area Ash Basin	6/3/2020	H-3	120	Mostly soil	
H-Area Ash Basin	6/3/2020	H-3	150	Mostly soil - trace ash	
H-Area Ash Basin	6/3/2020	H-3	180	Mostly soil - trace ash	
H-Area Ash Basin	6/3/2020	H-3	210	Ash / soil mix. 50/50	
H-Area Ash Basin	6/3/2020	H-3	240	Ash / soil mix. 50/50	
H-Area Ash Basin	6/3/2020	H-3	270	Ash / soil mix. 50/50	
H-Area Ash Basin	6/3/2020	H-3	300	Ash / soil mix to 10". 40/60	
H-Area Ash Basin	6/3/2020	H-3	330	Ash / soil mix to 10". 40/60	
H-Area Ash Basin	6/3/2020	H-3	360	Mostly soil	
H-Area Ash Basin	6/3/2020	H-3	390	Soil / ash mix. Dark.	
H-Area Ash Basin	6/3/2020	H-3	420	Soil / ash mix. Dark.	
H-Area Ash Basin	6/3/2020	H-3	450	Mostly soil. Dark.	
H-Area Ash Basin	6/3/2020	H-3	480	Mostly soil. Dark.	Thicket ahead. END OF ASH APPROX. 520 FT.
H-Area Ash Basin	6/3/2020	H-4	0	Soil	By drainage ditch
H-Area Ash Basin	6/3/2020	H-4	30	Ash	
H-Area Ash Basin	6/3/2020	H-4	60	Ash with soil	
H-Area Ash Basin	6/3/2020	H-4	90	Ash with soil	
H-Area Ash Basin	6/3/2020	H-4	120	Ash with soil. Dark.	
H-Area Ash Basin	6/3/2020	H-4	150	Soil	Near waste unit boundary marker
H-Area Ash Basin	6/3/2020	H-4	180	Soil	
H-Area Ash Basin	6/3/2020	H-4	135	Ash	END OF ASH 150 FT

H-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
H-Area Ash Basin	6/3/2020	H-5	0	Ash	Origin at 440556.62 / 3682552.73 m. No access to edge of dike.
H-Area Ash Basin	6/3/2020	H-5	30	Ash	
H-Area Ash Basin	6/3/2020	H-5	60	Soil	Near waste unit boundary marker
H-Area Ash Basin	6/3/2020	H-5	45	Ash 0-3" / Soil 3-12"	
H-Area Ash Basin	6/3/2020	H-5	52	Soil with trace ash	END OF ASH AT 52 FT
H-Area Ash Basin	6/3/2020	H-6	0	Ash	
H-Area Ash Basin	6/3/2020	H-6	30	Soil	
H-Area Ash Basin	6/3/2020	H-6	15	Soil with trace ash	END OF ASH AT 12 FT, NEAR WASTE BOUNDARY MARKER
H-Area Ash Basin	6/3/2020	H-7	0	Ash 0-3" / Soil 3-12"	Origin at 440257.52 / 3682617.35 m.
H-Area Ash Basin	6/3/2020	H-7	30	Soil	
H-Area Ash Basin	6/3/2020	H-7	15	Soil	
H-Area Ash Basin	6/3/2020	H-7	7.5	Surficial ash.	END OF ASH AT 7.5 FT.
H-Area Ash Basin	6/3/2020	H-8	0	Ash	Origin at 440295.48 / 3682702.79 m
H-Area Ash Basin	6/3/2020	H-8	30	Soil	
H-Area Ash Basin	6/3/2020	H-8	15	Ash	On embankment
H-Area Ash Basin	6/3/2020	H-8	22.5	Ash 0-5" / Soil 5-12"	END OF ASH APPROX. 25 FT.
Total No. Holes: 67					

K-AREA ASH PILE					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
K-Area Ash Basin	5/13/2020	K-1	0	Ash	Start at edge of gravel road. Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-1	30	Ash	
K-Area Ash Basin	5/13/2020	K-1	60	Trace coal and ash	
K-Area Ash Basin	5/13/2020	K-1	90	Trace coal and ash at surface	

K-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin** ***(ft)***	**Observation**	**Notes**
K-Area Ash Basin	5/13/2020	K-1	120	Approx. 50% soil / 50% coal and carbonaceous shale fragments	
K-Area Ash Basin	5/13/2020	K-1	150	Approx. 70% soil / 30% coal and carbonaceous shale fragments	No appreciable visible coal ash but material is not native soils
K-Area Ash Basin	5/13/2020	K-1	180	Approx. 90% soil / 10% coal and carbonaceous shale fragments	Transect terminated due to impenetrable brush. Sample location on top of manmade earthen mound.
K-Area Ash Basin	5/13/2020	K-1	45	Approx. 80% soil / 20% ash	
K-Area Ash Basin	5/13/2020	K-1	52	Approx. 80% soil / 20% ash	END OF ASH AT 52 FT.
K-Area Ash Basin	5/13/2020	K-2	0	Ash	Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-2	30	Ash	
K-Area Ash Basin	5/13/2020	K-2	60	Ash	
K-Area Ash Basin	5/13/2020	K-2	90	Thin layer of ash at surface	END OF ASH AT 90 FT.
K-Area Ash Basin	5/13/2020	K-2	120	Soil	
K-Area Ash Basin	5/13/2020	K-2	75	Ash	
Y					
K-Area Ash Basin	5/13/2020	K-3	0	Ash	Side of basin dike. Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-3	30	Soil	
K-Area Ash Basin	5/13/2020	K-3	15	Soil	
K-Area Ash Basin	5/13/2020	K-3	7.5	Soil	
K-Area Ash Basin	5/13/2020	K-3	3.5	Soil	END OF ASH AT 3.5 FT.
K-Area Ash Basin	5/13/2020	K-4	0	Ash	Top edge of dike. Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-4	30	Soil	Base of dike.
K-Area Ash Basin	5/13/2020	K-4	15	Soil	
K-Area Ash Basin	5/13/2020	K-4	7.5	Soil	END OF ASH AT 7.5 FT.

K-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
K-Area Ash Basin	5/13/2020	K-5	0	Soil	Near road. Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-5	30	Soil	NO ASH
K-Area Ash Basin	5/13/2020	K-6	0	Soil	Near power line. Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-6	30	Soil	NO ASH
K-Area Ash Basin	5/13/2020	K-7	0	Ash	Near power line. Origin is end of transect line as located using GPS.
K-Area Ash Basin	5/13/2020	K-7	30	Soil / ash mix (60% soil / 40% ash)	END OF ASH AT APPROX. 35 FT.
K-Area Ash Basin	5/13/2020	K-7	60	Soil	Pile of ash adjacent to hand auger boring - possible dump truck load
K-Area Ash Basin	5/13/2020	K-7	90	Soil	
Total No. Holes: 32					

L-AREA ASH PILE					
Unit	**Date**	**Transect No.**	**Distance from Origin *(ft)***	**Observation**	**Notes**
L-Area Ash Basin	5/14/2020	L-1	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-1	30	Soil	
L-Area Ash Basin	5/14/2020	L-1	60	Soil	NO ASH OBSERVED.
L-Area Ash Basin	5/14/2020	L-2	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-2	30	Soil	
L-Area Ash Basin	5/14/2020	L-2	60	Soil	NO ASH OBSERVED.
L-Area Ash Basin	5/13/2020	L-3	0	Ash	Start at edge of gravel road. Origin is end of transect line as located using GPS.
L-Area Ash Basin	5/13/2020	L-3	30	Soil	
L-Area Ash Basin	5/13/2020	L-3	15	Soil / Ash 50/50	
L-Area Ash Basin	5/13/2020	L-3	22	Soil	END OF ASH AT 22 FT.

L-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin** *(ft)*	**Observation**	**Notes**
L-Area Ash Basin	5/13/2020	L-4	0	Ash	Start at edge of gravel road. Origin is end of transect line as located using GPS.
L-Area Ash Basin	5/13/2020	L-4	30	Ash	
L-Area Ash Basin	5/13/2020	L-4	60	Soil	
L-Area Ash Basin	5/13/2020	L-4	45	Soil	
L-Area Ash Basin	5/13/2020	L-4	37	Soil	END OF ASH AT 37 FT.
L-Area Ash Basin	5/14/2020	L-5	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-5	30	Soil	
L-Area Ash Basin	5/14/2020	L-5	60	Soil and ash (?) mix	
L-Area Ash Basin	5/14/2020	L-5	90	Soil and ash (?) mix	
L-Area Ash Basin	5/14/2020	L-5	120	Soil and carbonaceous shale fragments	
L-Area Ash Basin	5/14/2020	L-5	150	Soil and carbonaceous shale fragments	
L-Area Ash Basin	5/14/2020	L-5	180	Soil and carbonaceous shale fragments	
L-Area Ash Basin	5/14/2020	L-6	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-6	30	Soil	
L-Area Ash Basin	5/14/2020	L-6	60	Soil	NO ASH OBSERVED. Swale at approx. 80 ft. with standing water. Approx. 30 ft wide.
L-Area Ash Basin	5/14/2020	L-7	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-7	30	Soil	
L-Area Ash Basin	5/14/2020	L-7	60	Soil	NO ASH OBSERVED.
L-Area Ash Basin	5/14/2020	L-8	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-8	30	Soil	
L-Area Ash Basin	5/14/2020	L-8	60	Soil	By waste unit boundary marker
L-Area Ash Basin	5/14/2020	L-8	90	Soil	Cinders present in swale at approx. 100 ft.
L-Area Ash Basin	5/14/2020	L-8	120	Soil	West of swale. NO ASH OBSERVED.

L-AREA ASH PILE *(Continued)*					
Unit	**Date**	**Transect No.**	**Distance from Origin** ***(ft)***	**Observation**	**Notes**
L-Area Ash Basin	5/14/2020	L-9	0	Soil	Top of dike.
L-Area Ash Basin	5/14/2020	L-9	30	Soil	
L-Area Ash Basin	5/14/2020	L-9	60	Soil	NO ASH OBSERVED.
Total No. Holes: 36					

Ash Basin Transects
SUMMARY

Area	No. Transects	No. Holes
A	**8**	**24**
F	**19**	**62**
H	**8**	**67**
K	**7**	**32**
L	**9**	**36**
TOTAL	51	221

APPENDIX B
Attachment 4

DATA MANAGEMENT SUMMARY

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Data Management Projective Narrative

Sampling Event: 1Q20HKL-ASH

Full Name: Characterization of H, K, and L-Area Ash Basins

The total number of lab qualified environmental records was: 1390

The total number of lab qualified environmental records with qalifiers reflecting quality issues was: 35 or 2.5%

Environmental Records are defined as records with Sample Types of REG, RS, SPL , or FD;
Analysis Codes of REG or RERUN; and Analyte Types of TRG or NAS.

Environmental Record Lab Qualifier Summary

Method Type	Method	LQ Null	LQ J	LQ NJ	LQ U	LQ UJ	LQ R	Total
AS	RADA-011	9	11	0	10	0	0	30
AS	RADA-038	22	8	0	0	0	0	30
GFPC	RADA-001	20	0	0	0	0	0	20
GFPC	RADA-009	0	1	0	9	0	0	10
GS	RADA-013	63	10	0	280	0	17	370
ICPA	EPA6010D	168	13	0	39	0	0	220
MRCY	EPA7471B	8	2	0	0	0	0	10
MTLS	EPA7196A	0	0	0	10	0	0	10
PHYS	EPA9045D	0	10	0	0	0	0	10
RAD	RADA-008	10	0	0	0	0	0	10
SVOA	EPA8270D	16	31	0	623	0	0	670
	TOTAL	316	86	0	971	0	17	1390
	% OF TOTAL	22.7%	6.2%	0.0%	69.9%	0.0%	1.2%	100.00%

SEIRs Mobilized

SEIR ID	Rev.	Number of Samples		Sample Collection Dates		Percent Collected
		Mobilized	Collected	First	Final	
1Q20HKL-ASH-01	0	10	10	05/11/20	05/11/20	100%
1Q20HKL-ASH-ADD DA	0	2	0			0%
	Totals:	12	10	05/11/20	05/11/20	50%

Sample Types

Sample Type	Number of Samples		Percent Collected
	Mobilized	Collected	
FD	1	1	100%
REG	11	9	82%
Totals:	12	10	83%

Data Management Projective Narrative

Sampling Event: 1Q20HKL-ASH

Full Name: Characterization of H, K, and L-Area Ash Basins

Results Expected and Received: Analysis Code = REG or RERUN / Analyte Type = TRG or NAS

Pay Item	Source Code	Records Expected	Records Received	Records Difference
241	GELFY19	10	10	0
253	GELFY19	10	10	0
303	GELFY19	30	30	0
304	GELFY19	40	30	-10
305	GELFY19	370	370	0
309	GELFY19	10	10	0
310	GELFY19	10	10	0
319	GELFY19	10	10	0
320	GELFY19	10	10	0
404	GELFY19	230	230	0
408	GELFY19	670	670	0
	Total:	1400	1390	-10

Records Per Method: Analysis Code = REG or RERUN / Analyte Type = TRG or NAS

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
AS	RADA-011	304	GELFY19	VU	30
AS	RADA-038	303	GELFY19	VU	30
				Total for Method	**60**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
GFPC	RADA-001	309	GELFY19	VU	10
GFPC	RADA-001	310	GELFY19	VU	10
GFPC	RADA-009	320	GELFY19	VU	10
				Total for Method	**30**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
GS	RADA-013	305	GELFY19	VU	370
				Total for Method	**370**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
ICPA	EPA6010D	404	GELFY19	VU	220
				Total for Method	**220**

Data Management Projective Narrative

Sampling Event: 1Q20HKL-ASH

Full Name: Characterization of H, K, and L-Area Ash Basins

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
MRCY	EPA7471B	404	GELFY19	VU	10
				Total for Method	**10**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
MTLS	EPA7196A	241	GELFY19	VU	10
				Total for Method	**10**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
PHYS	EPA9045D	253	GELFY19	VU	10
				Total for Method	**10**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
RAD	RADA-008	319	GELFY19	VU	10
				Total for Method	**10**

Method Type	Method	Pay Item	Source Code	Usage Code	Record Count
SVOA	EPA8270D	408	GELFY19	VU	670
				Total for Method	**670**

Total for all Methods 1390

Field Results, Field Measurements, and Coordinates

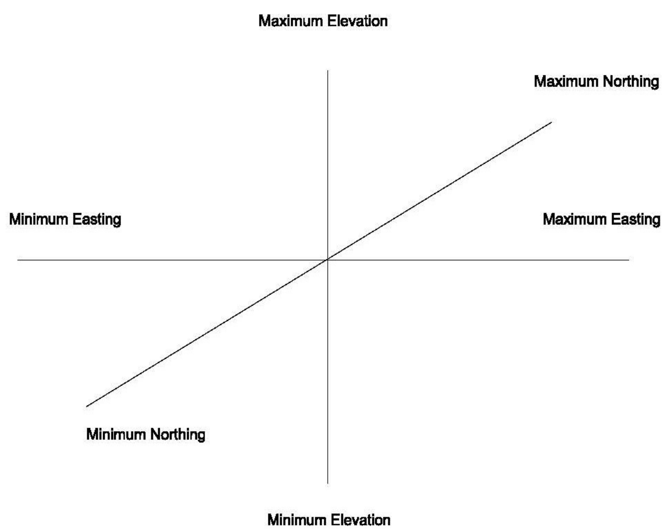
Records for this project recorded in the field measurements table:	0
Records for this project recorded in the field results table:	0
Water level Records for this project recorded in the field measure table:	0
Stations with collected samples:	9
Stations collected with elevations:	0
Stations collected with coordinates:	0

Data Management Projective Narrative

Sampling Event: 1Q20HKL-ASH

Full Name: Characterization of H, K, and L-Area Ash Basins

Minimum and Maximum Coordinates (UTM) and Elevations (ft)



Sample Comments

Station Id	Sample Id	Collection	Comments

APPENDIX C

Volume Estimates/Maps

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Ash Volume Calculations

Many of the ash units are in the early stages of characterizing and delineating the ash extent and volume. To determine a total ash volume at this stage, tools available in ArcGIS software were utilized with topography to provide some guidance. SRS has sitewide coverage of 1 by 1-meter light detection and ranging (LiDAR) data that gives a fine scale topographical coverage of the land surface elevation. Although the original land surfaces before construction of the ash units may not be available, an estimation of the previous land surface can be created by using the topography outside of the ash units in more undisturbed locations. Using this information, estimated ash thicknesses, areal size and consequently volumes can be estimated by subtracting the suspected original land surface from the current surface.

