Removal Action Report for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U)

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximate, approximately
ac	acre
ACP	Area Completion Projects
ARAR	Applicable or Relevant and Appropriate Requirement
ARF	Administrative Record File
BMPs	Best Management Practices
CCSI	Chesapeake Containment Systems, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
CPP	corrugated plastic pipe
CPRB	Coal Pile Runoff Basin
C-SWPPP	Comprehensive Stormwater Pollution Prevention Plan
DAOU	D-Area Operable Unit
DQO	Data Quality Objectives
DUR	Data Usability Report
FFA	Federal Facility Agreement
ft	feet
FSP	Field Sampling Plan
GPS	global positioning system
ha	hectare
HQ	hazard quotient
in.	inch, inches
IWT	Industrial Wastewater Treatment
kg	kilogram
km	kilometer
km^2	square kilometer
lb	pound
LGP	low ground pressure
LLC	Limited Liability Company
LLDPE	Linear low-density polyethylene
LUC	land use controls
m	meter
msl	mean sea level
m^3	cubic meter
mg/L	milligram per liter
mi	mile
mi^2	square mile

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

NE	northeast
NPDES	National Pollutant Discharge Elimination System
NTCR	non-time critical removal
NW	northwest
NWB	new western berm
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PE	Professional Engineer
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
QCTIP	Quality Control Testing and Inspection Plan
RADP	Removal Action Design Plan
RAO	remedial action objectives
RAR	Removal Action Report
RCRA	Resource Conservation and Recovery Act
RSER	Removal Site Evaluation Report
RSER/EE/CA	Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SEMS	Superfund Enterprise Management System
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SSDS	sub surface drainage system
STR	Subcontract Technical Representative
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
WSRC	Westinghouse Savannah River Company
WWTP	waste water treatment plant
yd^3	cubic yards

1.0 GENERAL DESCRIPTION

1.1 Purpose and Scope

This Removal Action Report (RAR) documents the completion of field implementation of the removal actions for the D-Area Operable Unit (DAOU) 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (CPRB). The DAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for the Savannah River Site (SRS).

The 488-2D Ash Basin, 488-4D Ash Landfill, 488-1D Ash Basin and 489-D CPRB are subunits of the DAOU located at the SRS, in Aiken, South Carolina. The 488-2D Ash Basin and 488-4D Ash Landfill were recently closed. The activities related to the 488-2D Ash Basin and 488-4D Ash Landfill closure are documented in the *Removal Action Report for the 488-2D Ash Basin and 488-4D Ash Landfill,* (Savannah River Nuclear Solutions [SRNS] 2017a).

This report summarizes the activities performed to implement the selected removal action requirements defined in the *Removal Action Design Plan* (RADP*) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin* (SRNS 2016a). In addition, this report serves as the closeout report for the closure of the Ash Basin Industrial Wastewater Treatment (IWT) Permit #7295 as applied to the 488-1D Ash Basin and 489-D CPRB facilities.

The removal actions, along with the applicable or relevant and appropriate requirements (ARARs), were established in the *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D-Area Ash Basin 488-1D* (SRNS 2016b); the *Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the D-Area Ash Basin 488-1D* (United States Department of Energy [USDOE] 2016a), *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the 489-D Coal Pile Runoff Basin, D-006 Outfall, and 484-10D Waste Oil Facility at the D-Area Operable Unit* (SRNS 2009) and; *Revision 3 Action Memorandum for the Non Time Critical Removal Action for the D Area Coal Pile Runoff Basin 489-D* (USDOE 2015a). Groundwater monitoring requirements, proposed new well

locations, well specifications, and sampling requirements are defined by the D-Area Groundwater Operable Unit (OU); however, the abandonment and installation of the wells, installed as part of the project scope, are included in this RAR.

The scope of this report includes the following items:

- A brief description of the 488-1D Ash Basin and 489-D CPRB background, including early action requirements and objectives;
- A chronology of completed events related to the removal action of the 488-1D Ash Basin and 489-D CPRB;
- A summary of construction/removal activities performed;
- Deviations from the original design/requirements of the approved RADP (SRNS 2016a);
- Performance standards and quality control inspections, including a summary of performance test results documenting verification of compliance with the acceptance criteria in the RADP (SRNS 2016a);
- Final inspection and verification of construction/removal completion;
- Well abandonments and installations;
- Figures including field photographs;
- As-built drawings;
- Forecasts of post-construction activities (e.g., operation and maintenance); and
- Project costs.

1.1.1 Document Format

This RAR was prepared in accordance with the requirements for submittal of regulatory documents identified in the FFA (FFA 1993) between the USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC). The format of this RAR was based on the Post-Construction Report protocol format found in the *Environmental Compliance and Area Completion Projects* (ACP) *Regulatory Document Handbook* (SRNS 2012) approved by the USEPA and SCDHEC as applicable to the RAR.

1.2 General Description and History of the Unit

SRS occupies 801.5 square kilometers (km^2) (309.4 square miles [mi^2]) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties in South Carolina. SRS is located approximately (~) 40.2-kiloment (km [25-miles {mi}]) southeast of Augusta, Georgia, and 32.1-km (20-mi) south of Aiken, South Carolina (Figure 1). D-Area is in the southwest quadrant of the SRS, ~914-meters (m) (3,000-feet [ft]) east of the nearest site boundary the Savannah River (Figure 2).

SRS reactors that were used to produce nuclear materials required heavy water as a moderator. The heavy water was produced at D-Area. D-Area also contained the heavy water rework facility to purify the SRS inventory of used reactor moderator. Like most of the industrial areas located at the SRS, D-Area was self-sustaining with needed utilities, administration, industrial and medical facilities located within the area. An inactive coal fired powerhouse is also located in D-Area.

The D-Area Powerhouse was built in 1953 and removed from service in 2012 after 59 years of operation. During its years of operation, the facility burned ~160,000 tons of coal per year. The 488-D Ash Basin, 488-1D Ash Basin, 488-2D Ash Basin, 488-4D Ash Landfill, and the 489-D CPRB were constructed in support of powerhouse operations in D-Area (Photos 1 through 3). Following the powerhouse shutdown, continued operations of the ash basins, ash landfill and coal pile runoff basin were no longer required. Deactivation of the D-Area Powerhouse and associated facilities began in 2012. Photo 3 provides a preconstruction view of the area from January 2013.

Previous remedial and removal activities associated with D-Area ash facilities have occurred. In 2007, the 488-D Ash Basin was closed under a CERCLA remedial action. A non-time critical removal (NTCR) action was completed on the northern 25% of the 489-D CPRB in 2011. In 2011, the USDOE, USEPA, and SCDHEC agreed to add the 488-1D Ash Basin, 488-2D Ash Basin, and the 488-4D Ash Landfill to the FFA for final closure under CERCLA. The 488-1D Ash Basin and 489-D CPRB operated under SCDHEC IWT Permit #7295. Negotiations were held with the USEPA and SCDHEC to discuss closure alternatives for these D-Area facilities. Due to size,

complexity, and potential hazards, an alternate closure schedule was developed that supported removal actions for the closure of these D-Area permitted facilities.

Because of the size and duration, the removal action activities were managed under two distinct Phases. Phase 1 included removal actions at the 488-2D Ash Basin and the 488-4D Ash Landfill completed in November 2016. Phase 2 included the removal actions at the 488-1D Ash Basin and the 489-D CPRB (Figure 3). This report documents the field implementation of the removal actions for Phase 2 (488-1D Ash Basin and the 489-D CPRB). A separate RAR (SRNS 2017a) was previously prepared for the Phase 1 (488-2D Ash Basin and the 488-4D Ash Landfill) removal activities and has been approved by USEPA and SCDHEC. Phase 2 removal action activities included the consolidation of coal fines, coal ash, and contaminated soil that originated from the 489-D CPRB, the west end of the 488-1D Ash Basin, the 488-1D inlet basins, the roads surrounding the 488-1D Ash Basin, and the area located along the east side of the 488-4D Ash Landfill into the covered portion (eastern end) of the 488-1D Ash Basin.

1.3 Removal Action Objectives

1.3.1 Removal Action Objectives 488-1D Ash Basin (including inlet basins)

Per the *RSER/EE/CA for the D-Area Ash Basin (488-1D)* (SRNS 2016b), the remedial action objectives (RAOs) for the D-Area Ash Basin (488-1D) subunit are follows:

- Achieve ecological risk-based thresholds and residential risk-based thresholds for unrestricted land use if possible. At a minimum, protect future industrial workers and ecological receptors from exposure to contaminants in surface sediments/soils.
- Prevent migration of potential contaminants to groundwater that could exceed groundwater protection standards.

1.3.2 Removal Action Objectives 489-D CPRB

Per the *Revision 3 Action Memorandum for the Non Time Critical Removal Action for the D-Area Coal Pile Runoff Basin 489-D* (USDOE 2015a) the RAOs are as follows:

- Protect future residents from exposure to arsenic at an exposure risk exceeding 1E-06 in surface sediment.

- Protect benthic organisms from exposure to arsenic and 2-methylnaphthalene at a Hazard Quotient (HQ) exceeding 1 and low pH in surface sediment.
- Protect aquatic organisms from exposure to aluminum, beryllium, cobalt, copper, iron, manganese, and zinc at a HQ exceeding 1 in surface water. In addition, protect aquatic organisms, mammals, and birds from exposure to low pH in surface water.
- Protect aquatic organisms from ARARs refined constituents of concern in surface water (e.g., aluminum, copper, iron, and zinc).

1.4 Selected Removal Actions

1.4.1 Selected Removal Action 488-1D Ash Basin

Per the *RSER/EE/CA for the D-Area Ash Basin (488-1D)* (SRNS 2016b), the selected removal action for the 488-1D Ash Basin subunit is as follows:

"The selected action was Ash Consolidation and Geosynthetic Cover System." Based on information currently available, the lead agency believes that "Ash Consolidation and Geosynthetic Cover System" meets the effectiveness criteria and provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. The preferred action will satisfy the statutory requirements in CERCLA Section 121(b) to: 1) be protective of human health and the environment, 2) comply with ARARs, and 3) be cost-effective.

Placement of a cover system consistent with SCDHEC Class Three Landfill permeability requirements provides overall protection to human health and the environment by providing immediate protection to human and ecological receptors by preventing direct contact. The geosynthetic cover system also provides assurance regarding the protection of groundwater by reducing infiltration from contact of the contaminated ash media with stormwater. The contaminated ash and other material approved for disposal in the 488-1D Ash Basin will remain in place and land use controls (LUCs) will be required.

Remediation of this subunit by utilization of a NTCR action is an effective strategy for cost-effectively reducing obvious risks, satisfying the closure requirements of the 488-1D Ash Basin IWT Permit #7295, and accelerating area closure by initiating early actions while meeting necessary ARARs.

This alternative will not preclude any additional remediation of the DAOU and is consistent with the current and future land use.

1.4.2 Selected Removal Action 489-D CPRB

Per the *Revision 3 Action Memorandum for the Non Time Critical Removal Action for the D-Area Coal Pile Runoff Basin 489-D* (USDOE 2015a) the selected removal action is as follows:

"Revision 3 to the action memorandum is specific to the removal action for the closure of the 75% southern section of the 489-D CPRB. This removal action will not impact the floodplain. The purpose of the action memorandum is to document the change from in-situ closure of the remaining 75% southern section outlined in the first revision to the action memorandum (ACP-10-255, dated August 26, 2010) to excavation and disposal with unrestricted land use. An evaluation of an excavation and disposal removal alternative was included in the *RSER/EE/CA for the 489-D Coal Pile Runoff Basin, D-006 Outfall, and 484-10D Waste Oil Facility at the D-Area Operable Unit* (SRNS 2009). Once the coal fines and residual coal-related contaminants were successfully removed, clean fill material was placed in the 489-D CPRB as necessary, and the area was contoured and re-graded to function as a storm water retention basin since it is necessary to continue to manage storm water in the area. This revision to the action memorandum has no impact on earlier decisions for the northern section of the basin, which requires land use controls as a part of the remedy decision as stated in the *Early Action Record of Decision Remedial Alternative Selection for the D-Area Operable Unit* (SRNS 2011)."

1.5 Chronology of Events

Table 1 provides the Chronology of Events.

Table 1. Chronology of Events

Description of Activity	Date
Submitted Revision 3 Action Memorandum 489-D (Appendix A) (USDOE 2015a)	August 11, 2015
SRNS begins Field Activities as Described in the 489-D Removal Action Start Letter	September 10, 2015
USDOE Submittal of the Notification of the Removal Action Start Date for the D-Area Coal Pile Runoff Basin 489-D (Appendix B((USDOE 2015b)	September 15, 2015
USDOE Submittal of the RADP for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin, Revision 0 (USDOE 2015c)	November 16, 2015
Contract Award 488-1D Ash Basin and 489-D CPRB (Phase 2)	March 31, 2016
SCDHEC Comments on RSER/EE/CA for the D-Area Ash Basin (488-1D) Rev 0 (SCDHEC 2016a)	April 6, 2016
USEPA Comments on RSER/EE/CA for the D-Area Ash Basin (488-1D) Rev 0 (USEPA 2016a)	June 6, 2016
DOE Submittal of the RSER/EE/CA for the D-Area Ash Basin (488-1D) Rev 1 (USDOE 2016b)	June 8, 2016
SCDHEC (Conditional Approval) of the RADP for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin, Revision 1 Redline (SCDHEC 2016b)	June 9, 2016
USEPA (Conditional Approval) of the Removal Action Design Plan (RADP) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin, Revision 1 Redline (USEPA 2016b)	June 29, 2016
USDOE Submittal of the Professional Engineer (PE) Stamped RADP for the 488-1D Ash Basin and 489-D CPRB, Revision 1 (Appendix C) (USDOE 2016c)	July 18, 2016
Start CPRB Dewatering	August 3, 2016
USDOE Submittal of the AM and Responsiveness Summary for the NTCR Action for the D-Area Ash Basin 488-1D (Appendix D) (USDOE 2016a)	August 17,2016
SRNS begins Field Activities as Described in the 488-1D Removal Action Start Letter	August 24, 2016
USDOE Submittal of the Notification of the Removal Action Start Date for the D-Area Ash Basin 488-1D (Appendix E) (USDOE 2016d)	September 19, 2016
Start 488-1D Activities with Excavation of the Area East of the 488-4D	October 3, 2016
Completed Excavation, Haul, and Placement of Coal Fines and contaminated soil from the 489-D CPRB into the East End of 488-1D	November 17, 2016
Completed Excavation, Haul, and Placement of ash and contaminated soil from the Area East of the 488-4D Ash Landfill into the East End of 488-1D	December 2, 2016
Completed consolidation of ash and contaminated soil from West End of 488-1D into the East End of 488-1D	November 27, 2017
Completed Excavation, Haul, and Placement of ash, and contaminated Soil from the 488-1D Inlet Basins into the East End of 488-1D	April 30, 2018
488-1D Completed Geosynthetics, LLDPE and Geotextile Installation	July 9, 2018
488-1D Cover Installation Completed to Include the, 20” Soil Layer, 4” topsoil Layer and Sod	October 2, 2018
Mechanical Completion of the 488-1D Ash Basin and the 489-D CPRB	October 10, 2018
“Completion Status of the D Area Ash Project”, Regulatory Concurrence of 488-1D and 489-D Completion” Walk down (Appendix F) (USDOE 2018)	October 29, 2018
Physical Completion of the 488-1D Ash Basin and the 489-D CPRB	November 14, 2018

2.0 CONSTRUCTION ACTIVITIES

2.1 Construction Team

SRNS provided project management, oversight, confirmation sampling, worker protection, and regulatory integration. During the construction phase of the project, SRNS Design Engineering provided Title 3 (Construction) support. Envirocon, the prime contractor for implementation of the removal action at the 488-1D Ash Basin and 489-D CPRB, was responsible for all remaining construction activities to include contract management, erosion and sediment control measures, stormwater controls, dewatering, excavation, placement and compaction of ash, stormwater conveyance system, subsurface drainage system (SSDS), placement of common fill, topsoil, crushed stone surfacing, submittals, etc. Envirocon used other sub-tier contractors for specific tasks, as they deemed appropriate. The sub-tier contractors included Carolina Sodding Services for the installation of seeding and sodding to include maintenance, and watering; Chesapeake Containment Systems, Inc. for the installation of geosynthetics for the cover system; Trotter Site Preparation for clearing, grubbing, chipping and transportation of root balls to the Three Rivers Landfill; and GEL Engineering, LLC for all surveying and as-built needs.

All work described in this section of the RAR was performed in accordance with the RADP (SRNS 2016a) associated design drawings, and manufacturer's recommendations. Deviations are discussed in Section 3 "Deviations from Original Design."

2.2 Equipment

Table 2 identifies the general equipment types and activities used during construction. Equipment or vehicles that were used for excavation, hauling, and/or compaction of ash were cleaned in areas of the work site not yet remediated (i.e. 488-1D Ash Basin/North Inlet Basin) prior to leaving the site. All rinse water was allowed to runoff into these areas.

Table 2. Equipment Types and Activities

General Equipment Type	Type Activity
D-6 and D-8 Dozers (Options Low Ground Pressure [LGP], global positioning system [GPS])	Construction of access roads around the basins, ash placement, grading of existing ash surface, placement of ash, common fill, and topsoil (Photo 4).
Excavator 300 and 400 series (Options GPS, Long reach)	Excavation of ash, excavation of borrow material, excavation in support of storm drain system (Photo 5 and 6).
30 and 40 -Ton Articulated Haul Trucks	Hauling ash, hauling common fill from D-Area Borrow Site (Photo 7).
Tandem Axle Dump Trucks	Hauling materials within the borrow area, supporting clearing and grubbing, hauling of materials to the 3 Rivers Landfill.
Water Trucks	Dust suppression, adding water to fill material to achieve compaction, assisting in watering revegetated areas (Photo 8).
Vibratory Compactors Smooth Drum and Sheep's Foot	Compaction of ash, compact common fill, compact crushed stone surfacing. (Photos 9 and 10).
Utility Compactor	Walk behind utility trenches, compact materials not accessible to larger equipment (Photo 11).
Vibratory Plate Compactor	Compact utility trenches, compact materials not accessible to larger equipment (Photo 11).
Backhoes Various Sizes	Excavate utility trenches, backfill utility trenches, construct storm drainage features
Disc and Plough	Turn ash material to assist in drying, incorporate drier ash material with wetter ash material to facilitate compaction (Photo 12).
Loaders w/bucket and forks Various Sizes	Load common fill material into trucks, assist with fill placement and grading, assist with road construction and grading, backfill utility trenches (Photo 13).
Motor Grader	Maintain site haul roads, assist in conditioning ash, installation of construction access points, fine grading (Photos 14).
Pickups	General site operations.
Telehandler	Material handling, Linear low-density polyethylene (LLDPE) material deployment.
GPS Satellite Station	Assist in grade checking and support machine control (Photo 15).
Pumps (Various Sizes)	Dewatering (Photo 16).
Track Sod Installer	Installation of sod (Photo 17).
Hydro seeder	Hydro seed applications.
All-Terrain Vehicle	General site operations.
Farm Tractors Various Sizes	Spread lime and fertilizer, prep topsoil surface, etc. (Photo 12).
Hot Wedge Dual Track Welder	Perform Dual Track Seaming of Geomembrane (Photo 18).
Air Pressure Gauges	Testing of Dual Track Seams
Field Tensiometer	Field Testing (Shear and Peel) of Wedge and Extrusion Welds (Photo 19).
Extrusion Welder	Perform Extrusion Welding of Geomembrane (Photo 20).
Extrusion Weld Vacuum Box Tester	Field Testing (Leak) of Extrusion Welds (Photo 21).

2.3 Removal Action Activities

The following provides a summary outline of construction activities performed during the removal actions.

Activities Common to all Segments of the Project

- Mobilization
- Surveying
- Stormwater Pollution Prevention and Erosion Control
- Initial Land Disturbance
- Clearing and Grubbing
- Demolition
- Dewatering
- Sampling
- Common Fill
- Compaction Requirements
- Top Soil
- Site Restoration (Final Vegetative Cover and Crushed Stone Surfacing)
- Rip Rap Aprons
- Demobilization

Major Construction Segments

Area East of the 488-4D Ash Landfill -Excavation (Ash and Contaminated Soil)

- Clearing and Grubbing
- Excavation of Ash and Hauling of Material to the East End of 488-1D
- Confirmation Sampling
- Backfilling
- Site Restoration

489-D CPRB Excavation (Coal Fines and Contaminated Soil)

- Clearing and Grubbing
- Dewatering
- Excavation of Ash/Contaminated Soil and Hauling of Material to the East End of 488-1D
- Confirmation Sampling
- Backfilling
- Stormwater Modifications (including the isolation and rerouting of the storm sewer that ran under the closed Northern section of the CPRB)
- Site Restoration

488-1D Ash Basin

- Clearing and grubbing
- Dewatering
- Processing/Initial Drying of Ash/Contaminated Soil in the West End of the 488-1D Ash Basin and Inlet Basins
- Loading and Hauling of Material to the East End of 488-1D
- Confirmation Sampling
- Placement and Compaction of Ash on the East end of 488-1D Covered Portion
- Construction of New Western Berm (NWB)
- Backfilling of Western Portion of the Basin
- Permanent Stormwater System Installation
- Geosynthetic Cover Installation
- Soil Cover
- Site Restoration

2.4 Construction Activities Common to all Segments of the Project

2.4.1 Mobilization

Prior to mobilization, the contractor project team participated in pre-construction meetings with SRNS. The team provided a detailed schedule and discussed each task. Meeting topics included operational requirements, review of safety requirements and site pre-construction requirements necessary to start work.

Project personnel began mobilization upon approval of required pre-construction submittals. The contractor management team performed submittal preparation and managed equipment mobilization during this time frame. The mobilization of craft personnel began once the Notice to Proceed was received. Two construction field office trailers were located at the site and included office spaces, a conference room, and a crew/lunch room. The temporary office trailer and parking area was set up on an existing concrete pad in one of the laydown/storage areas designated for the project. Several additional laydown/storage areas were established to allow for equipment maintenance, material storage, etc.

Upon arrival, all equipment delivered to the site is inspected for cleanliness, operability, and compliance with the Occupational Safety and Health Administration (OSHA) standards. Delivery and service vehicles, tools, and equipment entering the site, were subject to the same inspection

requirements. All equipment delivered to the site was required to have up-to-date maintenance logs and to be in proper functioning condition.

2.4.2 Project Surveying

Survey control points were provided to the contractor by SRNS prior to the start of work. Control point or benchmark/monument positions (x, y, and z coordinates) were used to maintain vertical and horizontal limits throughout the life of the project. Control points and survey monuments were protected during construction activities. In high traffic areas, benchmarks were demarcated by guard posts with reflective paint striping.

A Global Positioning System (GPS) was used to perform the site construction layout by the contractor. The GPS used Digital Terrain Models and electronic background maps to ensure continuous control of all excavation grades, limits of excavation and backfill soil placement, and minimize the possibility of induced error by limiting the number of field calculations needed to conduct layout operations.

A South Carolina licensed Professional Land Surveyor set additional project control monuments where needed. This included performing initial pre-excavation topographic surveys, ash placement surveys, bottom of excavation topographic surveys, cover material topographic surveys, stormwater system as-built surveys and spot-checking construction layout staking. All as-built survey data was provided to SRNS.

2.4.3 Stormwater Pollution Prevention and Erosion Control

All work was performed in accordance with SRNS's Comprehensive Stormwater Pollution Prevention Plan for the 488-1D Ash Settling Basin and 489-D Coal Pile Runoff Basin Closure (SRNS 2015a). All subcontractors of SRNS whose work at the project site involved activities that may impact stormwater discharges or controls were required to attend a pre-construction meeting to discuss and review the conditions of the Stormwater Pollution Prevention Plan (SWPPP) and then sign on to the SWPPP prior to commencing any land disturbing activities.

Erosion control measures were constructed and maintained to prevent releases during activities associated with this project. The primary objectives of the storm water/erosion controls used for this project were to:

- Prevent the spread of ash and/or sediments during remediation activities,
- Maintain stormwater run-on/run-off within the project site boundaries,
- Provide storm water/erosion control inspection and reporting, and
- Identify locations and methods of construction of storm water/erosion control measures and maintenance.

The work site was evaluated weekly or after rain events (1.3-centimeter (cm) [0.5-inch (in.)] and greater) during field operations to determine whether additional stormwater/erosion control measures were necessary. The Construction Field Engineer, Site Superintendent, Subcontract Technical Representative (STR), and SRNS Design Engineering participated in SWPPP (SRNS 2015a) inspections. Additional stormwater/erosion controls were installed as needed. All water that had contacted ash was pumped to the 488-1D Inlet Basins for management in accordance with the IWT permit and discussed in Sections 2.6.1 and 2.7.2.

2.4.4 Initial Land Disturbance

The initial erosion control measures were installed prior to the start of any excavation or other soil-disturbing activities. All stormwater/erosion control features were installed in the locations identified in the RADP (SRNS 2016a) documents. Initial land disturbance activities included the following:

- Installation of construction entrance(s),
- Providing check dams, and
- Clearing and grubbing to allow installation of silt fence.

Front-end loaders and graders were used to construct construction entrances to the site. Construction entrances were established where vehicles access the construction site's gravel or dirt roads from paved roads. Construction entrances were installed per design requirements in the RADP (SRNS 2016a) to prevent tracking of ash/sediment by vehicles entering hard surface roads.

All areas requiring the installation of silt fences were grubbed only to the extent necessary to facilitate silt fence installation. Throughout construction activities, the contractor used a range of erosion control Best Management Practices (BMPs) to stabilize non-vegetated areas. Erosion control BMPs included a combination of run-off berms, check dams (Photos 22 and 23), straw waddles, silt fence (Photo 24), surface roughening, temporary seeding, riprap, etc., to prevent the transport of ash/sediment off the project site.

2.4.5 Clearing and Grubbing

The 488-1D Ash Basin and the area east of the 488-4D Ash Landfill required clearing and grubbing to allow excavation of ash material. Minimal clearing and grubbing were required at the 489-D CPRB. Trotter Site Preparation was responsible for clearing and grubbing the area and transporting CERCLA Sanitary Waste to Three Rivers Landfill. All grubbed materials were disposed of in accordance with the Waste Management Plan (SRNS 2015b). Grubbed materials were size reduced to meet the waste acceptance criteria at the landfill, loaded into trucks, and hauled to Three Rivers Landfill. SRNS provided and signed waste manifests for the waste materials transported to the landfill. The CERCLA Off-Site Rule Documentation for the Three Rivers Landfill is provided in Appendix G.

2.4.6 Demolition

Demolition of miscellaneous items during construction of the project are listed below. Table 3 includes the general location, material, original function, and disposal route. As required, piping and other materials were size reduced per the Waste Management Plan (SRNS 2015b) and containerized for shipment to Three Rivers Landfill. Waste totals of the materials taken to Three Rivers Landfill are included in Summary Table in Section 2.10.

Table 3. Summary Table of Demolished Items

Location	Material	Function	Disposal Route
488-1D northwest (NW) Corner	Two 24-in. cast iron pipes	Overflow Culverts	Crushed/broken and buried east end 488-1D
488-1D NW Corner	2Two18-in. cast iron pipes	Overflow Culverts	Crushed/broken and buried east end 488-1D
488-1D NW Corner	Concrete	Spillway	Crushed/broken and buried east end 488-1D
488-1D South Berm	Rip Rap	Wave Protection	Buried east end 488-1D
488-1D northeast (NE) Corner	12-in. corrugated metal pipe	Overflow Culverts	Crushed/broken and buried east end 488-1D
488-1D East Berm	Six 18-in. cast iron pipes	Overflow Culverts	Crushed/broken and buried east end 488-1D /Three Rivers Landfill
488-1D Inlet Basin	Concrete	Apron	Crushed/broken and buried east end 488-1D
488-1D South and West Berm	8-in. Poly vinyl chloride (PVC) pipe and manhole	Toe Drain	Three Rivers Landfill
488-1D Southwest Corner	36-in. corrugated metal pipe (CMP)	Culvert under roadway	Three Rivers Landfill
489-D CPRB North Side	96-in. manhole and misc. pipe	Stormwater collection	Crushed/broken and buried east end 488-1D
489-D CPRB South West Corner	8-in. PVC pipe, concrete supports, encasement, anti-seep collar, an 18-in. corrugated metal pipe concrete	Spillway	Crushed/broken and buried east end 488-1D

2.4.7 Sampling

Toxicity Characteristic Leaching Procedure (TCLP) sampling was performed on the material prior to hauling and placement on the east end of the 488-1D Ash Basin. The material placed into the east end of the 488-1D Ash Basin from the 489-D CPRB was not a hazardous waste under the RCRA program.

Following removal of ash material from the area east of the 488-4D Ash Landfill, SRNS performed confirmatory sampling. Confirmation sampling requirements and sample results are discussed in Section 4.3.

2.4.8 Common Fill

Common fill was sourced from the D-Area Borrow Site located ~3.2-km (2-mi) east of the project site, material removed from the existing berm(s) from the west and south sides of 488-1D, and from the center fingers and east side berm of the inlet basins. The material from the D-Area Borrow Site was used in the 489-D CPRB bottom, area east of the 488-4D Ash Landfill, the inlet basins, the west end of the 488-1D Ash Basin, and the 50.8-cm (20-in.) thick common fill layer over the geosynthetic cover (linear low-density polyethylene [LLDPE] geomembrane and geotextile) in the east end of the 488-1D Ash Basin. The material sourced from the berms around the 488-1D Ash Basin was used in the construction of the new western berm. All remaining material from the berms was used in establishing the final grades in the west end of the 488-1D Ash Basin and the inlet basins. SRNS performed analytical testing of the fill material as described in Section 4.2.

Material from the D-Area Borrow Site was excavated in accordance with the approved SWPPP (SRNS 2014a). Tracked excavators and rubber tire loaders were used to excavate and load material into articulated haul trucks. The material was hauled to the construction site where it was dumped and spread by a dozer equipped with GPS.

2.4.9 Compaction Requirements

Compaction requirements for the project are provided in the Table 4 below.

Table 4. Summary Table of Compaction Requirements

Compaction		
Material	**General Location /Description**	**Compaction Requirement**
Ash, Contaminated Soil, Coal Fines	East End of 488-1D	Compact each lift (maximum 12-in. thick loose layers) using a minimum of 5 passes of a vibratory roller having a minimum dynamic force of 30,000 pounds per drum. Perform proof roll on every fourth lift.
Common Backfill	Initial Lift of the 50.8-cm (20-in.) Soil Cover Over the Geosynthetics	Traffic compact this lift (minimum loose thickness of 12 in. and a maximum loose thickness of 15 in.) using equipment with ground pressure less than 7 psi with a minimum of five passes over all areas.
Common Backfill	Remaining lift(s) of the 50.8-cm (20-in.) Soil Cover Over the Geosynthetics	Place remaining common fill in maximum loose lifts of 12 in.. Compact each lift (maximum 12-in. thick loose layers) 90% of maximum density.
Common Backfill	Roadways, other Traffic Areas, and Embankments	Compact each lift (maximum 12-in. thick loose layers) to 95% of maximum density.
Common Backfill	Non-Traffic Areas	Compact each lift (maximum 12-in. thick loose layers) to 85% of maximum density.
Common Backfill	Utility Trenches Embankments Traffic Areas	The first loose layer thickness shall not exceed ½ the diameter of the pipe being backfilled or 12 in., whichever is less. Subsequent lifts shall be a maximum 12-in. thick loose layers. Compact each lift to 95% of maximum density.
Common Backfill	Utility Trenches Non-Traffic Areas	The first loose layer thickness shall not exceed ½ the diameter of the pipe being backfilled or 12 in., whichever is less. Subsequent lifts shall be a maximum 12-in. thick loose layers. Compact each lift to 90% of maximum density.
Top Soil	All Vegetated Areas	Compact by the weight of the dozer or other equipment operating on the surface.

2.4.10 Top Soil

Topsoil for the 489-D CPRB and 488-1D Ash Basin was supplied from the onsite borrow area. Analytical testing of the topsoil was performed as described in Section 4.2.

A 10.2-cm (4-in.) layer of topsoil was placed over the 489-D CPRB, 488-1D Ash Basin, area east of the 488-4D Ash Landfill, and any other areas disturbed by construction activities. Prior to topsoil placement, the surface was scarified to a depth of 5.1-cm (2-in.). Topsoil was delivered to the work area by articulated haul trucks and either dumped on the scarified surface or staged elsewhere in the area of disturbance until placed. D-6 dozers equipped with GPS were used to place the topsoil in a uniform layer. The topsoil was compacted by the weight of the dozer or other equipment operating on the surface; no other compaction was required. The surface of the topsoil

was smoothed by raking or using a drag mat to achieve a uniform surface. Any rocks or sticks were removed prior to seeding or sodding.

2.4.11 Site Restoration (Final Vegetative Layer)

All surfaces disturbed by construction activities received seed or sod per design requirements prior to project completion. Carolina Sodding Services was responsible for installing sod, permanent seed, and related materials for the project. Lime and fertilizer were applied to topsoil within 72 hours of topsoil placement and mixed into the soil. The soil was wetted prior to sod placement. Sod was transported from delivery trucks to ground surface with track loaders. The sod was placed on topsoil so that sod to soil contact was maintained over the entire area and joints were staggered. After installation, the sod was rolled with a lawn roller perpendicular to the direction it was laid. Newly installed sod was watered to wet the soil to a 7.6-cm (3-in.) depth. Watering was performed as required by weather conditions at the time of installation of sod/seed utilizing travelling irrigation systems.

Seed was planted by mechanical spreader at the rate and mixture stated in the specification for the time of year the seed was planted. Seeded areas were lightly dragged to cover seeds and maintain a surface free of ridges and depressions. Straw mulch was placed at a rate of 1,814 kilograms (kg) (4,000 pounds [lbs]) per acre within 24 hours of seed placement. Mulch was anchored 7.6 cm (3 in.) into soil with a disc or other farm implement. Soil was maintained in a moist condition until accepted by SRNS.

2.4.12 Crushed Stone Surfacing Installation

Crushed stone surfacing was placed on the roads around the project site as specified in the design drawings. The width and depth of gravel paving was installed per design requirements in the RADP (SRNS 2016a). Vibratory compactors were used to construct a dense uniform surface.

2.4.13 Riprap Aprons

The riprap aprons consist of riprap, #57 stone, and non-woven geotextile filter fabric. The subgrade for the filter fabric and riprap was constructed to the lines and grades provided in the design requirements in the RADP (SRNS 2016a). Any fill required for the subgrade was

compacted to the density of the surrounding undisturbed material using a plate compactor or vibratory drum compactor. Filter fabric was installed over the soil surface where the riprap apron was to be placed. A minimum of 5.1 cm (2 in.) of gravel bedding (#57 stone) was placed between the filter fabric and riprap to prevent damage to fabric when placing riprap. The aprons were constructed to the grades required by design. The top of riprap at the downstream end was level with or slightly below the receiving area. All disturbed areas around the apron were stabilized with vegetation after construction.

2.5 Area East of the 488-4D Ash Landfill – Excavation

As discussed previously, during Phase 1 construction additional ash was identified in an area east end of the 488-4D Ash Landfill. It was decided that removal of this material would be added to the Phase 2 scope. This section provides an overview of the construction activities during the removal action for the area east of the 488-4D Ash Landfill.

2.5.1 Area East of the 488-4D Ash Landfill – Clearing and Grubbing

Clearing, grubbing, and removal of trees, scrub brush, and root balls from the area east end of the 488-4D Ash Landfill were performed as discussed in Section 2.4.5. Photos 25 and 26 provide an aerial view of the before and after conditions during clearing and grubbing. Root balls were hauled to the Three Rivers landfill and the remaining vegetation was chipped for beneficial reuse. Waste totals are included in Section 2.10.

2.5.2 Area East of the 488-4D Ash Landfill – Excavation and Haul of Ash to the East End of the 488-1D Ash Basin

The ash area east of the 488-4D Ash Landfill was generally dry. Prior to excavation TCLP sampling was performed. Upon receipt of acceptable sample results (i.e., nonhazardous) the material was excavated using tracked excavators and articulated trucks (Photo 26) and hauled to the east end of the 488-1D Ash Basin. The volume of material, including removal of a minimum of 30.48 cm (1 ft) of additional soil from the foot print of the area, was~2,554 cubic meters (m^3 [29,500 cubic yards {yd^3}]). Summary volumes for the project are included in Section 2.8.1.

2.5.3 Area East of the 488-4D Ash Landfill – Confirmation Sampling

Following removal of ash and soil from the area east of the 488-4D Ash Landfill, SRNS performed visual inspections of the area to confirm that all ash had been removed. Visual verification was followed by confirmatory sampling. Confirmation sampling requirements and sample results are discussed in Section 4.3.1.

2.5.4 Area East of the 488-4D Ash Landfill – Backfilling

Upon receipt of acceptable sample results, the area was regraded and backfilled with common fill and topsoil from the D-Area Borrow Site to achieve the final grade shown in the construction drawings (Photo 27). A dozer equipped with GPS was used to cut and place materials. A vibratory, smooth drum compactor was used to compact the fill to design requirements (SRNS 2016a) as outlined in Section 2.4.9. Final site restoration included the placement of topsoil, sod, and crushed stone surfacing as described in Sections 2.4.10, 2.4.11 and 2.4.12 respectively (Photos 28 and 29).

2.6 489-D CPRB Excavation (Coal Fines and Contaminated Soil)

This section provides an overview of the construction activities during the removal action for the 489-D CPRB. Only minimal clearing and grubbing were required. All trees were located outside of the area with any potential coal fines deposits. However, they were visually checked as a precaution. The trees and root balls were transported to the D-Area Borrow Site for processing as discussed in Section 2.4.5.

2.6.1 489-D – CPRB Dewatering

Prior to any excavation activities at the 489-D CPRB, ~4 million (M) gallons (gal) of storm water were neutralized from April 22, 2016 through December 20, 2016 through a temporary Waste Water Treatment Plant (WWTP) (Photo 30) to ensure compliance to National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Industrial Activities (Except Construction), SCR000000, Section 1.1.2 (Runoff from coal storage piles at steam electric generating facilities). Total suspended solids sampling was conducted at the beginning of operations with a result of 5 mg/L (50 mg/L limit). As part of operation routine

monitoring of pH was performed each day of operation as well as visual clarity of discharge. All discharge was maintained within the 6.0 to 9.0 pH range.

Once the coal residues and ~30.48 cm (12 in.) of under burden soils had been removed from the site, all subsequent stormwater management compliance shifted to the compliance requirements defined within the Comprehensive Stormwater Pollution Prevention Plan for the 488-1D Ash Settling Basin and 489-D Coal Pile Runoff Basin Closure (SRNS 2015a). All water was then pumped through a SWPPP BMP and discharged to the D-Area Discharge Canal.

2.6.2 489-D CPRB Excavation and Haul of Coal Fines to the east end of the 488-1D Ash Basin

Existing coal fines from within the footprint of the 489-D CPRB were removed using a D-6 size bulldozer, equipped with GPS, to push coal fines and contaminated soils into rows/piles. Prior to hauling the materials to the east end of the 488-1D Ash Basin, TCLP sampling was performed. Additional discussion and sample results is provided in Section 4.3.1. Upon receipt of acceptable sample results (i.e. nonhazardous), the material was loaded using tracked excavators and hauled in articulated trucks to the east end of the 488-1D Ash Basin. Excavation included a minimum of 30.5 cm (12 in.) of soil (Photo 31 and 32). Summary of the volume of materials placed in the 488-1D Ash Basin is located in Section 2.8.1, Table 7.

2.6.3 489-D Confirmation Sampling

Following removal of coal fines and soil from the 489-D CPRB, SRNS performed visual inspections of area to confirm that all ash had been removed. Visual verification was followed by confirmatory sampling. Confirmation sampling requirements and sample results are discussed in Section 4.3.1.

2.6.4 489-D - CPRB Backfilling

Following the removal of coal fines and soil from the 489-D CPRB, the surface of the basin bottom was regraded and backfilled with common fill from the D-Area Borrow Area. Backfill was hauled by articulated haul trucks. A dozer equipped with GPS placed material to achieve the final grade shown in the design drawings (Photo 33). A vibratory smooth drum compactor was used to

compact the fill to design requirements (SRNS 2016a). Final site restoration included the placement of topsoil, vegetative layer, and crushed stone surfacing as described in Sections 2.4.10, 2.4.11 and 2.4.12, respectively (Photos 34 and 35).

2.6.5 489-D CPRB Stormwater System Modifications

The existing 489-D CPRB outlet structure located in the southeast side of the basin was removed. This included a 20.32-cm (8-in.) polyvinyl chloride (PVC) discharge pipe, concrete supports, encasement, anti-seep collar, a 45.72-cm (18-in.) corrugated metal pipe, and existing concrete spillway. The excavation area was backfilled and restored to original grade. Existing guardrails were dismantled and removed for recycle, and a 4.6-m (15-ft) wide access road was constructed to design. Approximately 183 m (600 ft) of the existing 3.7-m (12-ft) wide access road, at the southeast corner of the 489-D CPRB, was offset to accommodate the installation of the new emergency spillway and outlet ditch.

As part of the regulatory agreements, the 1.2-m (48-in.) concrete pipe running under the previously closed portion of the 489-D CPRB was closed/plugged (Photo 35). Existing stormwater flow from ~35.2 ha (87 ac) flowed through the 1.2-m (48-in.) concrete pipe directly to the D-Area discharge canal. With the closure of the pipe, the flow was redirected to the 489-D CPRB. Closure of the pipe required plugging of two 1.52-m (60-in.) manholes upgradient of the previously closed portion of the basin and plugging of the 1.22-m (48-in.) concrete pipe itself on the down gradient side of the previously closed portion of the basin. The manhole structures and 1.22-m (48-in.) concrete pipe were filled with a low-slump concrete mix placed in multiple lifts (Photos 36 through 38).

The existing 3.44-m (96-in.) manhole for the existing 1.22-m (48-in.) corrugated plastic pipe (CPP) was dismantled and removed (Photo 39). A new 3.44-m (96-in.) manhole was placed and the 1.22-m (48-in.) reworked CPP leading to the 489-D CPRB was tied into the new manhole (Photos 40 through 42). As part of the reconfiguration various other pipes leading to the existing manholes also required plugging. All concrete plugs in existing pipes are a minimum of 61-cm (24-in.) thick. All pipe penetrations into manholes were sealed using non-shrink grout. Riprap aprons were constructed both at the downstream end of all culverts discussed in Section 2.4.13.

Final site restoration included the placement of topsoil, sodding, and seeding as described in Sections 2.4.10 and 2.4.11. Photo 43 provides an aerial view of the of the CPRB following completion of all construction activities associated with this segment of the project.

2.7 488-1D Ash Basin

2.7.1 488-1D Ash Basin Clearing and Grubbing

Clearing and grubbing, removal of trees, scrub brush, and root balls, of 488-1D Ash Basin was performed prior to ash excavation as discussed in Section 2.4.5. Photos 44 and 45 provide an aerial view of the clearing and grubbing process. A one-acre processing area was established at the northeast corner of the east end of the 488-1D Ash Basin and was used as a staging area to grind all vegetation material that was removed from 488-1D. The processing area was cleared and grubbed prior to being covered by a layer of clean backfill from D-Area Borrow Site. The process area was prepped and the backfill was spread using a small bulldozer. The backfill created a clean working area to prevent wood chips from being contaminated with ash during the grinding and loading operation and mitigated any potential issues with ash contaminated material being inadvertently placed within D-Area Borrow Site. Root balls were hauled to the Three Rivers Landfill and the remaining vegetation chipped for beneficial reuse. Waste totals are included in Section 2.10, Table 6.

Tracked excavators were used to remove trees and vegetation debris. A third excavator was used to assist in moving materials and to load out root balls for transport and disposal. As trees were dropped, the root balls were cut off by laborers and stacked for load out and transport to Three Rivers Landfill. Trees and vegetation debris taken from above grade were moved to the processing area and reduced by grinding. Wood chips were direct loaded into tandem dump trucks or stockpiled as needed. Stockpiled wood chips were loaded into trucks using a large frontend loader. Wood chips were transported to D-Area Borrow Site for future use.

2.7.2 488-1D Ash Basin Dewatering

Permitted (NPDES Permit #SC0047431) industrial wastewater (i.e., ash contaminated) from the 488-1D Ash Basin was removed and managed in accordance with the current NPDES permit

and/or transferred within the existing IWT permitted basin complex (i.e., 488-1D Inlet basins) or used for irrigation on the 488-D Ash Basin and 488-4D Ash Landfill. In addition, ash contaminated stormwater transferred to 488-1D during the closure of the 488-2D Ash basin (during Phase 1 of the project) was discharged as part of 488-1D Ash Basin Dewatering efforts. Intermittent NPDES permit discharges started in February 2016 and ran through December 2017. Table 5 provides the period of discharges and the summary of the passing toxicity test results. Intermittent irrigation events started in August 2016 and ran through June 2018 (Table 6). Supporting data are included in Appendix H (Discharge Monitoring Report Toxicity Test Results) and Appendix I (SCDHEC Irrigation Approval Letters).

Table 5. Summary Chronic Toxicity Discharge Monitoring Reports

Discharge Monitoring Report Summary Data			
Monitoring Period		Toxicity Testing Results	
From	To	Predicted % Survival Effect at CTC	Predicted % Reproduction Effect at CTC
1/1/2016	3/31/2016	0.0%	0.0%
4/1/2016	6/30/2016	10%	24%
7/1/2016	9/30/2016	0%	15%
10/1/2016	12/31/2016	No Discharge	No Discharge
1/1/2017	3/31/2017	No Discharge	No Discharge
4/1/2017	6/30/2017	11%	17%
7/1/2017	9/30/2017	4%	13%
10/1/2017	12/31/2017	0%	0%

Note 1. No wastewater discharges occurred after 12/31/2017.
CTC = Chronic Toxicity Concentration

Table 6. SCDHEC Approval of Water for Irrigation Purposes

SCDHEC Approval of Water for Irrigation Purposes		
SCDHEC Approval	Period of Performance	
	Start Date	End Date
SCDHEC 2016c	August 8, 2016	Note 1
SCDHEC 2017a	February 7, 2017	August 15, 2017
SCDHEC 2017b	July 20, 2017	February 28, 2018
SCDHEC 2018a	February 8, 2018	May 31, 2018
SCDHEC 2018b	May 17, 2018	June 30, 2018

Note 1. Approval granted for a onetime 8-million-gallon event.

All stormwater was removed/managed in accordance with the *Comprehensive Stormwater Pollution Prevention Plan (SWPPP) for the 488-1D Ash Settling Basin and 489-D Coal Pile Runoff Basin Closure* (SRNS 2015a).

2.7.3 488-1D Ash Basin Excavation and Haul of Ash to the East End

The ash in the entire 488-1D Ash Basin was saturated prior to the start of any excavation activities. To facilitate drying, the contractor excavated and graded drainage ditches and sumps through the ash across much of the basin to allow for collection of water (Photo 46 and 47). Once collected, the water was pumped to the inlet basins. Sumps and ditches were continually changed, modified, and redirected as field conditions dictated. Removal of interstitial and rain water was critical throughout the removal process.

Ash in the west end of the 488-1D Ash Basin (including the inlet basins) was excavated and placed on the east end of the 488-1D Ash Basin. Access lanes were created, as needed, in the 488-1D Ash Basin to allow haul trucks to be direct loaded by tracked excavators. Excavators, both standard reach and long reach, were used extensively to process the saturated ash in the west end of the 488-1D Ash Basin before it could be loaded into haul trucks. This process consisted of mostly stacking and restacking of the material until sufficient water had been drained (Photo 48). When required, mats were used to provide safe access for equipment and articulated haul trucks.

Once the ash had dried sufficiently, it was loaded and hauled (Photo 49) to the east end of the 488-1D Ash Basin. Trucks were loaded to minimize spilling of material during transport between the areas.

GPS models were used for the excavation of the 488-1D Ash Basin bottom. The final excavation in the basin bottom was initiated after most of the bulk ash had been removed and the bottom of the basin exposed. Approximately 6.1 cm (2 ft) of ash was intentionally left in place to prevent constant tracking of ash (Photo 50). The final excavation included the ~6.1-cm (2-ft) layer of ash and the 30.48 cm (1 ft) of contaminated soil (Photo 51). The original basin bottom in the west end of the from 488-1D Ash Basin generally slopes downward from north to south. Removal of this material progressed in the same general sequence of north to south to allow for control of stormwater runoff from the visually clean surface to areas of the bottom still contaminated.

Processing and removal of bulk ash from the west end of the 488-1D Ash Basin took approximately nine months. The volume of ash including removal of a minimum of 30.5 cm (1 ft) of additional soil from the foot print of the area, was ~183,356 m^3 (239,821 yd^3). Summary volumes for the project are included in Section 2.8.1.

2.7.4 488-1D Ash Basin Confirmation Sampling

Following removal of ash and soil from the west end of 488-1D Ash Basin, SRNS performed visual inspections of the area to confirm that all ash had been removed. Visual verification was followed by confirmatory sampling (Photo 51 and 52). Confirmation sampling requirements and sample results are discussed in Section 4.3.2.

2.7.5 488-1D Ash Basin Placement of Ash on the East End

Ash and contaminated soil from the area east of the 488-4D Ash Landfill, the west end of the 488-1D Ash Basin, and coal fines and contaminated soil from 489-D CPRB were hauled in articulated off-road trucks to the east end of the 488-1D Ash Basin (Photo 53). Ash was dumped onto the existing ash surface and spread into 15.2-cm (6-in.) to 30.4-cm (12-in.) thick loose lifts by a D-6 size dozer equipped with GPS. Ash that was too wet to compact was spread and allowed to dry. A disc or plow was used to turn the wet material to assist in drying (Photo 54). Any time rain was forecast, the ash surface was sealed by compacting with a vibratory smooth drum compactor to minimize impacts of precipitation.

During periods of heavy rainfall, work related to ash placement, conditioning, grading, and/or compaction was essentially stopped until conditions became manageable. Rain and weather events created impacts to the drying time of the ash and the compaction and stability of placed materials. Recovery time from rain events created delays while materials were reworked and dried to the extent required to be placed and compacted to specifications as defined in Section 2.4.9. When the ash surface had dried sufficiently to allow for the operation of equipment, the ash surface was disked/harrowed and allowed to dry until it could be compacted.

When the ash had dried to the extent needed to successfully compact, a smooth drum vibratory compactor was used to compact each lift (Photo 55). After four lifts were placed and compacted,

the surface of the ash was proof rolled to demonstrate successful compaction. Proof rolling was performed in the presence of the Testing Laboratory Technician, STR and SRNS Design Engineer. A four-wheeled (minimum) pneumatic tired piece of heavy equipment not weighing less than 25 tons was used for proof rolling the ash surface (Photo 56 and 57). Any areas that exhibit pumping or softness were excavated a minimum of 45.7-cm (18-in.) and the material reconditioned until material characteristics allowed for successful proof rolling.

The final ash profile including grade breaks (within the limits of the cover area) had an established point grid at a density of 7.6 x 7.6 m (25 x 25 ft) to verify proper slopes had been obtained. This also served as the baseline to verify the thickness at each grid point location. The point data were also analyzed to ensure that the thickness was built to the design and were within the specified tolerances. Any areas not meeting the specifications were immediately repaired and the points re-surveyed.

2.7.6 488-1D Ash Basin Construction of New Western Berm

Once ash within the area of the new western berm was removed and confirmation sampling completed, construction of the new berm was started. Backfill to construct the berm was harvested from the existing berms on the west and southwest perimeter of the main 488-1D Ash Basin and the reduced berms of north and south inlet basins. The backfill was removed using a tracked excavator and loaded into articulated haul trucks for transportation to the new berm location (Photo 58). The backfill was graded into 15.2-cm (6-in.) to 30.4-cm (12-in.) thick loose lifts using a D-6 size dozer with GPS and compacted with vibratory drum compactors to design specifications and as outlined in Section 2.4.9 (Photo 59 and 60).

2.7.7 488-1D Backfilling of Western Portion of the Basin and Inlet Basins

Following removal of ash material from the west end of the 488-1D Ash Basin and inlet basins and subsequent SRNS confirmatory sampling, the surface of the basin was regraded and backfilled with common fill. The common fill was harvested from berm material and topsoil from the D-Area Borrow Site to the final grade shown in the construction drawings. A dozer equipped with GPS was used to cut and place material in the basin. Both vibratory smooth drum and sheep's foot compactors were used to compact the fill to design requirements in the RADP (SRNS 2016a)

(Photos 61 through 63) and as outlined in Section 2.4.9. Site restoration included the placement of topsoil, sod, and crushed stone surfacing as described in Sections 2.4.10, 2.4.11, and 2.4.12, respectively.

2.7.8 488-1D Ash Basin Drainage System and Stormwater Conveyance Systems (Catch Basins)

The 488-1D Ash Basin subsurface drainage consists of perforated subsurface piping for the collection of any water that penetrates the 61-cm (24-in.) soil cover. Any water that penetrates the 61-cm (24-in.) soil cover is directed by the Integrated Drainage System (LLDPE Geomembrane [MicroDrain®] and Geotextile) to the subsurface drain piping and conveyed to the catch basins. The 488-1D Ash Landfill perimeter surface ditch, capturing the surface runoff, follows the same course as the subsurface drainage system.

There were six catch basins (Photo 64) installed for the collection water from the surface ditches and the perforated subsurface piping. Stormwater from the runoff of the 488-1D Ash Basin is collected from each of the catch basins and discharged to the D-Area Discharge Canal as described in Table 7.

Table 7. Summary Table of Catch Basins and Culverts

Catch Basin	Location (1)	Discharge Direction	To End Point
9	Northwest Corner (1)	North to 488-2D Detention Pond	Discharge Canal
10	Center West Side (1)	Southwest Down Slope to Ditch	Discharge Canal
11	Southwest Corner (1)	West Down Slope to Ditch	Discharge Canal
12	Northeast Corner (1)	North to 488-2D Detention Pond	Discharge Canal
13	Center East Side (1)	East Down Slope to Ditch	Discharge Canal
14	Southeast Corner (1)	South to Ditch Running Parallel to South Side of 488-1D	Discharge Canal
NA	Southwest Corner	Southwest Corner of the East End of the 488-1D to Ditch	Discharge Canal

(1) Relative to the Covered Portion of the 488-1D Basin

All catch basins, culverts, and 61 cm (24 in.) CPP discharge piping were installed to the lines and grades as specified in the design requirements in the RADP (SRNS 2016a). Bedding material was placed, graded, and consolidated using a plate or utility compactor prior to installation of the pipe (Photo 65) as outlined in Section 2.4.9. Tie-ins to catch basins were completed as required

(Photo 66). As-Built surveys were completed prior to any backfilling. RipRap Aprons (Photo 67) were installed as discussed in Section 2.4.13.

2.7.9 488-1D Ash Basin Geosynthetic Cover Installation

All geosynthetic material placement, seaming, and acceptance were in accordance with the design requirements (SRNS 2016a), manufactures recommendations, and the Envirocon/Chesapeake Containment Systems Quality Control Testing and Inspection Plan (QCTIP) (Appendix J, Envirocon 2018). The QCTIP provides detailed requirements for the following as outlined below:

MANUFACTURED MATERIALS

- Manufacturer's (AGRU America) Quality Control Testing Material Testing
- Manufacturer Quality Control Requirements
- Third Party Conformance Testing
- Panel Identification Coding System Requirements
- Delivery, Storage, and Handling Requirements
- Pre-Installation Requirements

LLDPE INSTALLATION

- Deployment
- Seams
- Trial Seaming
- Production Seaming
- Non-Destructive Testing
- Destructive Testing
- Repairs
- Cover Penetration Seals

GEOTEXTILE INSTALLATION

- Deployment
- Seams
- Repairs
- Final Inspection and Acceptance

As the materials were off loaded, the rolls were inspected for damage. The rolls were unloaded and placed into storage with minimal handling. Cloth chokers and spreader bars were used to handle materials. Original packaging material remained on the rolls until immediately prior to installation. All documentation that included manufacturer's testing/certification documentation

and third-party conformance test documentation was verified prior to shipment to the SRS. There were no materials accepted at the job site that did not meet requirements as defined in the QCTIP.

Discussion on the placement of ash on the east end of the 488-1D Ash Basin and installation of the catch basins is included in Sections 2.7.5 and 2.7.8, respectively.

Prior to the placement of the LLDPE geomembrane, the shaping/over excavation of the subsurface drainage system profile (Photo 68) was completed followed by backfilling of the subsurface drainage system to the landfill grade with clean fill. Excavation of the subsurface/perimeter drainage system and anchor trench followed (Photo 69) with the ash fine graded (Photo 70) and rolled with a smooth drum roller. The surface was inspected and documented by a qualified Quality Control (QC) Inspector. Any rocks, sticks, or miscellaneous debris found at that time were removed. A field survey of the finished ash surface was performed at a grid point density of 7.6 x 7.6 m (25 x 25 ft) to establish the baseline for the 61-cm (24-in.) soil cover.

The installation of the 488-1D Ash Basin cover system consisted of the following four main components: LLDPE geomembrane/geotextile and subsurface drainage system, 50.8-cm (20-in.) common fill layer, 10.2-cm (4-in.) topsoil layer, and vegetative layer (sod). These commodities were installed in a stepped parallel fashion. The remaining discussion in this section includes the placement of the LLDPE geomembrane and geotextile.

The LLDPE geomembrane was deployed using an all-terrain forklift or bobcat in the orientation recommended by the manufacturer. A spreader bar was attached to a steel bar inserted through the center core of the roll to pick and move the LLDPE geomembrane and geotextile (Photo 71 through 73).

Thermo-fusion seaming methods were used to join all LLDPE geomembrane panels in the field. Both dual hot wedge (Photos 74 and 75) and extrusion seaming were used (Photos 76, 77 and 78), with dual hot wedge being the primary method. Extrusion seaming was used primarily for repairs and detailing. The seaming equipment used included hot wedge (dual track), extrusion, and hot air (“leister”) welding machines. All seaming equipment was equipped with gauges that clearly displayed wedge temperature, rate of travel, barrel temperature, and nozzle (“pre-heat”)

temperature, as applicable. No placement of geosynthetic material or seaming could be conducted in the presence of precipitation, winds in excess of 20 miles per hour, or when sheet temperatures were below 35 degrees or above 135 degrees Fahrenheit. Each seam was uniquely identified during the seaming process **(**Photos 75 and 77).

Trial seaming (Photo 79) was performed in the presence of the QC Inspector using the same personnel, equipment, and seaming conditions that will be used during production seaming. Field destructive samples were obtained and tested in peel and shear by the QC Inspector prior to performing any production seaming.

Non-destructive testing (Photos 80 and 81) was performed by the LLDPE geomembrane Installer for 100 percent of all production seams and repairs to verify their continuity. Non-destructive testing was conducted as LLDPE geomembrane seaming and repair work progressed in the presence of the QC Inspector.

Both laboratory/third party and field destructive tests (Photo 82) were performed during placement of the LLDPE geomembrane. The LLDPE geomembrane Installer was responsible for obtaining samples and repairing sampling locations for all laboratory and field destructive testing. Field destructive testing of production seams was performed by the LLDPE geomembrane installer's QC Inspector.

Installation of the geotextile did not begin until the LLDPE geomembrane had been installed, verified, and accepted by the QC Inspector. It was deployed and placed in accordance with the design requirements. Panel seams were oriented in a direction parallel with the LLDPE geomembrane slope (i.e., down the slope) (Photo 83). The QC Inspector maintained a daily field record of geotextile panel placement.

The geotextile was placed in such a manner as to continuously keep the geotextile in tension and securely anchored by approved/specified methods (sand bags). The geotextile was placed in such a manner as to minimize dragging of panels into position ("spotting"). During placement of the geotextile, care was taken not to entrap soil, stones, or excessive moisture that could hamper subsequent seaming of the geotextile.

The geotextile was not exposed to precipitation prior to being installed and was not exposed to direct sunlight for more than 15 days after installation. Vehicular traffic was limited to the use of low ground pressure equipment having 0.414 bar (6 pounds per square in) or less contact pressure.

The geotextile was seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the engineer. Sewn seams (Photo 84) were made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. For heat seaming, fusion welding techniques recommended by the manufacturer was used.

During installation, the geotextile Installer and QC Inspector visually inspected all geotextile panels and seams for damage, and defects, or non-compliance with the contract drawings, technical specifications, and marked any such areas for repair. Any holes, tears, or rips were corrected by placing a patch over the damaged area in accordance with the manufacturer's repair procedures using the same type geotextile to overlap the damaged area extending a minimum of 30.5 cm (12-in.) beyond the damage in all directions and were heat bonded in place.

Approximately 7.85 ha (19.5 ac) of each of the geosynthetic materials (LLDPE geomembrane/ geotextile) were placed. Aerial Photo 85 provides an in-process view of the cover placement progress. A qualified QC Inspector inspected, tested, and documented the installation of the LLDPE geomembrane and geotextile. Temporary ditches, swales, and/ or sandbags were used to divert water from running onto the surface of the LLDPE geomembrane.

2.7.10 488-1D Ash Basin Subsurface Drainage System Piping

Following the installation of the LLDPE geomembrane and geotextile, the subsurface drainage system was installed. The subsurface drainage consists of ~1,098 m (3,600 ft) of perforated piping for the collection of any water that penetrates the 61-cm (24-in.) soil cover. Any water that penetrates the soil cover is directed by the Integrated Drainage System (LLDPE geomembrane and geotextile) to the subsurface drain piping and conveyed to the catch basins. The 488-1D Ash Basin perimeter surface ditch, capturing the surface runoff, follows the same course as the subsurface surface drainage system. As discussed in Section 2.7.8, there were six catch basins which collect water from the surface ditches and the perforated subsurface piping.

The subsurface surface drainage pipe trench was lined with geosynthetic filter fabric and filled with gravel. The surface drainage pipe was placed such that the orientation of the holes faced down approximately in the center of the trench and 5.1 cm (2 in.) from the bottom of the trench. The geosynthetic filter fabric was then wrapped around and overlapped (Photo 86 and 87). The remaining backfill (common fill) around and over piping, culverts, and structures was placed in specified loose lift thickness and compacted in accordance with design requirements in the RADP (SRNS 2016a) as outlined in Section 2.4.9. The material was placed using loaders, excavators, and various compaction equipment.

All structures and piping that included 15.2-cm (6-in.) diameter subsurface drainage system piping, culverts reinforced concrete pipe and CPP, and catch basins, were installed to the lines and grades as specified in the design requirements in the RADP (SRNS 2016a). Tie-in to catch basins were completed as required (Photo 88). Horizontal locations, size, and vertical elevations of associated structures and appurtenances were incorporated into the As-Built Drawings in Section 6.1 prior to the execution of backfill placement.

2.7.11 488-1D Ash Basin Soil Cover

The initial lift of the 50.8-cm (20-in.) common fill layer over the geosynthetic materials was placed as the installation of LLDPE geomembrane, geotextile, and subsurface drainage system progressed. Common fill was hauled from the borrow pit and spread over the geotextile by a D-6 size low ground pressure (LGP) dozer equipped with GPS. The initial lift was between 30.5- and 38.1-cm (12- and 15-in.) loose thickness. Fill was pushed out over the geotextile in an upward tumbling as prescribed by the manufacturer, to prevent wrinkles in the geosynthetics (Photo 89). Dumping of fill on the geotextile was limited to a maximum height of 0.9 m (3 ft). On slopes, fill was placed from the bottom of the slope upward. The equipment used to place the fill was not allowed to operate directly on the geosynthetics. Compaction of the initial lift of material above the geotextile was accomplished by traffic compaction with ground pressure less than 414 millibar (6 pounds per square in.) making at least two passes over the area as required by the design.

The remaining fill was placed in a lift thickness that results in an overall common fill layer 50.8 cm (20 in) (Photo 90). The fill was placed with a D-6 LGP dozer. A vibratory compactor

was utilized to ensure material was compacted to the specification as outlined in Section 2.4.9. Compaction was measured with a nuclear densometer. Because the traffic on the initial 30.5- to 38.1-cm (12- to 15-in.) lift was limited to low ground pressure equipment, the second common fill lift was placed as soon as practicable after the first lift was compacted to 85% maximum density in non-traffic areas and 95% in traffic areas per Section 2.4.9. A 10.2-cm (4-in.) topsoil layer was then placed over the 50.8-cm (20-in.) common fill layer.

Once the topsoil layer within the limits of the cover was completed, the cover was surveyed at a grid point density of 7.6 x 7.6 m (25 x 25 ft). As each layer of the cover was placed, the thickness was verified at each grid point location. These point data and as-built exhibits were analyzed to ensure that the thickness was built to the design and was within the specified tolerances. Any areas not meeting the specifications were immediately repaired and the points re-surveyed. The placement of topsoil and sodding (Photo 91) are described in Sections 2.4.10 and 2.4.11, respectively.

2.7.12 Seeding and Sodding

All surfaces disturbed by construction activities received seed or sod per design requirements prior to project completion as described in Section 2.4.11. Photo 92 provides an aerial view of the completed 488-1D Ash Basin. Photo 93 provides an aerial view of the completed project including Phase 1 (488-4D Ash Landfill and 488-2D Ash Basin) and Phase 2, (488-1D Ash Basin and 489-D CPRB).

2.7.13 Crushed Stone Surfacing

Crushed stone surfacing was placed on the roads around the project site as specified in the design drawings. The width and depth of gravel paving was installed per design requirements in the RADP (SRNS 2016a). Vibratory compactors were used to construct a dense uniform surface.

2.8 Summary Quantities

2.8.1 Summary of Materials Consolidated in the East End of the 488-1D Ash Basin

Table 8 provides a summary of the volume of material (ash, contaminated soil, and coal fines) from the area east of the 488-4D Ash Landfill, the 489-D CPRB, and the west end of 488-1D Ash Basin placed in the covered portion of the 488-1D Ash Basin.

SRNS performed visual inspections of each area to confirm that all material had been placed in the landfill in accordance with the design requirements of the RADP (SRNS 2016a). Following the visual inspection performed by SRNS, a topographic survey of the finished excavated surface (As-built Ash Surface Layer, Section 6.1) was developed by the contractor. Data from the topographic surveys were provided to SRNS for evaluation against the existing design. A summary of ash/contaminated soil/coal fine quantities placed into the 488-1D Ash Basin east end (covered portion) are provided below in Table 8.

Table 8. 488-1D Consolidated Material Quantities

Approximate Consolidated Material Quantities		
Material {ash, contaminated soil and coal fines (CPRB)} Moved from Location Identified Below to the 488-1D Ash Basin East End	**Volume** *(yd^3)*	**Volume** *(m^3)*
Area East of the 488-4D Ash Landfill (ash and contaminated soil)	29,500	22,554
489-D CPRB (coal fines and contaminated soil)	23,050	17,623
488-1D Ash Basin (ash and contaminated soil) (Material moved from the west end of the basin to the east end of the basin)	239,821	183,356
488-1D Inlet Basins (ash and contaminated soil)	5,759	4,403
TOTAL	**298,130**	**227,936**

Based on the Design Engineering evaluation comparing the As-built Ash Layer drawing (Section 6.1) versus the original basin design drawing (W705904), the total compacted volume of ash, including the existing volume of material prior to construction and the additional volume consolidated in the east end covered portion of the 488-1D Ash Basin is estimated to be 460,193 m^3 (601,910 yd^3).

2.8.2 Summary of Bulk Common Fill Quantities

Table 9 provides the Summary of Bulk Common Fill Quantities.

Table 9. Bulk Common Fill Quantities

Approximate Bulk Quantities		
Common Fill	**Volume** *(yd^3)*	**Volume** *(m^3)*
488-1D Ash Basin Cover System 50.8-cm. (20-in) common fill layer and Perimeter Ditch	56,600	43,274
488-1D New Western Berm	46,150	35,284
Area East of 488-4D Ash Landfill	18,500	14,144
488-1D Inlet Basins	5,650	4,320
489-D CPRB Bottom	10,400	7,951
TOTAL	**137,300**	**104,973**

2.8.3 Summary of Topsoil Quantities

A summary of topsoil quantities is provided in Table 10.

Table 10. Summary of Topsoil Quantities

Approximate Topsoil Quantities		
Topsoil	**Volume** *(yd^3)*	**Volume** *(m^3)*
488-1D Ash Basin Landfill Cover	10,450	7,990
489-D CPRB bottom	5,700	4,358
Area East of 488-4D Ash Landfill	1,000	765
Areas Outside the Cover Limits of the 488-1D Ash Landfill and CPRB	13,500	10,322
TOTAL	**30,650**	**23,435**

2.8.4 Summary of Sodded and Seeded Areas

All surfaces disturbed by construction activities received seed or sod per design requirements prior to project completion. An estimated 21.2 ha (52.4 ac) of sod was placed in and around the 488-1D Ash Basin, area east of the 488-4D Ash Landfill and on the interior side slopes of 489-D

CPRB. Approximately 4.2 ha (10.5 ac) of seeding was placed in and around the 488-1D Ash Basin and the 489-D CPRB of which 4.0 ha (9.9 ac) was in the 489-D CPRB basin bottom.

2.9 Demobilization

Upon completion of all construction activities, the contractor removed equipment, temporary erosion controls, excess materials, temporary office trailers, and personnel from the site. SRNS provided a radiological survey of the equipment (standard SRS operating procedure) prior to equipment demobilization. All documentation, including but not limited to, daily inspection records, field notes, geosynthetic cover installation data, inspection and test reports, final geosynthetic cover acceptance inspection report, as-built surveys/drawings, and Engineer's Certification Letter(s), etc., were submitted to SRNS as required by subcontract documents.

2.10 CERCLA Sanitary Waste

Waste management (handling, disposal and consolidation) and transportation of construction generated wastes have met the requirements of Federal and State regulations and applicable SRS manuals and procedures (e.g., SRS 3Q Manual, Environmental Compliance Manual [SRNS 2017b]; SRS C1 Manual [SRNS 2017c], Environmental Restoration Administrative Procedures, etc.). Waste reduction and recycling techniques were utilized as necessary for waste minimization.

Shipment of waste and construction debris (including preparation, packaging, and appropriate certifications) to disposal facilities was performed in accordance with the SRS 3Q Manual (SRNS 2017b) and the project specific Waste Management Plan (SRNS 2015a). The Generator Certification Official was responsible for ensuring the proper shipping manifests were available. Appendix G contains the verification documents for the CERCLA Off-Site Acceptability of Three Rivers Landfill during the periods of waste shipments from the project.

Table 11 provides a summary of waste stream activity and waste description.

Table 11. Waste Streams

Activity	Waste Description	Approximate Tonnage [1] *(Tons)*	Approximate Tonnage *(Metric Tons)*
Area East of the 488-4D Ash Landfill and 488-1D Ash Basin Clearing and Grubbing	Root Balls, Stumps, Misc. Vegetation, and Limited Amounts/Volumes of Cast Iron, PVC, and Corrugated Metal Pipe	1,257	1,140
North Inlet Basin	Ash	5,480	4,971
	TOTAL	**6,737**	**6,111**

1) Based on actual Three Rivers Landfill Trip Tickets

3.0 DEVIATIONS FROM ORIGINAL DESIGN

As set forth in the RADP (SRNS 2016a), "USDOE will notify USEPA and SCDHEC, within a reasonable time frame, when major problems arise with any aspect of the removal action process. In particular, major scheduling, implementability, and technical issues will be brought to the attention of the regulators as soon as they are identified. Major changes are considered changes that would significantly alter the configuration of the original design. Major changes will be summarized in the RAR. Minor changes during construction will be documented in accordance with SRNS Design Change Control."

The most significant change from the original design that occurred during the removal action was the substitution of the geosynthetic materials for the cover over the consolidated ash pile on the east end of the 488-1D Ash Basin. USEPA and SCDHEC were notified of this change as required (USDOE 2017). All other changes during construction are considered "Minor" and have been documented in accordance with SRNS Design Change Control and available in the project records. Table 12 provides a summary of the Significant Design Changes/Deviations.

Table 12. Summary of Significant Design Changes/Deviations

Item	Deviation (Note 1)	Reason (Note 2)
1	Substitution of the geosynthetic materials from a geosynthetic clay liner (GCL) overlain by a double-sided geosynthetic drainage layer (GDL) to an Integrated Drainage System (IDS) which includes a studded LLDPE (MicroDrain) overlaid by a geotextile.	Reduce risk associated with GCL installation with respect to rain, reduce cost and schedule, and overall improved end product.

4.0 VERIFICATION SURVEYING, PERFORMANCE STANDARDS, AND CONSTRUCTION QUALITY CONTROL

To ensure the "Performance Requirements and Standards" were achieved, the Project Team personnel comprised of SRNS ACP Engineering, Project Management, Quality Assurance, Safety, STRs, and Design Engineering performed routine monitoring/surveillance activities, as required by the approved construction procedures. ACP Engineering performed various functions including routine field oversight, verification of sampling results, sampling data management, and evaluation and acceptance of the analytical results. SRNS Quality Assurance performed surveillances of subcontractors as required by the SRNS Quality Assurance Program. Dedicated SRNS STRs were assigned to follow all work throughout the construction/removal process. The Envirocon Professional Engineer stamped and signed letters certifying that the construction activities for the 488-1D Ash Basin and 489-D CPRB were completed in accordance with design specifications in the RADP (SRNS 2016a) and are included in Appendix K.

4.1 Design Engineering Title III Construction Support Activities

SRNS Design Engineering provided Title III Construction Support throughout the construction phase of the project. The following elements of work were included in the project as Design Engineering Title III Construction Support activities:

- Review and evaluation of all proposed deviations of the original "Detailed Design" for conformance with regulatory requirements, codes, and standards;
- Review of all vendor drawings and submittals for conformance with the approved design requirements in the RADP (SRNS 2016a) and drawings;
- Inspection of the construction contractor's workmanship, materials, and equipment and reporting on their conformance or nonconformance with the approved drawings and specifications;
- Verification of field tests (compaction/proof rolling), laboratory tests, manufacturer's testing as necessary to ensure that construction materials, and practices are in accordance with the approved drawings and specifications;
- Verification of the incorporation of all approved as-built record drawings; and

- Verification that planned quality control measures were implemented and evaluation of the results of those measures to ensure that the work was completed in accordance with the approved plans and specifications.

Based on the project team reviews, inspections, and verifications that included SRNS Design Engineering, EC&ACP Engineering, Quality Assurance and the Envirocon PE's all construction activities for the 488-1D Ash Basin and 489-D CPRB were completed in accordance with design requirements in the RADP (SRNS 2016a). The data supporting the construction completion is included in the Appendices noted below and in subsequent sections of this document.

Appendix L	LLDPE & Geotextile Data and Documentation
Appendix M	LLDPE Data and Documentation
Appendix N	Geotextile Data and Documentation
Appendix O	Soil Test Data and Documentation
Appendix P	Ash Proof Roll Acceptance Reports
Appendix Q	Completed Cover Acceptance Reports

4.2 Fill Material and Topsoil Evaluation

Soil samples from the Clean Fill Borrow Site located near D-Area at the SRS; the 488-1D Inlet Basin berms and fingers; and the 488-1D Ash Basin western and southern berms were collected and evaluated per the requirements of the *SRS Fill and Soil Cover Material Verification Protocol* (WSRC 2003). The material from the Clean Fill Borrow Site and berms from the west and south sides of 488-1D and inlet basins was used as described in Sections 2.4.8 and 2.4.10. The evaluation concluded that the soil from all three source areas met the requirements for use as fill material/top soil under an unrestricted (residential) land use scenario. The supporting text and documentation are in Appendix R.

4.3 Sampling (488-1D Ash Basin, 489-D CPRB, and Area East of 488-4D Ash Landfill)

Prior to conformation sampling SRNS performed visual inspections of the area to confirm that all ash had been removed. Confirmation sample results were evaluated to demonstrate that the coal and/or ash had been successfully removed from the 489-D CPRB, 488-1D Ash Basin and Inlet Basins and the area east of the 488-4D Ash Landfill. The confirmation sampling was conducted in accordance with the *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at*

the Savannah River Site (SRNS 2014b) and the site-specific Field Sampling Plans (FSPs) as appropriate. A summary of the confirmation sampling for each of the subunits is provided below.

4.3.1 489-D CPRB

Confirmation sampling was conducted in accordance with the *Field Sampling Plan for the 489-D Coal Pile Runoff Basin* (SRNS 2015c). In addition to the 11 sample locations identified in the FSP, an additional 12 samples were collected for TCLP at locations where soil/coal fines were staged (within the 489-D CPRB) prior to placement in the 488-1D Ash Basin. Therefore, a total of 23 confirmation sample results were evaluated to demonstrate that the coal residue had been successfully removed from the 489-D CPRB. The *Human Health and Ecological Evaluation for the Confirmation Sampling at the 489-D Coal Pile Runoff Basin* (SRNS 2017d) concluded that the residual concentrations of all analytes met the pre-established cleanup levels for unrestricted land use. The *Data Usability Report* (DUR) *for Confirmation Sampling at the 489-D Coal Pile Runoff Basin* is presented in Appendix S.1.

Material from each of the staged piles was composited into three separate samples and submitted to the laboratory for TCLP analysis. The results are presented in Table 13. Only barium was detected. The maximum detected concentration of 0.159 milligrams per liter (mg/L) is below the regulatory threshold of 100,000 mg/L for toxicity characteristic hazardous waste. These sample results confirm the process knowledge that material from the 489-D CPRB is not a RCRA hazardous waste.

4.3.2 488-1D Ash Basin (including inlet basins) and Area East of the 488-4D Ash Landfill

Confirmation sampling was conducted in accordance with the *Field Sampling Plan for the 488-1D Ash Basin* (SRNS 2015d). In addition to the 19 samples that were collected from the western end of the 488-1D Ash Basin (16 basin interior, 3 basin berms), two additional samples were collected from the area east of the 488-4D Ash Landfill. Therefore, a total of 21 samples were evaluated to demonstrate that the ash has been successfully removed from the areas of excavation. The *Human Health and Ecological Evaluation for Confirmation Sampling at the 488-1D Ash Basin and Inlet Basins* (SRNS 2019) concluded that the residual concentrations of all analytes, except hexavalent chromium, met the pre-established cleanup levels for unrestricted land

use. The concentration of hexavalent chromium did not exceed the threshold level for an industrial use scenario. The report recommended that land use controls to prevent unrestricted use (i.e., residential) be implemented at the 488-1D Ash Basin and Area East of the 488-4D Ash Landfill.

Table 13. D-Area Coal Pile Runoff Basin 489-D TCLP Sample Results

D-Area Coal Pile Runoff Basin 489-D TCLP SAMPLE RESULTS											
Station Name	**Sample Use**	**Collection Date**	**Analyte Name**	**Analytical Method**	**MDL**	**PQL**	**Lab Qual**	**Result**	**Result Units**	**Regulatory Level (µg/L)**	**Exceeds Regulatory Level?**
489D-01	TCLP	9/22/2016	Arsenic	EPA6010C	50	300	U	300	µg/L	5,000	No
489D-02	TCLP	9/29/2016	Arsenic	EPA6010C	50	300	U	300	µg/L	5,000	No
489D-03	TCLP	10/18/2016	Arsenic	EPA6010C	50	300	U	300	µg/L	5,000	No
489D-01	TCLP	9/22/2016	Barium	EPA6010C	10	50		159	µg/L	100,000	No
489D-03	TCLP	10/18/2016	Barium	EPA6010C	10	50		153	µg/L	100,000	No
489D-02	TCLP	9/29/2016	Barium	EPA6010C	10	50		78.3	µg/L	100,000	No
489D-01	TCLP	9/22/2016	Cadmium	EPA6010C	10	50	U	50	µg/L	1,000	No
489D-02	TCLP	9/29/2016	Cadmium	EPA6010C	10	50	U	50	µg/L	1,000	No
489D-03	TCLP	10/18/2016	Cadmium	EPA6010C	10	50	U	50	µg/L	1,000	No
489D-02	TCLP	9/29/2016	Chromium	EPA6010C	10	50	U	50	µg/L	5,000	No
489D-03	TCLP	10/18/2016	Chromium	EPA6010C	10	50	U	50	µg/L	5,000	No
489D-01	TCLP	9/22/2016	Chromium	EPA6010C	10	50	U	11.6	µg/L	5,000	No
489D-01	TCLP	9/22/2016	Lead	EPA6010C	33	100	U	100	µg/L	5,000	No
489D-02	TCLP	9/29/2016	Lead	EPA6010C	33	100	U	100	µg/L	5,000	No
489D-03	TCLP	10/18/2016	Lead	EPA6010C	33	100	U	100	µg/L	5,000	No
489D-01	TCLP	9/22/2016	Mercury	EPA7470A	0.67	2	U	2	µg/L	200	No
489D-02	TCLP	9/29/2016	Mercury	EPA7470A	0.67	2	U	2	µg/L	200	No
489D-03	TCLP	10/18/2016	Mercury	EPA7470A	0.67	2	U	2	µg/L	200	No
489D-01	TCLP	9/22/2016	Selenium	EPA6010C	60	300	U	300	µg/L	1,000	No
489D-02	TCLP	9/29/2016	Selenium	EPA6010C	60	300	U	300	µg/L	1,000	No
489D-03	TCLP	10/18/2016	Selenium	EPA6010C	60	300	U	300	µg/L	1,000	No
489D-01	TCLP	9/22/2016	Silver	EPA6010C	10	50	U	50	µg/L	5,000	No
489D-02	TCLP	9/29/2016	Silver	EPA6010C	10	50	U	50	µg/L	5,000	No
489D-03	TCLP	10/18/2016	Silver	EPA6010C	10	50	U	50	µg/L	5,000	No

The *Data Usability Report for Confirmation Sampling at the 488-1D Ash Basin* is presented in Appendix S.2.

Two samples were collected from the area east of the 488-4D Ash Landfill prior to placement into the 488-1D Ash Basin. Results of the TCLP analysis are reported in Appendix C of the *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D-Ash Basin (488-1D)* (SRNS 2016b). Detected constituents include arsenic, barium, boron, cadmium, chromium, selenium, and thallium. No constituents exceeded the regulatory thresholds for toxicity characteristic hazardous waste. These sample results confirm the process knowledge that ash media found in D-Area is not a RCRA hazardous waste.

Inlet Basins: Confirmation sampling was conducted in accordance with the *Field Sampling Plan for the D-Area 488-1D Inlet Basins* (SRNS 2014c). The FSP identifies eight samples total, four from each of the two basins. The *Human Health and Ecological Evaluation for Confirmation Sampling at the 488-1D Ash Basin and Inlet Basins* (SRNS 2019) concluded that the residual concentrations of all analytes met the pre-established cleanup levels for unrestricted land use. The *Data Usability Report for Confirmation Sampling at the Inlet Basins* is presented in Appendix S.3.

4.4 Hydrologic Separation Study Status

The *White Paper on the Source of Groundwater Contamination and the Hydrologic Separation Study for the D-Area Ash Basins and Ash Landfill* (SRNS 2014d) posed the following questions:

1) Does groundwater monitoring indicate the contamination is sourced from the 488-4D Landfill and 488-1D Ash Basin?
2) After removal/remedial actions are completed, will the water table fall to an elevation that will support at least 0.9 m (3 ft) of unsaturated conditions beneath the buried ash?
3) How long will it take to achieve at least 0.9 m (3 ft) of unsaturated conditions beneath the buried ash?