Table C-1 provides the estimated ash volumes at each ash unit as well as the amount outside of the ash unit. Using the field soil observations conducted in 2020 as well as any previous investigations, the lateral extent of ash has been estimated outside the basin and is also provided in the table.

Table C-1. Estimated Ash Extent Areas and Volumes

Unit	Inside Acreage	Inside Volume	Outside Acreage	Outside Basin Volume	Total Volume
A-Area Ash Pile	2.55	53,070* yd^3	N/A	N/A	53,070 yd^3
A-Area Coal Pile Runoff Basin	2.62	10,000 yd^3	0	0	10,000 yd^3
D-Area Ash Overflow	>33	>50,000 yd^3 (TBD)	N/A	N/A	>50,000 yd^3 (TBD)
D-Area Ash Basin Wetlands	~90	739,000 yd^3	N/A	N/A	739,000 yd^3
K-Area Ash Basin	11.16	254,563yd^3	3.81	17,964 yd^3	272,527 yd^3
L-Area Ash Basin	17.61	305,000 yd^3	1.67	18,026 yd^3	323,026 yd^3
Wetland Area at Dunbarton Bay	4.5	22,000			
H-Area Ash Basin	13.06	111,103 yd^3	18.4	148,009 yd^3	259,112 yd^3
H-Area Coal Pile Runoff Basin	1.27	7,000 yd^3	0	0	7,000 yd^3,
F-Area Ash Landfill	7.01	198,099 yd^3	11.47	15,360 yd^3	213,459 yd^3

*This is the calculated value based on the description provided in this Appendix. A preliminary design for AAP excavation estimated that the total volume of material to be removed to meet the design grades is approximately 70,000 yd^3. The larger volume was used for evaluation of AAP alternatives.

A-Area Ash Pile

For the A-Area Ash Pile, ash volume was calculated by subtracting the estimated original topographic surface from the current topographic surface. The vertical thickness and subsequent volume calculation was restricted to within the lateral extent of ash (Figure C-1).

A-Area Coal Pile Runoff Basin

The volume of coal fines for the ACPRB was estimated to be 10,000 yd^3 as documented in the RFI/RI with BRA and CMS/FS for the AAP/ACPRB and A-14 Outfall. Sampling in the basin indicated that the depth of the fines was approximately (~) 1ft thick over the basin area of ~2.6 acres (ac). This estimate is higher than the quantities that were reported to be removed from other Coal Pile Runoff Basins (WSRC 1998).

D-Area Ash Basin Wetlands

The D-Area Ash Basin Wetlands volume was estimated based on operational history of the D-Area 484-D Powerhouse and the known capacity of the ash basins and did not utilize GIS tools to make any volume calculations. Although some ash may have been washed downstream in Beaver Dam Creek or in the Savannah River/Floodplain this volume estimate would be a worst-case scenario (Figure C-2). This unit is part of the Savannah River Floodplain and Swamp IOU program.

D-Area Ash Overflow Area

The D-Area Ash Overflow Area includes overflow ash to the northeast of the 488-4D Ash Landfill, all of the D-Area Effluent Discharge Canal, and all of Beaver Dam Creek. Beaver Dam Creek extends for ~2 miles from nearby the southwest corner of the 488-1D Ash Basin to the west and south through the Savannah River floodplain and swamp (Figure C-2). The full extent of ash within the D-Area Effluent Discharge Canal and Beaver Dam Creek has not yet been fully studied. This unit is part of the Savannah River Floodplain and Swamp IOU program.

K-Area Ash Basin

The K-Area Ash Basin volume inside the basin was calculated by using a flat surface value of 73.76 meters (m) mean seal level (msl) (242 feet [ft] msl) for a topographic bottom. This is approximately the lowest elevation within the basin (southeast corner). This was subtracted from the current surface topographic elevation to get a potential thickness and volume of ash within the basin. Outside the basin, the lateral extent of ash was estimated by visual field observations. The volume outside the basin was calculated within the boundary of the ash extent area by subtracting the estimated pre-ash basin topographic surface from the current topographic surface (Figure C-3).

L-Area Ash Basin

The L-Area Ash Basin volume inside the basin was calculated by using a flat surface value of 74.0 m msl (242.8 ft msl) for a topographic bottom. This is approximately the ground elevation outside the basin on the southwest side and slightly below the lowest elevation within the basin (northeast corner). This was subtracted from the current surface topographic elevation to get a potential thickness and volume of ash within the basin. Outside the basin, the lateral extent of ash was estimated by visual field observations. The volume outside the basin was calculated within the boundary of the ash extent area by subtracting the estimated pre-ash basin topographic surface from the current topographic surface (Figure C-4).

Wetland Ash Dunbarton Bay

During the excavation of zone 1 of the South Ash Remediation Area (SARA), additional ash was found outside of the previously delineated limits of ash. This area, zone 3A is ~1.2 ac and ash was found at depths ranging from 1 to 4 ft deep in this area. Additionally, ash was found at greater than anticipated depths in zone 1 during excavation. Based on field observations during excavation and examination of soil cores that were hand augured in zone 3A, it is estimated that 4.5 ac in the SARA contain an average depth of ash of 3 ft. The volume of ash remaining in zones 2, 3, 3A and 4 of the SARA is estimated to be 22,000 yd^3 (Figure C-5).

H-Area Ash Basin

The H-Area Ash Basin volume inside the basin was calculated by using a flat surface value of 85 m msl (278.9 ft msl) for a topographic bottom. This elevation is slightly below the lowest elevation within the basin. This was subtracted from the current surface topographic elevation to get a rough potential thickness and volume of ash within the basin. Outside the basin, the lateral extent of ash was estimated by extensive, visual field observation methods. The volume outside the basin was calculated within the boundary of the ash extent area by subtracting the estimated pre-ash basin topographic surface from the current topographic surface (Figure C-6).

H-Area Coal Pile Runoff Basin

No data has been collected at the HCPRB to determine the depth of coal fines present within the 1.27-ac basin. For purposes of this report, the volume of fines is estimated based on a comparison of what was found during the RI/RFI/BRA/CMS/FS investigation at the ACPRB (SRNS 2012) and a comparison of the operational histories. The volume of fines in the ACPRB (2.62 ac) was calculated to be 10,000 yd^3 based on characterization data. The CPRB operated from 1978 to 2008. The HCPRB is a much smaller basin, 1.27 ac, and operated from 1981 to 1990. Based on a 10-year shorter operational life, the coal fines in the HCPRB is assumed to be 7,000 yd^3.

F-Area Ash Landfill

The F-Area Ash Landfill volume inside is based on disposal numbers provided by landfill operations (C-CLC-F-00825). Outside the basin, the lateral extent of ash was estimated by visual field observations. A 10-inch (25.4 centimeter) ash depth was used as an average to estimate the volume across the ash extent area (Figure C-7).

REFERENCES

SRNS, 2012. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan and RFI/RI Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the A-Area Ash Pile (788-A), A-Area Coal Pile Runoff Basin (78-3A), and Stormwater Outfall A-013 (NBN) Operable Unit (U),* Rev. 1, July 2012, SRNS-RP-2010-01457, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

C-CLC-F-00825, 288-F Ash Basin Volume Calculation, Rev. 0, October 2012

WSRC, 1998. Record of Decision Remedial Alternative Selection for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P), WSRC-RP-97-850, Rev. 0, April 1998

WSRC 1989. Preliminary Report on Coal Pile, Coal Pile Runoff Basins, and Ash Basins at the Savannah River Site: Effects on Groundwater, WSRC-TR-97-0122, December 1989, Westinghouse Savannah River Company

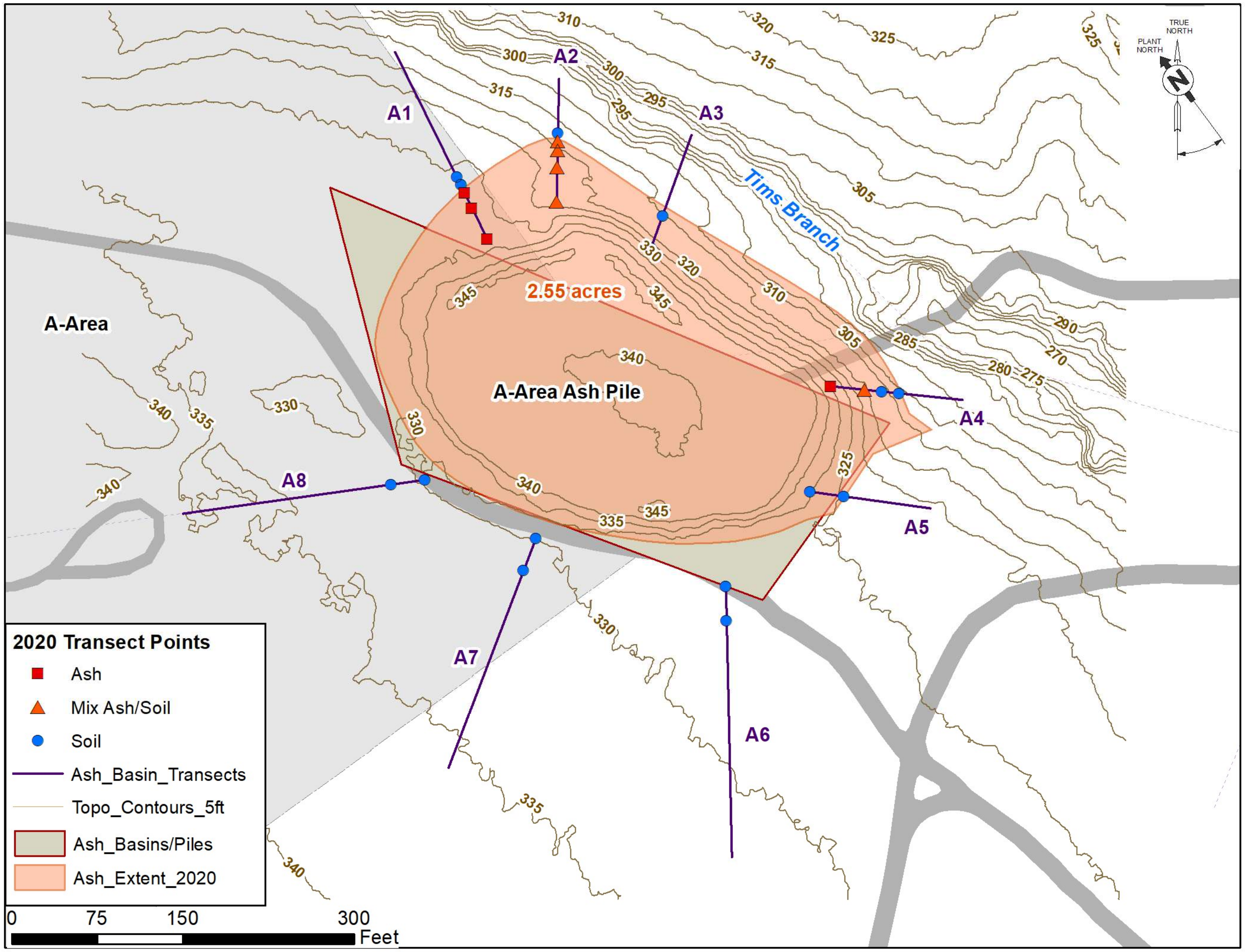

Figure C-1. A-Area Ash Pile Transects and Ash Extent

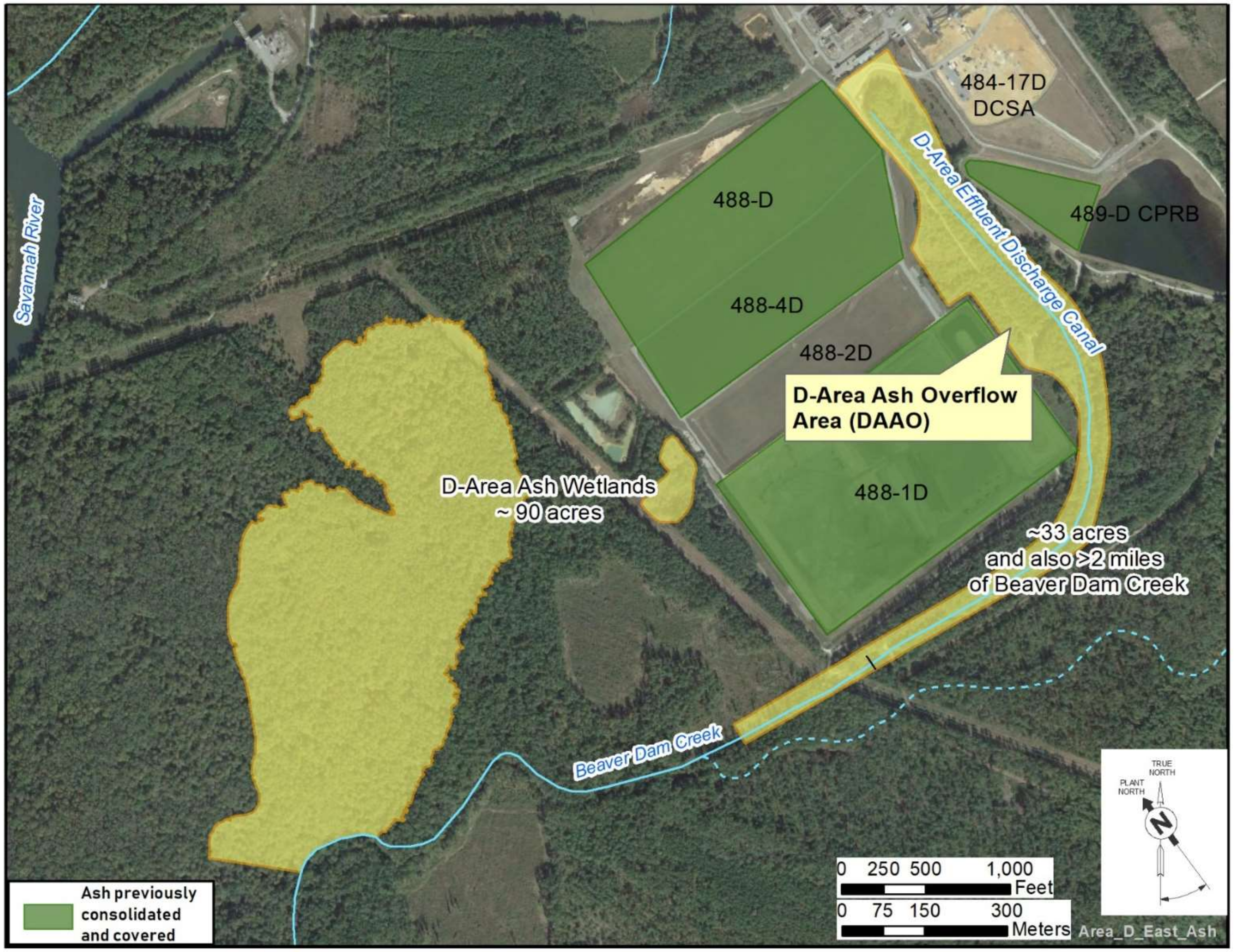

Figure C-2. D-Area Ash Overflow Area and D-Area Ash Wetlands Extent

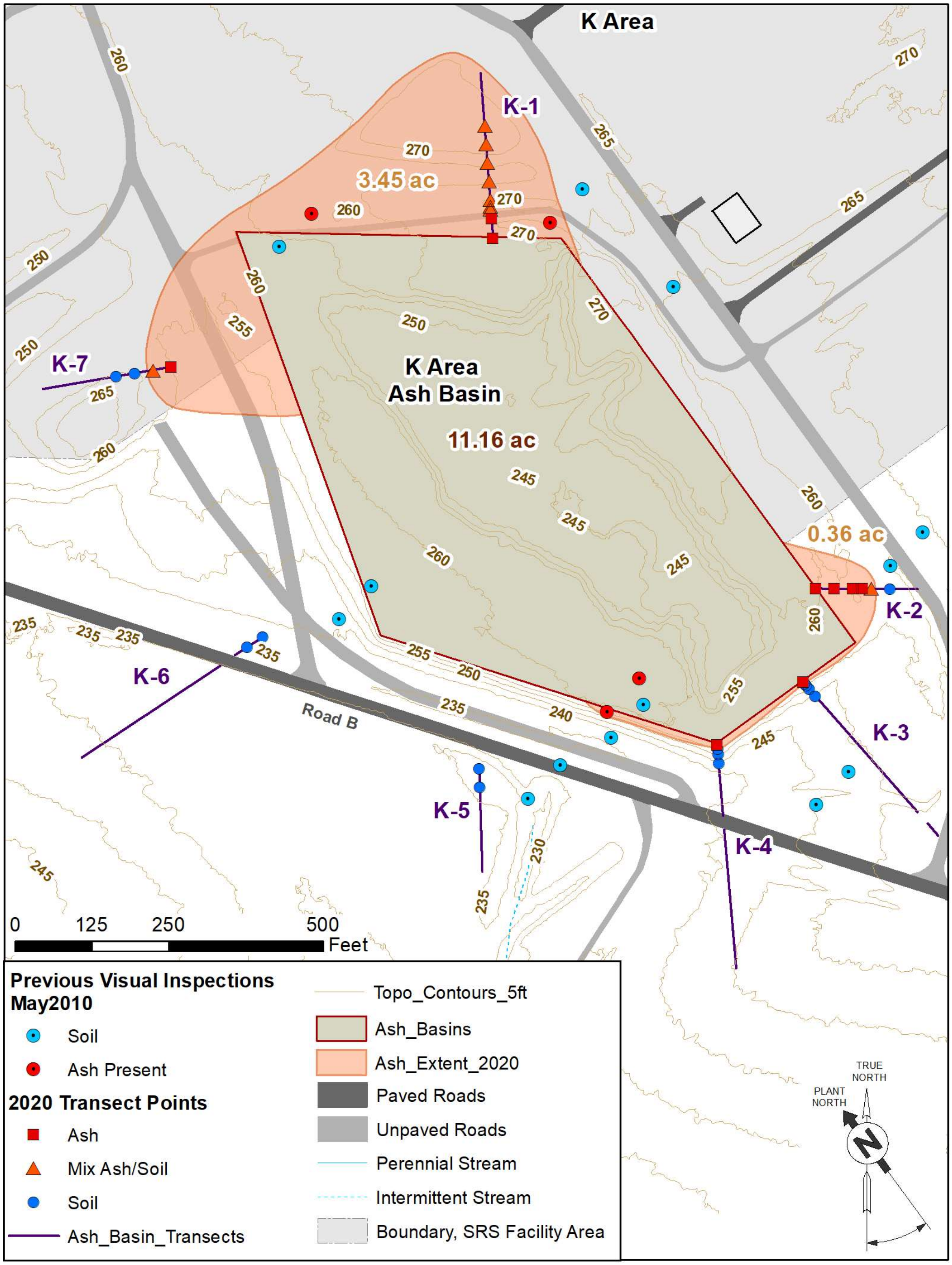

Figure C-3. K-Area Ash Basin Transects and Ash Extent

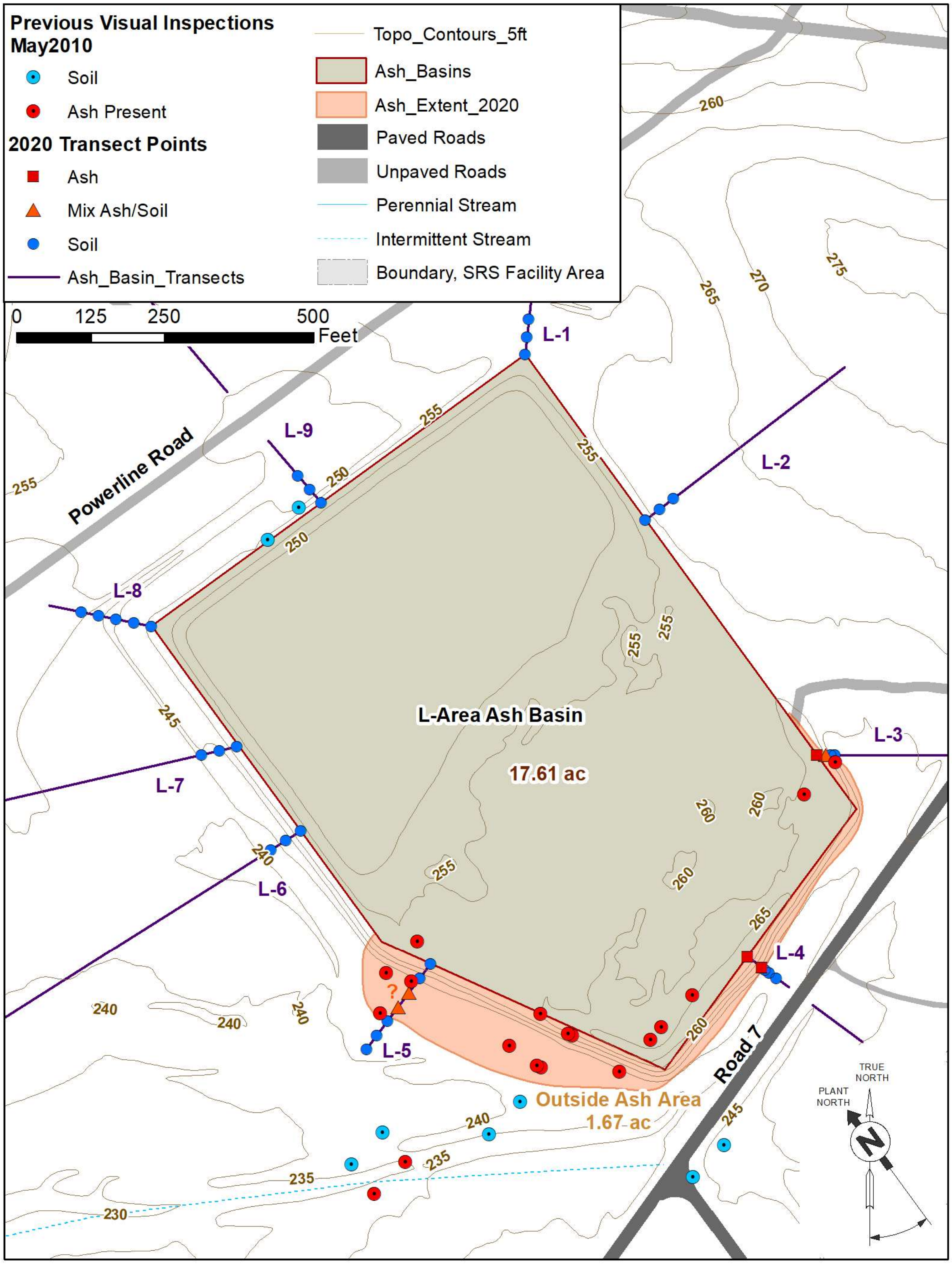

Figure C-4. L-Area Ash Basin Transects and Ash Extent

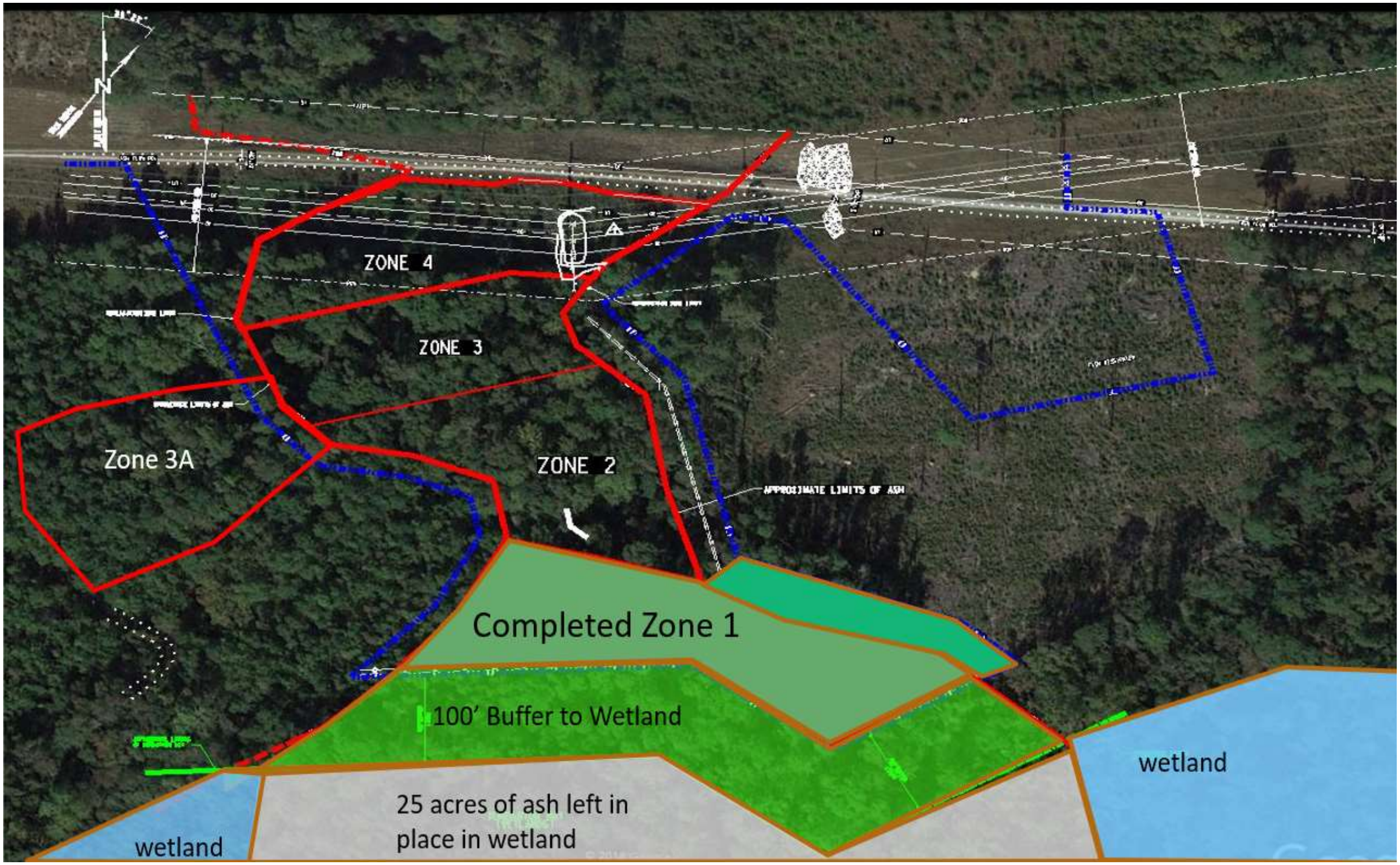

Figure C-5. Wetland Area at Dunbarton Bay Ash Extent

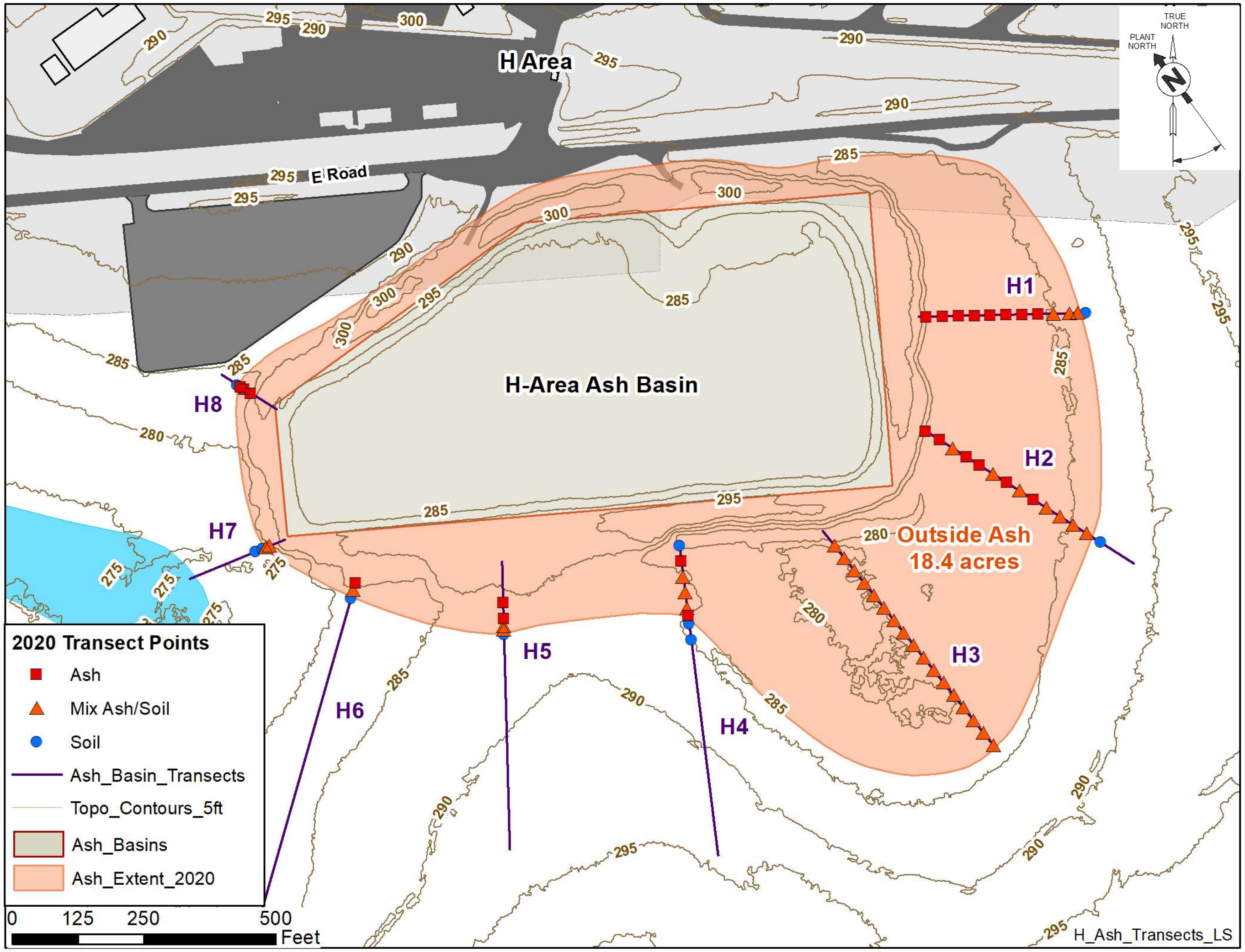

Figure C-6. H-Area Ash Basin Transects and Ash Extent

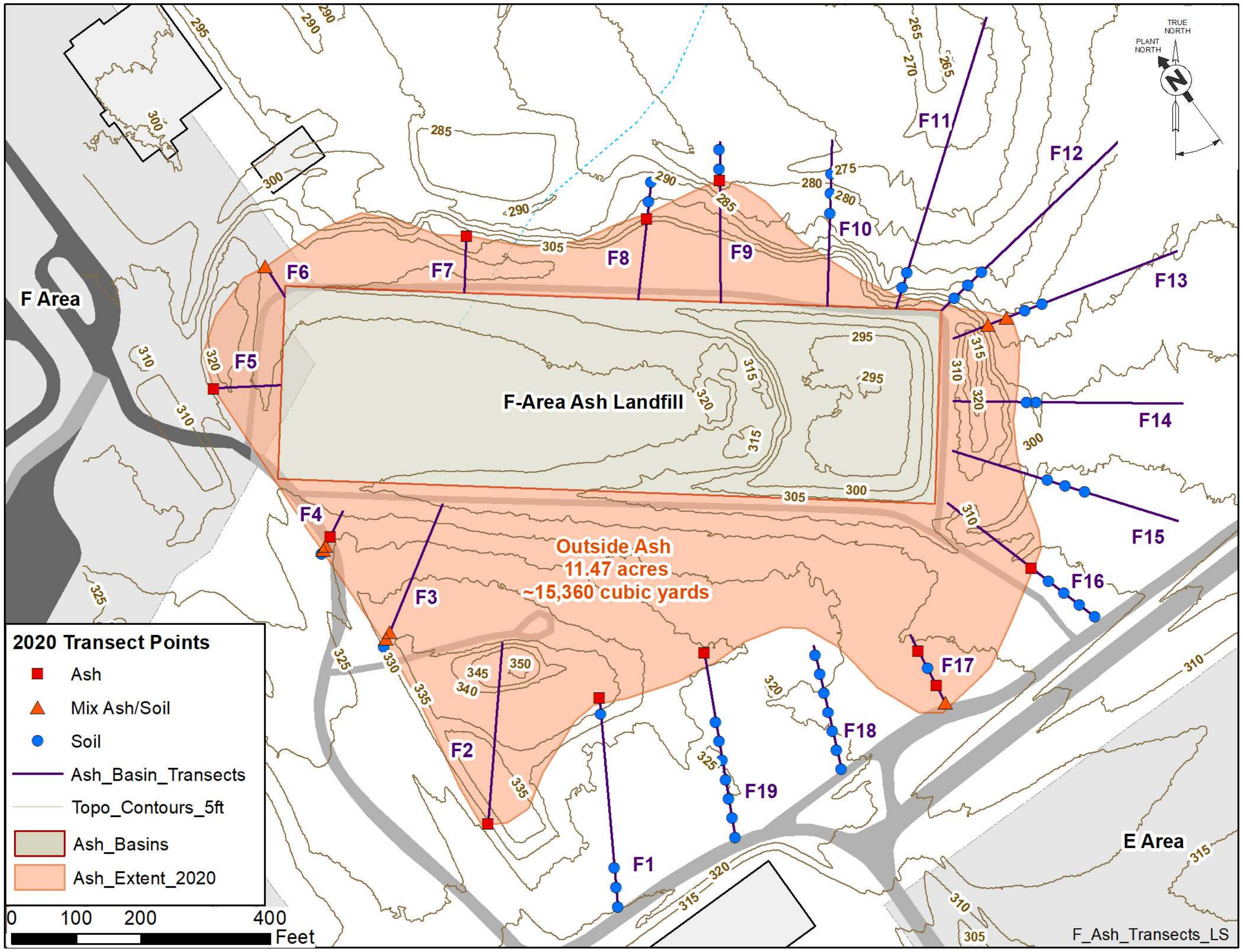

Figure C-7. F-Area Ash Landfill Transects and Ash Extent

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APPENDIX D

Beneficial Reuse Options

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The beneficial reuse of ash/bottom ash, instead of placing it in landfills, avoids the environmental degradation and energy costs associated with mining virgin materials. Beneficial reuse can be either encapsulated or unencapsulated. Encapsulated use of fly ash generally includes its use in concrete products. Unencapsulated examples include the use of fly ash as a structural fill in the subbase material for highway and runway construction, as well as in embankments.

The use of fly ash in concrete increases the strength of concrete and increases durability. According to the American Coal Ash Association (ACAA), for every ton of fly ash used in place of Portland cement about a ton of carbon dioxide is prevented from entering the Earth's atmosphere. Also, it takes the equivalent of 55 gallons of oil to produce a single ton of cement. Another significant benefit of using fly ash is that it requires less water than Portland cement. Boiler slag can be used to replace sand and aggregates.

For unencapsulated use as a structural fill in a non-roadway, the USEPA requires that a demonstration must be provided that shows environmental releases to groundwater, surface water, soil and air will be below relevant regulatory and health-based benchmarks for human and ecological receptors. The most common unencapsulated use of fly ash is in embankments. Using fly ash instead of materials taken from the earth, reduces the environmental impact and provides economic benefits associated with borrow pit construction and ash disposal.

DOE is providing a funding opportunity associated with R&D for beneficial reuse of CCR. R&D under this funding opportunity announcement (FOA) is intended to increase the beneficial use and advance the management of CCR, thereby reducing the volume of CCR needed to be disposed of in impoundments while protecting the environment and the health and safety of the public. One ongoing area of research is in the mining of ash for rare earth elements (REE). A secure, reliable, and sustainable domestic supply of REEs is both essential to the continued health of our Nation's energy and electronics industries and an important contributor to national security. DOE's REE Program has demonstrated the technical feasibility of extracting REEs from coal-based materials. The REE Program has moved into bench-scale and engineering-scale prototype materials processing, with technology and engineering scale up challenges and opportunities being addressed. DOE intends to accelerate the advancement of commercially viable technologies for the extraction of REEs and minerals from U.S. coal and coal by-product sources. (Fed Connect 89243320RFE000032).

Fly Ash:

Fly ash is a pozzolan, a substance containing aluminous and siliceous material and having mechanical and chemical properties that make it a valuable ingredient in a wide range of concrete products. Fly ash's major use is in concrete, substituting for manufactured cement. (NAUC 2020) It makes the concrete measurably stronger and more durable than concrete made with cement alone, and so can commonly be found in roads, bridges, and buildings. Because cement requires extreme heat for production, substituting fly ash for cement in concrete reduces carbon emissions from the offset in cement production. ACAA projects that every ton of fly ash used as a substitute for traditional cement roughly results in one ton of CO2 emission reduction, which approximates two months' average emissions from an automobile. Consequently, based on the average annual use of fly ash in concrete, carbon emissions could be reduced by an estimated 13 million tons of carbon each year. Fly ash is also used in the construction of structural fills and embankments, waste stabilization and solidification, mine reclamation, and as raw feed in cement manufacturing. ACAA cites the American Road & Transportation Builders Association, which estimated that using fly ash in roads and bridges saved $5.2 billion per year in U.S. construction costs. It is also a source of cenospheres, which are microscopic hollow spheres. Cenospheres are strong and lightweight, making them useful as fillers in a wide variety of materials, including concrete, paint, plastics, and metal composites. They are being researched for several new applications as discussed later in this section.