Insufficient data, following removal of the mounded water, is available at this time to respond to Question 1; however, sampling results continue to indicate there is no contamination sourced from the 488-4D Landfill and 488-1D Ash Basin. This discussion provides the current status of

Questions 2 and 3. The summary/conclusions in the white paper were stated "….it will take five to ten years for the buried ash in the 488-1D Ash Basin to drain sufficiently to support 0.9 m (3 ft) of unsaturated conditions between the buried ash and the water table [and] at the 488-4D Ash Landfill, obtaining 0.9 m (3 ft) of unsaturated conditions should occur sooner…".

After eliminating the artificial water mounds at the ash basins in D-Area by dewatering, water elevations are adjusting to natural levels. Water elevations at monitoring wells within and adjacent to the 488-1D and 488-2D Ash Basins, including the two new wells in the west end of the 488-1D Ash Basin, indicate that there is separation between the bottom of the ash in the 488-1D ash basin and the water table. Measurements from 4Q2018 indicate that the water table elevation is ~31.4- to 32.3-m (103- to 106-ft) mean sea level (msl) underneath the 488-1D Ash Basin. The bottom of the ash stored at the 488-1D Ash Basin varies from 33.2- to 34.1-m (109 to 112 ft) msl, running generally in the same direction, providing a separation of ~1.8-m (6 ft) between the ash and the water table. Measurements from 4Q2018 indicate that the water table elevation is ~32- to 33.5-m (105 to 110 ft) msl underneath the 488-4D Ash Basin. The bottom of the ash stored at the 488-4D Ash Basin varies from 34.1- to 34.7-m (112- to 114-ft) msl, running generally in the same direction, providing a separation of 7 to 4 ft, respectively, between the ash and the water table. In addition, there is a thick clay layer (2.4- to 4.2-m (9- to 14-ft) directly below the majority of ash at the 488-1D Ash Basin and the 488-4D Ash Landfill that would restrict any water intrusion and leaching of ash or contaminants if water elevations were higher. This is based on the logs obtained during the installation of the two new wells in the west end of the 488-1D Ash Basin and relatively recent wells installed to the east of the 488-4D Ash Landfill. In all locations the 0.9 m (3 ft) has been exceeded as of this time. It is expected that the hydrologic separation will continue to increase to some degree over time.

5.0 VERIFICATION OF CONSTRUCTION COMPLETION AND FINAL INSPECTION

5.1 Verification of Construction Completion

Per Section 4.0, construction activities required for the removal action have met the acceptance criteria established in the *Revision 3 Action Memorandum for the Non Time Critical Removal Action for the D-Area Coal Pile Runoff Basin 489-D* (USDOE 2015a), *RSER/EE/CA for the*

D-Area Ash Basin 488-1D (SRNS 2016b), RADP (SRNS 2016a), *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site* (SRNS 2014b), *Field Sampling Plan for the 489-D Coal Pile Runoff Basin* (SRNS 2015c), *Field Sampling Plan for the 488-1D Ash Basin* (SRNS 2015d), and the *Field Sampling Plan for the D-Area 488-1D Inlet Basins* (SRNS 2014c). The confirmation sample results were formally evaluated in two reports: *Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin* (SRNS 2017d) and the *Human Health and Ecological Evaluation for Confirmation Sampling at the 488-1D Ash Basin and Inlet Basins* (SRNS 2019). The results of the analytical sampling and construction testing have been documented and the records are on file in the SRS Environmental Restoration Data Management System and in the attachments included in this report.

The performance requirements were verified as meeting the Data Quality Objectives (DQOs) documented in the *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site* (SRNS 2014b). The DQO process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. The DQO process was used to establish performance and acceptance criteria, which served as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the project. Use of the DQO process lead to efficient and effective expenditure of resources; consensus on the type and quantity of data needed to meet the project goal; and the full documentation of actions taken during the development of the project. The DQO process is a series of seven planning steps based on the scientific method (Section 3 in SRNS 2014b) and is detailed in USEPA Guidance (USEPA 2006). The DURs for Confirmation Sampling at the 489-D CPRB, 488-1D Ash Basin and Inlet Basins are presented in Appendix S.

5.2 Final Inspection

A final walk down inspection with participation from the USDOE, USEPA, SCDHEC and SRNS was performed on October 29, 2018 **(**Appendix F, USDOE 2018) to observe and discuss the status and completion of the removal action construction activities for the 488-1D Ash Basin and 489-D CPRB. The personnel present observed and discussed the construction activities within the 489-D CPRB and the 488-1D Ash Basin.

Based on this review and walk down, the USDOE, SCDHEC, and USEPA personnel present agreed that there were no deficiencies observed with the completed field activities for the removal actions associated with 488-1D Ash Basin and 489-D CPRB.

6.0 AS-BUILT DOCUMENTATION

6.1 As-Built Drawings

As-built documentation for the project is included in Appendix T "As-Built Drawings" as provided below:

Appendix T.1 488-1D Ash Basin Cover As-Built Drawings

- 488-1D (Cover) Ash Surface Layer As-Built
- 488-1D (Cover) LLDPE (Microdrain) As-Built
- 488-1D (Cover) Geotextile As-Built
- 488-1D (Cover) SSDS and Utility As-Built
- 488-1D (Cover) Final Topsoil Surface As-Built

Appendix T.2 Other As-Built Drawings

- 488-1D (Entire Basin) Final Topographic & Utility As-Built
- 489-D CPRB Final As-Built (Including Utilities)
- Area East of 488-4D Final As-Built

6.2 Well Modifications

All well installations and abandonments were coordinated with SCDHEC. SCDHEC approvals are provided in Appendix U.1 SCDHEC 2018c (Monitoring Installation Well Approval)] and [SCDHEC 2015 (Monitoring Well Abandonment)].

Two new wells (DCB081, and DCB082) were installed down gradient of the 488-1D Ash Basin covered ash mound. The monitoring well installation reports and well development field parameters for these groundwater monitoring wells are included in Appendix U.2 (SRNS 2018a).

A total of 1 well (DB 6C) was abandoned during the construction activities related to the Phase 2 (488-1D Ash Basin and 489-D CPRB) removal activities. The Well Abandonment Report for

this well is included in Appendix U.3 (SRNS 2018b). Figure 4 shows both the new and abandon wells around the 488-1D Ash Basin.

7.0 POST CONSTRUCTION ACTIVITIES

Removal actions for the 488-1D Ash Basin, Inlet Basins, Area East of the 488-4D Ash Landfill and 489-D CPRB are complete. The 489-D CPRB and the 488-1D Inlet basins meet the criteria for unrestricted land use. The final remedial decision for the 488-1D Ash Basin, 488-1D Inlet Basins, Area East of the 488-4D Ash Landfill and 489-D CPRB will be described in the *DAOU Early Action Statement of Basis/ Proposed Plan and Second Early Action Record of Decision.* These documents will address the remedial decision for all DAOU subunits including the 488-2D Ash Basin and 488-4D Ash Landfill.

The final remedial action for these DAOU subunits is expected to be LUCs, but the final decision has not been determined at the time of this publication. LUCs will be implemented at 488-1D Ash Basin (not including the Inlet Basins) and the Area East of 488-4D Ash Landfill to prevent unauthorized access until the ash is no longer a threat to human health and the environment. Current groundwater monitoring and reporting under the D-Area Groundwater OU will continue and will be used to document the effectiveness of the cover system.

The 488-1D Ash Basin (not including the Inlet Basins) and the Area East of the 488-4D Ash Landfill will be maintained and inspected annually in accordance with EC&ACP Standard Operating Procedures for “Waste Site Unit Inspection and Maintenance” (SRNS 2018c) until the DAOU Early Action Land Use Control Implementation Plan is approved and implemented. These annual inspections will include the 488-2D Ash Basin as part of the storm water management system associated with the 488-4D Ash Landfill and 488-1D Ash Basin. The inspections will include verification of road accessibility; there are no excavations, digging or construction activities; integrity of drainage systems; no woody vegetation growth; density of the vegetation; no signs of unacceptable erosion or depressions (subsidence); and no sign of burrowing animals on the cover.

8.0 PROJECT COSTS

The cost in the RSER/EE/CA for the 488-1D Ash Basin included only the cost for the 488-1D Ash basin. As identified in the RSER/EE/CA for the 488-1D Ash Basin the estimated cost, direct and indirect, for the 488-1D Ash Basin was $27,735,175 (SRNS 2016b).

As stated in *Revision 3 Action Memorandum for the Non-Time Critical Removal Action for the D-Area Coal Pile Runoff Basin 489-D* (USDOE 2015a) "The purpose of the action memorandum is to document the change from in-situ closure of the remaining 75% southern section outlined in the first revision to the action memorandum to excavation and disposal with unrestricted land use." An evaluation of an excavation and disposal removal alternative was included in the 2009 RSER/EE/CA (SRNS 2009). Based on the Alternative 3 cost for excavation and disposal provided in the 2009 RSER/EE/CA, assuming a 25% reduction in total cost and a yearly escalation of 3.0 percent (as prescribed by SRNS site estimating) for seven years the estimated total cost for the 75% southern section of the 489-D CPRB are $9,413,101.

The final total actual cost associated with the removal action of Phase 2, 488-1D Ash Basin and 489-D CPRB, of the project were $36,767,276 as provided in Table 14. This is approximately 1% under the estimated cost.

Table 14. Project Cost Comparison

Project Cost Comparison 488-1D Ash Basin & 489-D CPRB					
Cost	**488-1D Estimated Cost 2016 RSER/EE/CA** *($)*	**489-D CPRB Estimated Cost (Escalated) 2009 RSER/EE/CA** *($)*	**Total Project Estimated Cost** *($)*	**Actual** *($)*	**Delta Cost** *(%)*
Total Cost	$27,735,175	$9,413,101	$37,148,276	$36,767,276	1%

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9.0 REFERENCES

Envirocon, 2018. *Geosynthetics (Integrated Drainage System, I.D.S.) Quality Control Testing and Inspection Plan*, Savannah River Site 488-1D and 489-D CPRB Closure Project, Subcontract No. 258194, Revision 1, February 27, 2018

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993), United States Department of Energy, Savannah River Operations, Aiken SC

SCDHEC, 2015. [SCDHEC Well Abandonment Approval] *Request for Approval of the Savannah River Site Hydrologic/Geotechnical Well Abandonment Program Plan for the D-Area Ash Project (Wells Around the 488-1D) (ER-HGPP-2015-00018)*, Dated December 8, 2015, SCDHEC Columbia, SC

SCDHEC, 2016a. SCDHEC Comments on the *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D Area Ash Basin (488-1D) (U)*, CERCLIS Number: 63, (SRNS-RP-2015-00490, Revision 0, February 2016), Received February 24, 2016, Dated April 26, 2016, SCDHEC Columbia, SC

SCDHEC, 2016b. *SCDHEC (Conditional Approval) of the Removal Action Design Plan RADP for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U),* CERCLIS Number: 63, SRNS-RP-2015-00196, Revision 1 Redline, May 2016, Received May 2016, Dated June 9, 2016, SCDHEC Columbia, SC

SCDHEC, 2016c. *SCDHEC Response to the Utilization of the D-Area Ash Basin 488-1D North Inlet Basin Water for Irrigation Purposes,* CERCLIS Number: 63, Dated August 31, 2016 and Received September 1, 2016, September 14, 2016, SCDHEC Columbia, SC

SCDHEC, 2017a. *SCDHEC Approval of the Continued Utilization of the D Area Ash Basin 488-1D Inlet Basin Water for Irrigation Purposes,* CERCLIS Number: 63, Dated February 7, 2017 and Received Via Electronic Mail on February 7, 2017, Dated February 22, 2017, SCDHEC Columbia, SC

SCDHEC, 2017b. *SCDHEC Approval of the Continuation for the Utilization of the D-Area Ash Basin 488-1D Inlet Basin Water for Irrigation Purposes,* CERCLIS Number: 63, Dated July 17, 2017, and Received July 18, 2017, Dated July 24, 2017, SCDHEC Columbia, SC

SCDHEC, 2018a. *SCDHEC Approval of the Extension Request for the Utilization of the D Area Ash Basin 488-1D Inlet Basin Water for Irrigation Purposes,* CERCLIS Number: 63, Dated February 6, 2018 and Received February 7, 2018, February 8, 2018, SCDHEC Columbia, SC

SCDHEC, 2018b. *SCDHEC Approval of the Extension Request for the Utilization of the D-Area Ash Basin (488-1D) Inlet Basin Water for Irrigation Purposes,* CERCLIS Number: 63, Dated February 6, 2018 and Received February 7, 2018 *(Letter #2)* May 23, 2018

SCDHEC, 2018c. B. Jumper (SCDHEC) to B.C. Terry (SRNS), [Monitoring Well Approval], *Request for the Approval of the Savannah River Site Hydrogeologic and Geotechnical Projects Program Plan for the installation of D-Area Ash Basin (488-1D) Monitoring Wells,* SRNS-05-2018-00031, March 14, 2018, SCDHEC Columbia, SC

SRNS, 2009. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the 489-D Coal Pile Runoff Basin, D-006 Outfall, and 484-10D Waste Oil Facility at the D-Area Operable Unit (U)*, SRNS-RP-2009-00805, Revision 1, CERCLIS Number: 63, September 2009, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2011. *Early Action Record of Decision Remedial Alternative Selection for the D-Area Operable Unit DAOU (U)*, CERCLIS Number: 63, SRNS-RP-2010-00162, Revision 1.1, July 2011, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2012. *Environmental Compliance and Area Completion Projects Regulatory Document Handbook,* ERD-AG-003, Revision 17, June 2012, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2014a. *Comprehensive Stormwater Pollution Prevention Plan (SWPPP) for the D-Area Borrow Site*, C-ESR-D-00005, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2014b. *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site (U)*, SRNS-RP-2013-00332, Revision 1.1, July 2014, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2014c. *Field Sampling Plan for the D-Area 488-1D Inlet Basins (U)*, CERCLIS Number: 63, SRNS-RP-2013-00342, Revision 1.1, July 2014, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2014d. *White Paper on the Source of Groundwater Contamination and the Hydrologic Separation Study for the D-Area Ash Basins and Ash Landfill*, ERD-EN-2014-0025, Revision 0, August 2014, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2015a. *Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) for the 488-1D Ash Settling Basin and 489-D Coal Pile Runoff Basin Closure*, C-ESR-D-00004, Revision 1, November 5, 2011, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2015b. *Waste Management Plan Ash Basin 488-1D Closure and Coal Pile Runoff Basin 489-D Conversion to Retention Basin,* SRNS-RP-2015-00805, Revision 0, October 27, 2015, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015c. *Field Sampling Plan for the 489-D Coal Pile Runoff Basin (U)*, CERCLIS Number: 63, SRNS-RP-2014-01048, Revision 1, May 2015, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015d. *Field Sampling Plan for the 488-1D Ash Basin (U)*, CERCLIS Number: 63, SRNS-RP-2015-00096, Revision 1, December 2015, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016a. *Removal Action Design Plan RADP for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U)*, CERCLIS Number 63, SRNS-RP-2015-00196, Revision 1, May 2016, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2016b. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D Area Ash Basin 488-1D (U)*, CERCLIS Number: 63, SRNS-RP-2015-00490, Revision 1, June 2016, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2017a. *Removal Action Report for the 488-2D Ash Basin and 488-4D Ash Landfill (U)*, CERCLIS Number: 63, SRNS-RP-2017-00057, Revision 1, September 2017, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2017b. *Savannah River Site 3Q Manual, Environmental Compliance Manual*, Latest Revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2017c. *Savannah River Site C1 Manual, Environmental Restoration Administrative Procedures,* Latest Revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2017d. *Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U)*, CERCLIS Number: 63, ERD-EN-2017-0027, Revision 1, October 2017, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2018a. SRNS Submittal of the *Monitoring Well Installation Reports and Well Development Data Field Parameters and Field Geologic Logs for D-Area Ash Basin (488-1D) Monitoring Wells DCB081 and DCB082 (ER-HGPP-2018-00002) (SCDHEC Monitoring Well Approval #MW-11483)*, SRNS-J2000-2018-00721, Dated November 29, 2018, Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC

SRNS, 2018b. *Submittal of the D-Area Ash Project (Well Abandonment Report)* Savannah River Nuclear Solutions, Savanah River Site, Aiken, SC (PENDING)

SRNS, 2018c Environmental Compliance and Area Completion Projects (EC&ACP) Standard Operating Procedures, Manual: C3 Procedure: ER-SOP-019, Waste Unit Inspection and Maintenance, Revision: 23, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2019 *Human Health and Ecological Evaluation for Confirmation Sampling at the 488-1D Ash Basin and Inlet Basins* (including area west of 488-1D), ERD-EN-2018-0007, Revision 1, January 2019, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

USDOE, 2015a. *DOE Submittal of the Revision 3 Action Memorandum for the Non-Time Critical Removal Action for the D Area Coal Pile Runoff Basin 489-D*, CERCLIS Number: 63, August 11, 2015, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2015b. *DOE Submittal of the Notification of the Removal Action Start Date for the D-Coal Pile Runoff Basin 489-D*, CERCLIS Number: 63, Dated September 15, 2015, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2015c. *DOE Submittal of the Removal Action Design Plan RADP for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin*, (SRNS-RP-2015-00196, Revision 0, November 2015), CERCLIS Number 63, Dated November 16, 2015, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2016a. DOE Submittal of the *Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the D-Area Ash Basin 488-1D*, CERCLIS Number: 63, Dated August 17,2016, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2016b. *DOE Submittal of the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D Area Ash Basin (488-1D) (U)*, (SRNS-RP-2015-00490, Revision 1, June 2016), (Clean Copy) Savannah River Sites Responses to Regulatory Comments on the Revision 0 Document and Draft Action Memorandum, CERCLIS Number: 63, Dated June 8, 2016, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2016c. *DOE Submittal of the Professional Engineer (PE) Stamped Removal Action Design Plan for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U)* (SRNS-RP-2015-000196, Revision 1, May 2016), CERCLIS Number: 63, Dated July 2018, 2016, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2016d. *DOE Submittal of the Notification of the Removal Action Start Date for the D-Area Ash Basin 488-1D*, CERCLIS Number: 63, Dated September 19, 2016, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2017. *DOE Submittal of the Minor Design Change to the Removal Action Design Plan RADP for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U)*, (SRNS-RP-2015-00196, Revision 1, May 2016, CERCLIS Number: 63), September 14, 2017, United States Department of Energy, Savannah River Operations, Aiken SC

USDOE, 2018. *DOE Submittal for the October 2018 Completion Status of the D-Area Ash Project*, SEMS Number: 63, November 8, 2018, United States Department of Energy, Savannah River Operations, Aiken SC

USEPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objective Process*, EPA QA/G-4, EPA/240/B-06/001, February 2006

USEPA, 2016a. EPA Comments on the *Removal Site Evaluation Report / Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D-Area Ash Basin (488-1D) (U)*, CERCLIS Number: 63, SRNS-RP-2015-00490, Revision 0, February 2016, June 6, 2017

USEPA, 2016b. EPA (Conditional Approval) of the *Removal Action Design Plan (RADP) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U)*, (SRNS-RP-2015-00196, Revision 1 Redline, May 2016), CERCLIS Number: 63, Received June 29, 2016

WSRC, 2003. *SRS Fill and Cover Material Protocol (U),* ERTEC-2003-00012, December 2003, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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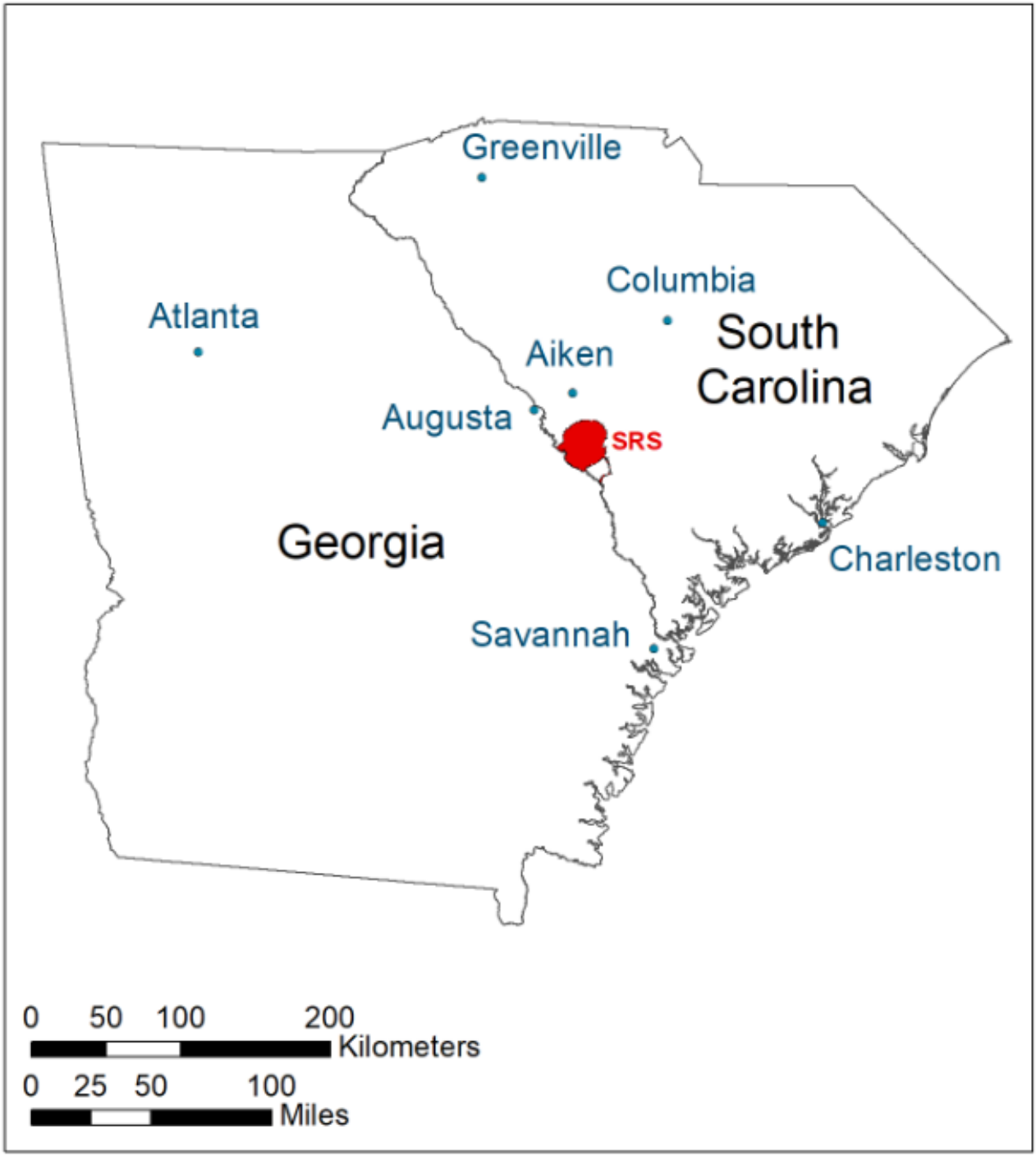

Figure 1. Location of the Savannah River Site

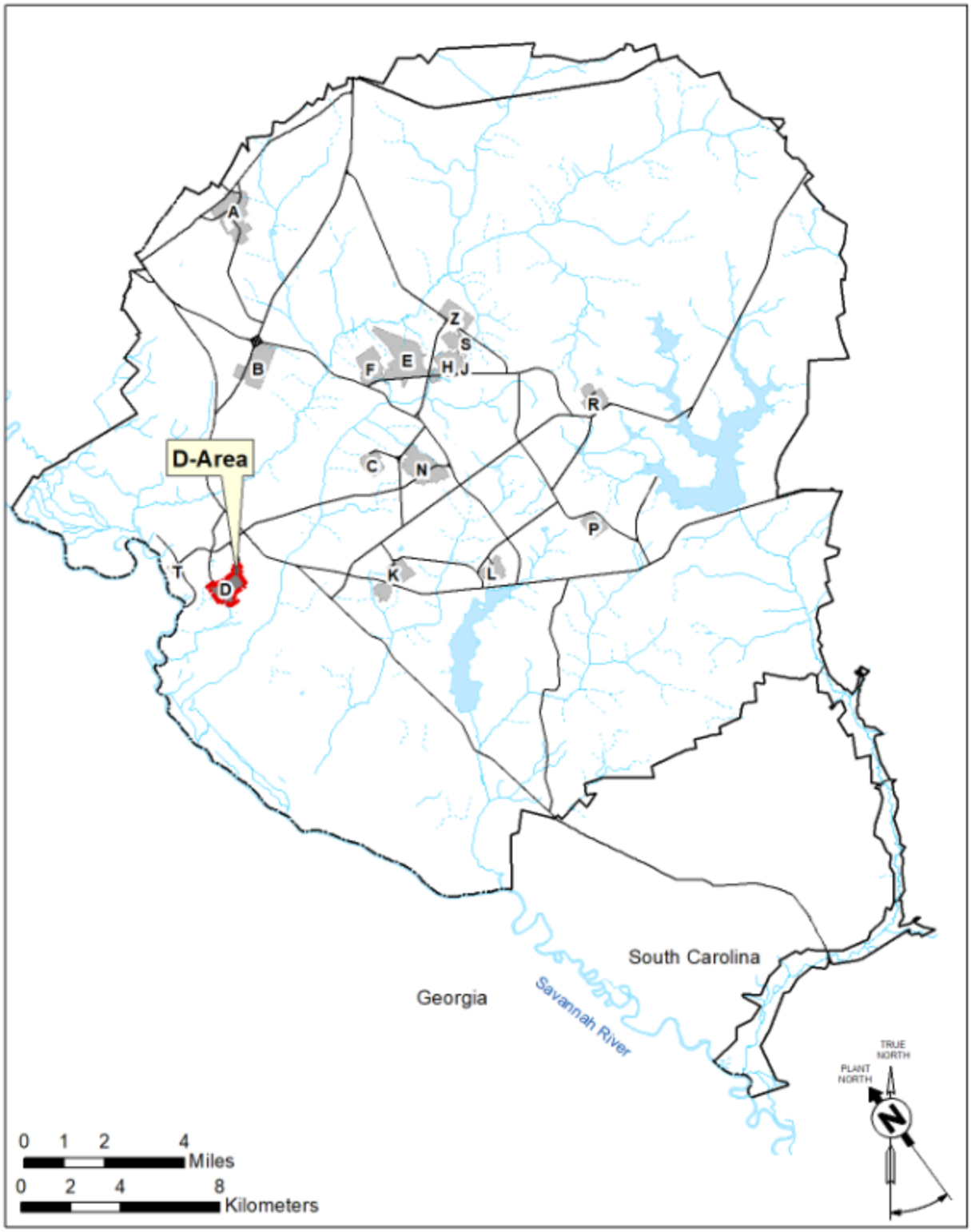

Figure 2. Location of D-Area Operable Unit at the Savannah River Site

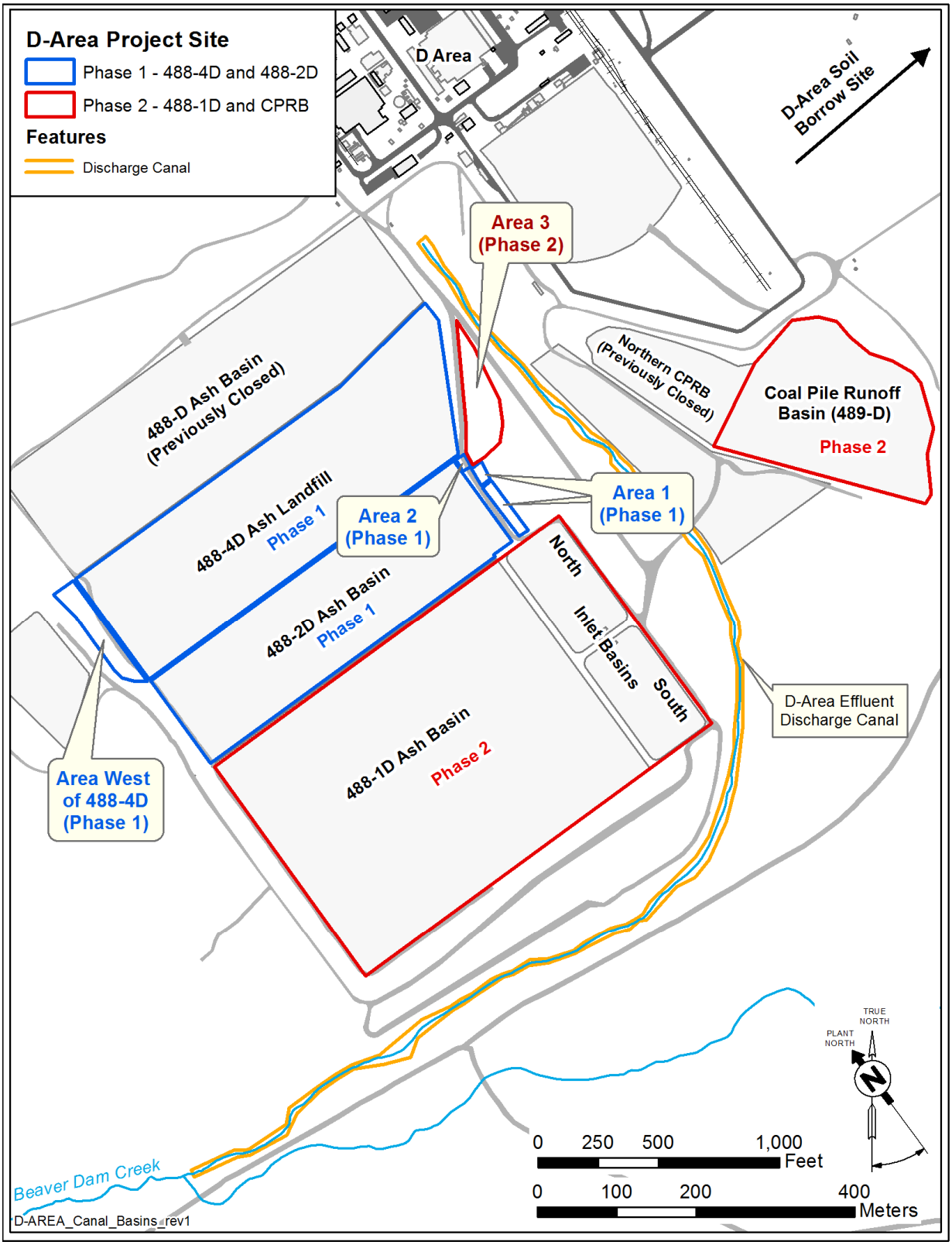

Figure 3. D-Area Project Site

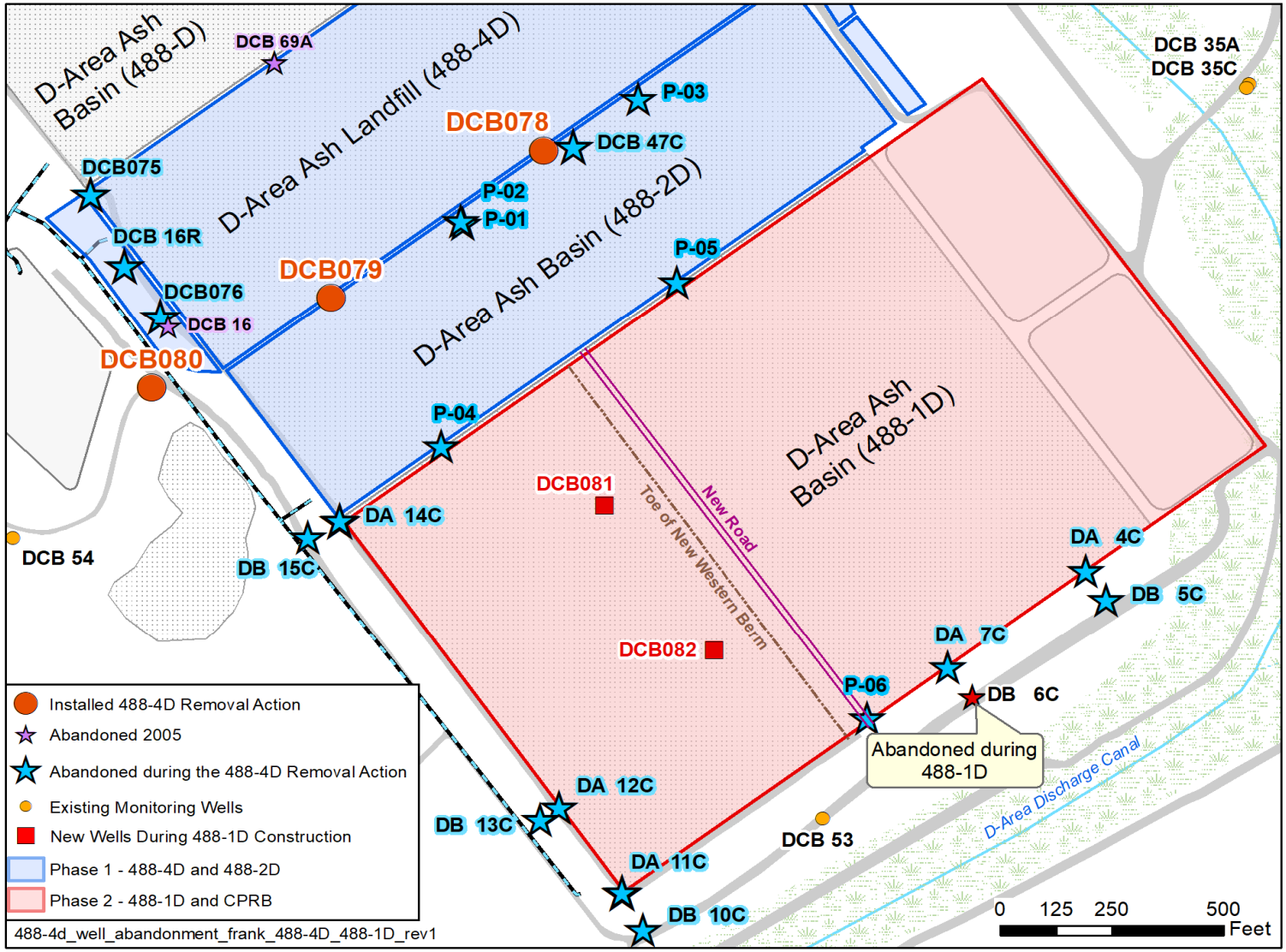

Figure 4. Well Modifications

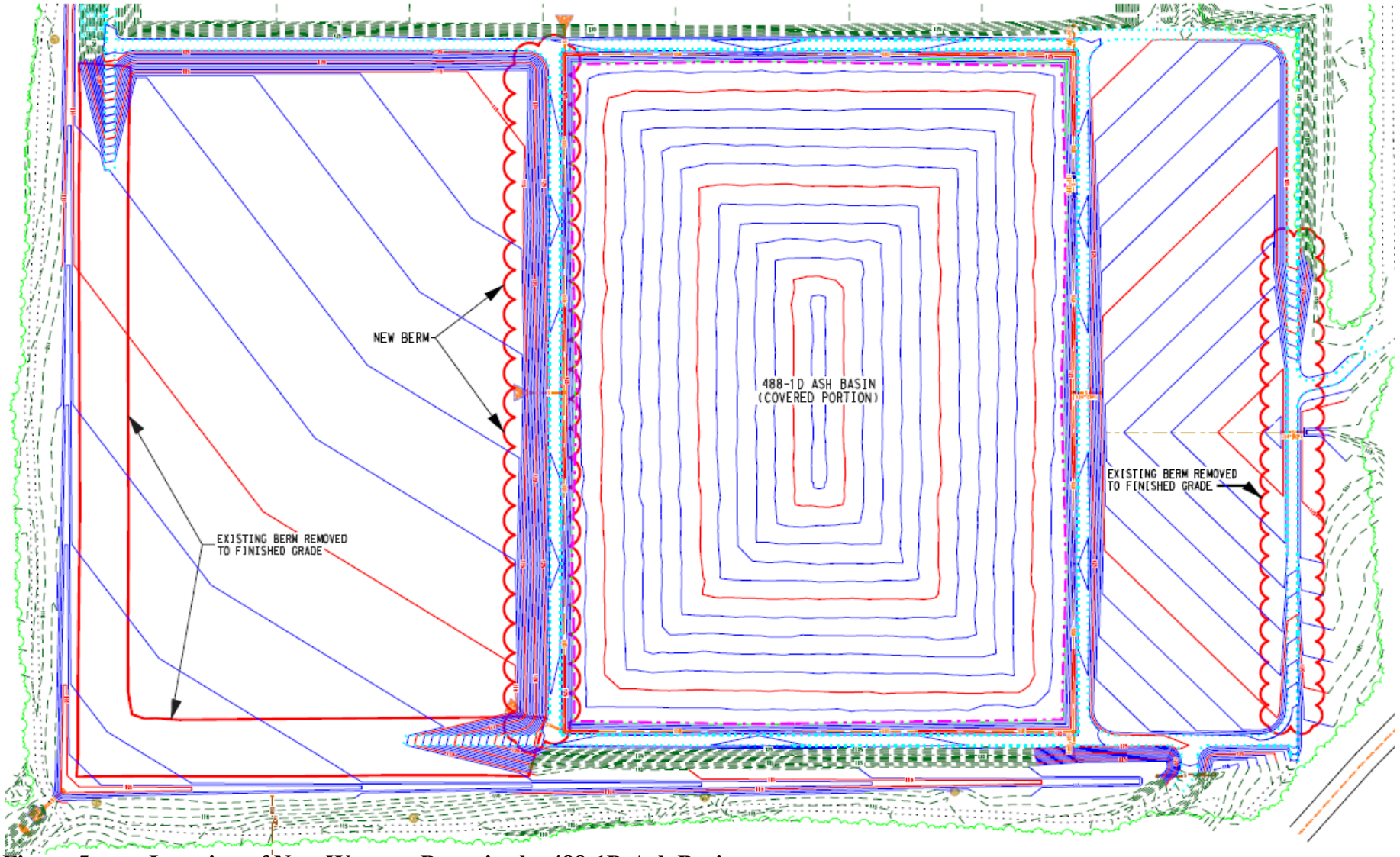

Figure 5. Location of New Western Berm in the 488-1D Ash Basin

Photo 1. Historical Photo of D-Area (1982)

Photo 2. Historical Photo of D-Area (1984)

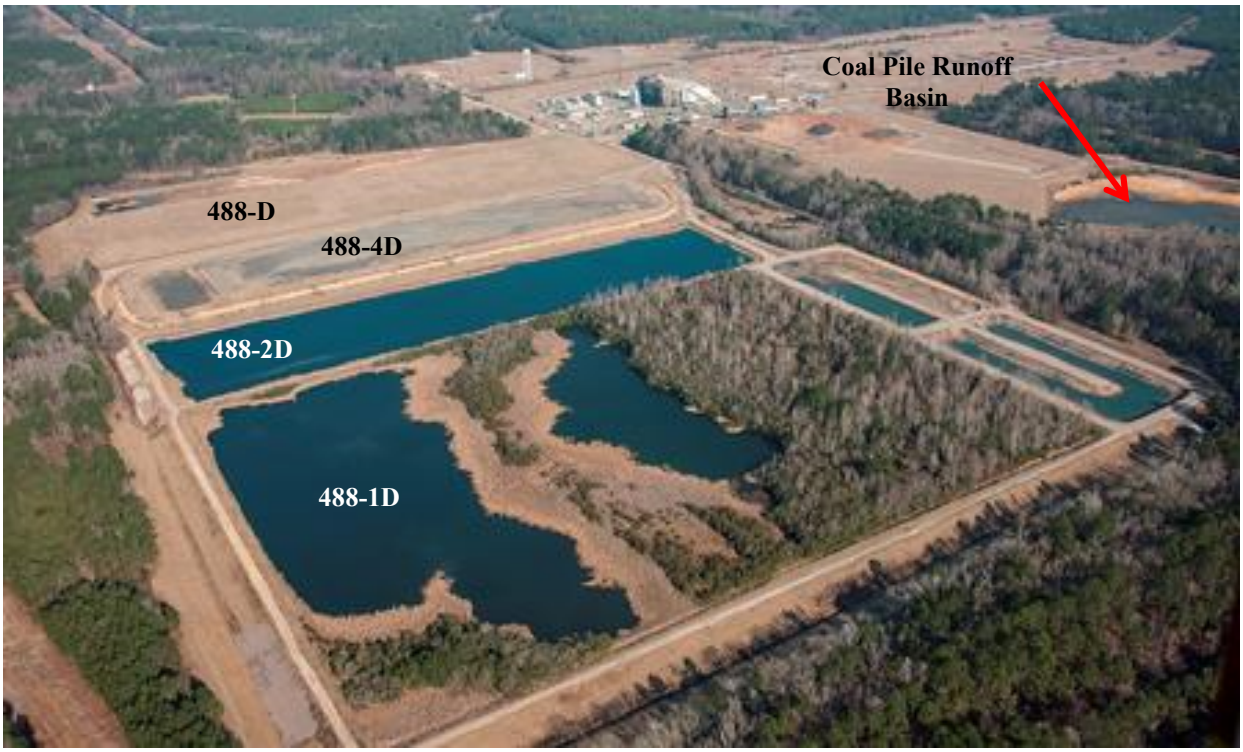

Photo 3. Preconstruction (January 2013)