Bottom Ash:

Bottom ash is a heavier, granular material collected from the "bottom" of coal-fueled boilers. Its agglomerated particles are too large to be carried in the flue gases and collect on furnace walls or fall through open grates to an ash hopper at the bottom of the furnace. Bottom ash is often used as an aggregate substitution for sand and gravel and as a lightweight aggregate ingredient in manufacturing concrete masonry or cinder blocks. Like fly ash, it can also be used in constructing structural fills and embankments, mine reclamation, and as raw feed in cement manufacturing.

Boiler Slag:

Boiler slag is a molten ash collected at the base of older generation wet-bottom boilers. Bottom ash is kept in a molten state in the boilers until it is actively removed. It flows into water that cools it rapidly causing it to crystallize immediately into a black, dense, glassy mass that fractures into sharp, angular particles. These particles are known as boiler slag and can be crushed into different sizes for a variety of uses. Boiler slag is in high demand for use as: (i) blasting grit and roofing granules; (ii) a mineral filler in asphalt; (iii) fill material for structural applications and embankments; and (iv) as snow and ice traction control material, as well as feed stock in cement production and aggregate in lightweight concrete products. Almost 90 percent of boiler slag is recycled or reused. However, although demand continues to grow, supplies are decreasing as a result of the retirement of older coal plants.

Potential Beneficial Reuse Options considered in alternative study include beneficiation via the STAR facility in Lexington, SC. This beneficial reuse would allow the fly ash to be treated and transformed to meet the requirements for concrete additives. Additional information about the STAR technology is provided in Appendix D.1. There is uncertainty associated with the use of SRS ash in the STAR facility due to the age of the ash basins/piles, type of coal used and the older, less efficient powerhouses that operated from the 1950s to the early 2000s. The coal at SRS was received from Kentucky, Pennsylvania, and Virginia. It was generally about 1-2% sulfur (WSRC 1989)

Another potential beneficial reuse option includes the use of ash as eventual backfill for the cover systems for F-Area and H-Area tank farms. This beneficial reuse would require the storage of ash unit the tank farms are closed, currently anticipated for 2064. Details about the projected backfill needs for the tank farm closures are provided in Appendix D.2.

The use of the 186 basins for a final disposal option was considered reuse of an existing structure. Volume capacity calculations and photos of the basins are provided in Appendix D.3.

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Appendix D.1

South Eastern Fly Ash (SEFA) Staged Air Turbulent Reactor

Introduction – SEFA Facility Information

The South Eastern Fly Ash (SEFA) Group in Lexington, SC has developed a proprietary thermal beneficiation technology, Staged Turbulent Air Reactor (STAR), to reclaim ash from ponds and landfills as raw feed material in the production fly ash for concrete mixtures (see figure D1-1). The first STAR Plant was built at the SCE&G's McMeekin Station in Lexington SC (see Figure D1-2). This plant was used to process fly ash from the adjacent coal fired power plant. The power plant has since converted to natural gas; therefore, the STAR facility is accepting ash from other sources. The McMeekin STAR Plant is owned and operated by the SEFA Group and is permitted as a stand-alone facility. The plant includes a wet scrubber for control of sulfur emissions, and a Continuous Emission Monitoring System (CEMS) to confirm environmental compliance.

The STAR Plant processes bituminous coal fly ash with raw feed ranging from 5% to 24% loss on ignition (LOI). The process removes all ammonia through chemical decomposition into nitrogen and water vapor and can also reduce other contaminants. The STAR process lowers the amount of unburned carbon, reducing the LOI, and produces a suitable pozzolan for use in Ready-Mix Concrete.

Site Requirements for Pre-processing SEFA Feedstock

Processing the excavated ash from the ash basins and piles in the STAR facility will provide encapsulated beneficial reuse of the material. Multiple environmental and economic benefits of this process are described in Figure D1-3. The heavily vegetated conditions and the mixture of fly ash and bottom ash in the ponds and basins will require on site sorting of organic material and sorting of the coal combustion byproducts by grain size. The larger grain size bottom ash will require shipment to alternate reuse facilities, e.g., as an aggregate in concrete products.

Ash samples from HAB, KAB and LAB were sent to SEFA for evaluation as a feedstock. The analysis of the samples and potential to use the ash in their process is provided in D.1.1. Volume estimates of SRS ash basins provided in D.1.1 were initial estimates and do not reflect the updated volumes as described in Appendix C.