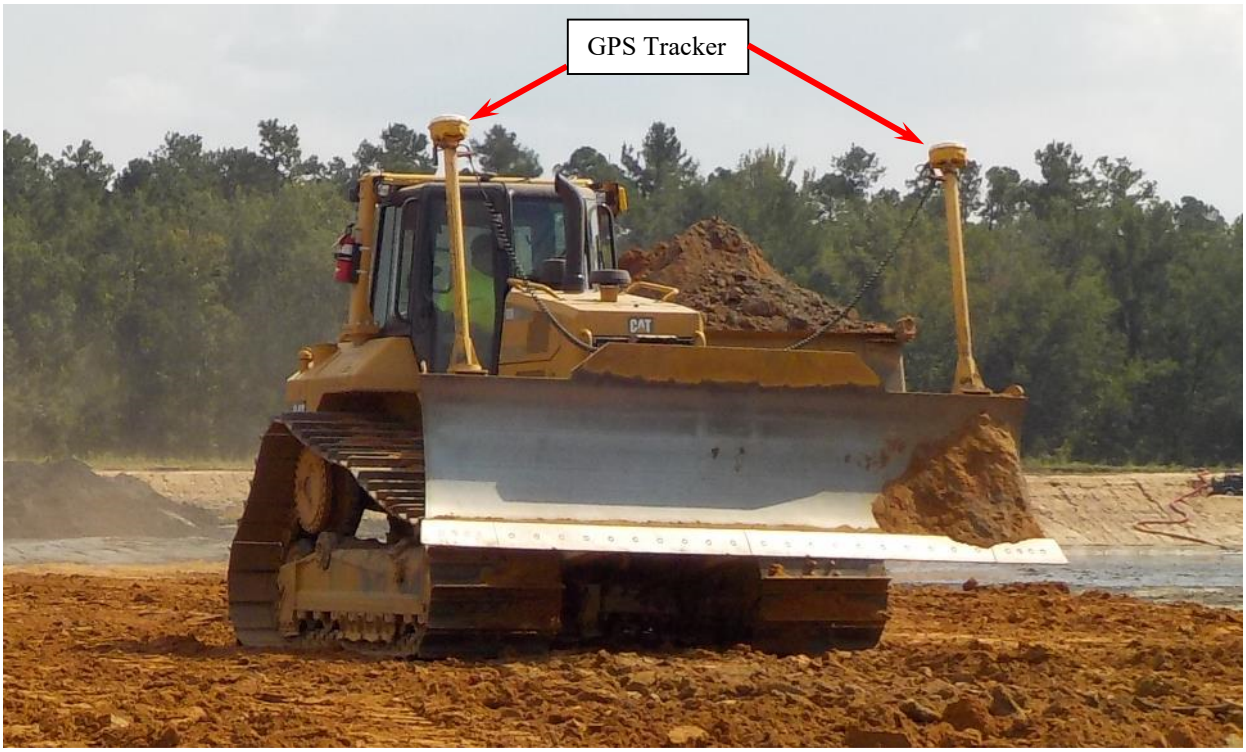

Photo 4. Dozer (Cat D-6)

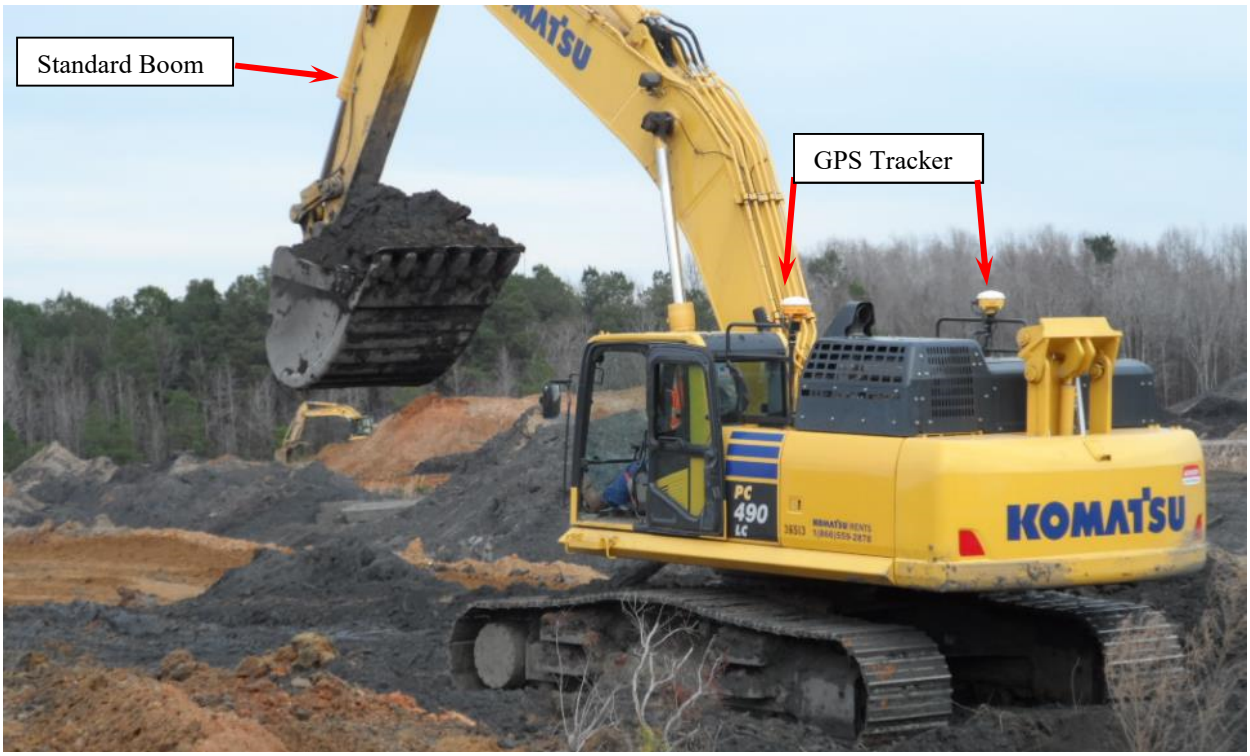

Photo 5. Excavator (Komatsu 490)

Photo 6. Long Reach Excavator

Photo 7. Articulated Haul Truck (Volvo A40F 30 CY)

Photo 8. Water Truck (4,000 gallon)

Photo 9. Roller (Smooth Drum)

Photo 10. Roller (Sheep's Foot)

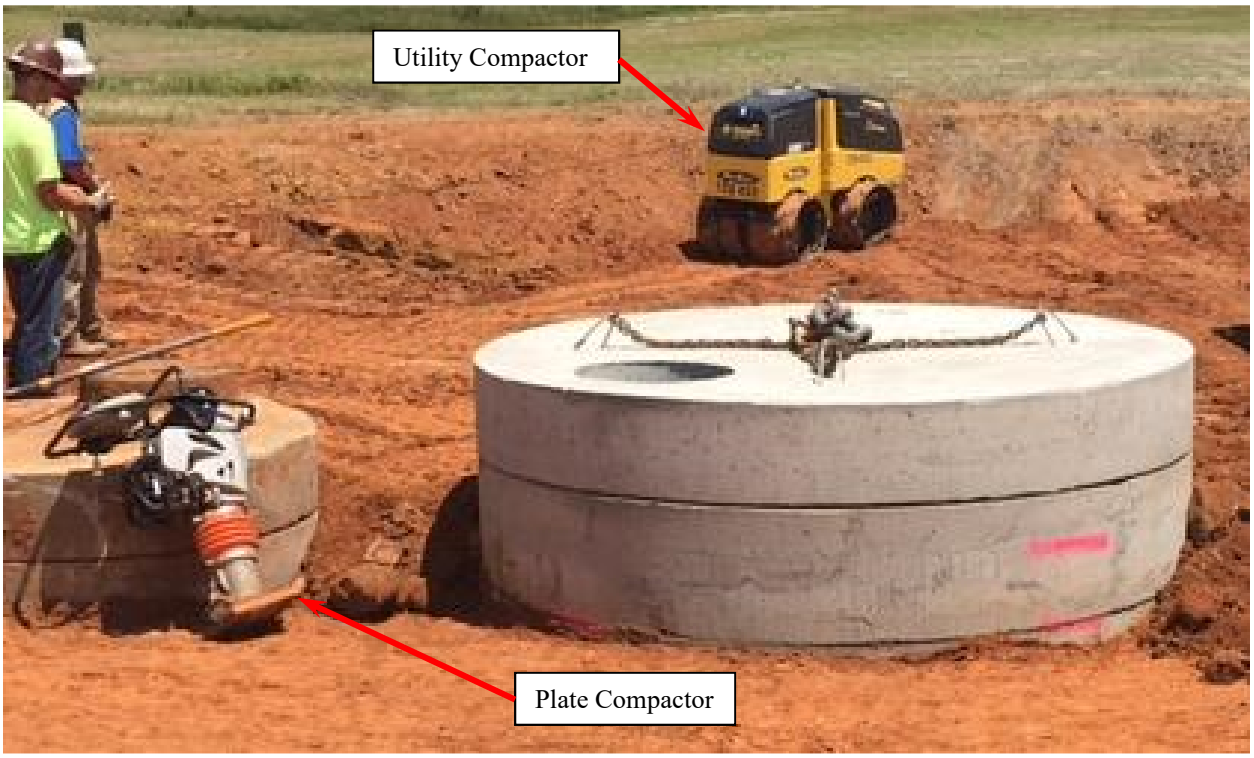

Photo 11. Small Compactors

Photo 12. Large Farm Tractor and Disk

Photo 13. Front End Loader (Komatsu 450)

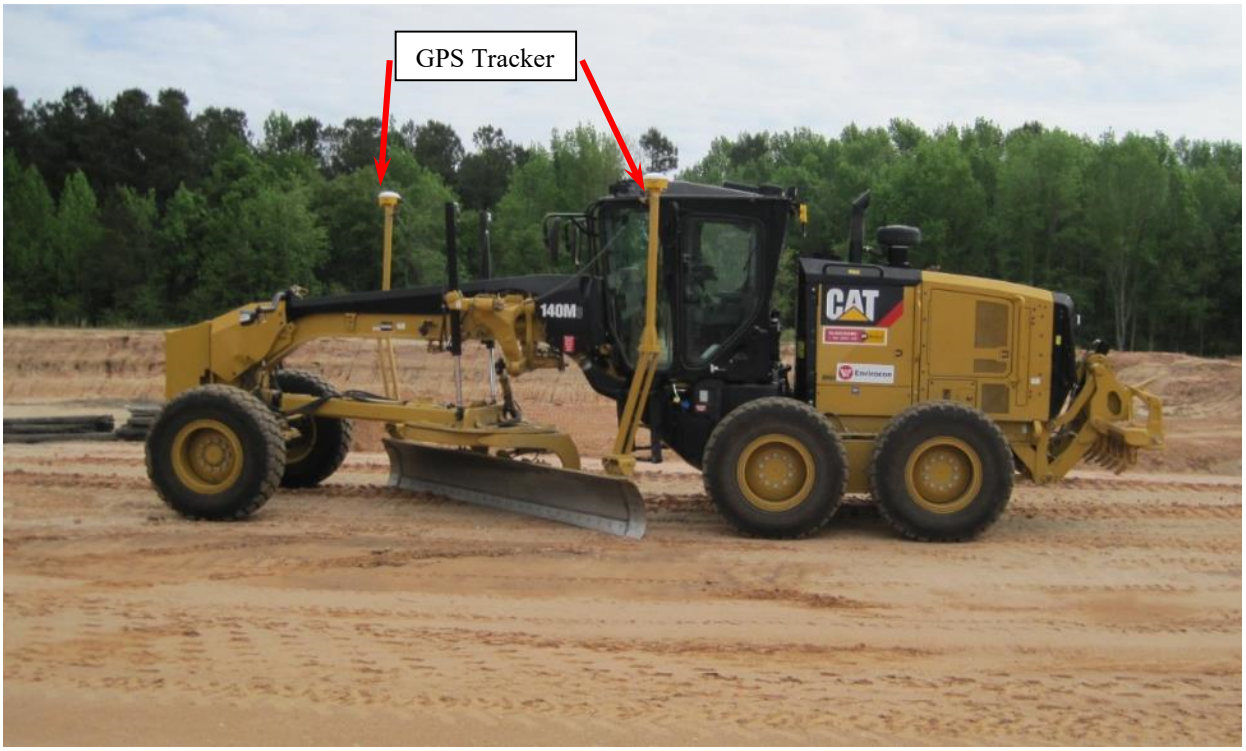

Photo 14. GPS Equipped Motor Grader (CAT 140M)

Photo 15. GPS Satellite Station

Photo 16. Dewatering Pump

Photo 17. Tracked Sod Installer

Photo 18. Hot Wedge Dual Track Welder

Photo 19. Tensiometer for Field Testing of Extrusion and Wedge Welds

Photo 20. Extrusion Welder

Photo 21. Vacuum Testing of Extrusion Weld

Photo 22. Typical Rock Check Dam

Photo 23. Stormwater Discharge through Check Dam

Photo 24. Silt Fence

Photo 25. Area East of 488-4D Ash Landfill (August 2016)

Photo 26. Area East of 488-4D Ash Landfill (October 2016)

Photo 27. Area East of 488-4D Ash Landfill (February 2017)

Photo 28. Area East of 488-4D Ash Landfill (March 2017)

Photo 29. Area East of 488-4D Ash Landfill (April 2017)

Photo 30. 489-D CPRB (August 2016)

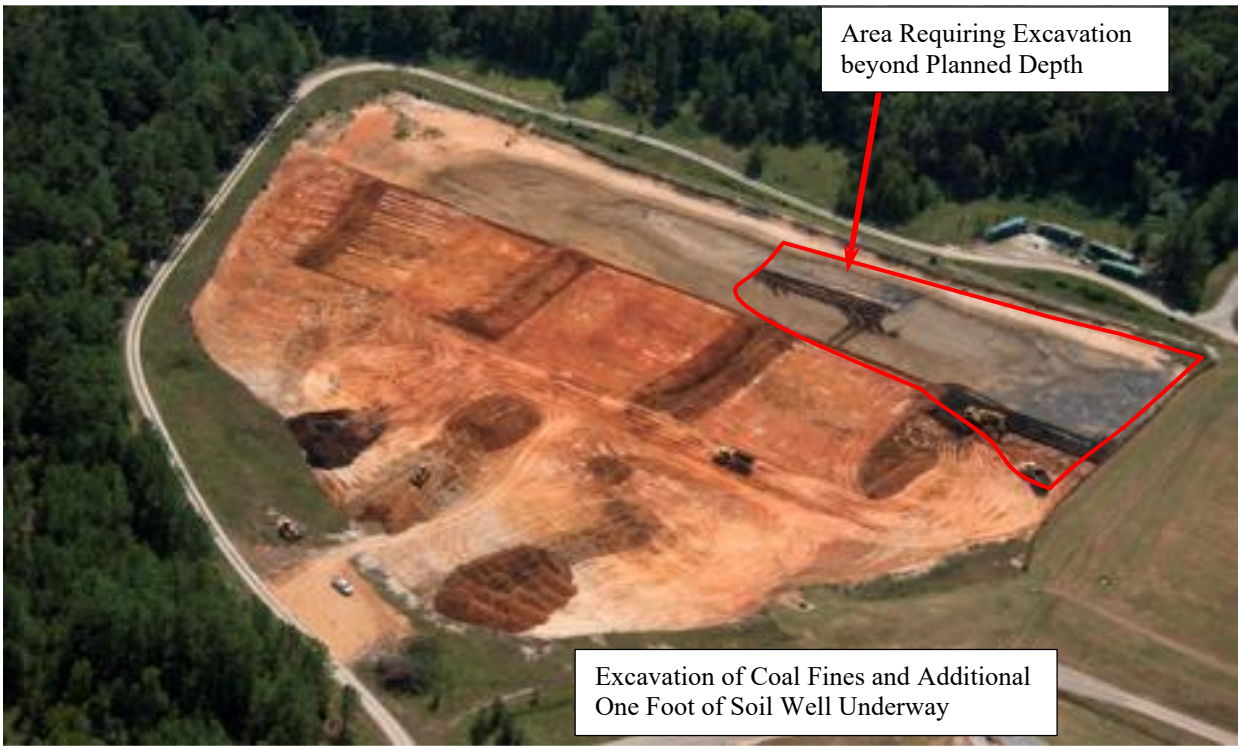

Photo 31. 489-D CPRB (September 2016)

Photo 32. 489-D CPRB (January 2017)

Photo 33. 489-D CPRB (February 2017)

Photo 34. 489-D CPRB (March 2017)

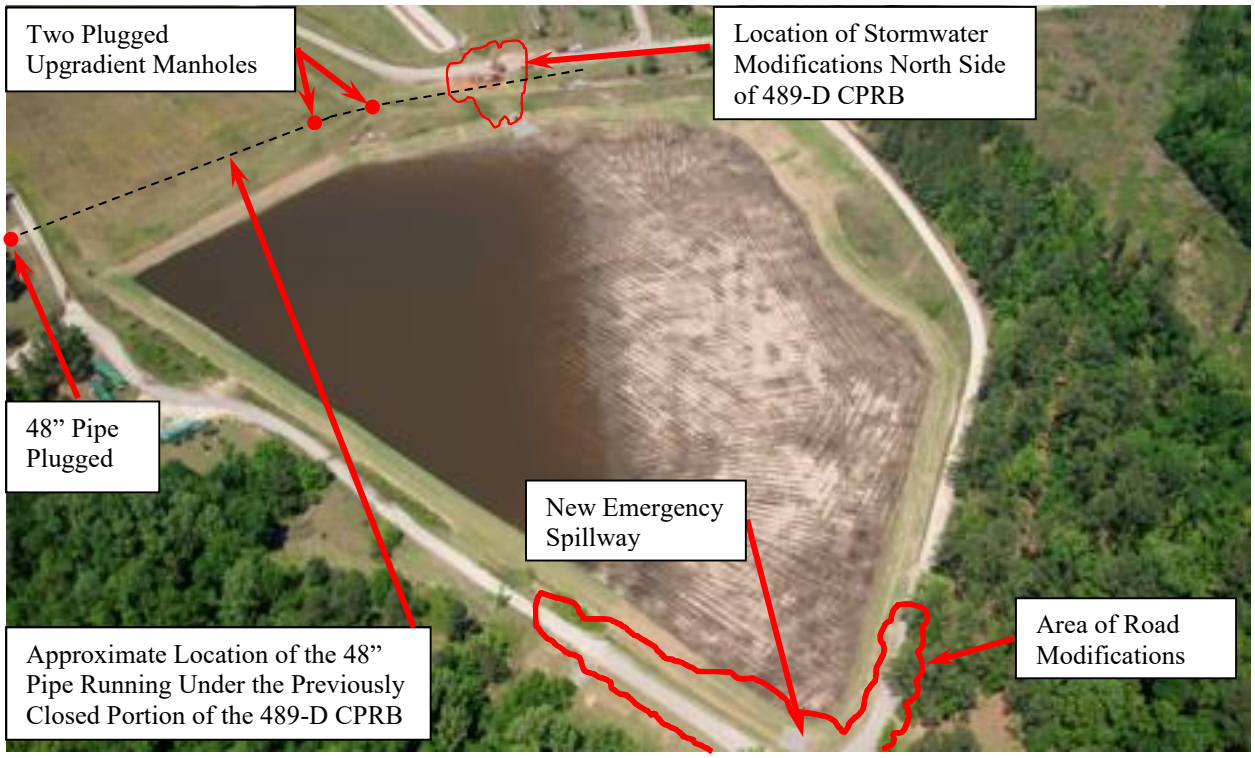

Photo 35. CPRB April 2017

Photo 36. 489-D CPRB Plugging of Upgradient Manholes

Photo 37. 489-D CPRB Plugged Manhole (Typical for 2)

Photo 38. 489-D CPRB Plugged 48" Pipe

Photo 39. 489-D CPRB Removal of Existing Manhole

Photo 40. 489-D CPRB Prepping for Placement of New Manhole

Photo 41. 489-D CPRB New Manhole in Place

Photo 42. 489-D CPRB Backfilling in Progress

Photo 43. 489-D CPRB Aerial After Completion

Photo 44. 488-1D Ash Basin Prior to Any Clearing of Trees (May 2016)

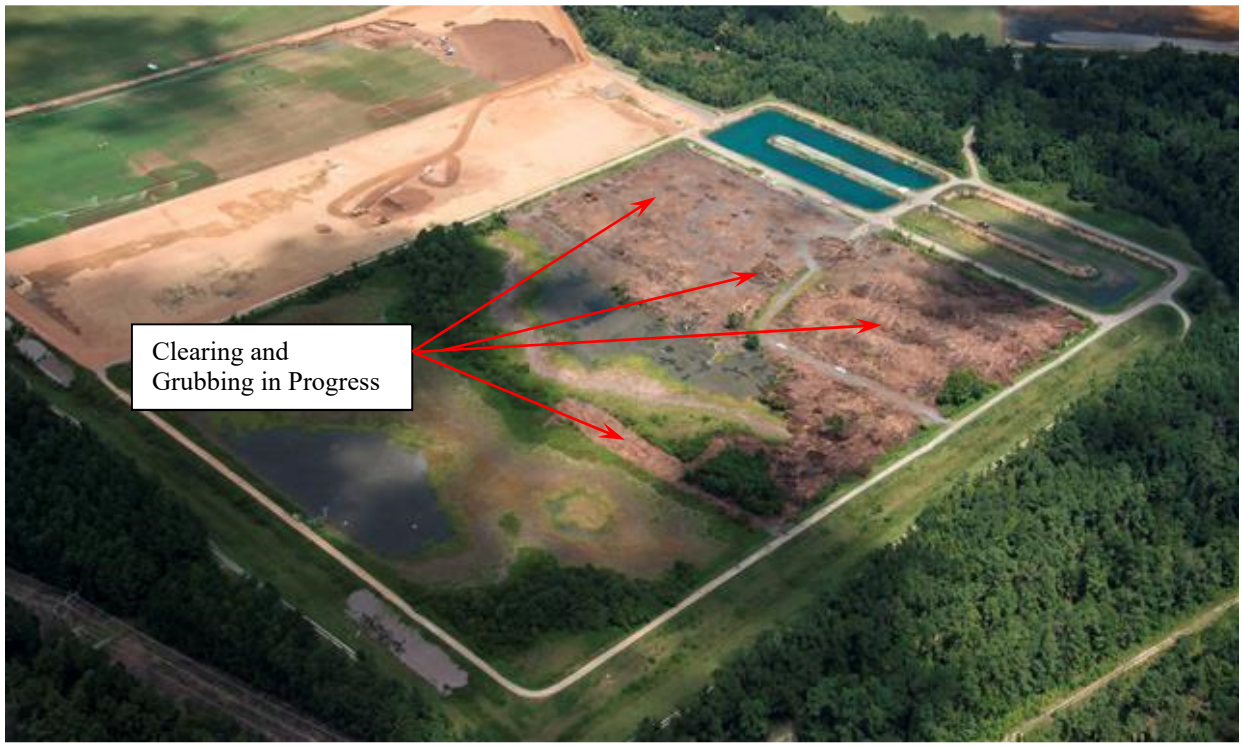

Photo 45. 488-1D Ash Basin (August 2016)

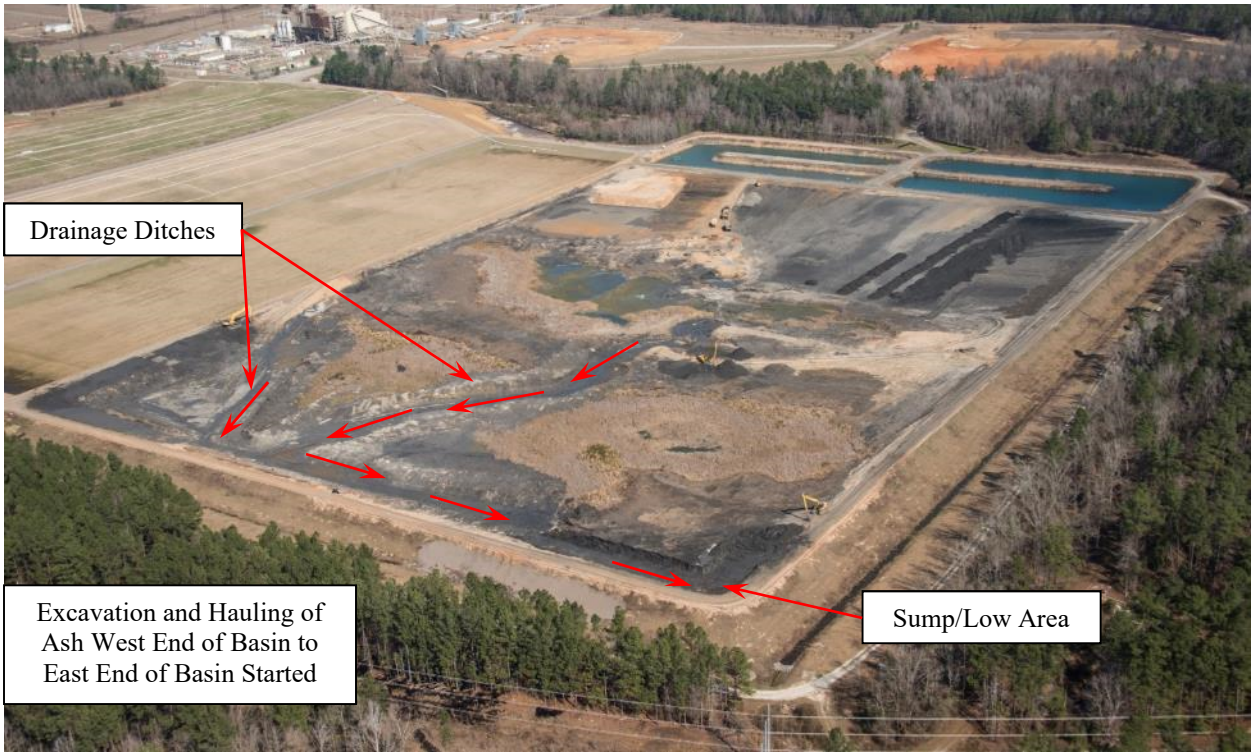

Photo 46. 488-1D Ash Basin (February 2017)

Photo 47. 488-1D Ash Basin (June 2017)

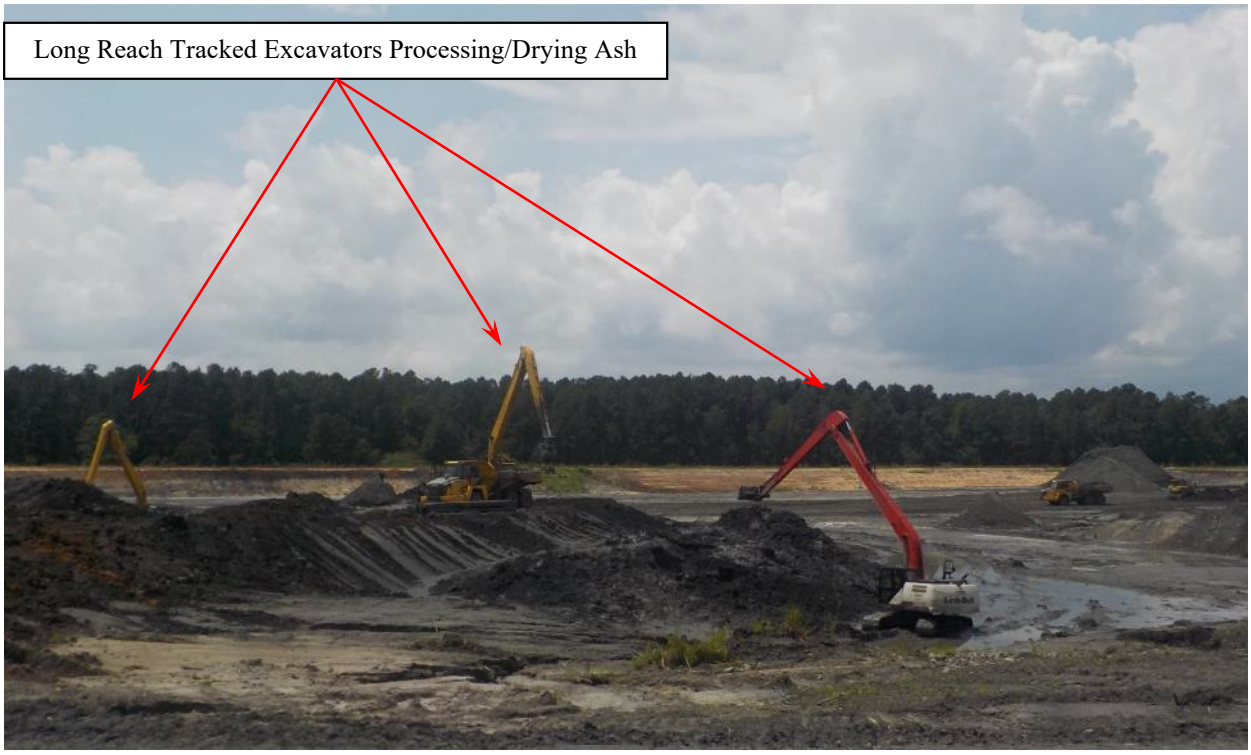

Photo 48. 488-1D Ash Basin Processing of Ash

Photo 49. 488-1D Ash Basin Loading /Hauling of Processed Ash

Photo 50. 488-1D Ash Basin West End Bulk Ash Removal

Photo 51. 488-1D Ash Basin West End Remaining Ash and 1 Foot of Soil Removed

Photo 52. 488-1D Ash Basin Northern Berm Face Visually Clean of Ash

Photo 53. Placement of Ash on East End of 488-1D Ash Basin

Photo 54. Disking of Ash to Allow for Additional Drying 488-1D Ash Basin (East End)

Photo 55. Compaction of Ash 488-1D Ash Basin (East End)

Photo 56. Proof Roll Inspection

Photo 57. Proof Roll Inspection

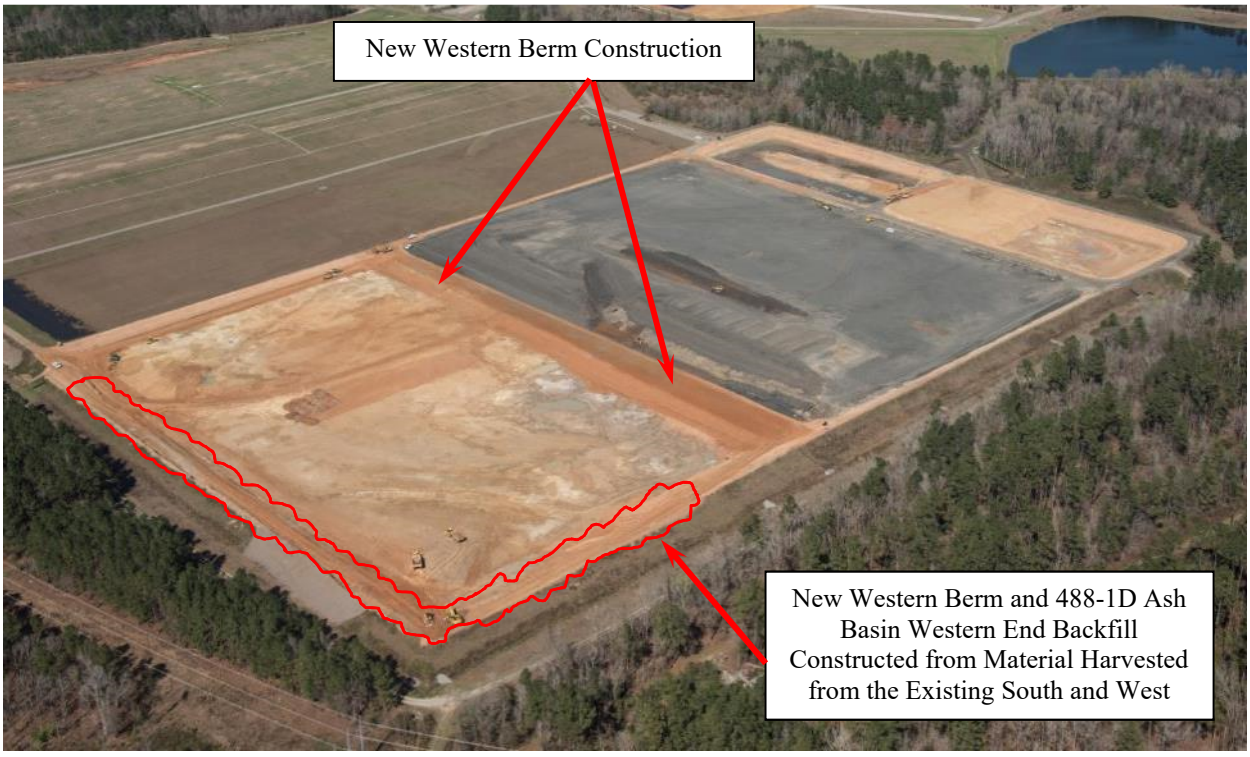

Photo 58. 488-1D Ash Basin (February 2018)

Photo 59. 488-1D Ash Basin (February 2018)

Photo 60. 488-1D Ash Basin Compaction Testing New Western Berm

Photo 61. Backfill 488-1D Ash Basin West

Photo 62. North Inlet Basin Removal of Residual Ash/Soil in Process

Photo 63. South Inlet Basin After Ash/Soil Removal and Confirmation Sampling

Photo 64. 488-1D Ash Basin Typical Catch Basin Installation

Photo 65. 488-1D Ash Basin Typical Compaction Testing around Utilities

Photo 66. 488-1D Ash Basin Interior of Catch Basin Typical Grouted 24" Culvert

Photo 67. Typical RipRap Apron

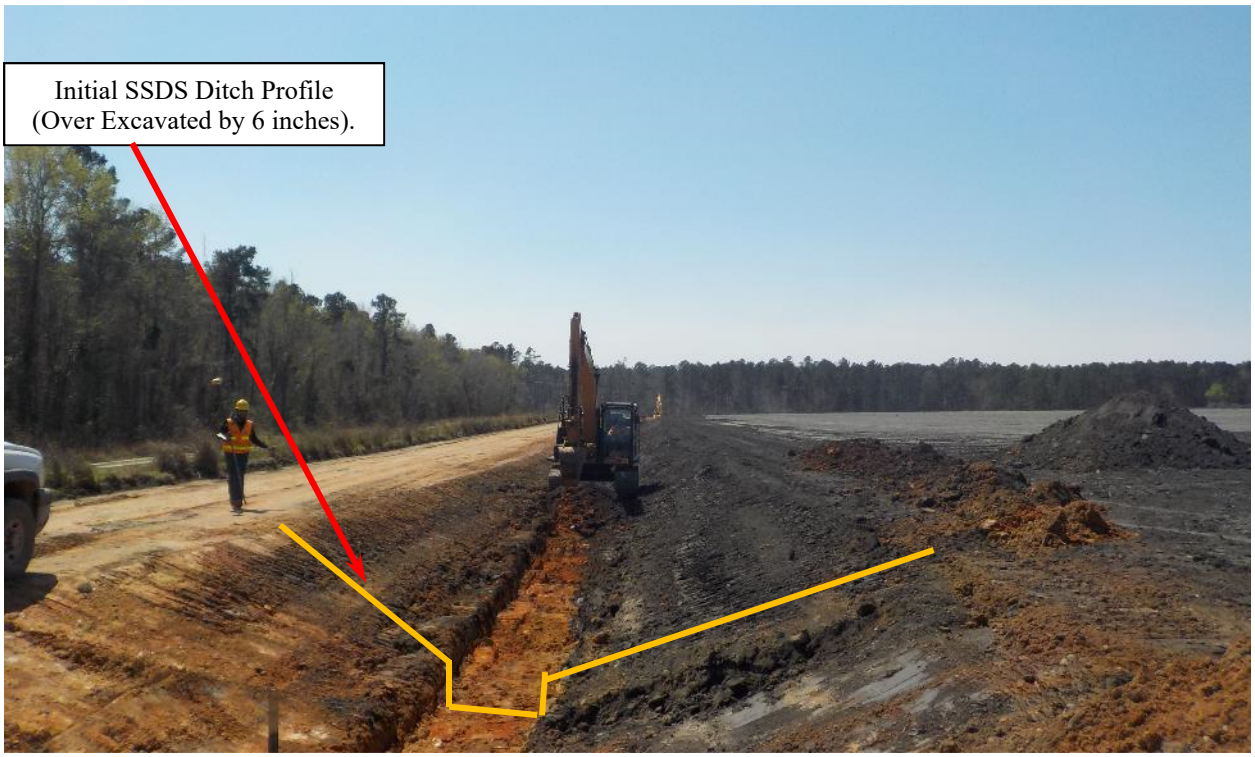

Photo 68. Initial SSDS Ditch Excavated Profile

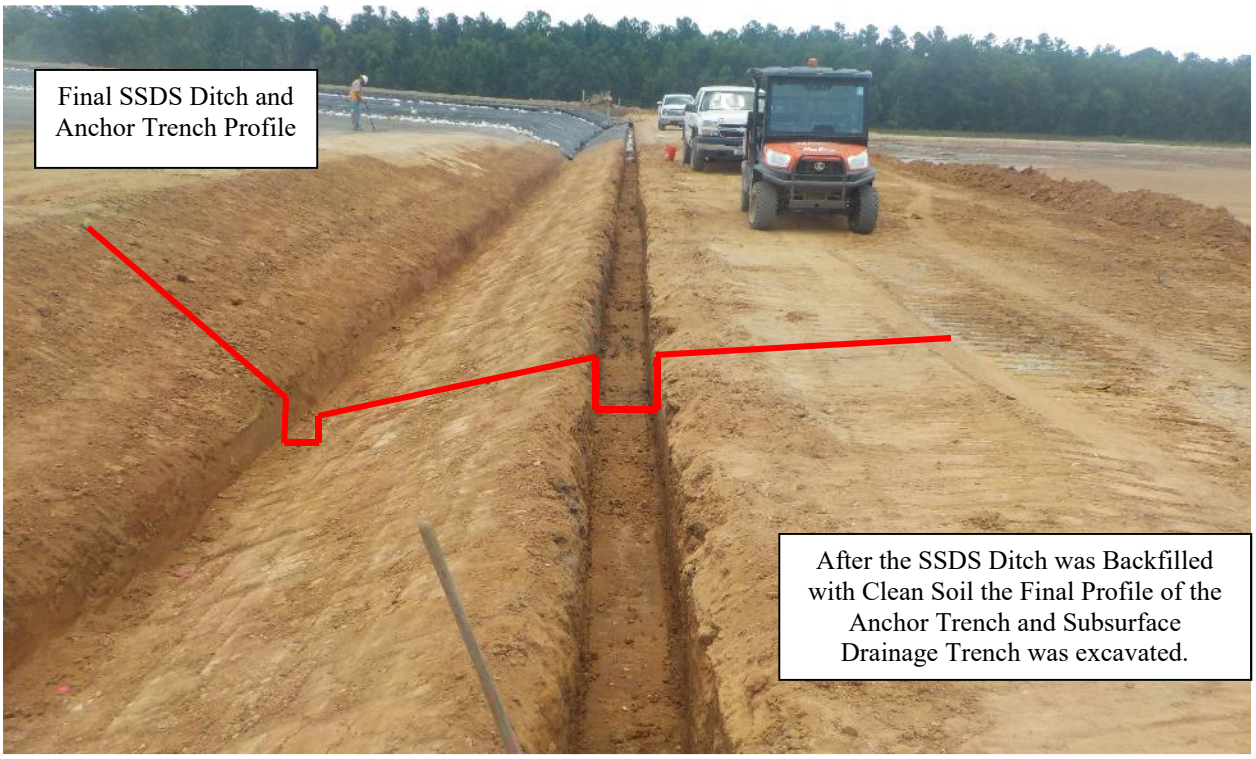

Photo 69. Final Excavated SSDS Ditch Profile and Anchor Trench

Photo 70. Fine Grading of the Ash Mound Prior to Final Ash Survey

Photo 71. LLDPE Placement (1)

Photo 72. LLDPE Placement (2)

Photo 73. LLDPE Placement at Anchor Trench and Subsurface Drainage Ditch

Photo 74. LLDPE Geomembrane Dual Hot Wedge Seaming (Production Seam)

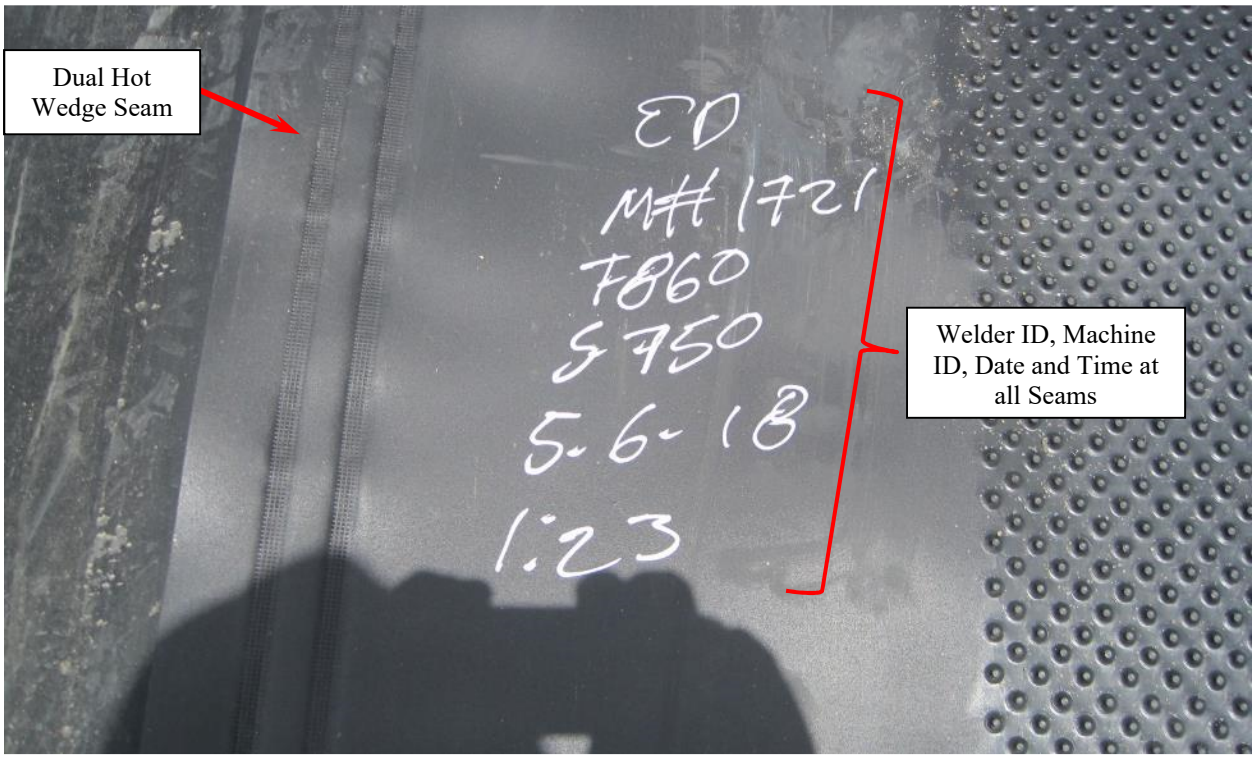

Photo 75. Typical LLDPE Dual Identifying Information

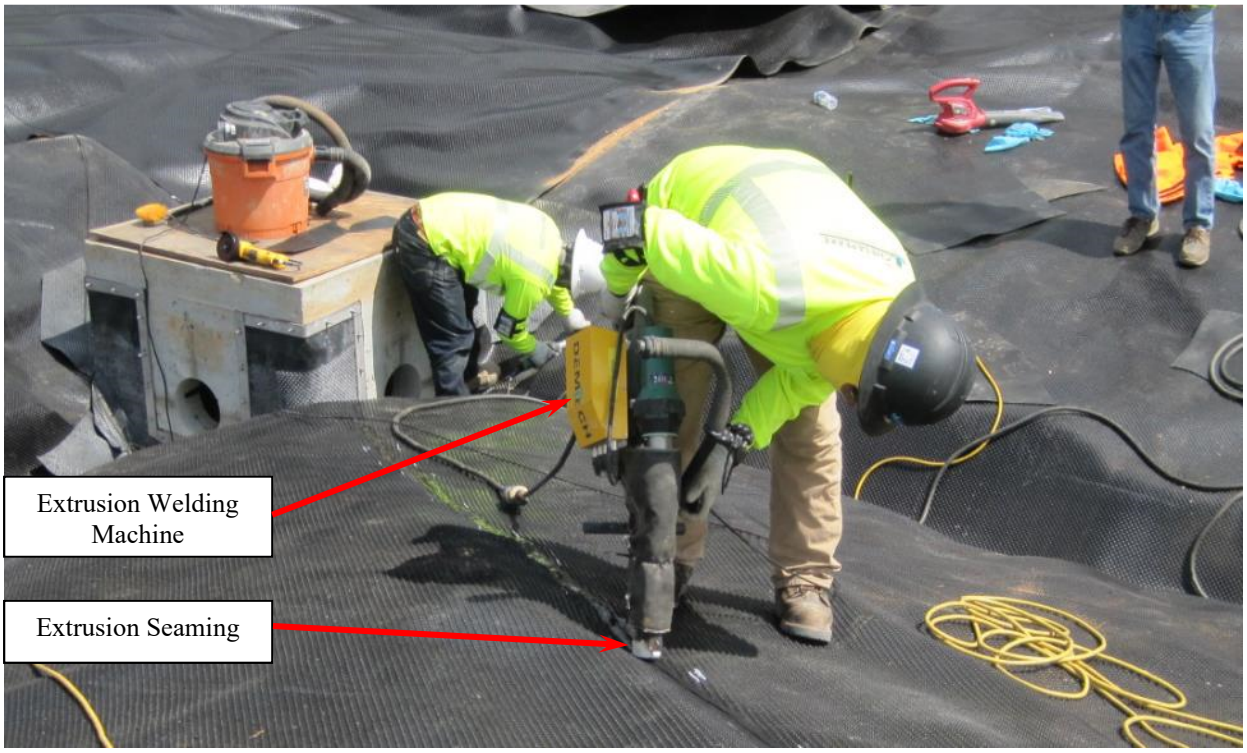

Photo 76. LLDPE Extrusion Seaming

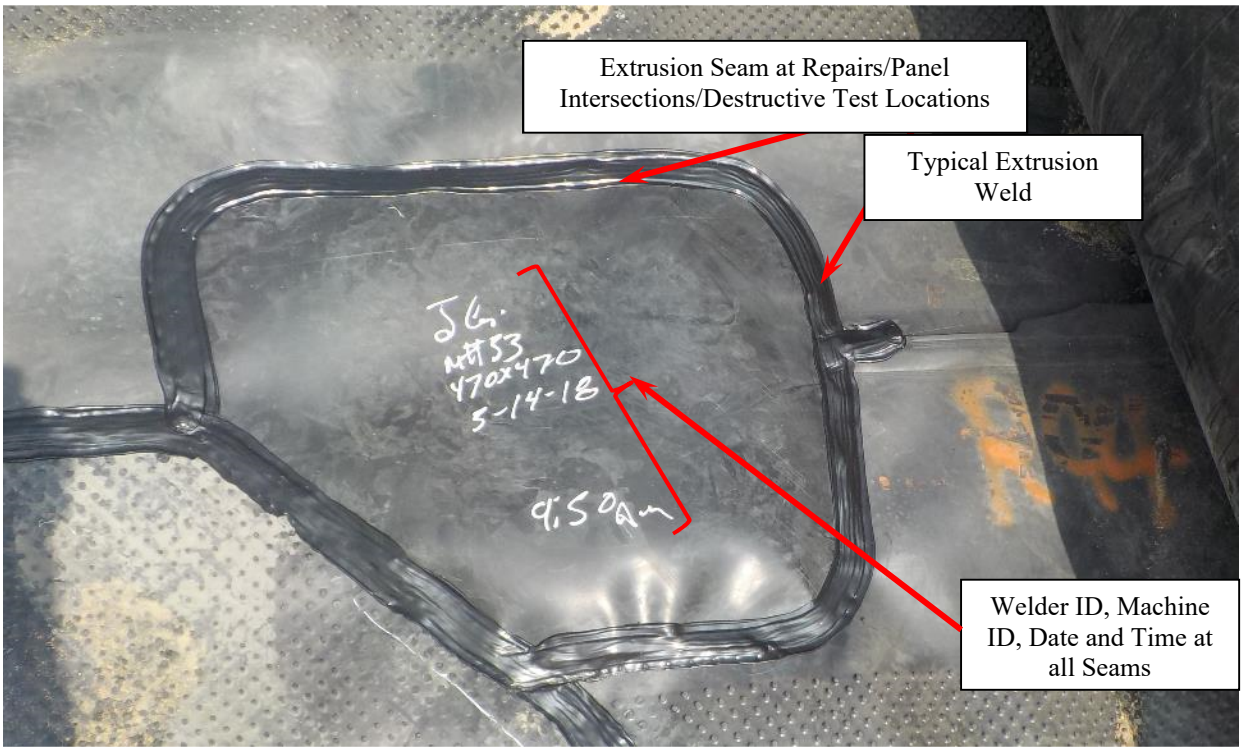

Photo 77. Typical LLDPE Extrusion Seaming

Photo 78. Typical LLDPE Tie into Catch Basin

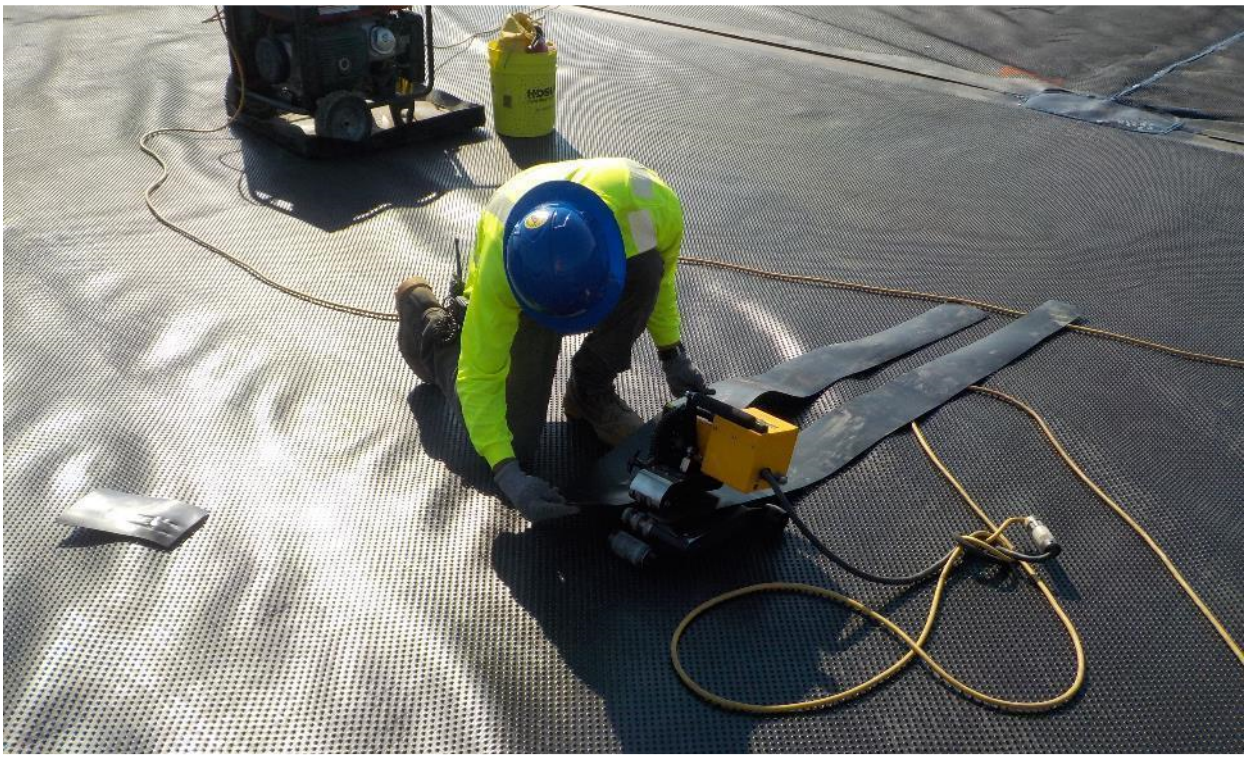

Photo 79. LLDPE Geomembrane Dual Hot Wedge Seaming (Trail Seam)

Photo 80. LLDPE Air Pressure Testing of Dual Hot Wedge Seam (Non-Destructive)

Photo 81. LLDPE Vacuum Testing of Extrusion Welds (Non- Destructive)

Photo 82. LLDPE Field Peel and Sheer Testing (Destructive)

Photo 83. Geotextile Placement over the LLDPE Geomembrane (1)

Photo 84. Geotextile Placement over the LLDPE Geomembrane (2)

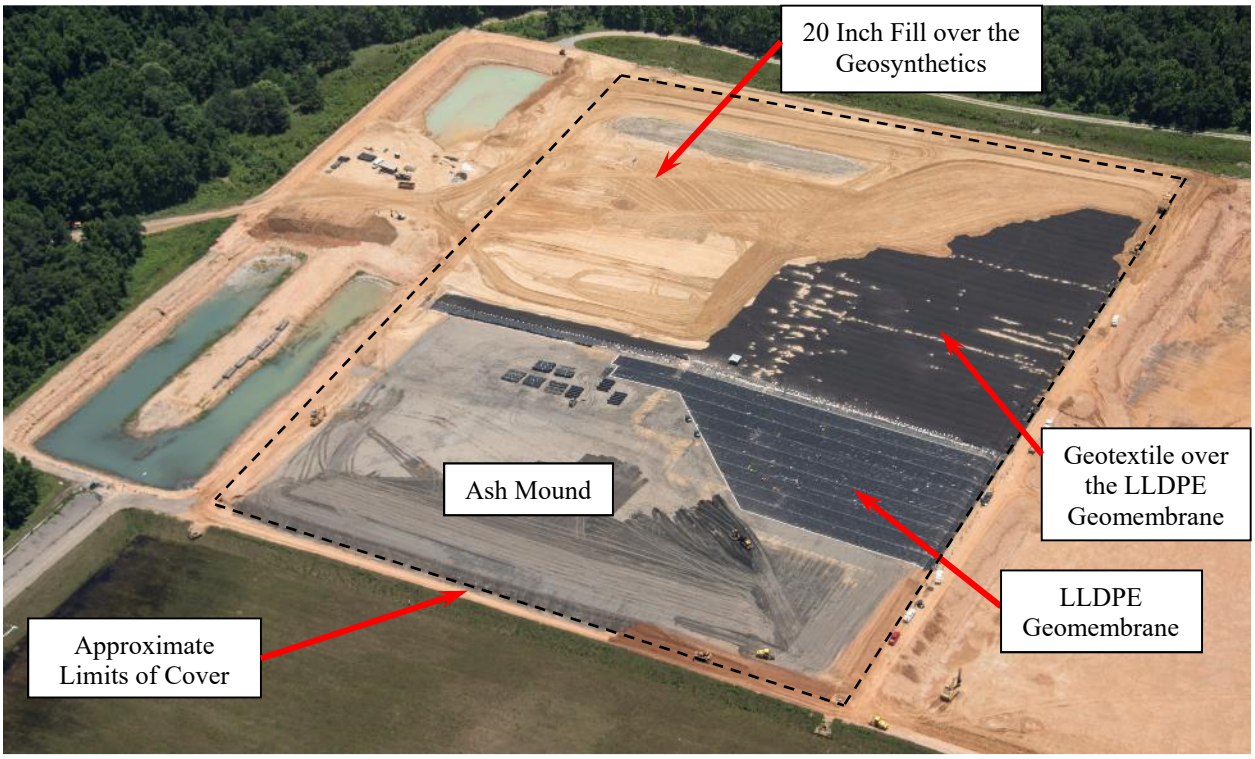

Photo 85. 488-1D Ash Basin East Aerial June 2018

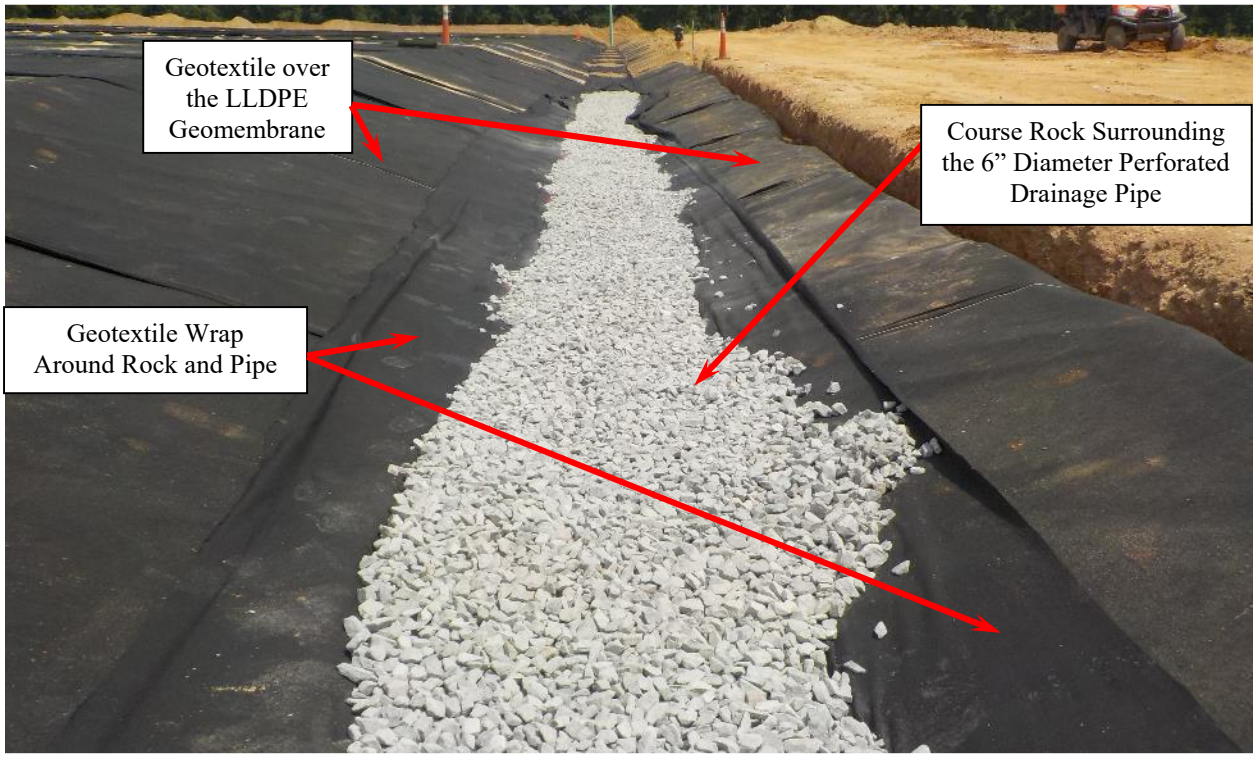

Photo 86. Subsurface Drainage Collection System

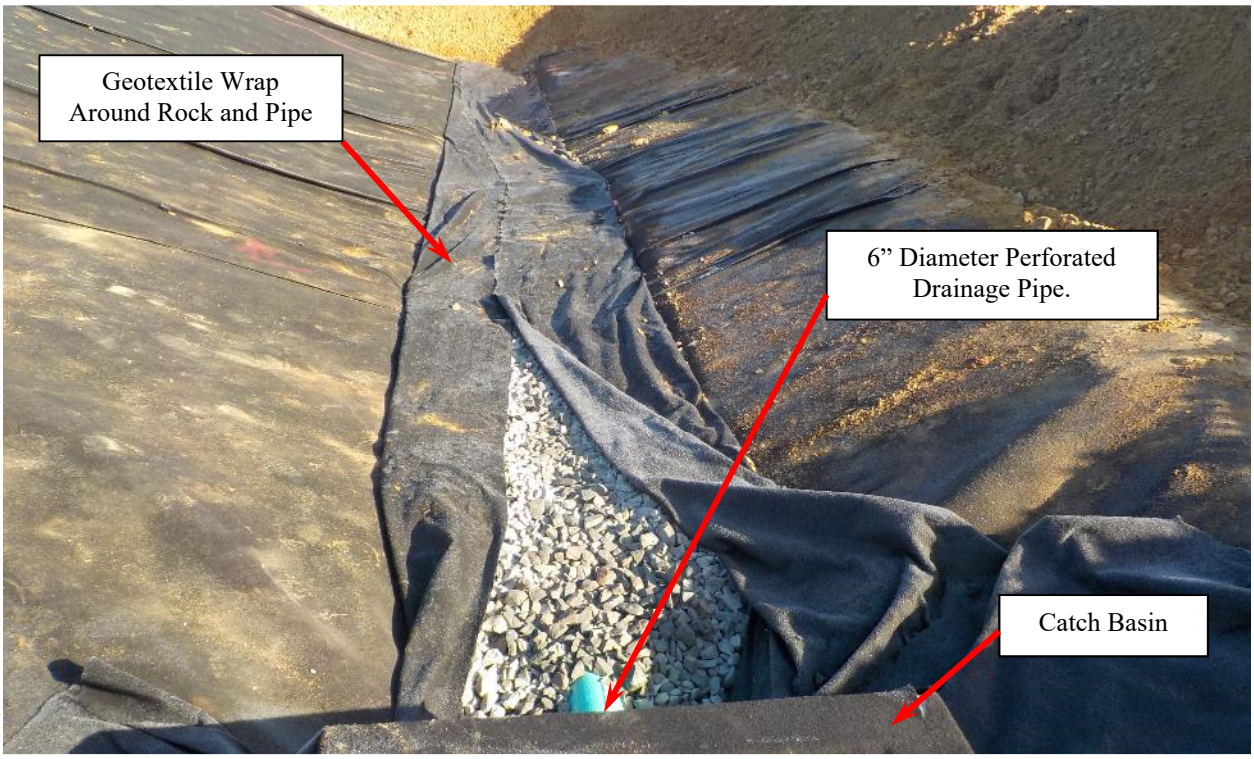

Photo 87. Subsurface Drainage (2)

Photo 88. Grouted Subsurface Drainage Pipe in Catch Basin

Photo 89. 488-1D Ash Basin East 20 Inch Soil Cover Placement

Photo 90. 488-1D Ash Basin East 20 Inch Soil Cover Placement

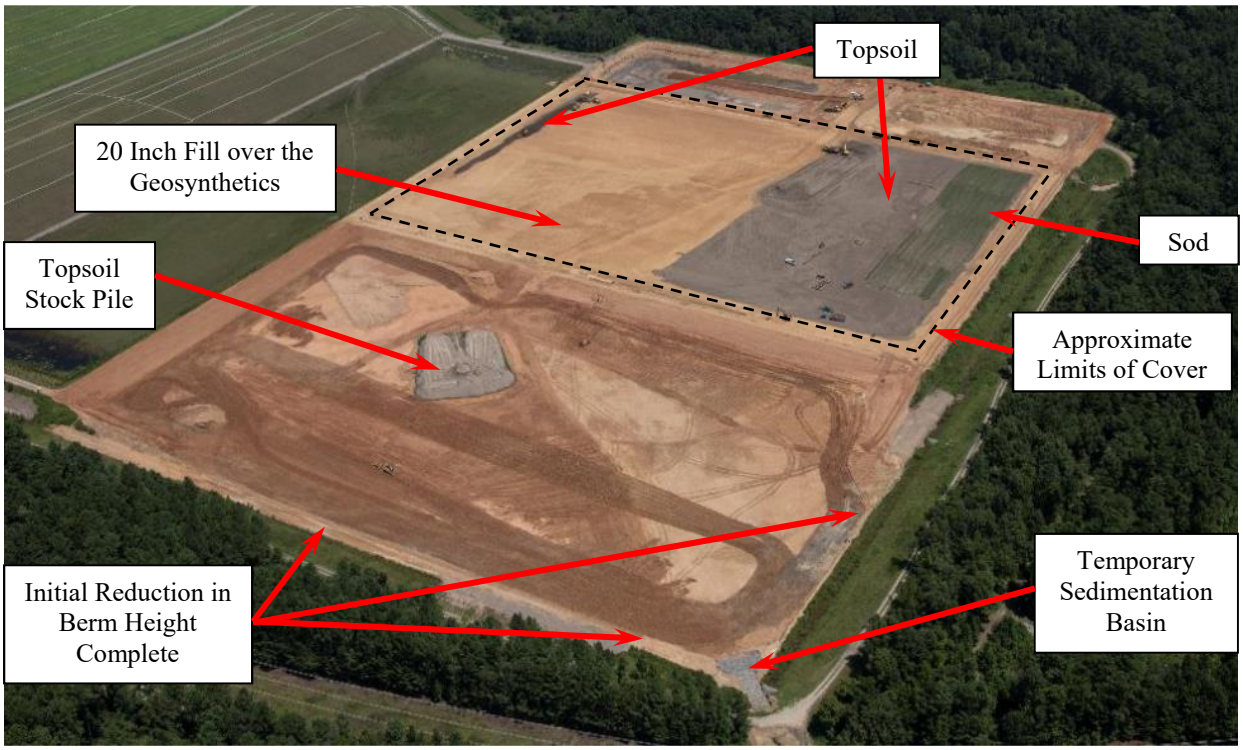

Photo 91. Aerial View of 488-1D Ash Basin (August 8, 2018)

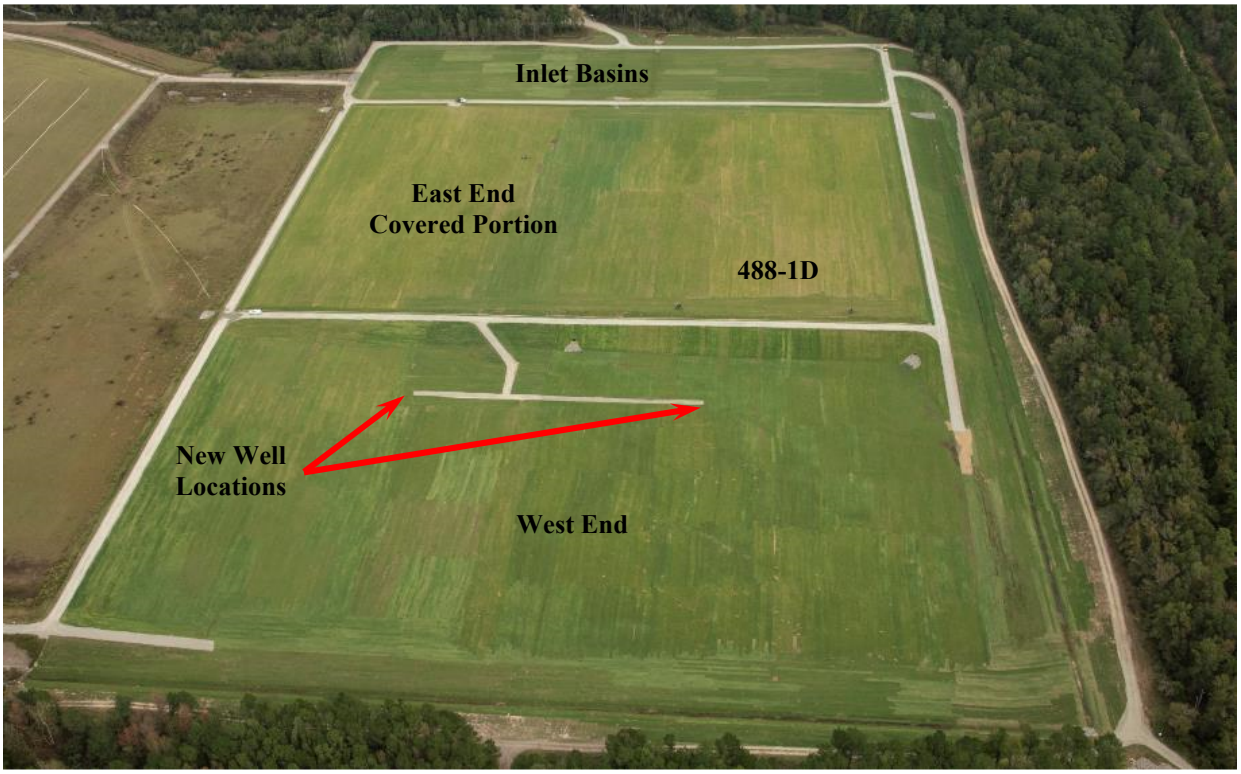

Photo 92. Aerial 488-1D Ash Basin (October 23, 2018)

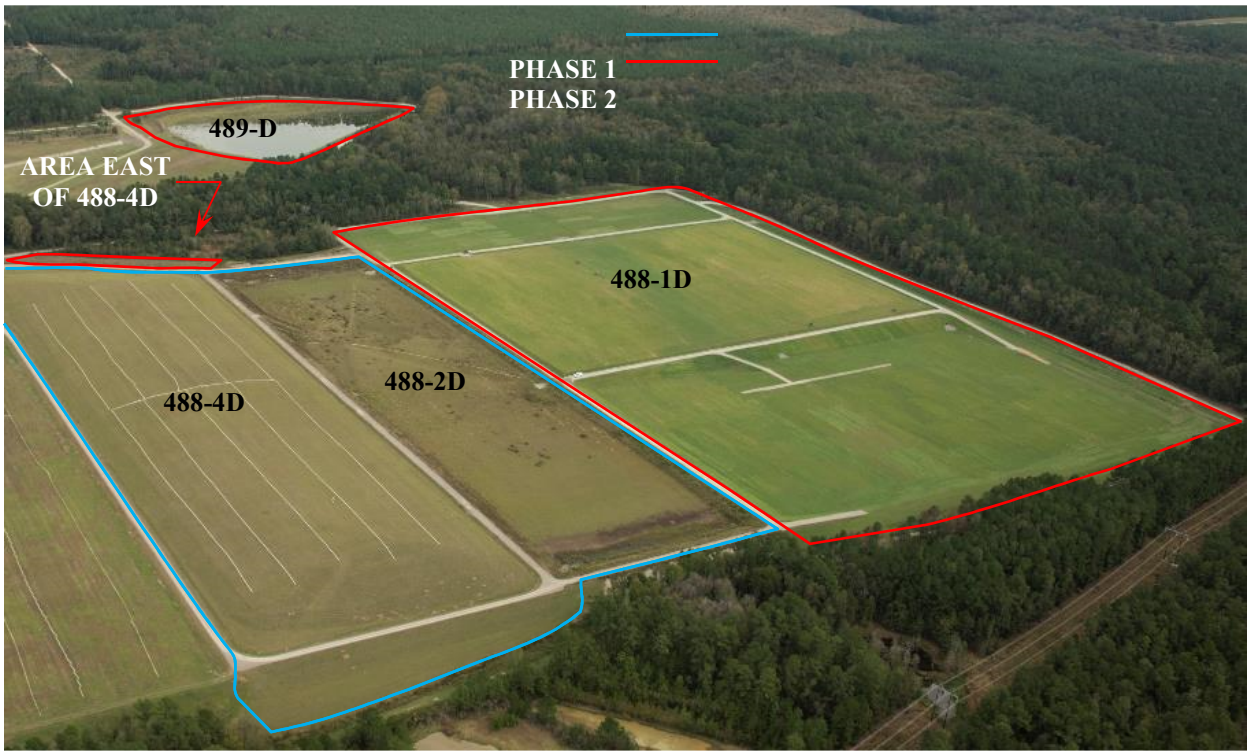

Photo 93. Aerial 488-1D Ash Basin (October 23, 2018)

APPENDIX A

USDOE SUBMITTAL OF THE REVISION 3 ACTION MEMORANDUM FOR THE NON-TIME CRITICAL REMOVAL ACTION FOR THE D AREA COAL PILE RUNOFF BASIN 489-D (USDOE 2015a)

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Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

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Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Robert H. Pope
Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Pope:

SUBJECT: Revision 3 Action Memorandum for the Non-Time Critical Removal Action for the D-Area Coal Pile Runoff Basin (489-D), CERCLIS Number: 63

Pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) Section 300.415(b)(2)(iv)] that states removal actions shall be considered when *"High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that might migrate."*, the U.S. Department of Energy (DOE) prepared a Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the 489-D Coal Pile Runoff Basin (CPRB), D-006 Outfall and 484-10D Waste Oil Facility at the D Area Operable Unit (DAOU) (SRNS-RP-2009-00805, Revision 1, September 2009). As documented in the RSER/EE/CA, the contaminant of concern in the coal fines associated with the sediment in the basin is arsenic (maximum concentration of 158 mg/kg), which results in an unacceptable exposure risk to a future resident. DOE selected Alternative 2, Consolidation and Soil Cover with Institutional Controls, in the initial action memorandum (ACP-10-129, dated December 21, 2009), which was issued to the public on January 8, 2010.

A revised action memorandum (ACP-10-255, dated August 26, 2010), recognizing a phased approach to the closure of the 489-D CPRB that resulted in the segmenting of the basin into two sections (southern and northern), was issued to the public on September 7, 2010. This phased approach was necessary to support the D-Area powerhouse operations and required the southern section to remain in operation. As part of the execution of the August 2010 action memorandum, the northern section of the 489-D CPRB (approximately 25% of the overall area of the basin) was closed. In addition, an Early Action Record of Decision Remedial Alternative Selection (EAROD) for the DAOU (SRNS-RP-2010-00162, Revision 1.2, July 2011) was issued in September 2011 for the closed northern section of the 489-D CPRB. The remaining southern section (75% of the basin area) remained in operation as a functioning basin managing storm water runoff.

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A Revision 2 action memorandum (ACP-11-152, dated March 23, 2011) addressed the deletion of the D-006 Outfall administratively from the DAOU. The D-006 Outfall removal action was transferred from the DAOU to the Savannah River and Floodplain Swamp Integrator Operable Unit. The Revision 2 action memorandum was issued to the public on March 28, 2011. The 489-D CPRB subunit was not impacted by the Revision 2 action memorandum.

This revision (Revision 3) to the action memorandum is specific to the removal action for the closure of the 75% southern section of the 489-D CPRB. This removal action will not impact the floodplain. The purpose of the action memorandum is to document the change from in-situ closure of the remaining 75% southern section outlined in the first revision to the action memorandum (ACP-10-255, dated August 26, 2010) to excavation and disposal with unrestricted land use. An evaluation of an excavation and disposal removal alternative was included in the 2009 RSER/EE/CA (SRNS-RP-2009-00805, Revision 1, September 2009). Once the coal fines and residual coal-related contaminants have been successfully removed, clean fill material will be placed in the 489-D CPRB as necessary, and the area will be contoured and re-graded to function as a storm water retention basin since it will be necessary to continue to manage storm water in the area. The retention basin will allow for a gentle sheet flow of rain/storm water runoff. This revision to the action memorandum has no impact on earlier decisions for the northern section of the basin, which requires land use controls as a part of the remedy decision as stated in the EAROD for the DAOU (SRNS-RP-2010-00162, Revision 1.2, July 2011).

HISTORY

The 484-D Powerhouse was a coal-fired facility that provided steam for the D-Area facilities and other areas at Savannah River Site (SRS). The power house was put into operation in 1952 and was shut down in 2012. As a support feature during operation of the powerhouse, the 489-D CPRB was constructed in 1978 and provided a collection point for storm water runoff that originated from the coal yard (484-17D) adjacent to the 484-D Powerhouse. Runoff water was collected through a network of drainage ditches around the coal yard and flowed to the 489-D CPRB via storm sewers. In 2012, the northern 25% of the 489-D CPRB was closed and capped in accordance with the EAROD for the DAOU (SRNS-RP-2010-00162, Revision 1.2, July 2011) and the Early Action Post-Construction Report for the DAOU (SRNS-RP-2012-00794, Revision 1, May 2013).

As part of the 484-D Powerhouse shutdown, all coal was removed from the coal yard in 2013 and the active, southern 75% portion of the 489-D CPRB was isolated from the coal yard. The 489-D CPRB no longer receives any storm water runoff originating from around the 484-D Powerhouse. The 489-D CPRB was dry until the fall of 2014, when heavy rains partially filled the basin. Rainwater accumulation in the basin fluctuates in quantity based on the amount of rainfall the area receives. In 2000, a maintenance action was performed in which 7,646 cubic meters of coal fines were excavated from the 489-D CPRB and burned in the powerhouse. The current design, high-end estimate of the total quantity of coal fines remaining in the 489-D CPRB is 5,000 cubic yards, which assumes a uniform layer of four inches of coal fines across the entire basin.

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PROBLEM WARRANTING ACTION

The problems warranting action associated with the remaining coal fines within the southern section of the 489-D CPRB include the following:

- Sediment is impacted with arsenic at concentrations exceeding 1E-06 that pose an exposure risk to a future resident (risk = 5.0E-05).
- Sediment is impacted with arsenic (hazard quotient [HQ] = 2.8) and 2-methylnaphthalene (HQ = 9.7) at concentrations exceeding an HQ of 1.0 that pose a risk to benthic organisms (e.g., crayfish).
- Surface water is impacted with aluminum (HQ = 791), beryllium (HQ = 45), cobalt (HQ = 17), copper (HQ = 13), iron (HQ = 127), manganese (HQ = 41) and zinc (HQ = 5) at concentrations exceeding an HQ of 1 that pose a risk to aquatic organisms. In addition, the low pH conditions pose a risk to aquatic organisms, mammals, and birds.
- Closure of the basin is necessary to complete closure of the Industrial Wastewater Treatment (IWT) Permit #7295.

REMOVAL ACTION OBJECTIVES

The removal action objectives for the southern section of the 489-D CPRB are:

NOTE: The impacted 'surface water' is contained within the 489-D CPRB. De-watering of 489-D CPRB will include discharge of contained storm water into Waters of the State in accordance with National Pollutant Discharge Elimination System (NPDES) General Permit SCR000000, and will achieve a degree of treatment and/or control which shall produce an effluent that is consistent with the South Carolina Water Pollution Control Act, the Clean Water Act, and South Carolina Department of Health and Environmental Control (SCDHEC) R.61-68.

- Protect future residents from exposure to arsenic at an exposure risk exceeding 1E-06 in surface sediment.
- Protect benthic organisms from exposure to arsenic and 2-methylnaphthalene at a HQ exceeding 1.0 and low pH in surface sediment.
- Protect aquatic organisms from exposure to aluminum, beryllium, cobalt, copper, iron, manganese, and zinc at a HQ exceeding 1.0 in surface water. In addition, protect aquatic organisms, mammals, and birds from exposure to low pH in surface water.
- Protect aquatic organisms from applicable, or relevant and appropriate requirements (ARARs) refined constituents of concern in surface water (e.g., aluminum, copper, iron, and zinc).

ARAR TABLE

In accordance with 40 CFR § 300.415(j) of the NCP, on-site removal actions are required to attain ARARs to the extent practicable, considering the exigencies of the situation. For this removal action, the original RSER/EE/CA (SRNS-RP-2009-00805, Revision 1, September 2009) did recognize the

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alternatives to remove the coal fines and place an earthen cover over the area; however, additional ARARs not included in the original RSER/EE/CA are necessary to complete this action and maintain it as a storm water retention basin. Enclosure 1 is included to identify all ARARs related to this action. The final disposition of the 489-D CPRB will be addressed as part of the final remedy selected in the Second EAROD for the DAOU.

REMOVAL ACTION DETAILS

In order to complete the closure of the southern section of the 489-D CPRB and convert it to a storm water retention basin, DOE will implement the following actions:

- Remove all remaining coal fines from the basin to meet clean closure parameters and place the excavated material under a cover system consistent with Class Three Landfill design requirements [SCDHEC R. 61-107.19(v)] as concurred by SCDHEC. Excavated material will be placed in the 488-4D Ash Landfill, 488-1D Ash Basin, or at an approved off-site disposal facility such as Three Rivers Landfill. An additional twelve (12) inches of soil will be removed from the original elevation of the bottom surface and disposed of with the coal fines. The 488-1D Ash Basin vegetation/tree removal and dewatering may be necessary as part of this removal action to facilitate placement of the excavated materials into the 488-1D Ash Basin. For this removal action, dewatering of the 488-1D Ash Basin that requires discharges to Beaver Dam Creek will be in compliance with the NPDES Permit SC0047431.
- Pursue clean closure with no land use controls by performing confirmatory sampling in accordance with an approved sampling and analysis plan (SRNS-RP-2013-00332, Revision 1.1, July 2014) and an approved field sampling plan (SRNS-RP-2014-01048, Revision 1, May 2015) prior to any backfilling of the bottom surface. These documents identify the human health risk-based levels that will be used to determine if residual concentrations of hazardous constituents commonly found in ash are at levels to qualify for clean closure. In addition, an ecological evaluation will also be performed. Backfill mixed with lime will be placed in the basin to attain necessary drainage layers. The backfill material will be analyzed per the SRS Fill and Cover Material Verification Protocol prior to placement to ensure the material does not re-contaminate the excavated area. Lime will be mixed with the backfill to serve as a soil amendment to promote vegetation growth in the high clay content soil.
- Modify basin berms, backfill with clean fill material to design grade, and grass to stabilize the area.
- Close/eliminate Outfall D-01B since the IWT permit will be closed and there will no longer be an industrial discharge from this basin.
- Grout ends of existing storm water pipe located under the closed 25% northern section of the 489-D CPRB and reroute storm water flow into the 75% southern section of the 489-D CPRB.
- Other activities of this removal action include land surveys, vegetation removal, removal of old signs/postings, implementation of road improvements for access, and implementation of erosion control measures and improvements.

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If dewatering of the accumulated rainwater within the 489-D CPRB becomes necessary, it will be accomplished using one or more of the following methods:

- Perform neutralization (pH between 6 and 9) as necessary, monitor water quality, and pump to the active storm sewer system in compliance with NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Except Construction), SCR000000, Section 1.1.2 (Runoff from coal storage piles at steam electric generating facilities). Once empty, future storm water management that requires pumping to the active storm sewer will continue to be in accordance with NPDES General Permit for Storm Water Discharges Associated with Industrial Activities. The 488-1D/489-D project specific Storm Water Pollution Prevention Plan will address sediment and erosion control.
- Transport storm water to an alternate SRS wastewater treatment facility in accordance with the SRS Scavenger Wastewater Program.