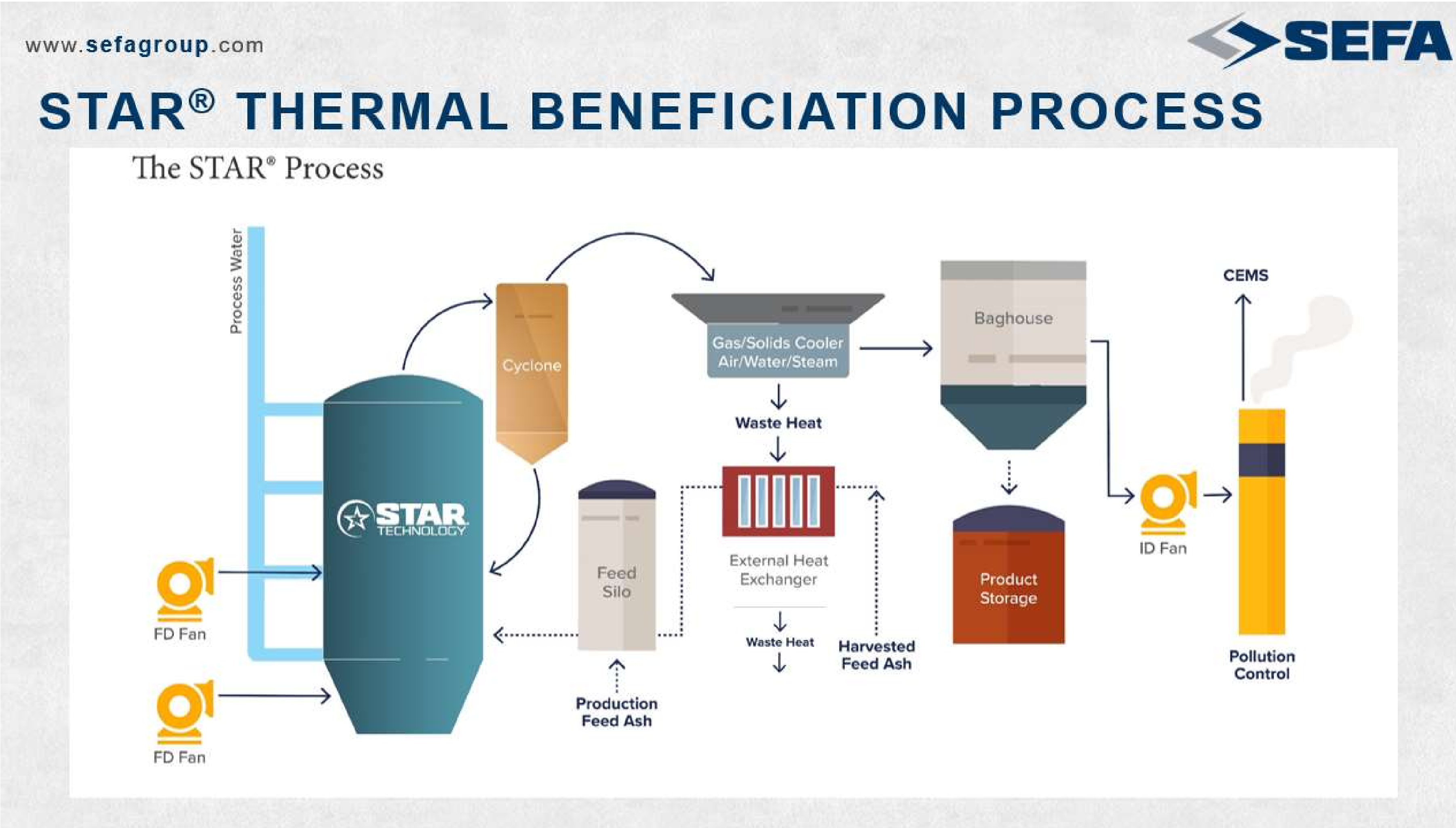


Figure D1-1. STAR Thermal Beneficiation Process Flow

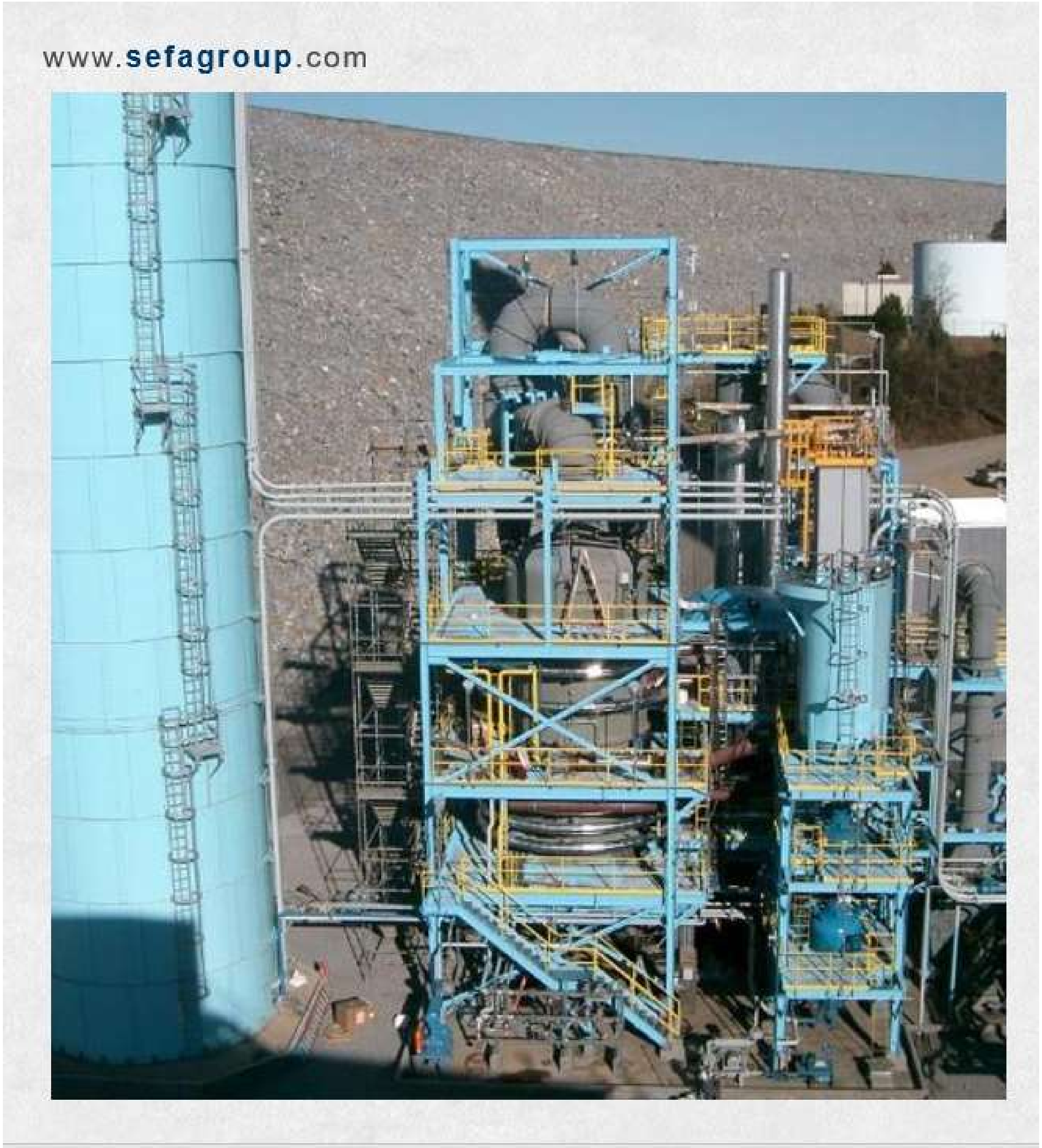


Figure D1-2. STAR McMeekin Plant in Lexington SC

Figure D1-3. Benefits of Processing Ash for Encapsulated Reuse in Concrete Products

SAVANNAH RIVER NUCLEAR SOLUTIONS

SAVANNAH RIVER SITE
PONDED ASH CHARACTERIZATION BENEFICIAL USE SUITABILITY STUDY

AUGUST 2020

217 Cedar Road
Lexington, SC 29073
803.520.9000

SITE DESCRIPTION – SAVANNAH RIVER – CCR/ASH BASIN SITES

The U.S. Department of Energy (DOE) owns the Savannah River Site, which is located within the southwestern portion of South Carolina adjacent to the Savannah River. Savannah River Nuclear Solutions (SRNS) is the management and operations contractor at the Savannah River Site (SRS). As provided by SRNS, under CCR Compliance Data and communications with SEFA's Business Development team, SEFA understands that the Savannah River Site has the following existing CCR Surface Impoundments, which may require closure, depending on final EPA CCR Rule requirements:

- **D-Area Ash Basin Wetlands Savannah River Floodplain (D-Area SRFP)** **[AC = TBD, Vol = TBD]**
- **F-Area Ash Basin, 288-0F** **[AC = 7.0, Vol = 200k cubic yards (CY)]**
- **Wetland Area Dunbarton Bay (WADB)** **[AC = 11.0, Vol = 22k CY]**
- **A-Area Ash Pile 788-A** **[AC = 1.0, Vol = 70k CY]**
- **A-Area Coal Pile Runoff Basin, 788-3A** **[AC = 2.6, Vol = to be determined (TBD)]**
- **D-Area Ash Overflow (DAAO)** **[AC = TBD, Vol = TBD]**
- **K-Area Ash Basin, 188-0K** **[AC = 11.2, Vol = Est. >200k CY]**
- **L-Area Ash Basin, 188-0L** **[AC = 18.0, Vol = Est. 148k CY]**
- **H-Area Ash Basin, 288-0H** **[AC = 13.0, Vol = Est. 150k CY]**
- **H-Area Coal Pile Runoff Basin, 289-H** **[AC = 1.3, Vol = TBD]**

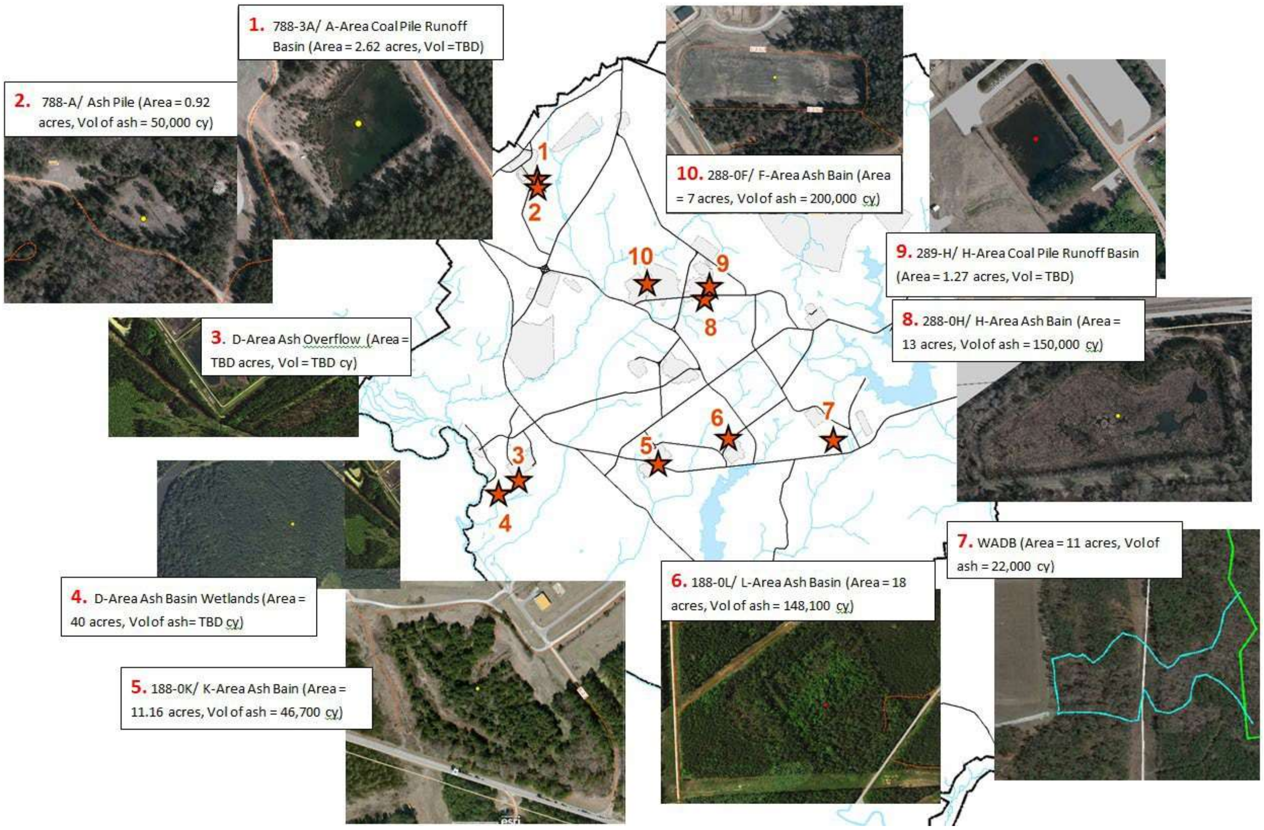
By implementing closure and consolidation plans, SRS may intend to excavate and either reclaim materials for beneficial use or seek to dispose of materials off-site to eliminate the CCR materials from on-site impoundments and associated risks.

Understanding the history of construction of the on-site impoundments and historical material flows to the on-site impoundments is helpful in determining the marketability of impounded combustion byproducts. Comingled ponds may require selective collection, or if there is a substantial mix of bottom ash in the basin a grinding circuit may be required to meet specifications for beneficial use. In basins where FGD waste or alterative waste streams have been deposited, if there is no clear delineation or ability to harvest fly ash from the site without cross contamination, the particular impoundment may not be suitable for beneficial use harvesting.

SRNS was able to provide notes on the existing status and a brief comment to the construction of the impoundments within the 'CCR/Ash Basin Strategy – CCR/Ash Waste Units Requiring Closure' information packet.

Some important notes related to site suitability or ease of reclamation include the distance between impoundment units, access to the site, the condition of the impoundment and the surrounding watershed and construction areas, as well as the characteristics or quality of the materials impounded.

SRNS shared, in earlier communications and during the site visit, that several of the impoundments are covered and heavily vegetated, as well as co-mingled with multiple waste streams or CCR Blends.



From the information provided by SRNS, the on-site observations made during the site visit, and the understanding we were provided about estimated material volumes and characteristics, SEFA was able to test the following basins for beneficial use consideration, specifically for use as a supplementary cementitious material (SCM) in the ready mixed concrete (RMC) market.

Test Type	SRS H-Area
LOI	30.51
Moisture	48.00%
Sieved LOI	27.79

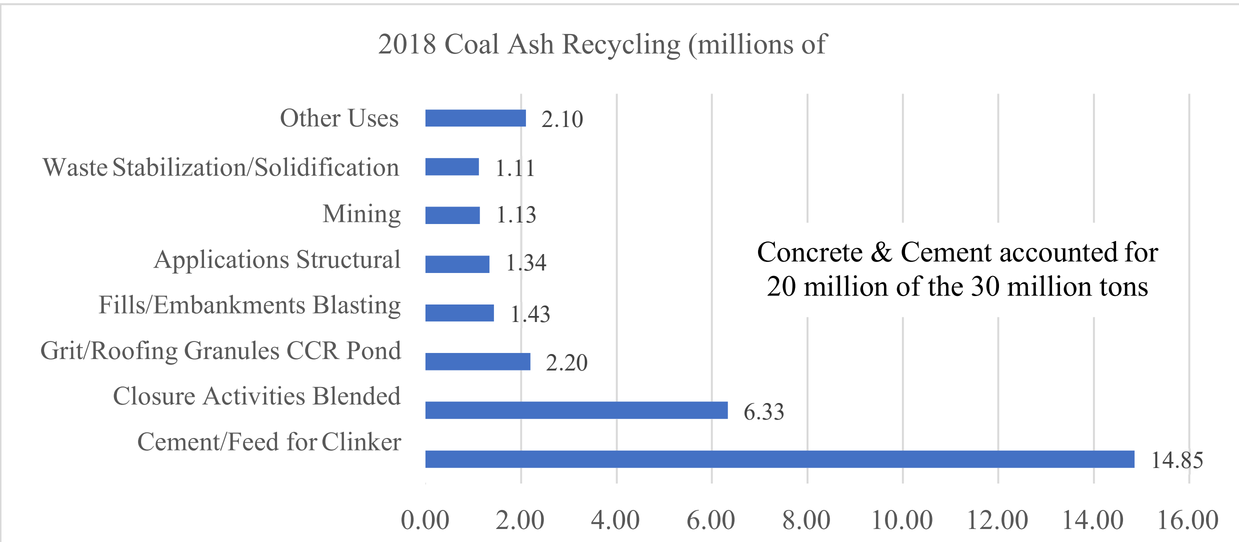
Test Type	SRS K-Area
LOI	34.59
Moisture	18.00%
Sieved LOI	21.54

Test Type	SRS L-Area
LOI	32.47
Moisture	21.00%
Sieved LOI	24.45

BENEFICIAL USE SUITABILITY – CONCRETE INDUSTRY

ENCAPSULATED BENEFICIAL USE IN READY-MIXED CONCRETE (RMC)

SEFA's primary market for fly ash as a supplementary cementitious material (SCM) has always been the Ready-Mixed concrete industry. Use within the concrete industries, including Blended Cement & Kiln Feed accounts for well over 50% of all fly ash usage, according to the American Coal Ash Association (ACAA) 2018 Usage Report.