This removal action is scheduled to start in September 2015. Upon conclusion of the removal action, a Removal Action Report that summarizes the work activities will be prepared and submitted for your review. Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-15-168

Enclosure:
1) Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

cc:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
J. R. Hughes, SCDHEC - Midlands EQC Region - Aiken
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
General Construction Standards — All Land-disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing storm water runoff from land-disturbing activities	Must comply with the substantive requirements for stormwater management and sediment control of *NPDES General Permit No. SCR100000.*	Large and small construction activities (as defined in R. 61-9) of more than 1 acre of land – **applicable**	S.C. R. 61-9.122.26(c) NPDES General Permit No. SCR100000
	The requirements of R.72-305 and R.72-307 will apply.	For land disturbing activities disturbing more than five (5) acres – **applicable**	S.C. R. 72-305.B.(3)
	The stormwater management and sediment control plan shall contain at a minimum the information provided in the following subsections:	Activities involving more than two (2) acres and less than five (5) acres of actual land disturbance which are not part of a larger common plan of development or sale – **applicable**	S.C. R. 72-307 I. – *South Carolina Storm Water Management and Sediment Reduction Regulations*
	A plan for temporary and permanent vegetative and structural erosion and sediment control measures which specify the erosion and sediment control measures to be used during all phases of the land disturbing activity and a description of their proposed operation;		S.C. R. 72-307 I.(3)(d)
	Provisions for stormwater runoff control during the land disturbing activity and during the life of the facility meeting the following requirements: 1. Post-development peak discharge rates shall not exceed pre-development discharge rates for the 2- and 10- year frequency 24-hour duration storm event. Implementing agencies may utilize a less frequent storm event (e.g. 25-year, 24- hour) to address existing or future stormwater quantity or quality problems. 2. Discharge velocities shall be reduced to provide a nonerosive velocity flow from a structure, channel, or other control measure or the velocity of the 10-year, 24-hour storm runoff in the receiving waterway prior to the land disturbing activity, whichever is greater.		S.C. R. 72-307 I.(3)(e)
Managing fugitive dust emissions from land disturbing activities	Emissions of fugitive particulate matter shall be controlled in such a manner and to the degree that it does not create an undesirable level of air pollution. Volatile organic compounds shall not be used for dust control purposes. Oil treatment is also prohibited.	Activities that will generate fugitive particulate matter (Statewide) – **applicable**	S.C. R. 61-62.6 Section III(g)- *Control of Fugitive Particulate Matter Statewide* S.C. R. 61-62.6 Section III(d)

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
Storm Water Swales and Retention Basin Standards			
Managing stormwater runoff in retention or detention structures	All stormwater management and sediment control practices shall be designed, constructed and maintained with consideration for the proper control of mosquitoes and other vectors. Practices may include, but are not limited to: (1) The bottom of retention and detention ponds should be graded and have a slope not less than 0.5 percent.	Design and construction of all stormwater detention or retention structures, as defined in 72-301– **applicable**	S.C. R. 72-307 D.(1)
	Permanent water quality ponds having permanent pool shall be designed to store and release the first ½ inch of runoff from the site over a 24-hour period. The storage volume shall be designed to accommodate, at least ½ inch of runoff from the entire site.		S.C. R. 72-307 C.(5)(d)
	Permanent water quality ponds, not having a permanent pool, shall be designed to release the first inch of runoff from the site over a 24-hour period.		S.C. R. 72-307 C.(5)(e)
	Permanent infiltration practices, when used, shall be designed to accept, at a minimum, the first inch of runoff from all impervious areas. Limitations of use of infiltration practices are listed in 72-307 C.(11)(a)-((j).	Use of "infiltration" practices, as defined in 72-301 as the passage or movement of water through the soil profile – **applicable**	S.C. R. 72-307 C.(5)(f)
Waste Characterization and Storage — (e.g., wastewaters, excavated coal fines, contaminated soils/sediments)			
Characterization of *solid* waste	Must determine if solid waste is a hazardous waste using the following method: Should first determine if waste is excluded from regulation under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 – **applicable**	40 CFR 262.11(a) S.C. R. 61-79 262.11*(a)*
	Must determine if waste is listed as hazardous waste under 40 CFR Part 261.	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – **applicable**	40 CFR 262.11(b) S.C. R. 61-79 262.11*(b)*
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR Part 261 by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261, or according to an	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – **applicable**	40 CFR 262.11(c) S.C. R. 61-79 262.11*(c)*

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
	equivalent method approved by the Administrator under 40 CFR 260.21; or (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.		
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be *hazardous* waste – **applicable**	40 CFR 262.11(d) S.C. R. 61-79 262.11*(d)*
Determinations for management of *hazardous* waste [1]	Must determine each EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 *et seq.*. *Note:* This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) S.C. R. 61-79 268.9*(a)*
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) S.C. R. 61-79 268.9*(a)*
	Must determine if the hazardous waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. *Note:* This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.7(a) S.C. R. 61-79 268.7*(a)* (1)

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
Temporary storage of hazardous waste in containers [1]	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 264.171-173; and • the date upon which accumulation begins is clearly marked and visible for inspection on each container • container is marked with the words "hazardous waste"; or	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 –**applicable**	40 CFR 262.34(a)(1),(2) S.C. R. 61-79 262.34*(a)* (1), (2) 40 CFR 264.34(a)(3) S.C. R. 61-79 262.34*(a)* (3)
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste or 1 quart of acutely hazardous waste listed in 261.33(e) at or near any point of generation – **applicable**	40 CFR 262.34(c)(1)(ii) S.C. R. 61-79 262.34*(c)* (1)(ii)
Use and management of hazardous waste in containers [1]	If container holding waste is not in good condition (e.g. severe rusting, structural defects), or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers – **applicable**	40 CFR 264.171 S.C. R. 61-79 264.171
	Must use a container made or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired.		40 CFR 264.172 S.C. R. 61-79 264.172
	A container holding hazardous waste must always be closed during storage, except when necessary to add or remove waste. A container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.		40 CFR 264.173(a) and (b) S.C. R. 61-79 264.173*(a)* and *(b)*
Storage of hazardous waste in container area [1]	Area must have a containment system designed and operated in accordance with 264.175(b).	Storage of RCRA hazardous waste in containers ***with free liquids*** – **applicable**	40 CFR 264.175(a) S.C. R. 61-79 264.175*(a)*
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA-hazardous waste in containers that ***do not contain free liquids*** (other than F020, F021, F022, F023, F026 and F027) – **applicable**	40 CFR 264.174(c)(1) and (2) S.C. R. 61-79 264.175*(c)* (1) and (2)

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AUG 1 1 2015

Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
Closure of RCRA container storage unit [1]	At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soils containing or contaminated with hazardous waste and hazardous waste residues must be decontaminated or removed. [Comment: At closure, as throughout the operating period, unless the owner or operator can demonstrate in accordance with 40 CFR 261.3(d) of this chapter that the solid waste removed from the containment system is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and must manage it in accordance with all applicable requirements of parts 262 through 266 of this chapter].	Storage of RCRA hazardous waste in containers in a unit with a containment system – **applicable**	40 CFR 264.178 S.C. R. 61-79 264.178
Disposal of Wastes in 488-4D Ash Landfill, 488-ID Ash Basin, or Off-Site (e.g., coal fines, contaminated soils/sediments)			
Disposal of *solid waste* off-SRS	Disposal of solid waste at facilities and/or sites permitted or registered by the Department for processing or disposal of that waste stream. Waste must meet state classification system for the permitted facilities.	Generation of solid waste intended for off- SRS disposal – Applicable	SCDHEC R. 61-107.15
Disposal of RCRA-*hazardous* waste in a land-based unit [1]	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste – **applicable**	40 CFR §268.40(a) S.C. R. 61-79 268.40*(a)*
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards (UTSs), found in 40 CFR 268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001-D043) not managed in a wastewater treatment system regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – **applicable**	40 CFR §268.40(e) S.C. R. 61-79 268.40*(e)*

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D) AUG 1 1 2015

Action	Requirements	Prerequisite	Citation
	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or Must be treated according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils – **applicable**	40 CFR §268.49(b) S.C. R. 61-79 268.49*(b)*
Dewatering of 489-D CPRB			
On-site Discharge to Surface Water	Any discharge into waters of the State must be permitted by the Department and receive a degree of treatment and/or control which shall produce an effluent which is consistent with the Act, the Clean Water Act (P.L. 92-500, 95-217, 97-117, 100-4), this regulation, and related regulations. *Note:* Under CERCLA Section 121(e) permits are not required for on-site response actions. Instead SRS must meet any applicable effluent limits in its existing NPDES discharge permit or other substantive requirements, including the numeric water quality criteria for the protection and maintenance of the appropriate class of surface waters as adopted in S.C. R.61-68 and listed in Sections E, G, and the appendix therein.	Discharge of pollutants (including toxic substances) into waters of the State of South Carolina – **relevant and appropriate**	S.C. R. 61-68E.4.a S.C. R. 61-68 E.14
	Site-specific permit effluent limitations and alternate criteria less stringent than those derived in accordance with the requirements in S.C. R. 61-68 E.14.c. may be derived where it is demonstrated that such limits and criteria shall maintain the existing and classified uses.		S.C. R. 61-68 E.14.c.(7)
	Discharge of garbage, cinders, ashes, oils sludges, or other refuse is not allowed.	Quality Standards for Waters of the State of South Carolina (classified as FW as provided in S.C. R. 61-68G.10) – **relevant and appropriate**	S.C. R. 61-68G.10.a
	Treated wastes, toxic wastes, deleterious substances in sufficient amounts to make the waters unsafe or unsuitable for primary contact recreation or to impair the waters for any other best usage are not allowed.		S.C. R. 61-68G.10.b

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D) AUG 1 1 2015

Action	Requirements	Prerequisite	Citation
	Discharge of toxic pollutants is not allowed except as prescribed in Section E of S.C. R. 61-68.		S.C. R. 61-68G.10.c
	Stormwater, and other nonpoint source runoff is allowed if water quality necessary for existing and classified uses shall be maintained and protected consistent with antidegradation rules.		S.C. R. 61-68G.10.d
	Dissolved oxygen – daily average not less than 5.0 mg/l with a low of 4.0 mg/l		S.C. R. 61-68G.10.e
	pH between 6.0 and 8.5		S.C. R. 61-68G.10.g
Transportation of Wastes			
Transportation of hazardous waste *on-site* [1]	The generator manifesting requirements of §262.20 and §262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in §§263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way – **applicable**	40 CFR §262.20(f) S.C. R. 61-79 262.20*(f)*
Transportation of hazardous waste *off-site* [1]	Must comply with the generator requirements of §§ 262.20-23 for manifesting, §262.30 for packaging, §262.31 for labeling, § 262.32 for marking, §262.33 for placarding, §§262.40, 262.41(a) for record keeping requirements, and §262.12 to obtain EPA ID number.	Generator who initiates the off-site shipment of RCRA-hazardous waste – **applicable**	40 CFR §262.10(h) S.C. R. 61-79 262.10*(h)*

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material – **applicable**	49 CFR §171.1(c)
Transportation of samples (i.e. solid waste, soils and wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when: • the sample is being transported to a laboratory for the purpose of testing; or • the sample is being transported back to the sample collector after testing. • the sample is being stored by sample collector before transport to a lab for testing.	Samples of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition – **applicable**	40 CFR 261.4(d)(1)(i)-(iii) S.C. R. 61-79 261.4*(d)* (1)
	In order to qualify for the exemption in 40 CFR 261.4 (d)(1)(i) and (ii), a sample collector shipping samples to a laboratory must: • Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements. • Assure that the information provided in (1) thru (5) of this section accompanies the sample. • Package the sample so that it does not leak, spill, or vaporize from its packaging.		40 CFR 261.4(d)(2)(i) 40 CFR 261.4(d)(2)(i)(A)and (B) S.C. R. 61-79 261.4*(d)*(2)(i)(A) and (B)
Location-Specific Requirements			
Protection of Migratory Birds	No person may take, possess, import, export, transport, sell, purchaser, barter or offer for sale, purchase or barter, any migratory bird, or the parts, nests, or eggs of such bird except as under the terms of a valid permit.	Migratory bird populations may be present in the vicinity – **applicable**	16 USC 703-704 – *Migratory Bird Treaty Act*

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Table 1: ARARs for Revision 3 NTCR Action Memorandum for D-Area CPRB (489-D)

Action	Requirements	Prerequisite	Citation
Presence of Threatened and Endangered Wildlife listed in 50 CFR 17.11(h) *–or critical habitat of such species*	Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of Interior, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section.	Agency action that may jeopardize listed wildlife species, or destroy or adversely modify critical habitat – **applicable**	16 U.S.C. 1536 (a)(2) – *Endangered Species Act of 1973*
Presence of Threatened and Endangered Wildlife listed in 50 CFR 17.11(h)	It is unlawful to take threatened or endangered wildlife in the United States. *Note:* Under 50 CFR 10.12 *Definitions* the term *Take* means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.	Action that may jeopardize listed wildlife species – **applicable**	50 CFR 17.21(c)
Within area impacting stream or any other body of water – *and* - presence of wildlife resources (e.g., fish)	The effects of water-related projects on fish and wildlife resources and their habitat should be considered with a view to the conservation of fish and wildlife resources by preventing loss of and damage to such resources.	Action that impounds, diverts, controls or otherwise modifies waters, including navigation and drainage activities — **applicable**	Fish and Wildlife Coordination Act (16 *USC* 661 *et seq.*)

1- The requirements for treatment, storage and disposal of RCRA *hazardous* wastes contained in this table will be triggered if any generated wastes, including coal fines, soil, sediments, and/or collected CPRB surface water are characterized as RCRA *hazardous* wastes.

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR = *Code of Federal Regulations*
CMBST = Combustion
CPRB = Coal Pile Runoff Basin
CWA = Clean Water Act of 1972
DOT = U.S. Department of Transportation
EPA = U.S. Environmental Protection Agency
HMTA = Hazardous Material Transportation Act of 1975
HMR = Hazardous Material Regulations
NPDES = National Pollutant Discharge Elimination System
NTCR = Non-time Critical Removal
RCRA = Resource Conservation and Recovery Act of 1976
RORGS = Recovery of Organics
S.C. = South Carolina Department of Health and Environmental Control
SRS = Savannah River Site
UTS = Universal Treatment Standard

APPENDIX B

USDOE SUBMITTAL OF THE NOTIFICATION OF THE REMOVAL ACTION START DATE FOR THE D COAL PILE RUNOFF BASIN 489-D (USDOE 2015b)

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ARF-020352

Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

SEP 15 2015

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Robert H. Pope
Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Pope:

SUBJECT: Notification of the Removal Action Start Date for the D-Area Coal Pile Runoff Basin (489-D) CERCLIS Number: 63

In accordance with the terms of the Federal Facility Agreement (FFA), the U. S. Department of Energy (DOE) is notifying the South Carolina Department of Health and Environmental Control (SCDHEC) and the U. S. Environmental Protection Agency (EPA) that the Removal Action Start for the D-Area Coal Pile Runoff Basin (CPRB) (489-D) was met on September 10, 2015, ahead of the FFA milestone date of September 28, 2015. The removal action start date was met with the initiation of the site land-survey of the 489-D CPRB.

The effort and time that the SCDHEC and the EPA have given on the subject operable unit are greatly appreciated. Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-15-176

ARF-020352

SEP 15 2015

Ms. Susan Fulmer
Mr. Robert Pope 2

cc:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
J. R. Hughes, SCDHEC - Midlands EQC Region - Aiken
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

APPENDIX C

USDOE SUBMITTAL OF THE PROFESSIONAL ENGINEER STAMPED REMOVAL ACTION DESIGN PLAN FOR THE 488-1D ASH BASIN AND 489-D COAL PILE RUNOFF BASIN (U)
(SRNS-RP-2015-000196, Revision 1, May 2016)
(USDOE 2016b)

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ARF-020773

Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

JUL 18 2016

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Robert H. Pope
Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Pope:

SUBJECT: Professional Engineer (PE) Stamped Removal Action Design Plan (RADP) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U) (SRNS-RP-2015-00196, Revision 1, May 2016) CERCLIS Number: 63

The U.S. Department of Energy (DOE) is submitting the enclosed Professional Engineer (PE) Stamped Removal Action Design Plan (RADP) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin for your files. The South Carolina Department of Health and Environmental Control (SCDHEC) and U.S. Environmental Protection Agency (EPA) conditionally approved the Revision 1 document in letters dated June 7, 2016 and June 26, 2016, respectively. To satisfy the requirements of the conditional approvals, the document was revised as follows:

- **SCDHEC Approval Condition:** Section 2.3.1, *General Project Requirements*, 2nd and 3rd bullets were revised as follows: "The decision criterion is the visual confirmation of ash in the root ball." was deleted from the second bullet and added to the third bullet.

- **EPA Approval Condition 1.** Section 2.7, Testing Requirements for Common Fill and Topsoil, first paragraph, was revised as noted below. Table 3 is also shown below.

  "Fill material and topsoil….The estimated total common fill needed for Phase 1 (488-2D / 488-4D) and Phase 2 (488-1D / 489-D) is 267,000 cubic yards to be obtained from the D Area Borrow Pit (Figure 5). The estimated total topsoil for Phase 1 (488-2D / 488-4D) and Phase 2 (488-1D / 489-D) is 55,000 cubic yards. Estimated volumes of common fill, top soil and minimum of samples for each subset are provided / described in Table 3. Due to the large volume…"

ARF-020773

Ms. Susan Fulmer
Mr. Robert Pope

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JUL 18 2016

Table 3. Estimated Common Fill and Topsoil Volumes

Ash Basins /Landfill[1]	Source	Cubic Yards	Sampling Criteria[2]
488-1D/489-D 488-4D/488-2D	Common Fill Onsite	267,000 (Phase 1 & 2)	Initial rate one composite sample every 1,000 yd^3 for the first 15,000 yd^3. Then one composite sample every 15,000 yd^3 thereafter.
488-1D/489-D	Topsoil Onsite	32,000	Initial rate one composite sample every 1,000 yd^3 for the first 10,000 yd^3. Then one composite sample every 2,500 yd^3 thereafter.
488-4D/488-2D	Topsoil Offsite	20,000+/-	**JACKSON location** - Initial rate one composite sample every 1,000 yd^3 for the first 10,000 yd^3. Then one composite sample every 2,500 yd^3 thereafter.
488-4D/488-2D	Topsoil Offsite	5000+/-	**BEECH ISLAND location** - Initial rate one composite sample every 1,000 yd^3 for the first 10,000 yd^3. Then one composite sample every 2,500 yd^3 thereafter.

1) Common fill and topsoil is shared between the landfill and three basins.
2) 6% of the common fill was tested at the initial rate. For the topsoil, 31% of the topsoil onsite, 50% of the topsoil from the offsite Jackson location, and 100% of the topsoil from the offsite Beech Island location will be tested at the initial rate.

- **EPA Approval Condition 2.** Appendix A, Section 4.2.3, *Ash Placement and Compaction Requirements*, 4th bullet was revised as follows: "Subcontractor will compact…To verify that the moisture content of the ash is within "workable limits", as each 12-inch lift is compacted the surface shall be visually verified by the construction field superintendent and engineer that the vibratory roller is not rutting, yielding, or pumping. If the surface is not stable and uniform, the area will be reworked by disking, harrowing, wind rowing, etc. and re-compacted and visually re-verified prior to proceeding to the next lift."

ARF-020773

Ms. Susan Fulmer
Mr. Robert Pope

JUL 18 2016

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The effort and time that the SCDHEC and the EPA have given on the subject operable unit are greatly appreciated. Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Area Completion Project

IACD-16-152

Enclosure:
Removal Action Design Plan (RADP) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (SRNS-RP-2015-00196, Revision 1, May 2016) CERCLIS Number: 63 (PE Stamped)

cc w/o encl:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
H. M. Reed, SCDHEC - Midlands EQC Region - Aiken

cc w/encl:
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

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APPENDIX D

USDOE SUBMITTAL OF THE ACTION MEMORANDUM AND RESPONSIVENESS SUMMARY FOR THE NON-TIME CRITICAL REMOVAL ACTION FOR THE D-AREA ASH BASIN 488-1D (USDOE 2016a)

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020798

Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

AUG 17 2016

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Robert H. Pope
Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Pope:

SUBJECT: Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the D-Area Ash Basin (488-1D), CERCLIS Number: 63

Pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan [40 CFR Section 300.415(b)(2)(iv)] that states removal actions shall be considered when "*High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that might migrate.*", the U.S. Department of Energy (DOE) prepared a Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the D-Area Ash Basin (488-1D) (SRNS-RP-2015-00490, Revision 1, June 2016) CERCLIS Number: 63. The regulatory review of the Revision 0 RSER/EE/CA occurred from February 24, 2016 to April 24, 2016. The Savannah River Site (SRS) received comments from the South Carolina Department of Health and Environmental Control (SCDHEC) on April 21, 2016 and the U.S. Environmental Protection Agency (EPA) on April 26, 2016. The SRS responses to the EPA's and SCDHEC's comments were incorporated into the Revision 1 RSER/EE/CA, which was made available for public review and comment from June 15, 2016 to July 14, 2016. Comments received during the public comment period are addressed in the enclosed Responsiveness Summary, which will be made part of the Administrative Record. In addition, a notice will be filed in the Environmental Bulletin within two (2) weeks of submittal of the Action Memorandum and Responsiveness Summary to the Administrative Record File/Information Repository File.

The D-Area Operable Unit (DAOU) is one of the area operable units identified at the SRS. DAOU is located in the southwest quadrant of SRS approximately (~) 0.9-kilometers (3,000-feet) east of the nearest site boundary, the Savannah River. The DAOU is ~85 hectares (ha [210 acres {ac}]) and contains surface units and source areas in D Area that potentially pose a threat to human health and the environment. The 488-1D Ash Basin is a subunit of the DAOU.

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AUG 17 2016

Ms. Susan Fulmer
Mr. Robert Pope

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The D-Area Powerhouse was built in 1953 and shut down in 2012 after 59 years of operation. The facility burned approximately 160,000 tons of coal per year during this period. During operation, the powerhouse ash was mixed with water and the slurry was pumped into one of two Inlet Basins of the 488-1D Ash Basin for settling. The ash would settle out in the Inlet Basins and the waste water would flow into the east end of the 488-1D Ash Basin. As the water level increased in the 488-1D Ash Basin, the water flowed through a pipe located at the west end of the basin into the 488-2D Ash Basin. When the Inlet Basins filled to capacity with ash, the dry ash was hauled to the 488-4D Ash Landfill for disposal. As a result of the powerhouse shutdown, operation of the 488-1D Ash Basin and Inlet Basins is no longer required.

The 488-1D Ash Basin is permitted as an Industrial Wastewater Treatment (IWT) Facility (IWT Permit #7295), and comprises an area of 16 ha (40 ac) (488-1D Ash Basin = 13.8 ha [34 ac]; two Inlet Basins = 2.4 ha [6 ac]). Currently, the 488-1D Ash Basin contains ~456,000 cubic meters (m^3 [596,000 cubic yards {yds^3}]) of ash. Approximately 60% of the 488-1D Ash Basin has been naturally vegetated by various grasses, shrubs, and trees.

The problems warranting action associated with the 488-1D Ash Basin are identified as follows:

- Arsenic and coal-related radionuclides are historically contaminants of concern in SRS surface ash and may pose a risk for human receptors (future industrial worker risk >1E-06) and ecological receptors.
- There is a potential for migration of contaminants to groundwater above groundwater protection standards due to the uncertainty in groundwater elevation and flow path changes over time.
- Closure of the 488-1D Ash Basin is required in order to complete closure of the IWT Permit #7295.

The removal action objectives to protect human health and the environment include the following:

- Achieve ecological risk-based thresholds and residential risk-based thresholds for unrestricted land use (if possible). If waste material (ash) is left in place, unrestricted land use is not possible in those locations. At a minimum, protect future industrial workers and ecological receptors from exposure to contaminants in surface sediments/soils posing an unacceptable risk.
- Prevent migration of potential contaminants to groundwater that could exceed groundwater protection standards.

In the June 2016 RSER/EE/CA, the preferred removal action for the 488-1D Ash Basin is Alternative 2, Ash Consolidation and Geosynthetic Cover System, which meets the effectiveness, implementation, cost, and acceptance criteria. The ash from the western portion of the 488-1D Ash Basin (~ 6.1 ha [15 ac]) will be excavated and consolidated into the eastern portion of the basin along with an additional twelve (12) inches (0.30 meters) of excavated soil from within the two Inlet Basins and ash from the top of the berms/roads around the Inlets Basins. In addition, coal residues/contaminated soils from the 489-

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Ms. Susan Fulmer
Mr. Robert Pope 3

D Coal Pile Runoff Basin (CPRB) (including the removal action waste generated from the pumping, neutralization, and sediment removal of the CPRB basin storm water) and the ash located to the east (exterior) of the 488-4D Ash Landfill will also be placed into the eastern portion of the 488-1D basin. A geosynthetic cover system that meets the permeability, infiltration and erosion control requirements of a SCDHEC Class Three Landfill will be placed over the ash consolidation area to ensure the overall protection to human health and the environment. The geosynthetic cover system will protect groundwater by reducing infiltration into the ash basin by rain and storm water and minimize migration of ash contaminants into groundwater. The geosynthetic cover system includes an initial 6 inches (0.15 meters) common fill base, a geosynthetic clay liner with permeability no greater than 1×10^{-5} cm/sec, a geosynthetic drainage layer, and a vegetative cover consisting of twenty (20) inches (0.51 meters) of common fill, 4 inches (0.10 meters) of top soil and vegetation. The ash and other material approved for disposal in the 488-1D Ash Basin will remain in place under the geosynthetic cover system.

The western portion of the 488-1D Ash Basin, Inlet Basins, and the area exterior to the 488-4D Ash Landfill will be backfilled as needed and graded to achieve appropriate slopes. Any wastewater (or accumulated storm water) discharged into waters of the State from the 488-1D Ash Basin (including the Inlet Basins) will be managed in accordance with National Pollutant Discharge Elimination System (NPDES) Permit SC0047431, or otherwise approved by the SCDHEC Bureau of Water – Water Facilities Permitting Division. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(e) permits are not required for on-site response actions. However, SRS will meet all applicable effluent limits in its NPDES discharge permit and other substantive requirements, including the numeric water quality criteria for the protection and maintenance of class FW (fresh waters), as adopted in SC R.61-68. The final configuration for the storm water management system will consist of a network of perimeter storm drains/structures that gravity drain away from the 488-1D Ash Basin. Groundwater monitoring and land use controls will be implemented as part of the final remedial action for the D-Area Groundwater Operable Unit and the DAOU, respectively, and is not part of this removal action.

The selected alternative will comply with all action- and location-specific Applicable or Relevant and Appropriate Requirements (ARARs) identified in Table 1 of the June 2016 RSER/EE/CA for the 488-1D Ash Basin. The action-specific ARARs include South Carolina requirements for managing storm water run-off and fugitive dust emissions during land-disturbing activities; Resource Conservation and Recovery Act (RCRA) waste characterization, storage and disposal requirements; and South Carolina regulations limiting discharges of pollutants to waters of the State. The capping and closure of 488-1D Ash Basin will also comply with State and federal requirements for closure and post-closure care of South Carolina Class III landfills, including minimum standards for landfill cover design and construction, run-on and run-off controls during and after closure, and post-closure groundwater monitoring. The selected alternative will also comply with on and off-site waste transportation ARARs, and location-specific ARARs for the protection of migratory birds under the Migratory Bird Treaty Act.

The waste streams generated as part of the selected alternative that contains ash material can be considered for placement under the 488-1D Ash Basin geosynthetic cover system or the waste can be transported to the appropriate CERCLA Off-Site Rule approved disposal facilities. The waste

020798

AUG 17 2016

Ms. Susan Fulmer
Mr. Robert Pope 4

anticipated to be generated includes job control waste, personal protective equipment, equipment and material used for implementing the removal action. If any wastes are generated that require disposal off-SRS, an acceptability determination from the appropriate Regional Off-Site Rule Coordinator will be obtained prior to transfer of these wastes for disposal and/or treatment.

Removal activities are scheduled to commence October 3, 2016. Upon conclusion of the removal action, a Removal Action Report that summarizes the work will be prepared and submitted to document the completion of the removal action.

Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-16-160

Enclosure:
Responsiveness Summary for the Non-Time Critical Removal Action for the for the D-Area Ash Basin (488-1D) CERCLIS Number: 63 (ERD-EN-2016-0034, Revision 0, August, 2016)

cc w/o encl:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
H. M. Reed, SCDHEC - Midlands EQC Region - Aiken

cc w/encl:
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

APPENDIX E

USDOE SUBMITTAL OF THE NOTIFICATION OF THE REMOVAL ACTION START DATE FOR THE D AREA ASH BASIN 488-1D (USDOE 2016c)

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ARF-020835

Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

SEP 19 2016

Ms. Susan B. Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Robert H. Pope
Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Pope:

SUBJECT: Notification of the Removal Action Start Date for the D-Area Ash Basin (488-1D) CERCLIS Number 63

In accordance with the terms of the Federal Facility Agreement (FFA), the U.S. Department of Energy (DOE) is notifying the South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Environmental Protection Agency (EPA) that the Removal Action Start for the D-Area Ash Basin (488-1D) was met on August 24, 2016, ahead of the FFA milestone date of October 3, 2016. The removal action start date was met with the subcontractor's initiation of site development of the new D-Area borrow pit. The new borrow pit will be the primary source of common fill and topsoil required for the construction of the D-Area Ash Basin (488-1D) cover system.

The effort and time that the SCDHEC and the EPA have given on the subject operable unit are greatly appreciated. Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-16-167

ARF-020835

SEP 19 2016

Ms. Susan Fulmer
Mr. Robert Pope 2

cc:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
H. M. Reed, SCDHEC - Midlands EQC Region - Aiken
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

APPENDIX F

USDOE SUBMITTAL OF THE OCTOBER 2018 COMPLETION STATUS OF THE PROJECT

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Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

NOV - 8 2018

Ms. Susan Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Jon Richards
Acting Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Richards:

SUBJECT: October 2018 Completion Status of the D-Area Ash Project, SEMS Number: 63

The U.S. Department of Energy (DOE) is submitting this letter to document the status and completion of construction activities in accordance with the selected removal actions defined in the following documents:

- *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the D-Area Ash Basin (488-1D) (U)* (SRNS-RP-2015-00490, Revision 1, June 2016) CERCLIS Number: 63
- *Revision 3 Action Memorandum for the Non-Time Critical Removal Action for the D-Area Coal Pile Runoff Basin (489-D), CERCLIS Number: 63* (IACD-15-168, dated August 11, 2015)
- *Removal Action Design Plan (RADP) for the 488-1D Ash Basin and the 489-D Coal Pile Runoff Basin (U)* (SRNS-RP-2015-00196, Revision 1, May 2016) CERCLIS Number: 63
- *Minor Design Change to the Removal Action Design Plan (RADP) for the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (U) (SRNS-RP-2015-00196, Revision 1, May 2016) CERCLIS Number: 63* (IACD-17-159, dated September 14, 2017)

To observe and discuss the status and completion of the removal action construction activities for the D-Area Ash Basin (488-1D) and D-Area Coal Pile Runoff Basin (489-D) (CPRB), a field visit by DOE, South Carolina Department of Health and Environmental Control (SCDHEC), and U.S. Environmental Protection Agency (EPA) personnel was conducted on October 29, 2018. Savannah River Nuclear Solutions, LLC (SRNS) personnel participated in the field visit to lead the tour and discussions. Table 1 provides a list of the attendees. The visual confirmation from the field visit included:

- The 488-1D North and South Inlet Basins have been eliminated. The 488-1D Ash Basin area has been graded to design elevations and sodded.
- All ash has been consolidated within 488-1D Ash Basin and the installation of the SCDHEC Class Three Landfill cover have been completed at 488-1D per the regulatory approved RADP and minor design change listed above.

NOV - 8 2018

Ms. Susan Fulmer
Mr. Jon Richards

2

- The location and schedule for installation of the two groundwater monitoring wells (DCB081 and DCB082) at the west end of 488-1D were discussed. The installation of the wells was completed on November 1, 2018.
- Visual observation of the 489-D CPRB area to confirm the storm water retention basin is functioning as designed.

Based on this review and walk down, the DOE, SCDHEC, and EPA personnel present agreed that there were no deficiencies observed with the completed field activities for the removal actions associated with 488-1D Ash Basin and 489-D CPRB. In addition, the SCDHEC Industrial Wastewater Treatment Permit #7295 should qualify for closure along with the associated National Pollutant Discharge Elimination System Permits for Outfalls D-01, D-01B, D-01C.

Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-19-111

cc:
D. Scaturo, SCDHEC-Columbia
S. French, SCDHEC-Columbia
M. D. Wilson, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
G. O'Quinn, SCDHEC–Aiken Environmental Affairs Office
R. H. Pope, EPA-Atlanta
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

APPENDIX G

CERCLA OFF-SITE ACCEPTABILITY OF THREE RIVERS LANDFILL

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Period of Shipments to Three Rivers Landfill from the D-Area Ash Project			Covered by EPA Letter(s) Issued on Dates Provided
8/24/2016	through	11/22/2016	8/18/16 and 10/17/16
5/3/2017	through	5/3/2017	3/17/2017
10/17/2017	through	10/18/2017	9/14/2017
1/17/2018	through	4/13/2018	1/16/18 and 3/16/18
7/17/2018	through	8/11/2018	7/11/2018

8/18/16

From: R4CERCLA_OffsiteContact <R4CERCLA_OffsiteContact@epa.gov>
To: "michele.wilson@srs.gov" <michele.wilson@srs.gov>
Cc: "joseph.burch@srs.gov" <joseph.burch@srs.gov>, "Katie.Davis@srs.gov" <Katie.Davis@srs.gov>
Date: 08/18/2016 02:47 PM
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC
Sent by: "Whiting, Paula" <Whiting.Paula@epa.gov>

Good Afternoon Michele,

Barely keeping it cool and dodging lots and lots of rain. Hoping you are stay cool and dry as well.

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

Paula A Whiting
R4 CERCLA Regional Off-Site Contact

10

Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

10/13/16

From: R4CERCLA_OffsiteContact <R4CERCLA_OffsiteContact@epa.gov>
Sent: Thursday, October 13, 2016 5:10 PM
To: Michele Wilson
Cc: Leighanne Clifton
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC

Good Afternoon Michele,

The year is flying past. I just turned off the A/C, but the afternoons are still kind of warm. No complaints though. Maybe we will get some snow this year . . . hmmm. Enjoy the autumn weather!

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

Paula A Whiting
Environmental Engineer
Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

3/17/17

From: R4CERCLA_OffsiteContact <R4CERCLA_OffsiteContact@epa.gov>
To: "michele.wilson@srs.gov" <michele.wilson@srs.gov>
Cc: "Leighanne.Clifton@srs.gov" <Leighanne.Clifton@srs.gov>
Date: 03/17/2017 05:10 PM
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC
Sent by: "Whiting, Paula" <Whiting.Paula@epa.gov>

Good Afternoon Michele,

Hoping all is well.

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

5

Paula A Whiting
R4 CERCLA Regional Off-Site Contact
Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

9/19/17

From: R4CERCLA_OffsiteContact <R4CERCLA_OffsiteContact@epa.gov>
Sent: Tuesday, September 19, 2017 4:55 PM
To: Michele Wilson
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC

Ciao Michele!!

Come stai?! [I love Google Translator!!!]

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

Paula A Whiting
R4 CERCLA Regional Off-Site Contact
Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW, 10th Floor
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

1/16/18

From: Whiting, Paula [mailto:Whiting.Paula@epa.gov] **On Behalf Of** R4CERCLA_OffsiteContact
Sent: Sunday, January 14, 2018 1:56 PM
To: Michele Wilson <michele.wilson@srs.gov>
Cc: Leighanne Clifton <Leighanne.Clifton@srs.gov>
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC

Good Afternoon Michele,

It was brief reprieve saturated with rain. I rather have snow. Please send some! Hoping you are staying warm and safe.

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

Paula A Whiting
R4 CERCLA Regional Off-Site Contact
Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

Please Respond to R4CERCLA_OffSiteContact@epa.gov

3/16/18

From: Whiting, Paula [mailto:Whiting.Paula@epa.gov] **On Behalf Of** R4CERCLA_OffsiteContact
Sent: Friday, March 16, 2018 9:39 AM
To: Michele Wilson <michele.wilson@srs.gov>
Cc: Leighanne Clifton <Leighanne.Clifton@srs.gov>
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC

Good Morning Michele,

I was blessed to avoid the huge outbreak that occurred in the office. I pray you were as fortunate.

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

Paula A Whiting

24

R4 CERCLA Regional Off-Site Contact
Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW, 10th Floor
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

7/11/18

From: Whiting, Paula [mailto:Whiting.Paula@epa.gov] **On Behalf Of** R4CERCLA_OffsiteContact
Sent: Wednesday, July 11, 2018 8:47 PM
To: Michele Wilson <michele.wilson@srs.gov>
Cc: Leighanne Clifton <Leighanne.Clifton@srs.gov>
Subject: CERCLA Off-Site Acceptability of Three Rivers Landfill, Aiken, SC

Good Evening Michele,

Nope, for some odd reason I chose this summer to assist our regional lab do sampling at Superfund sites. Wow! The joys of moisture wicking clothing! Hope you are staying cool.

Three Rivers Landfill (024202-1101), Aiken, South Carolina is acceptable to receive waste regulated by the CERCLA Off-Site Rule. The EPA advises you to contact us within 60 days to check for continued acceptability.

Thanks,

3

Paula A Whiting
R4 CERCLA Regional Off-Site Contact
Hazardous Waste Enforcement and Compliance Section
Enforcement and Compliance Branch
Resource Conservation and Restoration Division
US Environmental Protection Agency - Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW, 10th Floor
Atlanta, GA 30303
Phone: 404-562-9277
FAX: 404-562-8566

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APPENDIX H

DISCHARGE MONITORING REPORTOXICITY TEST RESULTS

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134739

02/17/2006

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results
Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent

Monitoring period	Year	Month	Day		Year	Month	Day
From	2016	01	01	To	2016	03	31

Date 01/25/16

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= 692 β= -12.5 γ= 24.9 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	9	0	23.8	5.44
50	10	0	25.0	24.0
60	9	0	26.7	34.0
71	9	0	24.9	7.86
84	10	0	23.7	11.3
100	9	0	25.6	13.8

Predicted Control Survival = 1
Predicted Control Reproduction = 24.9

Predicted % Survival Effect at CTC = 0%
Predicted % Reproduction Effect at CTC = 0%

Date _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____%
Predicted % Reproduction Effect at CTC = _____%

Signature of Principal Executive Officer or Authorized Agent

Name/Title of Principal Executive Officer *(typed or printed)*

Mary A. Flora
Vice President, ES&H

DHEC 3710 (09/2005) <x>

105240

02/17/2006

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results
Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent

	Year	Month	Day		Year	Month	Day
Monitoring period From	2016	04	01	To	2016	06	30

Date 04/11/16

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= 126 β= -11.7 γ= 30.1 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	10	0	28.0	37.1
50	10	1	31.5	31.2
60	10	0	30.7	20.0
71	10	0	28.6	15.6
84	10	0	25.3	48.7
100	10	1	23.4	112

Predicted Control Survival = 1
Predicted Control Reproduction = 30.1

Predicted % Survival Effect at CTC = 10%
Predicted % Reproduction Effect at CTC = 24%

Date _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____ %
Predicted % Reproduction Effect at CTC = _____ %

Signature of Principal Executive Officer or Authorized Agent

Amy J. Meyer

Name/Title of Principal Executive Officer *(typed or printed)*

KLISS R MCNEEL, VP ESH

DHEC 3710 (08/2005) <x>

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

02/17/2006 10587 9

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results
Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012 Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent

Monitoring period	Year	Month	Day		Year	Month	Day
From	2016	07	01	To	2016	09	30

Date 07/11/16

Lab ID 32566

Survival model

α= 855 β= -13 γ= 1 δ= N/A

Reproduction model

α= 4.5X109 β= -0.23 γ= 34.5 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	10	0	34.5	8.9
50	10	0	30.5	12.7
60	10	1	28.8	100.6
71	10	0	27.4	15.4
84	10	0	29.4	8.3
100	10	0	31.9	12.3

Predicted Control Survival = 1
Predicted Control Reproduction = 34.5

Predicted % Survival Effect at CTC = 0%
Predicted % Reproduction Effect at CTC = 15%

Date _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____ %
Predicted % Reproduction Effect at CTC = _____ %

Signature of Principal Executive Officer or Authorized Agent

Name/Title of Principal Executive Officer *(typed or printed)* KLISS R. MCNEELY, VP ES&SH

DHEC 3710 (08/2005) <a>

10E211

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

02/17/2006

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
FINAL LIMITS 08/01/2004-07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent.

Monitoring period	Year	Month	Day		Year	Month	Day
From	16	10	1	To	16	12	31

Date _____

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=
Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

Date _____

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=
Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

NO DISCHARGE

Signature of Principal Executive Officer or Authorized Agent _____
Name/Title of Principal Executive Officer *(typed or printed)* KLISS R. MCNEEL, VICE PRESIDENT ES&SH

DHEC 3710 (8/05)

106864

02/17/2006

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
FINAL LIMITS 08/01/2004-07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent.

Monitoring period	Year	Month	Day		Year	Month	Day
From	17	1	1	To	17	3	31

Date _____

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=
Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

Date _____

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=
Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

Signature of Principal Executive Officer or Authorized Agent _____
Name/Title of Principal Executive Officer *(typed or printed)* KLISS R. MCNEEL, VICE PRESIDENT ES&SH

DHEC 3710 (8/05)

107315

02/17/2006

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results
Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent

	Year	Month	Day		Year	Month	Day
Monitoring period From	2017	04	01	To	2017	06	30

Date 04/03/17

Lab ID 32566

Survival model

α= 73887 β= -0.72 γ= 1 δ= N/A

Reproduction model

α= 110 β= -37 γ= 25.9 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	9	0	27.8	15.7
50	10	1	24.8	86.8
60	10	1	25.5	111.4
71	9	1	25.6	117.8
84	10	1	25.6	65.2
100	10	1	21.4	91.6

Predicted Control Survival = 1
Predicted Control Reproduction = 25.9

Predicted % Survival Effect at CTC = 11%
Predicted % Reproduction Effect at CTC = 17%

Date _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____%
Predicted % Reproduction Effect at CTC = _____%

Signature of Principal Executive Officer or Authorized Agent

Name/Title of Principal Executive Officer *(typed or printed)* KLISS R. MCNEEL, VICE PRESIDENT ES&SH

DHEC 3710 (08/2005) <x>

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

02/17/2006

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent

Monitoring period	Year	Month	Day		Year	Month	Day
From	2017	07	01	To	2017	09	30

Date 07/24/17

Lab ID 32566

Survival model

α= 832.5 β= -3.46 γ= 1 δ= N/A

Reproduction model

α= 307.6 β= -3.81 γ= 33.6 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	10	0	33.3	21.4
50	10	0	33.2	28.2
60	10	0	32.0	17.6
71	10	0	30.5	19.5
84	10	1	27.8	112.8
100	10	0	30.5	30.1

Predicted Control Survival = 1
Predicted Control Reproduction = 33.6

Predicted % Survival Effect at CTC = 4%
Predicted % Reproduction Effect at CTC = 13%

Date ____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = ____
Predicted Control Reproduction = ____

Predicted % Survival Effect at CTC = ____ %
Predicted % Reproduction Effect at CTC = ____ %

Signature of Principal Executive Officer or Authorized Agent _____
Name/Title of Principal Executive Officer *(typed or printed)* _____
DHEC 3710 (08/2005) <e>

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

02/17/2006

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012 FINAL LIMITS 08/01/2004-07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent.