Whether marketing material from by-product sources or beneficiated processes, SEFA ensures that all materials sold meet relevant specifications and customer requirements for the region of use, which may vary slightly from state to state. However, most State Department of Transportation (DOT) programs and specifications are based on the following standards:

ASTM C311/C311M-19: *Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete*

ASTM C618-19, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
AASHTO M295 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
State DOT specifications typically require fly ash (Class F/C) to meet the following:

- Loss on Ignition (LOI) of less than 6.0% (ASTM C618) or 5.0% (AASHTO M295)
  - **Georgia State DOT reduces the LOI specification to 5.0% or less. (AASHTOI M295)**
- Calcium Oxide (CaO) is the determining constituent between Class C and Class F ash
- Sum of Silicon Dioxide, Iron Oxide & Aluminum Oxide at a minimum of 50.0% for C and 70.0% for F Ash.
- Sulfur Trioxide content no greater than 5.0%
- Fineness - % retained on #325 Sieve no greater than 34%

- Moisture Contents less than 3.0% (for any recovered impounded materials, a drying or thermal process may likely be required to meet this requirement). Pneumatic conveying requires <1.0% Moisture Content.
- Additional performance limitations related to strength activity, expansion, uniformity, and water requirements are specified but not relevant to the data provided by SRNS to date

Based on a very simple model of the McMeekin STAR Capacity within the ash quality values shared by SRNS, the CCR impoundments could potentially begin reclamation and marketing within 2 years of commercial operation. Assuming that the remaining SRS impoundments are available for harvesting and an estimated total CCR volume of 1,000,000 CY is excavated and beneficiated, the STAR Facility would be able to operate and complete recycling within 5-6 years of start-up, depending on the amount of non-ash waste/overburden materials within the site. These capacity values are estimated from the information provided as well as the test result data on the ash characteristics. Assuming Waste of 10%, Moisture Content of < 5.0% and the estimated Loss on Ignition (LOI) of the lower end of 20.0%.

*** CONFIDENTIAL ***

SEFA Capacity Model

Savannah River Site- Target (CY)	**1,000,000**	**Non-Ash Waste %**	**10.00%**
Total CCR Material (tons)	**1,200,000**	**Avg. Moisture**	**5.00%**
Adjusted CCR Material (tons)	**780,000**	**Avg. Feed LOI**	**20.00%**
Annual McM STAR Capacity (tons)	**120,000**		

Year		SRS Production (months)	STAR Operation (months)	Excavated Ash Volume (tons)	Recycled Feed to STAR (tons)	Total Recycled (Tons)
2022	**0**	12	12	120,000	120,000	120,000
2023	**1**	12	12	120,000	120,000	120,000
2024	**2**	12	12	120,000	120,000	120,000
2025	**3**	12	12	120,000	120,000	120,000
2026	**4**	12	12	120,000	120,000	120,000
2027	**5**	12	12	120,000	120,000	120,000
2028	**6**	6	12	60,000	60,000	60,000

Total Tons Recycled	**780,000**
Total CY Beneficiated	**650,000**

SAVANNAH RIVER SITE ASH ANALYSIS RESULTS

Test Type	SRS H-Area
LOI	30.51
Moisture	48.00%
Sieved LOI	27.79

Test Type	SRS K-Area
LOI	34.59
Moisture	18.00%
Sieved LOI	21.54

Test Type	SRS L-Area
LOI	32.47
Moisture	21.00%
Sieved LOI	24.45

H-Area		
Sieve #	Amount in Sieve *(grams)*	Percent
50	27.1451	34%
100	11.3221	14%
200	11.908	15%
Pan	29.6512	37%
Total *(grams)*	**80.0264**	**100%**

K-Area		
Sieve #	Amount in Sieve *(grams)*	Percent
50	63.8925	80%
100	5.7435	7%
200	4.4194	7%
Pan	6.2455	6%
Total *(grams)*	**80.3009**	**100%**

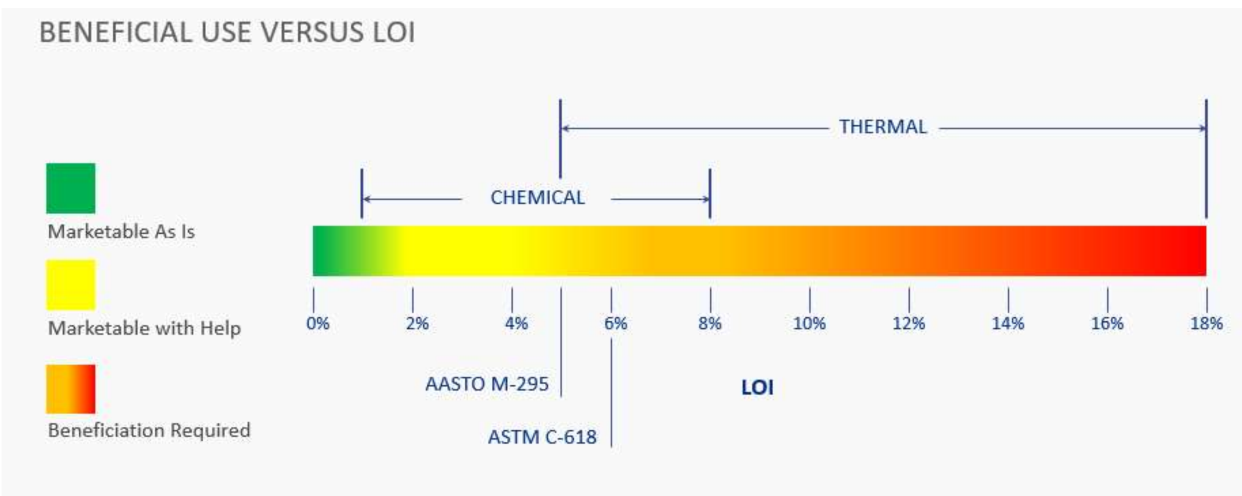
L-Area		
Sieve #	Amount in Sieve *(grams)*	Percent
50	63.9267	80%
100	6.4178	8%
200	3.9586	5%
Pan	5.6095	7%
Total *(grams)*	**79.9126**	**100%**

SUMMARY OF INITIAL FINDINGS

LOSS ON IGNITION

The Loss on Ignition (LOI) values of the materials collected and tested from SRS were on the high end of typical STAR feed ash, however, STAR can process ash at any LOI. Considering additional measures to improve beneficiation of high LOI materials would be advantageous, including blending SRS material with alternative sources that present a low LOI profile , blending during excavation to balance LOIs in- situ, and blending the SRS ash with additionally sourced materials of lower LOIs, either from ponds onsite or within Georgia CCR systems.

Based solely on LOI values, the expectation that SRS CCR materials would be blended with low LOI sources would increase the amount of time required to process all of SRS CCR materials. For each ton of lower LOI material required to blend the feed stock down to a more suitable level, a ton of SRS material would be displaced within the STAR Feed volumes. Alternative markets may be a suitable solution for SRS, including cement kiln feed markets, which typically seek higher LOI blend as selective materials for the increased fuel or heat value of the materials.



MOISTURE

In a typical pond excavation and reclamation process, the material is often field screened with a $^3/_8$" or a #100 screen depending on the beneficiation technology being considered. Moisture content can be best controlled to supply a < 30% moisture feed material during excavation and as part of a process feed storage management program, by windrowing materials in-field and managing water content during

pre-process staging of feed material for further processing. Excavated fly ash from impoundments will need drying to achieve low moisture contents (often less than 1.0%) to facilitate conveying as well as to meet specification. Moisture Contents of the SRS materials are in line with what SEFA has typically seen across impounded material sites.

PARTICLE SIZE

The particle size profiles of the SRS Pond ash are favorable for STAR beneficiation, as well as other non-thermal beneficiation, however, additional analysis or confirmation of results is recommended, since the values do not typically vary to the degree presented. The portion passing this initial screening is then typically analyzed for particle size distribution. Particle size distribution plays a larger role in fly ash performance in concrete and concrete products. SEFA often designs a size classification recycle circuit for the feed material of a STAR which help maximize the amount of material we can process through a STAR for beneficial use in the concrete industry. With additional particle size analysis data, SEFA can help determine the appropriate equipment or technology to allow for particle classification to bring the materials within Specifications. We can also identify potential markets for the remaining fines for an alternative beneficial use.

CONCLUSION

SEFA's typical targeted ranges for STAR Thermal Beneficiation vary depending on a variety of factors and conditions, but generally, for process design engineering the ash characteristics used for a feed source are most ideal within a 6.0 to 12.0% LOI range, at a moisture content of <30%, with sufficient fines and no organic materials > 3/8". The STAR can process coal ash of almost any LOI, however, when processing a coal ash of greater than 18% LOI, blending of lower LOI source CCRs may be required to sustain optimal operation. Though each application must be analyzed on its own merits. There is always the possibility of blending high and low LOI sources to achieve an ideal blend.

Generally, the area of concern within the data set provided from SRS Ponds is the extremely high LOI values and the general deviation between Pond Sieve analysis results. There are several samples across each unit tested that do not currently meet specification for use in DOT projects or meet ASTM/AASHTO specifications. If it appears that the material in question cannot achieve the fineness specification after excavation, a small size classification circuit to process the raw feed material can be added to the scope of the beneficiation facility or pre-processing/drying system. Screening operations in the field can be performed to eliminate large foreign materials (> 3/8") prior to processing. Moisture content can be best controlled to supply a < 30% feed material during excavation and as part of a storage management program, by windrowing materials in-field and managing water content during pre-process staging.

Excavated fly ash from impoundments will need drying to achieve low moisture contents (less than 3.0%) to facilitate conveying as well as to meet specification.

Based on the samples provided for the preliminary data analysis shared with SEFA by SRNS, it is of our opinion that these ponds contain fly ash material that could potentially be beneficiated with the intent of beneficial reuse into the concrete industry, if a lower LOI source used in conjunction to allow for blending and lowering the overall STAR Feed LOI values.

The SRS ponded materials, as the data shared shows, have characteristics typically seen more favorably within the Cement Kiln feed industry, but values of up to 25% LOI have been processed through the STAR facility previously and we are currently utilizing multiple feed sources for operations at McMeekin Station STAR.

Appendix D.2

Use of Ash Material as Structural Fill for Final Cover Systems for the F-Area and H-Area Tank Farms.

Beneficial Reuse as Structural Fill Underneath the H-Area and F-Area Tank Farms Final Cover Systems

The final closure action for the F-Area and H-Area tank Farms will include a multilayer cover system. The conceptual design for these cover systems includes a foundation layer with a minimum thickness of 7 ft under multiple layers including an erosion barrier, geotextile fabric, a drainage layer, high density polyethylene (HDPE) Geomembrane, and a geosynthetic clay liner. The layers above the foundation layer will have a thickness greater than 7 ft. The volume of material estimated for the foundation layer is more than 2.6 M yd^3.

F-Area and H-Area Preliminary Design of Final Cover Systems

The Consolidated General Closure Plan for F-Area and H-Area Waste Tank Systems (CGCP) (SRR-CWDA-2017-00015) was prepared to support the future removal from service (RFS) of the F Area Tank Farm (FTF) and H Area Tank Farm (HTF) underground radioactive waste tanks and ancillary structures at the Savannah River Site (SRS) that are regulated under the F and H Area High Level Radioactive Waste Tank Farms Construction Permit No. 17424-IW. The SRS Federal Facility Agreement (FFA) will control the subsequent remediation of the F-Area Tank Farm and H-Area Tank Farm. The FFA lists a remedial action start date for the final closure of the F-Area and H-Area tank farms as April 2041 and May 2046, respectively.

The CGCP does not contain closure cap details and instead defers to the F-Area and H-Area Tank Farm Performance Assessments (PA) (SRS-REG-2007-00002, SRR-CWDA-2010-00128), with details of the potential closure caps contained in Section 3 of the PAs. The PA closure cap design details are drawn from WSRC-STI-2007-00184, Revision 2 (FTF Closure Cap Concept and Infiltration Estimates).

In general, the acceptability of a particular fill material would depend on its properties and its ability to meet the assumptions of WSRC-STI-2007-00184 (particularly with respect to structural stability). The best use of the ash material in the final cover system would be for the lower backfill as the PA modeling takes no infiltration credit for that layer. The function of the lower backfill (foundation layer) includes the following:

- Provide structural support of the rest of the overlying closure cap
- Produce the required contours to a slope of 2% for the overlying layers
- Produce the maximum 3:1 side slopes of the closure cap
- Provide a smooth surface free from deleterious materials for installation of the geosynthetic clay liner
- Promote drainage of infiltration water away from and around the tanks and ancillary equipment, and
- Contain utilities, equipment, facilities, etc. that are not removed from above current grade prior to installation of the closure cap.

All the other soil layers have specific transport properties assumed in the closure cap calculations. The lower backfill is the largest volume material so it is ideal in terms of reusing ash material in place of virgin material. A schematic drawing of the generic closure caps for the H-Area and F-Area tank farms is provided in Figure D2.1. In this schematic, the "Foundation Layer" consists of the Lower Backfill will have a minimum thickness of 7 ft (84-inches thick) and a 12-inch thick foundation layer that consists of

The F-Area and H-Area tank farm closure cap quantity estimates of the volumes of the various cap layers are provided in Table D2-1. The designs of the TF closure caps were based on the most recent topography and locations of tank units and these quantities are subject to change with change in conditions. The quantities are also based on an incomplete design but should represent an approximation of the mass properties. The HDPE and GCL areas were deemed to be close enough that the totals were deemed to be the same. All quantities are "neat" quantities and have not been adjusted for earthwork compaction or overlap and waste of geosynthetics.

Table D2-1. F-Area and H-Area Tank Farm Closure Cap Quantity Estimates.

	FTF Totals	HTF Totals	Units
6-feet (ft) Topsoil	12,100	18,500	yd^3
30-ft Upper Backfill	61,100	93,300	yd^3
12-ft Erosion Barrier	25,600	40,000	yd^3
Middle Backfill	26,100	49,000	yd^3
12-ft Drainage Layer	26,500	41,700	yd^3
12-ft Foundation Layer	26,900	42,600	yd^3
Lower Backfill	766,600	1,853,800	yd^3
HDPE/GCL	80,000	126,500	yd^2
Riprap	30,300	109,400	yd^3
6-ft Stone Bedding	6,600	22,200	yd^3
Overall Cap Area	21	49	ac

ac = acre yd^2 = square yards yd^3 = cubic yards

WSRC-STI-2007-00184, REVISION 1

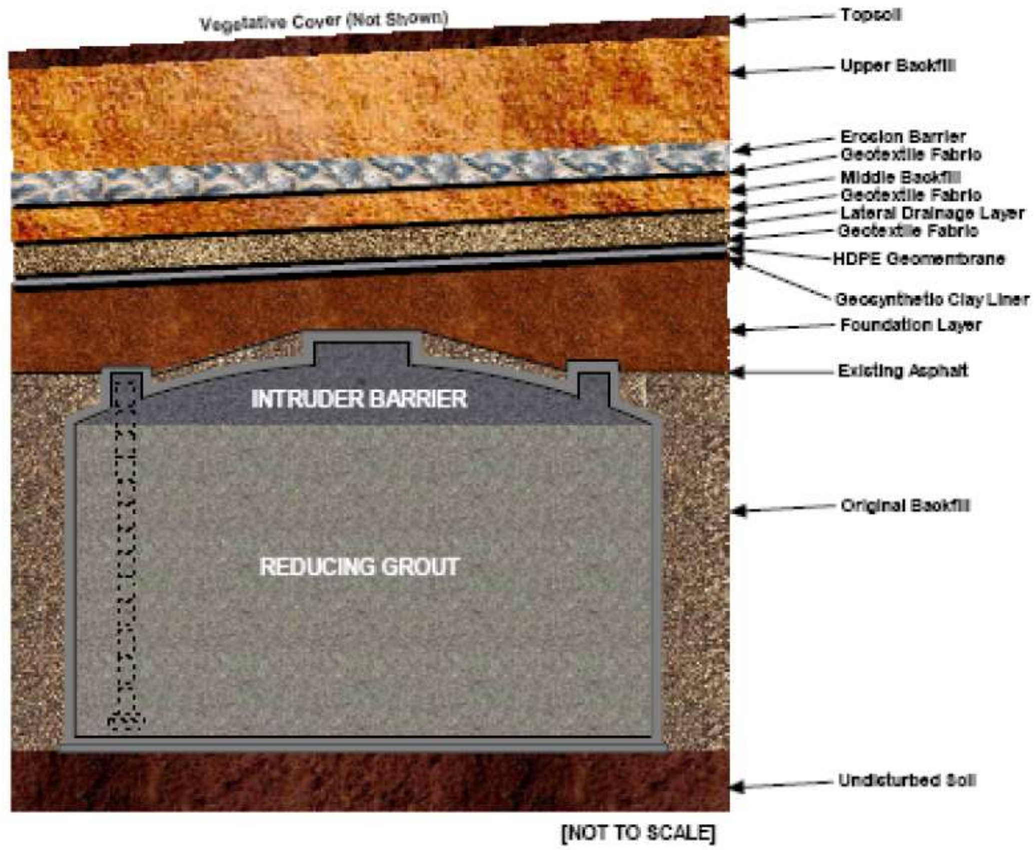


Figure D2-1. Generic Tank Farm Closure Cap

Appendix D.3

Reuse of 186 Basins in Reactor Areas for Final Ash Storage

186-C

W142683, W142685, W142686

186-C Dimensions

Total Length: 800 ft **Total Width:** 248 ft **Total Height:** 19 ft 3 in

- Length used 792 ft (Compensation for width of perimter and enclosed walls)
- Width used 245 ft (Compensation for width of perimter walls)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 792 X 245 X 18.75 = 3,638,250 ft^3