Monitoring period	Year	Month	Day		Year	Month	Day
From	17	10	1	To	17	12	31

Date 1/22/18

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0	9	0	25.9	33.1
50.0000	10	0	29.4	21.4
60.0000	10	0	26.8	18.6
71.0000	10	0	29.0	12.2
84.0000	10	0	26.0	66.9
100.0000	10	0	29.0	15.3
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= 1 Predicted % Survival Effect at CTC= 0.00%

Reproduction Model α= β= γ= δ= Predicted Control Reproduction= 25.9 Predicted % Reproduction Effect at CTC= 0%

Date

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=

Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

Signature of Principal Executive Officer or Authorized Agent

Name/Title of Principal Executive Officer *(typed or printed)* Kliss R. McNeel Vice President, ES&SH

DHEC 3710 (8/05)

104739

02/17/2006

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0007431 Discharge number D012 Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC =1 CTC =0.00% effluent

Monitoring period	Year	Month	Day		Year	Month	Day
From	2016	01	01	To	2016	03	31

Date 01/25/16

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= 692 β= -12.5 γ= 24.9 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	9	0	23.8	5.44
50	10	0	25.0	24.0
60	9	0	26.7	34.0
71	9	0	24.9	7.86
84	10	0	23.7	11.3
100	9	0	25.6	13.8

Predicted Control Survival = 1
Predicted Control Reproduction = 24.9

Predicted % Survival Effect at CTC = 0%
Predicted % Reproduction Effect at CTC = 0%

Date _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____ %
Predicted % Reproduction Effect at CTC = _____ %

Signature of Principal Executive Officer or Authorized Agent
Name/Title of Principal Executive Officer *(typed or printed)*
DHEC 3710 (08/2005) <o>

Amy J Meyer
Mary M. Flora
Vice President, ES&H

105240

02/17/2006

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012
Final Limits 08/01/2004 – 07/31/2007 Parameter Code TOP3B MLOC=1 CTC=100.00% effluent

	Year	Month	Day		Year	Month	Day
Monitoring period From	2016	04	01	To	2016	06	30

Date 04/11/16

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= 126 β= -11.7 γ= 30.1 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	10	0	28.0	37.1
50	10	1	31.5	31.2
60	10	0	30.7	20.0
71	10	0	28.6	15.6
84	10	0	25.3	48.7
100	10	1	23.4	112

Predicted Control Survival = 1
Predicted Control Reproduction = 30.1

Predicted % Survival Effect at CTC = 10%
Predicted % Reproduction Effect at CTC = 24%

Date: _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____%
Predicted % Reproduction Effect at CTC = _____%

Signature of Principal Executive Officer or Authorized Agent

Amy J Meyer

Name/Title of Principal Executive Officer *(typed or printed)*

KLISS R MCNEEL, VP ES&SH

DHEC 3710 (08/2005) <o>

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

02/17/2006 105849

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012 Final Limits 08/01/2004 – 07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent

Monitoring period	Year	Month	Day		Year	Month	Day
From	2016	07	01	To	2016	09	30

Date 07/11/16

Lab ID 32566

Survival model

α= 855 β= -13 γ= 1 δ= N/A

Reproduction model

α= 4.55E109 β= -0.23 γ= 34.5 δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0	10	0	34.5	8.9
50	10	0	30.5	12.7
60	10	1	28.8	100.6
71	10	0	27.4	15.4
84	10	0	29.4	8.3
100	10	0	31.9	12.3

Predicted Control Survival = 1
Predicted Control Reproduction = 34.5

Predicted % Survival Effect at CTC = 0%
Predicted % Reproduction Effect at CTC = 15%

Date _____

Lab ID 32566

Survival model

α= N/A β= N/A γ= N/A δ= N/A

Reproduction model

α= N/A β= N/A γ= N/A δ= N/A

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Actual Variance
0				
50				
60				
71				
84				
100				

Predicted Control Survival = _____
Predicted Control Reproduction = _____

Predicted % Survival Effect at CTC = _____%
Predicted % Reproduction Effect at CTC = _____%

Signature of Principal Executive Officer or Authorized Agent

Name/Title of Principal Executive Officer *(typed or printed)* KLISS R. MCNEELY, VP ESESH

DHEC 3710 (08/2005) <a>

106311

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

02/17/2006

DMR Attachment for Chronic Multi-Concentration Whole Effluent Toxicity Test Results Using 3-Parameter Logistic Regression

US DOE/SRS/D-AREA POWERHOUSE Permit number SC0047431 Discharge number D012 FINAL LIMITS 08/01/2004-07/31/2007 Parameter Code TCP3B MLOC=1 CTC=100.00% effluent.

Monitoring period	Year	Month	Day		Year	Month	Day
From	16	10	1	To	16	12	31

Date _____

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=
Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

NO DISCHARGE

Date _____

Lab ID 32566

Group	Mortality Data # Adults	Mortality Data # Dead	Reproduction Data Group Average	Reproduction Data Group Variance
0				
50.0000				
60.0000				
71.0000				
84.0000				
100.0000				
.0000				
.0000				
.0000				
.0000				

Survival Model α= β= γ= δ= Predicted Control Survival= Predicted % Survival Effect at CTC=
Reproduction Model α= β= γ= δ= Predicted Control Reproduction= Predicted % Reproduction Effect at CTC=

Signature of Principal Executive Officer or Authorized Agent _____
Name/Title of Principal Executive Officer *(typed or printed)* KLISS R. MCNEEL, VICE PRESIDENT ES&SH

DHEC 3710 (9/95)

APPENDIX I

SCDHEC IRRIGATION APPROVAL LETTERS

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ARF-020830

dhec
Healthy People. Healthy Communities.

September 9, 2016

ENVIRONMENTAL COMPLIANCE &
SEP 14 2016
AREA COMPLETION PROJECTS

Mr. Brian T. Hennessey, SRS Remedial Project Manager
Infrastructure and Area Completion Division
U. S. Department of Energy
Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29802

Re: Utilization of the D-Area Ash Basin (488-1D) North Inlet Basin Water for Irrigation Purposes, CERCLIS Number: 63, dated August 31, 2016 and received September 1, 2016.

Dear Mr. Hennessey:

On August 8, 2016, a conference call between the U. S. Department of Energy, the U. S. Environmental Protection Agency, and South Carolina Department of Health and Environmental Control (the Department) was held to discuss the utilization of the D-Area Ash Basin (488-1D) North Inlet Basin Water for irrigation purposes at the D-Area Ash Basin (488-D) and the D-Area Ash Landfill (488-4D). During this conference call, approval was granted to proceed with the irrigation; however, it was requested that the decisions made during the call be documented in a letter to be sent to the regulatory agencies. The Department has completed its review of the above referenced letter and has the following requirements:

1. It should be noted that approval is only granted for a one-time application of the water from the D-Area Ash Basin (488-1D) North Inlet Basin. If the basin is refilled due to rainfall, the Department of Energy must request an additional review of application of the water to the caps. If discharged to applicable outfalls, all conditions associated with Bureau of Water's NPDES permit must be met.

2. During application of the water, efforts should be made to ensure the ponding does not occur on the cap of either landfill.

3. If damage occurs to either cap from the "traveling gun" irrigation systems, repairs must be made to the cap within 90 (ninety) days. Any damage and repairs should be reported to the Department in a timely manner.

4. It should be acknowledged in future reports that although the beryllium (Be) and cadmium (Cd) do not exceed the tap water standards, these constituents do exceed the maximum contaminant level (MCL). With this being said, the Waste Assessment Section within the Division of Compliance and Enforcement of the Department reviewed the analytical data results documented in Appendix A of the *Removal Site Evaluation Report/Engineering*

ARF-020830

Evaluation/Cost Analysis (RSER/EE/CA) for the D-Area Ash Basin (488-1D) (U) (SRNS-RP-2015-00490, Revision 1, June 2016) and determined that the application of the overall addition of Be and Cd, when distributed uniformly to the 39 acres of the caps, would provide only a 4.0% and 3.5% addition, respectively, to the underlying soils. Please see the attached memorandum from the Waste Assessment Section for further explanation.

If you should have any questions, please contact me at (803) 898-4331.

Sincerely,

Susan B. Fulmer, P.G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management

cc: C. L. Bergren, SRNS-ACP (Signed Original)
Travis Fuss, Midlands EQC Region – Aiken (via email)
Rob Pope, EPA Region IV
Heather Cathcart, BLWM

ARF-020830

dhec
SC Department of Health and Environmental Control

Memorandum

To: Justin Koon, Project Manager
Solid Waste Permitting Section
Division of Mining and Solid Waste Management

From: Stephen Burdick, Manager
Waste Assessment Section
Division of Compliance and Enforcement, BLWM

Date: August 5, 2016

References:
Inlet basin surface water sample results SRNS-RP-2015-00490 Rev.1
Computations: brian.hennessey@srs.gov **Sent:** Thursday, August 4, 2016 1:54 PM
Baseline Soils: Top 1 inch – inlet basin soils data

Re: Use 0f 488-1D inlet basin surface water for irrigation of the 488-4D landfill vegetative cover

The Department has received the request to allow for the inlet basin (488-1D) surface waters, approximately 8,000,000 gallons for a one time irrigation application until the basin waters are consumed. The proposed estimates for application would be up to 1 inch of water over each of the 39 acres of vegetative cover, once every three days. The application goal and rate is designed to apply irrigation water without runoff and while preventing runoff and over saturation of the vegetative cover and then consume the basin contents approximately within 30 days.

The analytical data provided included the Total Analyte List, TAL, of Metals and parameters, reported as part per billion levels, for USEPA MCL (drinking water) values.

Only Beryllium and Cadmium concentrations exceeded drinking water values, which are based on and intended for a 70 year ingestion timeline. Aggregate local soils values were also reviewed and compared additively to the cap soils concentrations. The overall addition of Beryllium and Cadmium, when distributed uniformly to the 39 acres of cap, would provide only a 4.0% and 3.5% addition, respectively, to the underlying soils. Further, our computations mirrored the proposed computations as submitted by SRNS personnel.

We next assessed the potential uptake of heavy metals into Bermuda grass. Cadmium has limited uptake all based on relative concentration which, when compared to the underlying soils, is statistically insignificant. With regards to beryllium, there are only 2

ARF-020830

forms of hydroxide salts which are typically formed, the remainder is found to be insoluble and in the bottom sediments.

Based on this review of the submittal and the associated computations, we have concluded that the application of these surface waters to the vegetative cover only will be acceptable.

The application process should minimize the transfer of any underlying sediments from the inlet basin to the vegetative cover.

We concur, that based on the reported pH of the basin surface waters, that the addition of lime to the cap area will enhance the growth of the vegetative cover.

Lastly, we understand that this is a one-time application process of this basin volume to the cap intended to disperse these approximate 8,000,000 gallons of surface water.

If we may provide any further information in this matter, please contact me immediately.

ARF-020979

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February 16, 2017

Mr. Brian T. Hennessey, SRS Remedial Project Manager
Infrastructure and Area Completion Division
U. S. Department of Energy
Savannah River Operations Office
Post Office A
Aiken, South Carolina 29802

Re: Continued Utilization of the D-Area Ash Basin (488-1D) Inlet Basin Water for Irrigation Purposes, CERCLIS Number: 63, dated February 7, 2017 and received via electronic mail on February 7, 2017.

Dear Mr. Hennessey:

On January 25, 2017, the Department of Energy (DOE) contacted South Carolina Department of Health and Environmental Control (SCDHEC) to convey that the D-Area Ash Basin (488-1D) South Inlet Basin had reached its capacity due to recent rain events. Since the South Inlet Basin water had recently failed the chronic toxicity test, Savannah River Site (SRS) was not able to discharge the water via the outfall into the Beaver Dam Creek. Therefore, DOE requested permission to transfer the water from the South Inlet Basin to the North Inlet Basin and to use this water for irrigation of the 488-4D Ash Landfill and 488-D Ash Basin covers. The Department has reviewed the request sent electronically on February 7, 2017, as well as the data from the chronic toxicity test (See attached memo from the Division of Solid Waste and Mining.). Since no exceedances of the MCL or RSL thresholds were noted, approval is granted to proceed with irrigation. However, the Department has the following requirements:

1. It should be noted that approval to irrigate the 488-4D Ash Landfill and 488-D Ash Basin cover with the North Inlet Basin water is granted through August 15, 2017. At the end of this time period and if further irrigation is needed, a written request from DOE must be submitted.

2. During the application of the water, efforts should be made to ensure that ponding does not occur on the cap of either landfill.

3. If damage occurs to either cap from the "traveling gun" irrigation systems, repairs must be made to the cap with 90 (ninety) days. Any damage and repairs should be reported to the Department within a timely manner.

ARF-020979

If you should have any questions, please contact me at (803) 898-4331.

Sincerely,

Susan B. Fulmer, P.G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management

cc: C. L. Bergren, SRNS-ACP (Signed Original)
Travis Fuss, Midlands EQC Region – Aiken (via email)
Rob Pope, EPA Region IV
Heather Cathcart, BLWM

ARF-020979

dhec

MEMORANDUM:

TO: Heather Cathcart, Project Manager
Site Assessment, Remediation, and Revitalization Division
Bureau of Land and Waste Management

FROM: Justin Koon, Project Manager
Solid Waste Permitting and Monitoring Section
Bureau of Land and Waste Management

DATE: February 15, 2017

RE: **Approval to Irrigate Landfill**
Request to Use North and South Inlet Basin Water received on February 7, 2017
Aiken County

The Solid Waste Permitting and Monitoring Section approves the use of water stored in the North and South Inlet Basins of D-Area to be applied to the final cover systems of 488-4D and 488-D units. The application should be such that no runoff occurs and should minimize the transfer of any underlying sediments from the inlet basins to the vegetative cover. Lime should be added as needed to adjust the pH of the waters to enhance the growth of the vegetative covers.

While approved, alternate plans to reduce the water volumes in these basins should be submitted to the Department as continued irrigation is not believed to be a viable option.

Should you have any comments or questions, please contact me at (803) 898-1339 or at koonj@dhec.sc.gov.

cc: Bureau File #999999

ARF-021219

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ENVIRONMENTAL COMPLIANCE &
JUL 24 2017
AREA COMPLETION PROJECTS

July 20, 2017

Mr. Brian T. Hennessey, SRS Remedial Project Manager
Infrastructure and Area Completion Division
U. S. Department of Energy
Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29802

Re: Continuation for the Utilization of the D-Area Ash Basin (488-1D) Inlet Basin Water for Irrigation Purposes, CERCLIS Number: 63, dated July 17, 2017 and received July 18, 2017.

Dear Mr. Hennessey:

The Savannah River Site (SRS) has requested that South Carolina Department of Health and Environmental Control grant its concurrence on the continuation of the utilization of the 488-1D Inlet Basins storm water for the irrigation of the 488-4D Ash Landfill and 488-D Ash Basin covers through February 2018 in support of the 488-1D Removal Action. The Department has reviewed the request; and after consultation with the Division of Mining and Solid Waste Management, approval is granted to proceed with irrigation. However, the Department has the following requirements:

1. It should be noted that approval to irrigate the 488-4D Ash Land fill and 488-D Ash Basin covers with the 488-1D Inlet Basins storm water is granted through February 28, 2018. At the end of this time period and if further irrigation is needed, a written request from the Department of Energy must be submitted.

2. During the application of the water, efforts should be made to ensure that ponding does not occur on the cap of either landfill.

3. If damage occurs to either cap from the "traveling gun" irrigation systems, repairs must be made to the cap within ninety (90) days. Any damage and repairs should be reported to the Department within a timely matter.

If you should have any questions, please contact me at (803) 898-4331.

S.C. Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201 (803) 898-3432 www.scdhec.gov

ARF-021219

Sincerely,

Susan B. Fulmer, P.G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management

cc: C. L. Bergren, SRNS-ACP (Signed Original)
Travis Fuss, Aiken Environmental Affairs Office (via email)
Rob Pope, EPA Region IV
Heather Cathcart, BLWM

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ENVIRONMENTAL COMPLIANCE &
FEB 12 2018
AREA COMPLETION PROJECTS

February 8, 2018

Mr. Brian T. Hennessey, SRS Remedial Project Manager
Infrastructure and Area Completion Division
U. S. Department of Energy
Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29802

Re: Extension Request for the Utilization of the D-Area Ash Basin (488-1D) Inlet Basin Water for Irrigation Purposes, CERCLIS Number: 63, dated February 6, 2018 and received February 7, 2018.

Dear Mr. Hennessey:

The Savannah River Site (SRS) has requested that South Carolina Department of Health and Environmental Control grant its concurrence on the continuation of the utilization of the 488-1D Inlet Basins storm water for the irrigation of the 488-4D Ash Landfill and 488-D Ash Basin covers through May 2018 in support of the 488-1D Removal Action. The Department has reviewed the request; and after consultation with the Division of Mining and Solid Waste Management, approval is granted to proceed with irrigation. However, the Department has the following requirements:

1. It should be noted that approval to irrigate the 488-4D Ash Land fill and 488-D Ash Basin covers with the 488-1D Inlet Basins storm water is granted through May 31, 2018. At the end of this time period and if further irrigation is needed, a written request from the Department of Energy must be submitted.

2. During the application of the water, efforts should be made to ensure that ponding does not occur on the cap of either landfill.

3. If damage occurs to either cap from the "traveling gun" irrigation systems, repairs must be made to the cap within ninety (90) days. Any damage and repairs should be reported to the Department within a timely matter.

If you should have any questions, please contact me at (803) 898-4331.

S.C. Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201 (803) 898-3432 www.scdhec.gov

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Sincerely,

Susan B. Fulmer, P.G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management

cc: C. L. Bergren, SRNS-ACP (Signed Original)
Travis Fuss, Aiken Environmental Affairs Office (via email)
Jon Richards, EPA Region IV
Heather Cathcart, BLWM

ARF-021653

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ENVIRONMENTAL COMPLIANCE &
MAY 23 2018
AREA COMPLETION PROJECTS

May 17, 2018

Mr. Brian T. Hennessey, SRS Remedial Project Manager
Infrastructure and Area Completion Division
U. S. Department of Energy
Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29802

Re: Extension Request for the Utilization of the D-Area Ash Basin (488-1D) Inlet Basin Water for Irrigation Purposes, CERCLIS Number: 63, dated February 6, 2018 and received February 7, 2018 (Letter #2).

Dear Mr. Hennessey:

The Savannah River Site (SRS) has requested that South Carolina Department of Health and Environmental Control grant its concurrence on the continuation of the utilization of the 488-1D Inlet Basins storm water for the irrigation of the 488-4D Ash Landfill and 488-D Ash Basin covers through June 2018 in support of the 488-1D Removal Action. The Department has reviewed the request; and after consultation with the Division of Mining and Solid Waste Management, approval is granted to proceed with irrigation. However, the Department has the following requirements:

1. It should be noted that approval to irrigate the 488-4D Ash Land fill and 488-D Ash Basin covers with the 488-1D Inlet Basins storm water is granted through June 30, 2018. At the end of this time period and if further irrigation is needed, a written request from the Department of Energy must be submitted.

2. During the application of the water, efforts should be made to ensure that ponding does not occur on the cap of either landfill.

3. If damage occurs to either cap from the "traveling gun" irrigation systems, repairs must be made to the cap within ninety (90) days. Any damage and repairs should be reported to the Department within a timely matter.

If you should have any questions, please contact me at (803) 898-4331.

S.C. Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201 (803) 898-3432 www.scdhec.gov

ARF-021653

Sincerely,

Susan B. Fulmer, P.G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management

cc: C. L. Bergren, SRNS-ACP (Signed Original)
Travis Fuss, Aiken Environmental Affairs Office (via email)
Jon Richards, EPA Region IV
Heather Cathcart, BLWM

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APPENDIX J

ENVIROCON/CHESAPEAK CONTAINMENT SYSTEMS QCTIP

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ERD-EN-2018-0016

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DOCUMENT REVIEW SIGNATURE PAGE

Envirocon, Inc. / Chesapeake Containment Systems
Geosynthetics (IDS / Geotextile)
Quality Control Testing and Inspection Plan (QCTI)
For
Savannah River Site 488-1D Ash Basin & 489-D CPRB Closure Project

SRNS Contract 00258194

We, the undersigned, have reviewed the above-named documents and have found the documents to be satisfactory. The appropriate procedures and USEPA Guidance document EPA/600/R-93/182 and ASTM D 6495 were used to develop these documents. All comments and concerns received on these documents have been addressed.

Date: 3/6/18
Signature:
Name: Frank Sappington
Title: EC&ACP Cognizant Technical Function

Date: 3/6/18
Signature:
Name: Stanley M. Pruitt
Title: EC&ACP Cognizant Quality Function

Date: 3/6/18
Signature:
Name: Don Baston
Title: SRNS Design Engineering

Date: 3/7/18
Signature:
Name: William D. West (Billy)
Title: SRNS Subcontractor Technical Rep.

Date: 3/12/18
Signature: GEORGE B SEWELL
Name: George Sewell
Title: SRNS CAM / Subcontract Manager

Date: 3/12/18
Signature:
Name: Susan Bell
Title: SRNS Project Manager

Envirocon, Inc / Chesapeake Containment Systems

Geosynthetics (IDS / Geotextile) Quality Control Testing and Inspection Plan (QCTI) REV01

For:

Savannah River Site 488-1D and 489-D CPRB Ash Basin Closure Project

Subcontract No. 258194

Prepared for:

Savannah River Nuclear Solutions, LLC

Savannah River Site, Aiken, SC 29808

Envirocon, Inc. / Chesapeake Containment Systems, Inc. has reviewed the above named document and has found it to be satisfactory. The appropriate procedures, USEPA Guidance document EPA/600/R-93/182 and ASTM D 6495 were used to develop the document. All comments and concerns received on the document have been addressed.

Review / Approval Signatures:

Envirocon, Inc. QCTI Plan Document Preparer:

Print Name: Tripp Winfree

Signature: R. Tripp Winfree Date: 3/2/18

Envirocon, Inc. Site QA Officer:

Print Name: Tripp Winfree

Signature: R. Tripp Winfree Date: 3/2/18

Envirocon, Inc. Project Manager:

Print Name: John Lindsey

Signature: John Lindsey Date: 3/2/18

Chesapeake Containment Systems, Inc

Print Name: Scott Perugia

Signature: Scott Perugia Date: 03/01/2018

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safety and proficiency are maintained. CCS shall maintain the procedure(s) to be followed to ensure that these training and qualification requirements will be met and shall verify, by submittal of appropriate certifications, that all employees have completed the necessary training and qualification requirements to perform their assigned tasks as per contract documents to include, but are not limited to C-SPP-D-00003, SDDR 004 and SDDR 005.

4. Material Testing

4.1. Manufacturer's (AGRU America) Quality Control Testing

4.1.1. 50-Mil Linear Low Density Polyethylene (LLDPE) IDS Geomembrane

4.1.1.1. Agru America has been contracted by CCS to manufacture the IDS materials for this project. As manufacturing proceeds Agru will test samples at the frequency outlined in 4.1.1.2. Results will be reviewed by CCS and EI, and upon conformance be submitted to SRNS.

4.1.1.2. Manufacturer Quality Control Requirements 50-Mil LLDPE IDS Geomembrane.

Property (UNITS)	MQC Testing Frequency (Minimum)	Test Method[2]	Required Value
Resin			
Density (g/ml) maximum	1 per Resin Batch	ASTM D 792 Method B	0.939
Melt Flow Index (g/10 min)	1 per Resin Batch	ASTM D 1238	1.0 (max)
Finished Sheet			
Core Thickness (mil)	Each roll	ASTM D 5994	47.5 (min ave)[3]
Drainage Stud Height (mil)	Every second roll	ASTM D7466	130
Friction Spike Height (mil)	Every second roll	ASTM D7466	20
Density, (g/cc) maximum	1 per 200,000 lbs	ASTM D 792 Method B	0.939
Carbon Black Content (%)	1 per 20,000 lbs	ASTM D 4218[4]	2.0-3.0
Carbon Black Dispersion	1 per 45,000 lbs	ASTM D 5596	see note 5
Tensile Properties (each direction)[6] Break Strength (lb/in) Break Elongation (%)	1 per 20,000 lbs	ASTM D 6693Type IV Test in machine direction and cross-machine direction	 100 (min ave) 275 (min ave)
Tear Resistance (lb)	1 per 45,000 lbs	ASTM D 1004	30 (min ave)
Puncture Resistance (lb)	1 per 45,000 lbs	ASTM D 4833	60(min ave)
Oxidative Induction Time (min ave.)[7] Standard OIT	1 per 200,000 lbs	ASTM D 3895	140 (min ave)
Oven Aging at 85 degrees Celsius (°C) [7,8]Standard OIT (percent retained after 90 days) or High Pressure OIT (percent retained after 90 days)	Per each formulation	ASTM D 5721 ASTM D3895 ASTM D 5885	35 (min ave) or 60 (min ave)
UV Resistance[9] High Pressure OIT (percent retained after 1,600 hours)	Per each formulation	ASTM D 7238 ASTM D 5885	35 (min ave)
Transmissivity (m^2/sec)[10,11]	One per project[10]	ASTM D4716	1 x 10^{-3}

Notes:

1 The required properties specified herein may be revised by the Owner's Engineer to reflect new or revised test methods or to conform with improvements to the state-of-the practice.

2 Number of specimens per test established in applicable test method unless otherwise noted.

3 Lowest individual of 10 values = 42.5

Envirocon

I.D.S Quality Control Testing and Inspection Plan- Rev. 1 February 27, 2018
SRNS 488-1D and 489-D CPRB Closure SRS PO 25819

1. **Purpose and Scope**
   1.1. The purpose of this Quality Control Testing and Inspection Plan is to provide directions and guidelines for testing, inspection and installation of the Geosynthetics associated with the Savannah River Nuclear Solutions (SRNS) 488-1D and 489-D CPRB Closure Project. These activities include, but are not limited to procurement, verification of the manufacturer's quality control, verification of material conformity, earthwork and installation. This plan complies with the applicable I.D.S cover system subcontract documents. Specific contract documents to include, but are not limited to C-SPP-D-00003, SDDR 004, SDDR 005, C-CG-D-00029 through C-CG-D-00034, C-CG-D-00042 and C-CG-D-00043.
2. **Organization and Responsibilities**
   2.1. **Envirocon Inc. (EI)**
   2.1.1. Placing the common and structural fill in accordance with project specifications including the verification of compaction and moisture content.
   2.1.2. Providing Quality Assurance for oversight of all activities.
   2.1.3. Coordination of Subcontractor activities
   2.1.4. Providing GPS oversite for Envirocon surveying activities as well as GEL Engineering.
   2.1.5. Review of all documentation as part of I.D.S activities.
   2.1.6. Implement the applicable and relevant Quality Assurance (QA) and Quality Control (QC) processes needed to meet Envirocon's QMS and site specific QAPP.
   2.2. **Chesapeake Containment Systems, Inc**
   2.2.1. Chesapeake Containment Systems, Inc (CCS) has been contracted by EI to procure, install, test and certify all Geosynthetic materials.
   2.2.2. Roles and Responsibilities
   2.2.2.1. **Project Manager** – Reports directly to the Vice President of CCS. Responsible for overall management of all CCS projects with respect to technical, contractual, quality, and financial specifications, from award to project close-out. Involved with preparing bids and budgets, sales liaison and customer liaison. Duties include total responsibility for all field work; supervision of Field Supervisors and crew; monitoring production, costs, quality, and labor issues. Responsible for procuring and shipping necessary materials, procuring necessary equipment, submittals, invoicing, and tracking quality, safety and production to ensure work is meeting contract requirements.
   2.2.2.2. **Field Supervisor** – Reports directly to the Project Manager. Responsible for the overall management of the installation crew and implementation of all Installation Quality Control Programs, Health and Safety Plans and Work Control Plans.
   2.2.2.3. **Quality Control Inspector** – Works independently of the Field Supervisor and is responsible for the implementation and documentation of all Installation Quality Control Plans.
   2.2.2.4. **Installation Foreman** – Reports directly to the Field Supervisor. Responsible for scheduling work on a daily basis and implementing all Health & Safety Plans and Work Control Plans.
   2.2.2.5. **Master Seamer (may also be the Supervisor)** – All seaming will be performed under this position and will be present during all seaming operations.
   2.2.2.6. **Technicians** – Reports directly to the Field Supervisor. Responsible for the installation and seaming of the Geosynthetics.
   2.3. **Geotechnics, (GEO)**
   2.3.1. GEO is an independent testing laboratory (Accreditation #GAI-LAP – 14-96), as a sub tier subcontractor to CCS will cut samples, ship and perform the laboratory tests during manufacturing to ensure all materials delivered to site conform to the site specific requirements.
   2.4. **GEL Engineering, LLC (GEL)**
   2.4.1. GEL has been contracted by EI to perform land surveying services to support the placement and locations of the grading and structural fill, I.D.S locations (to include seams, repairs, panels, testing locations, limits of cover) and cover soils to comply with Project Specifications and Drawings.
3. **Personnel Training and Qualifications**
   3.1. The purpose of this section is to establish measures to assure that project personnel are adequately and appropriately trained and have appropriate experience to conduct required tasks.
   3.2. Persons performing work on this project shall be trained and qualified to perform their assigned tasks and shall be retrained, as appropriate to changes to the procedures, instructions, or other governing documents to ensure that job

3

4 ASTM Method D 1603 is acceptable if an appropriate correlation to D 4218 can be established.

5 For 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 or 10 views in Categories 1 or 2.. Only near spherical agglomerates are to be considered.

6 Machine direction and cross machine direction average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gage length of 1.3 inches. Break elongation is calculated using a gage length of 2.0 inches.

7 IDS Geomembrane Manufacturer may select either of the OIT methods listed to evaluate antioxidant content.

8 It is recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

9 Condition of test should be 20-hour UV cycle at 75°C followed by 4-hour condensation at 60°C. UV resistance is based on percent retained value regardless of the original HP-OIT value.

10 Transmissivity conditions for MQC and QA Conformance before deployment at 21 degrees C, gradient of 0.25, normal load of 500 psf, seat time 100 hours, boundary conditions: plate/sand/10 oz. per sy nonwoven geotextile/IDS geomembrane/plate.

11 Transmissivity conditions at 50% completion at 21 degrees C, gradient of 0.25, normal load of 500 psf, seat time 100 hours, boundary conditions: plate/site final cover soil /10 oz. per sy nonwoven geotextile/IDS geomembrane/plate.

4.1.2. Geotextile (10oz) by Agru America's Agrutex 101

4.1.2.1. Agru America has been contracted by CCS to manufacture the Geotextile materials for this project. As manufacturing proceeds Agru will test samples at the frequency outlined in 4.1.2.2. Results will be reviewed by CCS and EI, and upon conformance be submitted to SRNS.

4.1.2.2. Manufacturer Quality Control Requirements Agrutex 101.

Property (Units)	Test Method	MQC Testing Frequency	Value
Mass per Unit Area, oz/yd^2 (g/m^2)	ASTM D5261	1 per 100,000 SF	10.0 (339)
Grab Tensile Strength, lbs. (N)	ASTM D4632	1 per 100,000 SF	270 (1200)
Grab Elongation, %	ASTM D4632	1 per 100,000 SF	50
Trapezoidal Tear, lbs. (N)	ASTM D4533	1 per 100,000 SF	105 (467)
CBR Puncture, lbs. (kN)	ASTM D6241	1 per 500,000 SF	725 (3.2)
Permittivity(1), sec^{-1}	ASTM D4491	1 per 500,000 SF	1.1
Water Flow(1), gpm./ft^2 (l/min/m^2)	ASTM D4491	1 per 500,000 SF	80 (3280)
AOS(1)(2), U.S. Sieve max (mm)	ASTM D4751	1 per 500,000 SF	100 (0.150)
UV Resistance, % Retained at 500 hours	ASTM D4355	Per Formulation	70

Notes:
(1) At time of manufacture. Handling may change these properties
(2) Apparent Opening Size (AOS) reported as maximum average roll value

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4.2. **Conformance Testing**

4.2.1. Geotechnics (Third Party Testing Lab) will sample project materials at the manufacturing plant throughout the duration of production. This way, in the event the Geosynthetic materials do not conform to the specifications, material will not have to be removed from the site at additional costs, time and labor. The only materials that will be shipped to the project site will be materials that have been tested and approved per the project specifications and QC Testing and Inspection Plan.

4.2.2. LLDPE samples will be taken per the required frequency detailed in 4.2.5, while Geotextile samples will be taken per the required frequency detailed in 4.2.6., by GEO Representative, and sent to the GEO lab for testing.

4.2.3. Results of Conformance Testing will be reported after testing requirements are complete.

4.2.4. In the event the tested materials do not meet the project specifications, material will be retested to include bounding lot samples. If, for any reason after the material has been retested the materials still do not meet project specifications, the material will be rejected and replaced with new, passing materials.

4.2.5. **LLDPE Conformance Test Requirements**

Property (UNITS)	Test Method[2]	QA Conformance Testing Frequency (Minimum)	Required Value
Core Thickness (mil)	ASTM D 5994	1 per 100,000 SF	47.5 (min ave)[3]
Drainage Stud Height (mil)	ASTM D7466	1 per 100,000 SF	130
Friction Spike Height (mil)	ASTM D7466	1 per 100,000 SF	20
Density, (g/cc) maximum	ASTM D 792 Method B	1 per 100,000 SF	0.939
Carbon Black Content (%)	ASTM D 4218[4]	1 per 250,000 SF	2.0-3.0
Carbon Black Dispersion	ASTM D 5596	1 per 250,000 SF	see note 5
Tensile Properties (each direction)[6] Break Strength (lb/in) Break Elongation (%)	ASTM D 6693Type IV Test in machine direction and cross-machine direction	1 per 100,000 SF	 100 (min ave) 275 (min ave)
Tear Resistance (lb)	ASTM D 1004	1 per 250,000 SF	30 (min ave)
Puncture Resistance (lb)	ASTM D 4833	1 per 250,000 SF	60(min ave)
Transmissivity (m^2/sec)[10,11]	ASTM D4716	One before deployment[10] and one at 50%[11]	1×10^{-3}

Notes:

2 Number of specimens per test established in applicable test method unless otherwise noted.

3 Lowest individual of 10 values = 42.5

4 ASTM Method D 1603 is acceptable if an appropriate correlation to D 4218 can be established.

5 For 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 or 10 views in Categories 1 or 2.. Only near spherical agglomerates are to be considered.

6 Machine direction and cross machine direction average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gage length of 1.3 inches. Break elongation is calculated using a gage length of 2.0 inches.

10 Transmissivity conditions for MQC and QA Conformance before deployment at 21 degrees C, gradient of 0.25, normal load of 500 psf, seat time 100 hours, boundary conditions: plate/sand/8 oz. per sy nonwoven geotextile/IDS geomembrane/plate.

11 Transmissivity conditions at 50% completion at 21 degrees C, gradient of 0.25, normal load of 500 psf, seat time 100 hours, boundary conditions: plate/site final cover soil /8 oz. per sy nonwoven geotextile/IDS geomembrane/plate.

4.2.6. **Geotextile Conformance Test Requirements**

Property	Test Method	Q/A Conformance Test Frequency	Value
Mass per Unit Area, oz/yd² (g/m²)	ASTM D5261	1 of 250,000 SF	10.0 (339)
Grab Tensile Strength, lbs. (N)	ASTM D4632	1 of 250,000 SF	270 (1200)
Grab Elongation, %	ASTM D4632	1 of 250,000 SF	50
Trapezoidal Tear, lbs. (N)	ASTM D4533	1 of 250,000 SF	105 (467)
CBR Puncture, lbs. (kN)	ASTM D6241	1 per 500,000 SF	725 (3.2)
Permittivity(1), sec⁻¹	ASTM D4491	1 per 500,000 SF	1.1
Water Flow(1), gpm./ft² (l/min/m²)	ASTM D4491	1 per 500,000 SF	80 (3280)
AOS(1)(2), U.S. Sieve max (mm)	ASTM D4751	1 per 500,000 SF	100 (0.150)

Notes:
(1) At time of manufacture. Handling may change these properties
(2) Apparent Opening Size (AOS) reported as maximum average roll value

4.3. **IDS LLDPE Extrudate Rod**

4.3.1. Extrudate rod to be used for all extrusion seaming of the IDS geomembrane shall be made from the same resin as the IDS geomembrane and shall be free of contamination by moisture or other materials. Carbon black and additives shall be thoroughly dispersed throughout the extrudate rod.

4.3.2. Extrudate rod resin and finished rod shall be sampled and tested in accordance with the IDS Geomembrane Manufacturer's approved MQC manual. Extrudate rod resin shall meet the IDS LLDPE geomembrane resin requirements of this specification. Finished extrudate rod shall meet the IDS LLDPE geomembrane carbon black content and carbon black dispersion requirements of this specification. Testing frequencies and test procedures shall comply with the requirements of this specification, as applicable. Results from the extrudate rod sampling and testing program are to be submitted to the QC Inspector.

5. Delivery, Storage and Handling

5.1. SRNS will be notified at least 24 hours before scheduled delivery. The QC Inspector will be onsite during delivery and unloading. Inspector will ensure materials are shipped, stored, stacked and handled in accordance with the manufacturer's recommendations and as specified in subcontract documents. Any rejected materials as determined by the QC Inspector and/or SRNS will be segregated from undamaged rolls (i.e. roped off) and each roll clearly identified as damaged.

5.1.1. Due to the weight of the LLDPE rolls, at no point shall the LLDPE rolls be unloaded by pushing them off the delivery truck.

5.1.2. Geosynthetic materials shall be unloaded using industry standard practices and manufacture recommendations while also conforming to applicable construction specifications.

5.2. Labels or markings shall be legible and located so that each roll of geosynthetic materials can be identified by

examining the outside of the roll or the core ends. Markings or labels shall be weatherproof. All material rolls will have at a minimum the following information:

5.2.1. Manufacturer's name
5.2.2. Product identification
5.2.3. Batch, lot and roll numbers (Roll identification numbers shall conform to the numbering system established on the geosynthetic materials Manufacturer's Quality Control Certificates.)
5.2.4. Roll dimensions and weight
5.2.5. Date of manufacture

5.3. The IDS geomembrane shall be stored at the project site in an area(s) designated by the QC Inspector. Contractor shall grade the storage area so that it is reasonably level (no wooden pallets), dry and well-drained, and shall prepare the ground surface so that it is firm, smooth, and free of stones, sticks, or other materials that may damage the geosynthetic materials.

5.4. The laydown yard will be secured to limit vehicle traffic around the Geosynthetics.

5.5. The geosynthetic material rolls will be handled in accordance with the manufacture's recommendations and as specified in subcontract documents.

5.6. Extreme care shall be taken by all personnel while unloading and handling geosynthetic materials. Equipment used to unload and handle geosynthetic materials shall have sufficient capacity to manage the roll/panel weight without damaging the geosynthetic materials. The IDS geomembrane shall only be unloaded and handled using a stinger, spreader bar assembly, or the straps/slings approved by the IDS Geomembrane Manufacturer. Pushing, sliding, or dragging of geosynthetic material rolls is not permitted. The QC Inspector shall inspect all geosynthetic materials panels, prior to final placement, to verify that all defects or damage are identified for repair

5.7. As to not damage the geosynthetic materials, the following are prohibited:

5.7.1. No hooks, tongs, or other sharp tools or instruments shall be used for handling the I.D.S
5.7.2. Rolls shall not be folded, twisted or dragged
5.7.3. Stacking the liner rolls higher than 3 layers

6. Pre-installation

6.1. I.D.S installation drawings showing the proposed location, orientation, overlap, penetration tie-in and anchor details will be submitted and approved by SRNS before installation begins. The design for anchorage, splicing, layout, placement, repairs, patching, seams, and other system requirements shall be in accordance with manufacturer's recommendations, and this specification. Include the panel identification for all panels. Installation drawings shall be approved by SRNS prior to installation of the IDS.

6.2. All conformance tests and reports will be completed and accepted by the QC Inspector and SRNS prior to geosynthetic material deployment.

6.3. Prior to I.D.S Deployment

6.3.1 EI shall verify correct survey grades prior to any CCS subgrade inspection/acceptance. EI will document the acceptance of the finished grade on the Verification of Surveyed Subgrade Surface Acceptance Form. Any grades found out of tolerance shall be corrected by EI prior to proceeding.

6.3.2 Prior to any I.D.S deployment, the subsurface layer will be fine graded to fill in any voids, cracks or depressions and rolled with a smooth drum roller to eliminate any irregularities in the subgrade. Rocks larger than 0.5 inch in diameter, sharp stones, sticks, roots, sharp objects or debris of any kind shall be removed, crushed, or pushed into the surface with the roller. The surface shall provide a firm unyielding foundation for the IDS with no sudden, sharp, or abrupt changes or breaks in grade. The QC Inspector will provide SRNS written acceptance of the subgrade documented on the Subgrade Surface Acceptance Form, ensuring there is no debris of any kind that will damage the I.D.S. during deployment. Any deficiencies in the supporting subgrade that have appeared since the acceptance of the subgrade shall be repaired by EI and re-accepted by the QC Inspector.