186-C Pump Well Dimensions

Total Length: 266 ft **Total Width:** 29 ft **Total Height:** 19 ft 3 in

- Pump well is only located in the middle section of 186 basin (Basin has three sections)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 266 X 29 X 18.75 = 144,638 ft^3

Final Calculation:

3,638,250 - 144,638 ft3 = 3,493,613 ft^3

ft^3 to yd^3: 1 cubic feet to cubic yards = 0.037 cubic yards

3,493,613 X 0.03704 = **129,403 yd^3**

186-K

W139196, W139198, W139200

186-K Dimensions

Total Length: 800 ft   Total Width: 248 ft   Total Height: 19 ft 3 in

- Length used 792 ft (Compensation for width of perimter and enclosed walls)
- Width used 245 ft (Compensation for width of perimter walls)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 792 X 245 X 18.75 = 3,638,250 ft3

186-K Pump Well Dimensions

Total Length: 266 ft   Total Width: 29 ft   Total Height: 19 ft 3 in

- Pump well is only located in the middle section of 186 basin (Basin has three sections)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 266 X 29 X 18.75 = 144,638 ft3

Final Calculation:

3,638,250 - 144,638 ft3 = 3,493,613 ft3

ft^3 to yd^3: 1 cubic feet to cubic yards = 0.037 cubic yards

3,493,613 X 0.03704 = **129,403 yd3**

186-L

W139020, W139022, W139023

186-L Dimensions

Total Length: 800 ft **Total Width:** 248 ft **Total Height:** 19 ft 3 in

- Length used 792 ft (Compensation for width of perimter and enclosed walls)
- Width used 245 ft (Compensation for width of perimter walls)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 792 X 245 X 18.75 = 3,638,250 ft3

186-L Pump Well Dimensions

Total Length: 266 ft **Total Width:** 29 ft **Total Height:** 19 ft 3 in

- Pump well is only located in the middle section of 186 basin (Basin has three sections)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 266 X 29 X 18.75 = 144,638 ft3

Final Calculation:

3,638,250 - 144,638 ft3 = 3,493,613 ft3

ft^3 to yd^3: 1 cubic feet to cubic yards = 0.037 cubic yards

3,493,613 X 0.03704 = **129,403 yd3**

186-P

W136259, W136260, W136494

186-P Dimensions

Total Length: **800 ft** **Total Width:** **248 ft** **Total Height:** **19 ft 3 in**

- Length used 792 ft (Compensation for width of perimter and enclosed walls)
- Width used 245 ft (Compensation for width of perimter walls)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 792 X 245 X 18.75 = 3,638,250 ft3

186-P Pump Well Dimensions

Total Length: **266 ft** **Total Width:** **29 ft** **Total Height:** **19 ft 3 in**

- Pump well is only located in the middle section of 186 basin (Basin has three sections)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 266 X 29 X 18.75 = 144,638 ft3

Final Calculation:

3,638,250 - 144,638 ft3 = 3,493,613 ft3

ft^3 to yd^3: 1 cubic feet to cubic yards = 0.037 cubic yards

3,493,613 X 0.03704 = **129,403 yd3**

186-R

W136091, W136102, W136312

186-R Dimensions

Total Length: 800 ft Total Width: 248 ft Total Height: 19 ft 3 in

- Length used 792 ft (Compensation for width of perimter and enclosed walls)
- Width used 245 ft (Compensation for width of perimter walls)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 792 X 245 X 18.75 = 3,638,250 ft3

186-R Pump Well Dimensions

Total Length: 266 ft Total Width: 29 ft Total Height: 19 ft 3 in

- Pump well is only located in the middle section of 186 basin (Basin has three sections)
- Height used 18 ft 9 in (Compensation for slope of basin floor)
- Calculation:
  - 266 X 29 X 18.75 = 144,638 ft3

Final Calculation:

3,638,250 - 144,638 ft3 = 3,493,613 ft3

ft^3 to yd^3: 1 cubic feet to cubic yards = 0.037 cubic yards

3,493,613 X 0.03704 = **129,403 yd3**

Figure D3-1. – 186-C Photo

Figure D3-2 – 186-K Photo

Figure D3-3 – 186-L Photo

Figure D3-4 – 186-P Photo

Figure D3-5 – 186-P Photo

APPENDIX E

Cost Estimates

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Table E-1. Estimated Costs for Each Alternative – In-Situ Options

Alternative #	Options to Evaluate	IA/ FA	Alternative #	Candidate Sites	COST						Footprint Reduction
					Total Estimated Project	Capital	Short Term O&M	Long Term O&M	Transport & Handling	Offsite Disposal	
IN SITU OPTIONS											
1	**Land Use Controls w/Beneficial Reuse**	**IA**	H-1	H-Ash Basin	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
		IA	HC-1	H-CPRB	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
		IA	K-1	K-Ash Basin	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
		IA	L-1	L-Ash Basin	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
		IA	W-1	WADB	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
	No Beneficial Reuse	**FA**	D-1	D-Ash Basin W	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
		FA	DO-1	D-Overflow	$190,920	$31,185	$43,760	$159,735	$0	$0	0.0
2	**Cap in Place w/SCDHEC Class II Cover System w/Beneficial Reuse**	**IA**	A-2	A-Ash Pile	$2,201,584	$1,812,809	$11,484	$388,775	$0	$0	0.0
		IA	AC-2	A-CPRB	$1,556,119	$1,167,344	$10,640	$388,775	$0	$0	0.0
		IA	L-2	L-Ash Basin	$6,311,835	$5,382,973	$22,397	$928,862	$579,785	$0	9.0
		IA	K-2	K-Ash Basin	$5,651,282	$5,025,858	$13,692	$625,424	$490,035	$0	5.1
		IA	H-2	H-Ash Basin	$6,438,867	$5,703,524	$16,845	$735,343	$464,905	$0	6.5
	No Beneficial Reuse	**FA**	F-2	F-Ash Landfill	$5,213,368	$4,710,248	$10,183	$503,120	$0	$0	0.0
3	**In-situ Stabilization with soil cover**	**FA**	L-3	L-Ash Basin	$127,970,789	$127,022,405	$22,397	$948,385	$0	$0	0.0
		FA	H-3	H-Ash Basin	$102,684,046	$101,929,181	$16,845	$754,866	$0	$0	0.0
		FA	W-3	WADB	$8,026,621	$7,620,090	$6,852	$406,531	$0	$0	0.0
4	**Cap In-Place w/SCDHEC Class III Cover System**	**FA**	F-4	F-Ash Basin	$6,878,721	$6,376,488	$10,183	$502,233	$0	$0	0.0
		FA	L-4	L-Ash Basin	$9,266,361	$8,998,623	$22,397	$267,737	$579,785	$0	9.0
		FA	K-4	K-Ash Basin	$7,103,563	$6,680,733	$13,692	$422,830	$490,035	$0	5.1
		FA	H-4	H-Ash Basin	$8,345,146	$7,862,792	$16,845	$482,354	$464,905	$0	6.5

Reference: Excel File: ***Ash Basin Cost Estimates*** **Worksheet:** ***Alternatives***

Table E-2. Estimated Costs for Each Alternative – Excavate and Haul Onsite Options

Alternative #	Options to Evaluate	IA/ FA	Alternative #	Candidate Sites	COST						Footprint Reduction
					Total Estimated Project	Capital	Short Term O&M	Long Term O&M	Transport & Handling	Offsite Disposal	
EXCAVATE & HAUL OPTIONS											
5	Consolidate at multiple locations and Cap In-Place w/ SCDHEC Class II Cover System w/Beneficial Reuse	IA	AC-5	F-Tank Farm, stage @A-CPRB A-Ash	$11,411,094	$10,886,645	$13,035	$524,449	$2,120,794	$0	3 ac Initial 5.62 ac Final
		IA	H-5	H-Tank Farm, stage @H-Ash Basin K/L, H-CPRB, WADB Ash	$92,088,381	$90,858,862	$76,313	$1,229,519	$14,186,974	$0	40.43 ac Initial 53.43 ac Final
		IA	K-5	H-Tank Farm, stage @K-Ash Basin L-Ash, WADB Ash	$69,843,246	$68,832,462	$53,674	$1,010,784	$15,520,042	$0	29 ac Initial 39.16 ac Final
		IA	L-5	H-Tank Farm, stage @L-Ash Basin K-Ash, WADB Ash	$65,816,809	$64,449,793	$53,674	$1,367,016	$13,771,987	$0	21.16 ac Initial 39.16 ac Final
	No Beneficial Reuse	FA	AC-5a	A-CPRB	$4,691,298	$4,153,814	$13,035	$537,484	$847,700	$0	3.0
6	Consolidate at Existing Ash Basin w/SCDHEC Class III Cover	FA	AC-6	A-CPRB	$5,315,952	$4,778,468	$13,035	$537,484	$847,700	$0	3.0
		FA	A-6	A-Ash Pile	$3,776,966	$3,776,966	$11,693	$758,607	$121,100	$0	2.6
		FA	K-6	K-Ash Basin	$58,956,826	$57,772,656	$89,348	$1,184,170	$14,585,151	$0	55.9
		FA	L-6	L-Ash Basin	$63,501,465	$61,961,063	$89,348	$1,540,402	$13,084,131	$0	48.1
7	Construct Onsite SCDHEC Permitted Landfill	FA	N-7	N-Area	$236,532,699	$235,704,277	$130,788	$828,422	$17,878,580	$0	-5.3

Table E-2. Estimated Costs for Each Alternative – Excavate and Haul Onsite Options *(Continued/End)*

Alternative #	Options to Evaluate	IA/ FA	Alternative #	Candidate Sites	COST						Footprint Reduction
					Total Estimated Project	Capital	Short Term O&M	Long Term O&M	Transport & Handling	Offsite Disposal	
EXCAVATE & HAUL OPTIONS											
8	Excavate and Ship for Encapsulated Beneficial Reuse.	FA	S-8	SEFA via Truck	$71,318,232	$71,318,232	$398,227	$0	$52,953,230	$0	51.2
		FA	S-8	SEFA via Rail	$72,971,571	$72,971,571	$398,227	$0	$59,407,656	$0	51.2
9	Excavate and Store/Entomb in 186 Basins	FA	C-9	186-C	$8,455,901	$7,750,928	$34,741	$704,973	$2,102,778	$0	5.6
		FA	L-9	186-L	$11,572,868	$10,853,290	$38,428	$537,947	$3,059,684	$0	12.0
		FA	P-9	186-P	$13,270,048	$12,512,816	$47,932	$757,233	$3,341,915	$0	24.0
		FA	R-9	186-R	$9,896,076	$9,181,645	$37,129	$714,431	$2,534,448	$0	14.3
10	Excavate and Dispose at TRL	FA	T-10	Three Rivers Landfill	$167,060,722	$166,706,748	$353,974	$0	$25,883,312	$91,102,374	51.2

Reference: Excel File: ***Ash Basin Cost Estimates*** **Worksheet:** ***Alternatives***

Table E-3. Estimated Costs for Each Ash Site

IN-SITU OPTIONS				
In-Situ Cost Estimates	**LUCs Only**	**Cap In-Place w/Class II Cover System**	**Stabilization w/ Soil Cover**	**Cap In-Place w/ SCDHEC Class III Cover system**
Alternative	**1**	**2**	**3**	**4**
DAABW	$190,920			
F-Ash		$5,213,368		$6,878,721
WADB	$190,920		$8,026,621	
A-Ash		$2,201,584		
A-CPRB		$1,556,119		
DAAO	$190,920			
K-Ash	$190,920	$5,651,282		$7,103,563
L-Ash	$190,920	$6,311,835	$127,970,789	$9,266,361
H-Ash	$190,920	$6,438,867	$102,684,046	$8,345,146
H-CPRB	$190,920			
Totals	**$1,336,440**	**$27,373,055**	**$238,681,457**	**$31,593,791**

Reference: Excel File: ***Ash Basin Cost Estimates*** **Worksheet:** ***Summary***

Table E-4. Estimated Costs for Each Ash Site

	Haul to Consolidate Onsite w/ No Beneficial Reuse					Haul to Consolidate Onsite w/Beneficial Reuse					Haul Offsite		
Haul Cost Estimates	**Consolidate at A-CPRB and Cover w/ Soil**	**Consolidate at A-CPRB and Cover w/ GCL**	**Consolidate at KAB and Cover w/ GCL**	**Consolidate at LAB and Cover w/ GCL**	**Consolidate in new Onsite LF**	**Consolidate in 186 basins**	**Stage @A Haul to F Tank Farms**	**Stage @H Haul to H Tank Farms**	**Stage @K Haul to H Tank Farms**	**Stage @L Haul to H Tank Farms**	**Truck Haul to SEFA**	**Rail Haul to SEFA**	**Haul to 3 Rivers Landfill**
Alternative	**5a**	**6**	**6**	**6**	**7**	**9**	**5**	**5**	**5**	**5**	**8**	**8**	**10**
DAABW													
F-Ash											$11,230,001	$8,669,097	
WADB			$3,606,854	$3,514,501	$2,700,641	$3,204,138		$3,618,712	$3,491,873	$3,386,175	$2,742,546	$952,677	$5,315,565
A-Ash	$2,906,897	$2,924,751	$6,090,260	$5,754,533	$4,995,869	$5,377,025	$2,969,976				$4,643,450	$2,861,112	$18,750,584
A-CPRB	$1,784,402	$2,391,201	$1,554,727	$2,168,188	$1,250,592	$1,430,795	$9,374,119				$2,200,050	$429,907	$3,235,913
DAAO													
K-Ash			$9,199,977	$15,074,717	$15,959,403			$18,815,831	$48,978,098	$15,055,839	$15,897,945	$11,112,532	$74,199,673
L-Ash			$18,967,259	$18,151,594	$18,760,036	$9,858,540		$22,898,301	$18,948,265	$49,652,746	$18,333,700	$24,919,931	$92,541,864
H-Ash			$18,627,213	$17,963,553	$13,537,158	$15,802,799		$47,853,683			$14,469,072	$10,558,134	$70,459,825
H-CPRB			$887,751	$879,530	$797,110	$825,656		$731,488			$1,801,470	$302,492	$2,362,359
Disposition Site					$114,192,280	$2,954,746							
Totals	**$4,691,298**	**$5,315,952**	**$58,956,826**	**$63,501,465**	**$236,532,699**	**$39,453,698**	**$11,411,094**	**$92,088,381**	**$69,843,246**	**$65,816,809**	**$71,318,232**	**$72,971,571**	**$167,060,722**

Reference: Excel File: ***Ash Basin Cost Estimates*** **Worksheet:** ***Summary***

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Appendix F

Ranking of Alternatives

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Table F-1. Ranking by Alternative

Alternative #	Options to Evaluate	IA/FA	Alternative Subset #	Candidate Sites	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
	Weighting Factor				**2**	**5**	**8**	**5**	**2**	**2**	**10**	**2**	**2**	**2**	
	IN SITU OPTIONS														
1	**Land Use Controls w/Beneficial Reuse**	**IA**	W-1	WADB	3	0	8	10	0	10	10	10	8	10	**296**
		IA	L-1	L-Ash Basin	3	0	8	10	0	10	10	10	8	10	**296**
		IA	H-1	H-Ash Basin	3	0	8	10	0	10	10	10	8	10	**296**
		IA	K-1	K-Ash Basin	3	0	8	10	0	10	10	10	8	10	**296**
		IA	HC-1	H-CPRB	3	0	8	10	0	10	10	10	8	10	**296**
	No Beneficial Reuse	**FA**	D-1	D-Ash Basin W	3	0	0	10	5	10	10	10	8	10	**242**
		FA	DO-1	D-Overflow	3	0	0	10	5	10	10	10	8	10	**242**
2	**Cap in Place w/SCDHEC Class II Cover System w/Beneficial Reuse**	**IA**	A-2	A-Ash Pile	6	0	8	10	5	5	8	5	5	10	**266**
		IA	AC-2	A-CPRB	6	0	8	10	5	5	8	5	5	10	**266**
		IA	L-2	L-Ash Basin	6	2	8	10	5	10	8	5	5	8	**282**
		IA	K-2	K-Ash Basin	6	2	8	10	5	10	8	5	5	8	**282**
		IA	H-2	H-Ash Basin	6	2	8	10	5	10	8	5	5	8	**282**
	No Beneficial Reuse	**FA**	F-2	F-Ash Landfill	6	0	0	10	10	10	8	5	5	10	**222**
3	**In-situ Stabilization with Soil Cover**	**FA**	L-3	L-Ash Basin	8	0	0	10	5	10	0	5	5	10	**136**
		FA	H-3	H-Ash Basin	8	0	0	10	5	10	0	5	5	10	**136**
		FA	W-3	WADB	8	0	0	10	5	5	8	5	5	10	**206**
4	**Cap In-Place w/SCDHEC Class III Cover System**	**FA**	F-4	F-Ash Landfill	6	0	0	10	5	10	8	5	5	10	**212**
		FA	L-4	L-Ash Basin	6	2	0	10	5	10	8	5	5	8	**218**
		FA	K-4	K-Ash Basin	6	2	0	10	5	10	8	5	5	8	**218**
		FA	H-4	H-Ash Basin	6	2	0	10	5	10	8	5	5	8	**218**

Table F-1. Ranking by Alternative *(Continued)*

Alternative #	Options to Evaluate	IA/FA	Alternative Subset #	Candidate Sites	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
	Weighting Factor				**2**	**5**	**8**	**5**	**2**	**2**	**10**	**2**	**2**	**2**	
	EXCAVATE & HAUL OPTIONS														
5	**Consolidate at multiple locations and Cap In-Place w/ SCDHEC Class II Cover System w/Beneficial Reuse**	**IA**	AC-5	F-Tank Farm, stage @A-CPRB	10	2	8	10	5	5	4	5	5	2	**228**
		IA	H-5	H-Tank Farm, stage @H-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
		IA	K-5	H-Tank Farm, stage @K-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
		IA	L-5	H-Tank Farm, stage @L-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
5a	**No Beneficial Reuse**	**FA**	AC-5a	A-CPRB	6	2	0	10	10	5	8	5	5	4	**210**
6	**Consolidate at Existing Ash Basin w/SCDHEC Class III Cover**	**FA**	AC-6	A-CPRB	10	2	0	10	10	5	8	5	5	4	**218**
		FA	A-6	A-Ash Pile	10	2	0	10	0	5	8	5	5	4	**198**
		FA	K-6	K-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
		FA	L-6	L-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
7	**Construct Onsite SCDHEC Permitted Landfill**	**FA**	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
8	**Excavate and Ship for Encapsulated Beneficial Reuse.**	**FA**	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
		FA	S-8	SEFA via Rail Transport	10	10	2	5	10	5	0	7	10	4	**183**

Table F-1. Ranking by Alternative *(Continued/End)*

Alternative #	Options to Evaluate	IA/FA	Alternative Subset #	Candidate Sites	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
	Weighting Factor				**2**	**5**	**8**	**5**	**2**	**2**	**10**	**2**	**2**	**2**	
	EXCAVATE & HAUL OPTIONS														
9	**Excavate and Store/Entomb in 186 Basins**	**FA**	C-9	186-C	10	6	6	10	10	10	6	7	5	4	**280**
		FA	L-9	186-L	10	6	6	10	10	10	6	7	5	4	**280**
		FA	P-9	186-P	10	6	6	10	10	10	4	7	5	4	**260**
		FA	R-9	186-R	10	6	6	10	10	10	6	7	5	4	**280**
10	**Excavate and Dispose at TRL**	**FA**	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**

Table F-2. Ranking by Ash Site

Ash Site	IA/FA	Alternative Subset #	Disposition Location	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
A-Ash Pile	IA	A-2	A-Ash Pile	6	0	8	10	5	5	8	5	5	10	**266**
	IA	AC-5	F-Tank Farm, stage @A-CPRB	10	2	8	10	5	5	4	5	5	2	**228**
	FA	AC-5a	A-CPRB	6	2	0	10	10	5	8	5	5	4	**210**
	FA	AC-6	A-CPRB	10	2	0	10	10	5	8	5	5	4	**218**
	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	C-9	186-C	10	6	6	10	10	10	6	7	5	4	**280**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**
A-CPRB	IA	A-2	A-Ash Pile	6	0	8	10	5	5	8	5	5	10	**266**
	IA	AC-5	F-Tank Farm, stage @A-CPRB	10	2	8	10	5	5	4	5	5	2	**228**
	FA	AC-5a	A-CPRB	6	2	0	10	10	5	8	5	5	4	**210**
	FA	AC-6	A-CPRB	10	2	0	10	10	5	8	5	5	4	**218**
	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	C-9	186-C	10	6	6	10	10	10	6	7	5	4	**280**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**
D-Overflow	FA	DO-1	D-Overflow	3	0	0	10	5	10	10	10	8	10	**242**
D-Ash Basin W	FA	D-1	D-Ash Basin W	3	0	0	10	5	10	10	10	8	10	**242**
F-Ash Landfill	FA	F-2	F-Ash Landfill	6	0	0	10	10	10	8	5	5	10	**222**
	FA	F-4	F-Ash Landfill	6	0	0	10	5	10	8	5	5	10	**212**

Table F-2. Ranking by Ash Site *(Continued)*

Ash Site	IA/FA	Alternative Subset #	Disposition Location	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
H-Ash Basin	IA	H-1	H-Ash Basin	3	0	8	10	0	10	10	10	8	10	**296**
	IA	H-2	H-Ash Basin	6	2	8	10	5	10	8	5	5	8	**282**
	FA	H-3	H-Ash Basin	8	0	0	10	5	10	0	5	5	10	**136**
	FA	H-4	H-Ash Basin	6	2	0	10	5	10	8	5	5	8	**218**
	IA	H-5	H-Tank Farm, stage @H-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	FA	K-6	K-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	L-6	L-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	R-9	186-R	10	6	6	10	10	10	6	7	5	4	**280**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**
H-CPRB	IA	HC-1	H-CPRB	3	0	8	10	0	10	10	10	8	10	**296**
	IA	H-5	H-Tank Farm, stage @H-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	FA	K-6	K-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	L-6	L-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	R-9	186-R	10	6	6	10	10	10	6	7	5	4	**280**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**

Table F-2. Ranking by Ash Site *(Continued)*

Ash Site	IA/FA	Alternative Subset #	Disposition Location	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
K-Ash Basin	IA	K-1	K-Ash Basin	3	0	8	10	0	10	10	10	8	10	**296**
	IA	K-2	K-Ash Basin	6	2	8	10	5	10	8	5	5	8	**282**
	FA	K-4	K-Ash Basin	6	2	0	10	5	10	8	5	5	8	**218**
	IA	H-5	H-Tank Farm, stage @H-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	IA	K-5	H-Tank Farm, stage @K-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	IA	L-5	H-Tank Farm, stage @L-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	FA	K-6	K-Ash Basin	10	8	0	10	10	10	2	5	5	4	**198**
	FA	L-6	L-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**
L-Ash Basin	IA	L-1	L-Ash Basin	3	0	8	10	0	10	10	10	8	10	**296**
	IA	L-2	L-Ash Basin	6	2	8	10	5	10	8	5	5	8	**282**
	FA	L-3	L-Ash Basin	8	0	0	10	5	10	0	5	5	10	**136**
	FA	L-4	L-Ash Basin	6	2	0	10	5	10	8	5	5	8	**218**
	IA	H-5	H-Tank Farm, stage @H-Ash Basin	10	8	8	10	5	5	5	5	5	2	**268**
	IA	K-5	H-Tank Farm, stage @K-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	IA	L-5	H-Tank Farm, stage @L-Ash Basin	10	8	8	10	5	5	6	5	5	2	**278**
	FA	K-6	K-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	L-6	L-Ash Basin	10	8	0	10	10	10	2	5	5	4	**198**

Table F-2. Ranking by Ash Site *(Continued/End)*

Ash Site	IA/FA	Alternative Subset #	Disposition Location	Long-Term Effectiveness	Footprint Reduction	Beneficial Reuse	Project Risks	Regulatory Acceptance	Schedule Issues	Capital Costs per Site	Short-Term O&M Costs per Site	Long-Term O&M Costs per Site	Transport, Handling & Disposal Cost	Total Score
L-Ash Basin *(cont'd)*	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	L-9	186-L	10	6	6	10	10	10	6	7	5	4	**280**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**
WADB	IA	W-1	WADB	3	0	8	10	0	10	10	10	8	10	**296**
	FA	W-3	WADB	8	0	0	10	5	5	8	5	5	10	**206**
	IA	H-5	H-Tank Farm, stage @H-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	IA	K-5	H-Tank Farm, stage @K-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	IA	L-5	H-Tank Farm, stage @L-Ash Basin	10	8	8	10	5	5	2	5	5	2	**238**
	FA	K-6	K-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	L-6	L-Ash Basin	10	8	0	10	10	10	0	5	5	4	**178**
	FA	N-7	N-Area	10	6	0	10	10	10	0	2	0	4	**152**
	FA	S-8	SEFA via Truck Transport	10	10	2	5	10	5	0	7	10	4	**183**
	FA	P-9	186-P	10	6	6	10	10	10	4	7	5	4	**260**
	FA	T-10	Three Rivers Landfill	10	10	0	0	5	0	0	7	10	0	**114**

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APPENDIX G

Conceptual Design Sketches

G-1	**A-Area Coal Pile Runoff Basin**
G-2	**L-Area Ash Basin**

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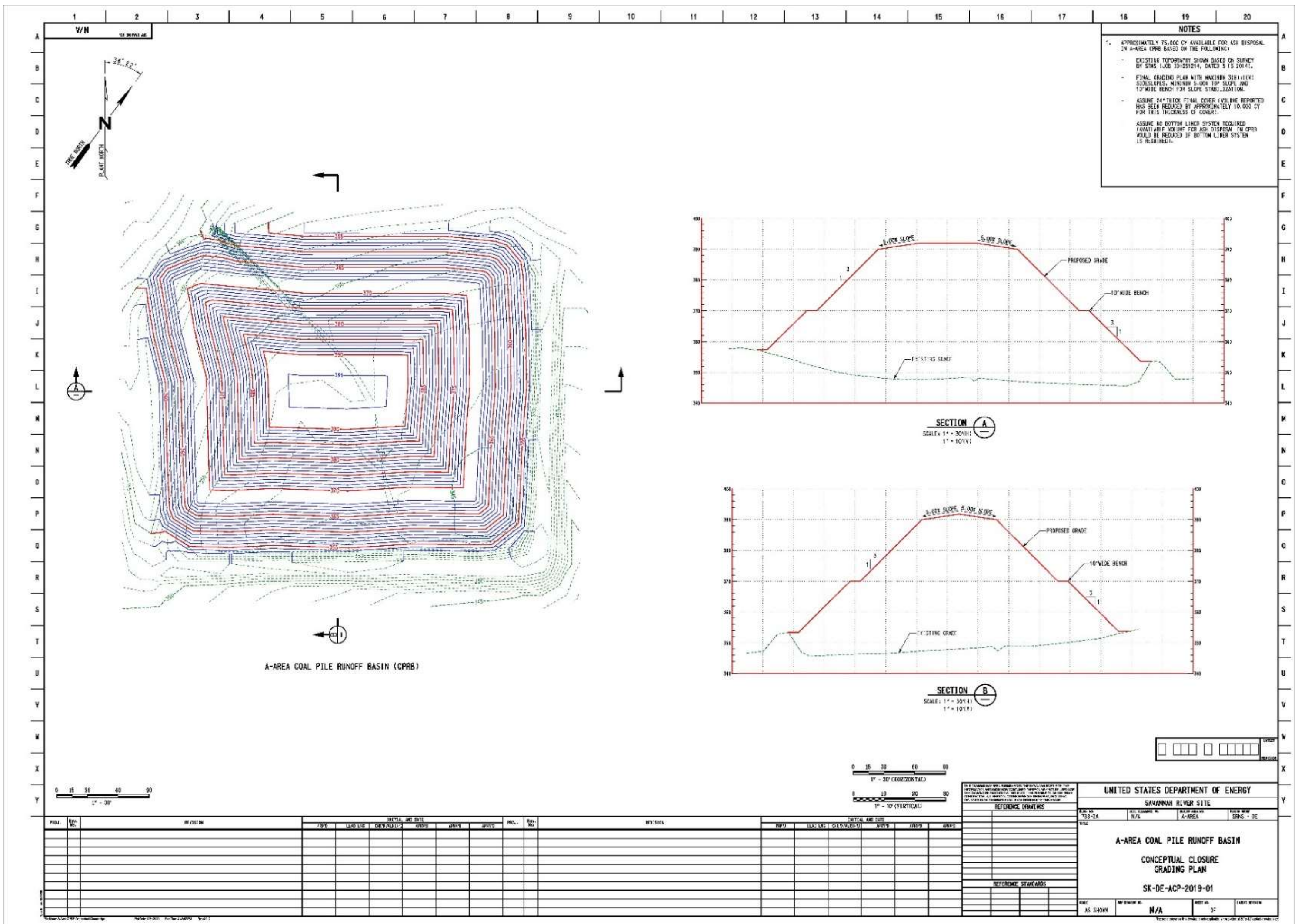
G-1
A-Area Coal Pile Runoff Basin



G-2
L-Area Ash Basin