6.4. **Panel Identification Coding System**

6.4.1. Identification: During installation, each panel will be marked with a number which will be correlated with a batch or roll number. This panel identification number shall be related on the CCS Panel Placement Log, which will be submitted after installation is complete.

6.4.2. Location: CCS will attempt to install panels as indicated on the layout drawing. If the panels are deployed in a location other than that indicated on the layout drawings, the revised location will be noted in the field. These notations will be maintained and submitted by CCS and/or Envirocon, Inc. after installation is complete.

6.4.3. Documentation of Panel Placement: Information relating to the I.D.S panel placement including date, time, roll number, panel number and panel dimensions shall be maintained on the Panel Placement Log.

6.4.4. In the event a portion of a roll is set aside to be used at a later time, the roll number will be written on the remainder of the roll in several places. The roll will then be re-packaged for protection until it is needed for use

7. LLDPE Installation

7.1. **Deployment**

7.1.1. The IDS Geomembrane shall be deployed and placed in general accordance with the IDS Geomembrane Installer's approved field installation drawings. Depending on field conditions, it may be necessary to alter the IDS geomembrane panel arrangement from that shown on the approved field installation drawings.

7.1.2. The IDS QC Inspector shall maintain a daily field record of actual placement of each geomembrane panel, noting Prepared Subgrade conditions, weather, seaming parameters, panel numbers placed, seams completed, samples taken, and tests run. Daily Inspection, Field notes and IDS Installation Data shall be submitted to the owner.

7.1.3. The IDS geomembrane shall only be placed on Prepared Subgrade that has been accepted in writing by the Contractor, IDS Geomembrane Installer, and QC Inspector.

7.1.4. It is imperative to keep surface water runoff from beneath the IDS geomembrane at all times during installation. The IDS geomembrane Installer's panel placement and seaming techniques and schedule shall minimize or eliminate the potential for accumulation of water beneath the IDS geomembrane.

7.1.5. Equipment and tools used to deploy and place IDS geomembrane shall not stretch, tear, puncture, or otherwise damage the IDS geomembrane, and shall not damage the underlying prepared subgrade.

7.1.6. Under no circumstances shall any construction or vehicular traffic be allowed to drive over exposed IDS geomembrane other than specified herein. IDS geomembrane showing evidence of trafficking shall be inspected by the IDS Geomembrane Installer, Contractor, and QC Inspector to evaluate damage, if any. At the direction of the QC Inspector, any damaged IDS geomembrane shall be tested, rejected, or repaired. The use of low ground pressure equipment (having 6 pounds per square inch or less contact pressure) is allowed by the IDS Geomembrane Installer during installation, but use shall be prohibited if excessive trafficking or any IDS geomembrane damage is observed.

7.1.7. The IDS geomembrane shall be placed in such a manner as to minimize dragging of panels into position ("spotting"). The IDS Geomembrane Installer shall immediately provide temporary anchorage of the IDS geomembrane to prevent wind uplift, panel movement during field seaming, and bridging.

7.1.8. Temporary anchorage methods shall be approved by the QC Inspector. If bags are used for temporary anchorage, they shall be filled with fine-grained sand that has been approved for use by the QC Inspector. Any IDS geomembrane exhibiting damage due to insufficient or improper temporary anchorage shall be repaired or replaced, as directed by the QC Inspector.

7.1.9. The IDS geomembrane shall be installed so as to minimize or eliminate bridging ("trampolining") at the toe of slopes. Bridging control measures may include providing slack, using and maintaining additional temporary anchorage (e.g., sandbagging), or other methods approved by the QC Inspector. If bridging is observed, the IDS Geomembrane Installer shall repair affected areas, as directed by the QC Inspector.

7.1.10. Panel seams shall be oriented in a direction parallel to the line of maximum Prepared Subgrade slope (i.e., down, not across the slope) and shall be placed in a manner that minimizes the number and length of field seams. In corners and odd-shaped geometric locations, the number of field seams shall be minimized and moved to locations outside the corners as appropriate.

7.1.11. For IDS geomembrane seams on benches, panels shall be shingled such that the "upstream" panel overlaps the "downstream" panel in order to minimize infiltration potential.

7.1.12. Transverse seams on benches shall be staggered.

7.1.13. Contractor shall be responsible for excavation, maintenance, and backfilling of the IDS geomembrane anchor trench. Backfilling of the anchor trench shall commence only after the IDS geomembrane has been approved by the QC Inspector.

7.2. **Seams**

7.2.1. Thermo-fusion seaming methods shall be used to join IDS geomembrane panels in the field. A minimum overlap of 4 inches shall be used. Seams shall be hot wedge or extrusion welded as prescribed by the IDS Geomembrane Manufacturer and approved by the QC Inspector. For joining IDS geomembrane panels, dual hot wedge is the preferred seaming method. Extrusion seaming shall be used primarily for repairs and detailing.

7.2.2. The IDS Geomembrane Installer shall provide the following equipment, and any required accessories, to complete IDS geomembrane seaming. Equipment shall be provided and maintained in sufficient numbers to avoid delaying work.

7.2.2.1. Seaming equipment: Hot wedge (single and dual track), extrusion, and hot air ("leister") welding machines. All seaming equipment shall be equipped with gauges that clearly display wedge temperature, rate of travel, barrel temperature, and nozzle ("pre-heat") temperature, as applicable

7.2.2.2. Destructive testing equipment: Punch press and field tensiometer for field destructive testing of IDS geomembrane seams. Punch press shall be capable of producing die-cut IDS geomembrane specimens in

accordance with ASTM D 6392. Tensiometer shall be built to applicable ASTM specifications, be in good working order, and shall be accompanied by evidence of calibration within the last year.

7.2.2.3. Non-destructive testing equipment: Air pump(s) and gauges, air lance, and voltage applicator(s) for non-destructive testing of IDS geomembrane seams and repairs. All testing equipment shall be built to applicable ASTM specifications and be in good working order.

7.2.2.4. Portable electric generators: Capable of providing constant voltage under a combined-line load. Generators must have rubber tires or be placed on a layer of cushioning material that does not damage the IDS geomembrane.

7.2.2.5. Miscellaneous equipment: Any other equipment or tools (e.g., hook blades, scissors, markers, etc.) necessary to complete IDS geomembrane seaming, testing, and labeling in accordance with the Technical Specifications and the IDS Geomembrane Installer's approved CQC manual.

7.2.3. No production seaming shall commence until trial seaming is successfully completed and accepted by the QC Inspector.

7.2.4. The IDS Geomembrane Installer and Contractor, shall establish site-specific limits of weather conditions, including, but not limited to, temperature, humidity, precipitation, and wind speed and direction, within which IDS geomembrane panel placement and seaming can be conducted. In the absence of site-specific criteria, the following limitations shall apply:

7.2.4.1. No placement or seaming shall be conducted in the presence of precipitation, such as rain, snow, or sleet.

7.2.4.2. No placement or seaming shall be conducted in the presence of winds in excess of 20 miles per hour, when dirt or debris is blown into seaming areas, or when seaming temperatures cannot be adequately monitored and controlled.

7.2.4.3. Seaming shall not be conducted when IDS geomembrane sheet temperature falls below 35 degrees Fahrenheit unless approved by the QC Inspector.

7.2.4.4. Seaming shall not be conducted when the IDS geomembrane sheet temperature exceeds 135 degrees Fahrenheit unless approved by the QC Inspector.

7.2.5. For purposes of monitoring production seaming, IDS geomembrane sheet temperature shall be measured and recorded by the QC Inspector at multiple locations along seam overlap areas.

7.2.6. The IDS Geomembrane Installer shall not cause excessive overheating of the IDS geomembrane during trial or production seaming. Excessive overheating is defined as any of the following:

7.2.6.1. Application of seaming temperatures or seaming rates that result in visible warping, deformation, or discoloration of the bottom surface of the lower IDS geomembrane in the seam area.

7.2.6.2. Seaming over an existing seam ("piggybacking"), except for repairs (patches, cap strips, etc.) which cross over existing seams.

7.2.6.3. Seaming using temperatures in excess of the IDS Geomembrane Manufacturer's recommended seaming temperatures as defined at the pre-installation meeting.

7.2.7. All extrusion seaming material shall be of a type or types recommended by the IDS Geomembrane Manufacturer and shall be delivered to the project site in original sealed containers or packaging, each with an indelible label bearing the manufacturer's name, and manufacturer's batch or lot number.

7.2.8. Storage of fuel, oils, and other petroleum products shall be restricted to off-IDS geomembrane areas. Similarly, fueling of equipment (e.g., generators) and changing of oil and oil filters shall be restricted to off-IDS geomembrane areas. If any fuel, oils, or other petroleum products are leaked or accidentally spilled on the IDS geomembrane, they shall be immediately removed. The spill area shall be inspected for damage by the Contractor, IDS Geomembrane Installer, and QC Inspector, and any damaged IDS geomembrane shall be repaired or replaced as directed by the QC Inspector.

7.3. **Trial Seaming**

7.3.1. The IDS Geomembrane Installer shall be responsible for field destructive testing of all trial seams.

7.3.2. Trial seams shall be prepared for each piece of seaming equipment whenever any of the following conditions occur:

7.3.2.1. Shift start-up.

7.3.2.2. "Cold" restart of seaming equipment (i.e. mid Shift).

7.3.2.3. Change in welding technician.

7.3.2.4. Significant change in IDS geomembrane sheet temperatures.

7.3.2.5. As required by the QC Inspector.

7.3.3. Trial seams shall be prepared in the presence of the QC Inspector using the same personnel, equipment, and

seaming conditions that will be used during production seaming. Field destructive test results acceptable to the QC Inspector shall be obtained prior to performing any production seaming. This may require resampling of completed trial seams or repeating the trial seam process, as directed by the QC Inspector.

7.3.4. Trial seams shall have a minimum length of 6 feet and minimum width of 1 foot, with the seam centered across the width. The IDS Geomembrane Installer shall cut the trial seam into two equal length samples suitable for testing. One sample shall be kept by the IDS Geomembrane Installer for destructive testing at the project site in the presence of the QC Inspector. The duplicate sample shall be furnished to the QC Inspector for the project record and possible future testing. The IDS Geomembrane Installer shall mark the duplicate sample with the date, time, ambient temperature, seaming machine identification, seaming technician initials, and seaming parameters (set temperature, rate of travel, etc.) used to prepare the trial seam.

7.3.5. Trial seam samples shall be destructively tested in peel and shear in accordance with the IDS Geomembrane Installer's approved CQC manual. A minimum of three specimens shall be tested in peel and 2-inch shear for each trial seam. For dual hot wedge seams, specimens must be tested in peel for each external seam track. Test specimens shall be die cut by the IDS Geomembrane Installer using a die and punch press capable of producing specimens in accordance with ASTM D 6392. Specimens shall be cut from the center two-thirds of the trial seam sample once it has cooled to ambient temperature.

7.3.6. Qualification criteria for all trial seam destructive testing are summarized in Section 7.3.9 of this specification. If any specimens fail to meet qualification criteria, the QC Inspector may have additional specimens from the sample tested in order to determine trial seam acceptance.

7.3.7. If a trial seam fails to meet all qualification criteria, a new trial seam must be prepared. If this second trial seam also fails, the seaming equipment and/or seaming technician preparing the trial seams shall not be allowed to perform production seaming until any deficiencies are corrected and two consecutive trial seams meeting all qualification criteria are prepared, tested and accepted by the QC Inspector.

7.3.8. Trial seam test results shall be recorded in the IDS Geomembrane Installer's "preweld" test log or daily field record and a copy furnished to the QC Inspector no later than the following work day. Specimens tested by the IDS Geomembrane Installer shall be marked and stored on the project site for inspection by the Owner.

7.3.9.

	Trial Seaming[2]
Hot Wedge Seams[1] (units)	
Peel Strength (lbs)	63
Peel Separation (%)	25
Shear Strength (lbs)	75
Shear Elongation at Break (%)	50
Extrusion Fillet Seams[1] (units)	
Peel Strength (lbs)	57
Peel Separation (%)	25
Shear Strength (lbs)	75
Shear Elongation at Break (%)	50

Notes:

(1) Peel strengths, shear strengths, and shear elongations listed are minimum required values. Peel separation percentages listed are maximum allowable values.

(2) For trial seaming, In order to be considered qualified, all 5 trial seam test specimens must meet all strength and separation requirements. Field test in accordance with project Technical Specifications and Geosynthetic QCTIP.

7.4. **Production Seaming**

7.4.1. No production seaming shall commence until trial seaming is successfully completed and accepted by the QC Inspector.

7.4.2. All IDS geomembrane panels shall be permanently seamed on the same day they are placed except where explicitly approved by the QC Inspector.

7.4.3. IDS geomembrane that is to be hot wedge seamed shall be prepared as follows:

7.4.3.1. Position IDS geomembrane sheets to create a minimum overlap of 4 inches. If the overlap is excessive, excess IDS geomembrane shall be trimmed from the lower sheet where possible. If excess IDS geomembrane is trimmed from the upper sheet, IDS Geomembrane Installer shall not damage the lower sheet. IDS geomembrane damaged during trimming may be removed and the panel overlap reset, as directed by the QC Inspector.

7.4.3.2. Temporarily anchor sheets in a manner approved by the QC Inspector to prevent movement during seaming and to maintain a "flat" lap of sheets. No glue or tape shall be used to temporarily hold sheets together before seaming.

7.4.3.3. Prepare overlap area to provide a suitable welding surface. Overlap area shall be free of dirt, dust, moisture, or other foreign material. No solvents shall be used to clean IDS geomembrane sheets prior to seaming.

7.4.3.4. Seaming shall be completed as soon as is practical after preparation and cleaning is completed.

7.4.4. IDS Geomembrane that is to be extrusion seamed shall be prepared as follows:

7.4.4.1. Position IDS geomembrane sheets to create a minimum overlap of 4 inches.

7.4.4.2. Grind the edge of the upper IDS geomembrane sheet to a 45 degree bevel using a disc grinder or equivalent tool. Lift the upper IDS geomembrane sheet away from the lower sheet during beveling to prevent gouging of the lower sheet.

7.4.4.3. Temporarily bond IDS geomembrane sheets, using hot air ("leister") equipment, to prevent movement during seaming and to maintain a 'flat" lap of sheets. No glue or tape shall be used to temporarily hold sheets together before seaming. Overheating of the IDS geomembrane during temporary bonding shall result in rejection of the seam or repair in question and shall be repaired as directed by the QC Inspector.

7.4.4.4. Grind IDS geomembrane surfaces that are to receive the extrusion weld bead, using a disc grinder or equivalent tool, no more than 15 minutes prior to seaming. Grinding area shall extend no more than 0.25-inches beyond the extrusion weld bead area and the grinding depth shall not exceed 10 percent of the IDS geomembrane sheet thickness. Extrusion seam ends that are more than 5 minutes old shall be ground prior to joining or extending the seam. All IDS geomembrane residue generated during grinding shall be cleared from the seaming area.

7.4.4.5. Prior to extrusion seaming, the QC Inspector shall visually inspect all prepared IDS geomembrane surfaces to verify that excessive grinding has not occurred and that the upper IDS geomembrane sheet is properly beveled. QC Inspector may require repair of areas exhibiting excessive grinding or improper beveling, which may include removal and replacement of affected IDS geomembrane.

7.4.4.6. Extrusion welding machines are to be purged of all heat- degraded extrudate prior to seaming. During seaming operations, extrudate purging will be required whenever the welding machine is idle for more than 2 minutes, or as directed by the QC Inspector.

7.4.5. No folds, wrinkles, or "fish-mouths" shall be allowed within any seam areas. Where wrinkles or folds occur, the material shall be cut, overlapped, and a patch applied. During wrinkle or fold repairs, adjacent IDS geomembrane may not be required to meet the 4-inch minimum overlap, if approved by the QC Inspector.

7.4.6.

Type of Seam	**Production Seaming**[2, 3]
Hot Wedge Seams[1]	
Peel Strength (lbs)	63
Peel Separation (%)	25
Shear Strength (lbs)	75
Shear Elongation at Break (%)	50
Extrusion Fillet Seams[1]	
Peel Strength (lbs)	57
Peel Separation (%)	25
Shear Strength (lbs)	75
Shear Elongation at Break (%)	50

Notes:

(1) Peel strengths, shear strengths, and shear elongations listed are minimum required values. Peel separation percentages listed are maximum allowable values.

(2) For production seaming, values listed for shear and peel are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values. Laboratory test in accordance with ASTM D 6392.

(3) Five out of five specimens should meet the shear elongation and peel separation values.

7.5. **Non-Destructive Testing**

7.5.1. IDS Geomembrane Installer shall be responsible for non-destructive testing of the entire length (100 percent) of all production seams and repairs to verify their continuity. Non-destructive testing shall be conducted as IDS geomembrane seaming and repair work progresses and shall be performed in the presence of the QC Inspector.

7.5.2. Non-destructive test methods shall include the air lance, air-pressure test, spark test, or other methods listed in ASTM D 4437 or approved by the Owner

7.5.3. The IDS Geomembrane Installer shall submit copies of all non- destructive testing documentation to the QC Inspector.

7.6. **Destructive Testing**

7.6.1. Laboratory destructive testing of production seams is the responsibility of the IDS Installer. Field destructive testing of production seams is the responsibility of the IDS Geomembrane Installer's QC Inspector. The IDS Geomembrane Installer is also responsible for obtaining samples and repairing sampling locations for all laboratory and field destructive testing.

7.6.2. Destructive testing sample locations shall be repaired in accordance with the repair procedures outlined in this plan.

7.6.3. Production seam samples suitable for laboratory destructive testing shall be obtained by the IDS Geomembrane Installer at locations established by the QC Inspector as production seaming progresses. Production seams will be representatively sampled at a rate of one sample per 750 linear feet per day. Additional samples shall be obtained by the IDS Geomembrane Installer from areas of questionable integrity, as directed by the QC Inspector.

7.6.4. Laboratory destructive testing samples shall have a minimum length of 3 feet and minimum width of 1 foot, with the seam centered across the width. The IDS Geomembrane Installer shall cut the destructive sample into two equal length samples suitable for testing. Both samples shall be furnished to the QC Inspector, who will forward one sample to a Geosynthetic testing laboratory where it shall be destructively tested in peel and shear in accordance with ASTM D 6392. The duplicate sample shall be retained by the QC Inspector for the project record and possible future testing. An additional duplicate destructive sample may be obtained and retained for testing by the IDS Geomembrane Installer at the Installer's discretion.

7.6.5. Qualification criteria for all production seam destructive testing are summarized in Section 8.4.6 of this specification. If any specimens fail to meet qualification criteria, QC Inspector may have additional specimens from the sample

tested in order to determine production seam acceptance.

7.6.6. If a destructive test sample fails to meet all qualification criteria, the IDS Geomembrane Installer shall obtain additional production seam samples for laboratory destructive testing.

7.6.7. In order for a production seam to be accepted, a failed destructive test sample shall be bounded by two passing destructive test samples, and the seam between the two passing test locations shall be reconstructed. Alternatively, the entire length of the seam in question may be repaired by placement of a cap strip, or by another repair procedure, as directed by the QC Inspector.

7.6.8. The QC Inspector or Owner may require that additional destructive test samples be taken at random locations from production seams completed during the same work shift as a failing destructive test sample or in areas that visually appear defective or not in accordance with these Technical Specifications. Testing of these samples shall be performed by the QC Inspector, but obtaining the samples and repairing the sampling locations shall be the responsibility of the IDS Geomembrane Installer.

7.7. **Repairs**

7.7.1. During installation, the IDS Geomembrane Installer and QC Inspector shall visually inspect all IDS geomembrane panels and seams for damage, defects, or non- compliance with the Contract Drawings and Technical Specifications, and shall mark any such areas for repair. The IDS Geomembrane Installer shall repair marked areas as soon as possible. Any defects that could allow surface water runoff beneath the IDS geomembrane shall be repaired on the same day they are marked.

7.7.2. Acceptable IDS geomembrane repair methods include:

7.7.2.1. Patching: For repair of surface defects, small tears, punctures, destructive sampling locations, etc. Patches shall have a minimum size of 12 inches by 12 inches, extend at least 6 inches beyond the edge(s) of a defect, and have rounded corners so that the repair may be completed with a continuous extrusion seam. In some cases, the Owner's Representative may direct the IDS Geomembrane Installer to cut out and remove a defect prior to patching.

7.7.2.2. Spot welding ("bead repairs"): For repair of pinholes or other minor, localized defects. Spot welding shall only be permitted where explicitly approved by the QC Inspector prior to performing the repair.

7.7.2.3. Reconstruction: For repair of lengths (segments) of unacceptable seams. Performed by cutting and removing the unacceptable seam segment and replacing it with new IDS geomembrane that is seamed into place.

7.7.2.4. Cap stripping: For repair of lengths (segments) of unacceptable seams in lieu of reconstruction. Cap strips shall extend at least 12 inches beyond the edge(s) of a seam, and have rounded corners.

7.7.3. Seam intersections ("tees") shall be covered with a patch as described in Section 8.7.2.1.

7.7.4. The QC Inspector may require repair or replacement of any area where overheating or unacceptable preparation, seaming or testing techniques are observed. Such repair or replacement may be required even if samples removed from affected areas pass destructive testing.

7.7.5. Under no circumstances shall seams be repaired by placing extrusion seams directly atop previously seamed areas ("piggybacking").

7.7.6. All repairs shall be non-destructively tested by the IDS Geomembrane Installer.

7.8. **Cover Penetration Seals**

7.8.1. Cover penetrations in the geomembrane shall be sealed using LLDPE pipe boots (sleeves and skirts), gaskets, banding straps, or other materials as shown on the Contract Drawings and specified in the Technical Specifications.

7.8.2. Surfaces where pipe boots are to be attached (including pipe) shall be cleaned to remove dirt, oil, debris, or other deleterious materials.

7.8.3. Prior to attaching and/or seaming pipe boots, the QC Inspector shall visually inspect all prepared surfaces to verify that proper preparation techniques have been followed. The QC Inspector may require repair of areas exhibiting improper preparation techniques or damage, which may include removal and replacement of affected geomembrane or pipe.

7.8.4. Geomembrane Installer shall be responsible for non-destructive testing of the entire length (100 percent) of all pipe boot seams to verify their continuity. Non-destructive testing shall be performed in the presence of the QC Inspector and in accordance with this specification

7.8.5. Connections at cover penetrations shall be sealed using gaskets, banding straps, or other materials as shown on the Contract Drawings and Technical Specifications

8. Geotextile Installation

8.1. **Deployment**

8.1.1. Installation of the Geotextile may begin after a sufficient area of the IDS Geomembrane has been installed, verified, and accepted by the QC Inspector.

8.1.2. The Geotextile shall be deployed and placed in general accordance with the Geotextile Installer's approved field installation drawings. Depending on field conditions, it may be necessary to alter the Geotextile panel arrangement from that shown on the approved field installation drawings.

8.1.3. The Geotextile QC Inspector shall maintain a daily field record of actual placement of each Geotextile panel, noting IDS Geomembrane conditions, weather, seaming parameters, panel numbers placed, seams completed, samples taken, and tests run. The QC inspector shall submit Daily Inspection, Field notes and Geotextile Installation Data

8.1.4. The Geotextile shall only be placed on IDS Geomembrane that has been accepted in writing by the Contractor, Geotextile Installer, and QC Inspector.

8.1.5. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the contractor damage the geotextile to the extent that it is no longer usable as determined by these specifications or by the engineer, the contractor shall replace the geotextile.

8.1.6. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.

8.1.7. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material. The contractor shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the contractor, the latter shall repair the damaged materials to the satisfaction of the QC Inspector.

8.1.8. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the QC Inspector.

8.1.9. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct Sun light for more than 15 days after installation.

8.1.10. Under no circumstances shall any construction or vehicular traffic be allowed to drive over exposed Geotextile other than specified herein. Geotextile showing evidence of trafficking shall be inspected by the Geotextile Installer, Contractor, and QC Inspector to evaluate damage, if any. At the direction of the QC Inspector, any damaged Geotextile shall be tested, rejected, or repaired. The use of low ground pressure equipment (having 6 pounds per square inch or less contact pressure) is allowed by the Geotextile Installer during installation, but use shall be prohibited if excessive trafficking or any damage to Geomembrane or Geotextile is observed.

8.1.11. The Geotextile shall be placed in such a manner as to minimize dragging of panels into position ("spotting"). The Geotextile Installer shall immediately provide temporary anchorage of the Geotextile to prevent wind uplift, panel movement during field seaming, and bridging.

8.1.12. Temporary anchorage methods shall be approved by the QC Inspector. If bags are used for temporary anchorage, they shall be filled with fine-grained sand that has been approved for use by the QC Inspector. Any Geotextile exhibiting damage due to insufficient or improper temporary anchorage shall be repaired or replaced, as directed by the QC Inspector.

8.1.13. Panel seams shall be oriented in a direction parallel to the line of maximum IDS Geomembrane slope (i.e., down, not across the slope) and shall be placed in a manner that minimizes the number and length of field seams. In corners and odd-shaped geometric locations, the number of field seams shall be minimized and moved to locations outside the corners as appropriate.

8.1.14. For Geotextile seams on benches, panels shall be shingled such that the "upstream" panel overlaps the "downstream" panel in order to minimize infiltration potential.

8.1.15. Contractor shall be responsible for excavation, maintenance, and backfilling of the anchor trench. Backfilling of the anchor trench shall commence only after the cover materials have been approved by the QC Inspector. Backfilling materials and compaction methods shall be as outlined in the Technical Specifications.

8.2. **Seams**

8.2.1. The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the engineer. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat seaming, fusion welding techniques recommended by the manufacturer shall be used.

8.3. **Repairs**

8.3.1. During installation, the Geotextile Installer and QC Inspector shall visually inspect all Geotextile panels and seams for damage, defects, or non- compliance with the Contract Drawings and Technical Specifications, and shall mark any such areas for repair. The Geotextile Installer shall repair marked areas as soon as possible.

8.3.2. Holes, tears, or rips shall be repaired by placing a patch over the damaged area in accordance with the manufacturer's repair procedures.

8.3.2.1. Use a patch of the same type geotextile to overlap the damaged area extending a minimum of 12-inches beyond the damage in all directions

8.3.2.1.1. The geotextile patch shall be heat bonded in place.

9. Final Inspection, Acceptance and Covering

9.1. The approved QC Inspector will document all installation activities through daily inspections, field notes and geosynthetic material installation data to be submitted upon completion, including but not limited to the following:

9.1.1. Date
9.1.2. Weather conditions
9.1.3. Type of work performed and equipment used
9.1.4. Location where work was performed
9.1.5. Method of liner deployment, quantity installed and areas covered
9.1.6. Details of significant events, conditions, or concerns
9.1.7. Identification of deficiencies
9.1.8. Corrective measures and verification of corrections
9.1.9. Summary of tests performed
9.1.10. Recorder's printed name and signature
9.1.11. Submit Daily Inspection, Field notes and Geotextile Installation Data Logs

9.2. QC Records of the following logs will be recorded each day installation is occurring and shall be signed by the QC Inspector upon completion of work that day. The field logs/records may be either hand written or electronically recorded in the field during the inspection process.

9.2.1. Geomembrane Field Trail Seam Log
9.2.2. Panel Placement Log
9.2.3. Seaming and Non Destructive Test Log
9.2.4. Repair Log
9.2.5. Geomembrane Seam Destructive Test Log

9.3. Neither the LLDPE or Geotextile layers shall be covered until it has been accepted by the QC Inspector in writing. Once accepted the IDS shall be covered as soon as possible in accordance with the contract drawings and technical specifications.

9.4. A final visual examination of all IDS geomembrane panels, seams, and repairs, and penetration seals shall be completed by the QC Inspector prior to accepting the IDS geomembrane. The QC Inspector's inspection shall only be performed following a complete inspection and approval by the IDS Geomembrane Installer's field superintendent or designated quality control technician. Contractor shall be responsible for cleaning, sweeping, or other measures necessary to provide a thoroughly visible IDS geomembrane surface for the QC Inspector's inspection.

9.5. The IDS Geomembrane Installer shall repair and test any areas identified during the QC Inspector's final inspection as not being in accordance with the Contract Drawings and Technical Specifications. Any such repairs and testing shall be performed at no cost to Owner.

9.6. No IDS geomembrane shall be covered until it has been accepted by the QC Inspector in writing. Once accepted, IDS geomembrane shall be covered as soon as possible in accordance with the contract drawings and technical specifications.

9.7. Prior to placing IDS geotextile, the Contractor shall verify that the underlying IDS geomembrane is free of holes, tears, wrinkles, and foreign objects. In all cases, wrinkles shall not be of a size that they can fold back on themselves.

9.8. Prior to placing Geotextile, the Contractor shall verify that the underlying IDS geomembrane is free of holes, tears, wrinkles, and foreign objects. In all cases, wrinkles shall not be of a size that they can fold back on themselves.

9.9. Acceptance of the installed IDS shall be based on visual inspection by SRNS and the results of both the MQC Manufacture's Testing and the QA Conformance Testing per criteria in this Specification.

9.10. The visual inspection shall note conditions such as overlaps and seams, damaged areas, adequacy of repairs, and the quality of installation, in particular where the potential for damage or failure exists. The final IDS Acceptance Inspection Report shall be submitted to the Owner

9.11. Only low ground pressure vehicles (6 psi max) shall drive directly across the IDS until it covered with a minimum of 12 inches of cover soil unless otherwise approved by the Owner's Engineer.

10. Equipment

10.1. A Rubber-Track Skid Steer
10.1.1. Rubber Tracked in order to operate directly on previously installed Geosynthetic materials
10.1.2. No sudden stops, starts or turns while operating directly on previously installed Geosynthetics.
10.2. Rubber Tired Forklift
10.2.1. Used to stage materials prior to deployment. In areas of tight access, Forklift will be used to install Geosynthetic materials using the telescoping boom feature

11. Cover Materials

Envirocon will be utilizing two GPS mounted Caterpillar D6T LGP (6.4 PSI) and one GPS mounted Caterpillar D6N (4.6 PSI) to place the initial lift over the Geosynthetics. No equipment used to place fill will operate directly on the top surface of the I.D.S. and will follow the manufacturer's guidelines. Any equipment placing fill over the cover will be prohibited to engage in any activities that have the possibility to damage the underlying Geosynthetics, including sudden changes in speed, sharp turns, or speeds exceeding 5 miles per hour. Sandbags will be used on the Geosynthetics to provide ballast. Care will be taken to leave the leading edge clean and available for the following day installation activities. Panel corners, repair and test locations will be GPS surveyed and incorporated into final As-built drawings. Once installed, the QC Inspector will give final approval before EI will begin placing cover materials over the I.D.S. Initially, the cover materials will be an adequate thickness to protect the liner from both weather events and equipment traffic. Thereafter, the initial lift will include the cover lift and will be between a 12" and 15" loose lift and tracked packed with at least 2 passes over all areas. The following lifts will be no more than 12" and have a maximum density of 90%. All fill placement and compaction will be recorded in the Field Engineer's daily report.

12. References

12.1. EPA Guidance document EPA/600/R-93/182
12.2. Agru America Geomembrane and Drainage Installation Specification Manual
12.3. Agru America Geotextile Installation Manual
12.4. SRS PO 258914 Subcontract Documents
12.5. CCS QAQC Manual
12.6. WPP and TSP's

13. Appendix A

13.1. Subgrade Surface Acceptance Form
13.2. Geomembrane Field Trial Seam Log
13.3. Panel Placement Log
13.4. Seaming and Non Destructive Test Log
13.5. Repair Log
13.6. Geomembrane Seam Destructive Test Log
13.7. Verification of Surveyed Subgrade Surface Acceptance Form

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

SUBGRADE SURFACE ACCEPTANCE

Project Name: _____ Customer: _____

Project Number: _____ Date: _____

Location: _____ Partial: _____ Final: _____

This document only applies to the acceptability of surface conditions for installation of geosynthetic products. Chesapeake Containment Systems, Inc. does not accept responsibility for weather damage, compaction, elevation or moisture content, subsurface conditions, nor for the surface condition maintenance during deployment. Structural integrity of the subgrade and maintenance of these conditions are the responsibility of the Owner or Earthwork Contractor.

For Chesapeake Containment Systems, Inc. For Contractor/Owner/Inspector:

_____ _____

_____ _____

Acceptance Number: _____ Area Accepted: _____

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Field Trial Seam Log

Project No.: I17-128
Project Name: Savannah River Basin Closure
Date:
Project Location: Aiken, SC

Material: IDS LLDPE MicroDrain

50 mil Thickness

Project Seam Requirements

Fusion:		Extrusion:	
Peel:	63	Peel:	57
Shear:	75	Shear:	75

Sample #	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
				Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN/OUT					Shear (ppi)							
								1	2	3	4	5	1	2	3	4	5			

QC:_____ Date:_____

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Panel Placement Log

Project No.: I17-128
Project Name: Savannah River Basin Closure
Date:
Project Location: Aiken, SC

Material: IDS LLDPE MicroDrain
50 mil

Date Deployed	Panel No.	Time Deployed	Panel Location	Roll No.	Width (FT)	Length (FT)	Area (SQ FT)

QC:_____ Date:_____

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Panel Placement Log

Project No.: I17-128
Project Name: Savannah River Basin Closure
Date:
Project Location: Aiken, SC

Material: Geotexile
10 oz

Date Deployed	Panel No.	Time Deployed	Panel Location	Roll No.	Width (FT)	Length (FT)	Area (SQ FT)

QC:_____ Date:_____

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I17-128
Project Name: Savannah River Basin Closure
Date:
Project Location: Aiken, SC

Material: IDS LLDPE MicroDrain
Thickness : 50 mil

Weld Date	Seam # (P#/P#)	Weld Time	Tech ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		

QC:_____ Date:_____

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I17-128
Project Name: Savannah River Basin Closure
Date:
Project Location: Aiken, SC

Material: IDS LLDPE MicroDrain
Thickness: 50 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		
		Seam #							P/F	Date	Tech

QC:_____ Date:_____

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Seam Destructive Test Log

Project No.: I17-128
Project Name: Savannah River Basin Closure
Date:
Project Location: Aiken, SC

Material: IDS LLDPE MicroDrain
50 Mil Thickness

Project Seam Requirements

Fusion:		Extrusion:	
Peel:	63	Peel:	57
Shear:	75	Shear:	75

DT #	Location	Date Removed	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
			Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN/OUT					Shear (ppi)							
							1	2	3	4	5	1	2	3	4	5			

QC:_____ Date:_____

Legends

DEFECT CODE			
BO-	Burn Out	SI-	Soil Surface
CR-	Crease	DD-	Deployment Damage
DS-	Destructive Test Number	MD-	Material Damage
EE-	Earthwork Equipment Damage	WR-	Wrinkle
FM-	Fishmouth	WS-	Welder Restart
FT-	Pressure Test Cut	FD-	Factory Defect
T-	Joint	AT-	Air Test

REPAIR TYPE	
C-	Cap Strip
P-	Patches
B-	Extrudate Bead
GB-	Grind & Bead
BT-	Boot
GV-	Gas Vent

NOTATIONS	
SOS	Start of Seam
EOS	End of Seam
EL	Existing Liner
AT	Anchor Trench

TEST RESULTS	
P-	Pass
F-	Fail

Envirocon

VERIFICATION OF SURVEYED SUBGRADE SURFACE ACCEPTANCE

PROJECT NAME:_____PROJECT NUMBER: _____

LOCATION: _____

AREA ACCEPTED: _____

DATE OF AREA SURVEY: _____

AUTHORIZED REPRESENTATIVE (ENVIROCON): _____

FIELD ENGINEER (ENVIROCON): _____

The undersigned representatives verify that the subgrade surface, which was surveyed and found to be acceptable for installation of the geomembrane on the above date, has not been modified or changed since the initial acceptance and survey. The subgrade surface and the survey for the area accepted have both been approved and the area accepted is now ready for installation of the geomembrane.

AUTHORIZED REPRESENTATIVE OF ENVIROCON

_____	_____	_____
Signature	*Title*	*Date*

FIELD ENGINEER or DESIGNEE

_____	_____	_____
Signature	*Title*	*Date*

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APPENDIX K

ENVIROCON ENGINEER CERTIFICATION LETTERS

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Envirocon

ENVIROCON, INC.
6722 W. Kennewick
Ave. Ste. A,
Kennewick, WA 99401
(509) 987-1771
(509) 987-1774 FAX
www.envirocon.com

January 26, 2017

To: **Donald Baston**
SRNS Civil Lead

From: **Raymond Scott Ribes**
Envirocon Field Engineer

Subject: **Field Engineer Certification**
Project SRNS 488-1D Ash Basin and 489-D Coal Pile Runoff Basin (CPRB) Closure

As an employee of Aerotek, I was subcontracted by Envirocon, Inc. to serve as the Field Engineer, for the above referenced project, in charge of verifying all construction activities, inspections, and testing were performed in accordance with the contract specifications. I observed the construction activities, geotechnical and materials inspections, storm water inspections, fill placement and compaction reports, and surveying.

Based on these observations of the construction and on my review of all testing and inspection reports, I hereby certify that all construction activities performed in association with the landfill closure have been completed in accordance with the contract specifications and drawings. I am certifying all construction activities from project start to Thursday, January 26, 2017.

Sincerely,

Raymond Scott Ribes, P.E.
South Carolina #15758

1/26/17

Envirocon

1999 Broadway
Suite 800
Denver, CO 80202
P: 303.215.0187

December 15, 2017

To: Mr. Don Baston, PE
SRNS Engineering

From: Mike Beardsley, PE
EI/GGE Field Engineer

Subject: Field Engineer Certification: SRNS 488-1D Ash Basin and 489-D Coal Pile Runoff Basin Closure Project, Subcontract No. 0000258194

Hello Don:

It has been my pleasure to serve as the Interim Field Engineer for our project. I was subcontracted by Envirocon, Inc. to serve as the South Carolina Licensed Field Engineer, for the above referenced project after Mr. Ribes resigned until another permanent Engineer could be hired. As you know, Mr. Patrick Tinnes has been hired and is assuming the role as SC Licensed Field Engineer for the project.

During the time in which I fulfilled this role, I was in charge of verifying that all construction activities, inspections, and testing were performed in accordance with the contract specifications and that all items were built to the contract drawings, SDDR's, RFI's and field directives. I, or my authorized designee under my responsible charge, observed the construction activities, geotechnical and materials inspections, storm water inspections, fill placement and compaction reports, and surveying activities for compliance with the contract documents.

Based on these observations of the construction and on my review of the testing and inspection reports, I hereby certify that all construction activities performed in association with the project have been completed in accordance with the contract documents during my tenure. I am certifying all construction activities from January 30th, 2017 through December 15th, 2017, which was the time period during which I was the Interim Field Engineer.

Sincerely,

Mike Beardsley, PE
Field Engineer
mbeardsley@greenglobeinc.com
(720) 838 - 7107

101 International Dr.
PO Box 16655
Missoula, MT 59808
P: (323) 728-5463

Envirocon

November 1, 2018

To: Mr. Don Baston
SRNS Engineering

From: Patrick Tinnes
Field Engineer

Subject: Field Engineer Certification: SRNS 488-1D Ash Basin Closure Project

Hello Don:

As required in the 488-1D Ash Basin and 489-D Coal Pile Runoff Basin Closure specifications, document C-SPP-D-00003, dated November 4, 2015, responsibilities of the certifying engineer are to verify that all construction activities, inspections, and testing are performed in accordance with the contract specifications and that all items are built to the contract drawings, SDDR's, RFI's and field directives. I, or my authorized designee, observed the construction activities, geotechnical and materials inspections, storm water inspections, fill placement and compaction reports, and grade checking activities for compliance with the contract documents.

Based on these observations of the construction and on my review of the testing and inspection reports, I hereby certify that all construction activities performed in association with the project have been completed in accordance with the contract documents. I am certifying all construction activities from, December 15, 2017 through October 31, 2018, excluding February 26, 2018 through March 2, 2018 and August 6, 2018 through August 10, 2018.

Sincerely,

South Carolina
Temporary Permit No. 2017025
Date Issued 12/15/2017

Patrick Tinnes, PE
Project Engineer
ptinnes@envirocon.com
(323) 728 - 5463

Envirocon

1999 Broadway
Suite 800
Denver, CO 80202
P. 303.215.0187

March 09, 2018

To: Mr. Don Baston, PE
SRNS Engineering

From: Mike Beardsley, PE
EI/GGE Field Engineer

Subject: Field Engineer Certification: SRNS 488-1D Ash Basin and 489-D Coal Pile Runoff Basin Closure Project, Subcontract No. 0000258194

Hello Don:

During the time period from February 26, 2018 through and including March 2, 2018, Envirocon, Inc. subcontracted me to serve as the South Carolina Licensed Field Engineer, for the above referenced project, while Mr. Patrick Tinnes was off site.

During this time in which I fulfilled this role, I was in charge of verifying that all construction activities, inspections, and testing were performed in accordance with the contract specifications and that all items were built to the contract drawings, SDDR's, RFI's and field directives. I, or my authorized designee under my responsible charge, observed the construction activities, geotechnical and materials inspections, storm water inspections, fill placement and compaction reports, and surveying activities for compliance with the contract documents.

Based on these observations of the construction and on my review of the testing and inspection reports, I hereby certify that all construction activities performed in association with the project have been completed in accordance with the contract documents during this timeframe. I am certifying all construction activities from February 26th, 2018 through March 2nd, 2018, which was the time period during which I was the Interim Field Engineer. My reports for this time period have been provided under separate submittal.

Sincerely,

Mike Beardsley, PE
Field Engineer
mbeardsley@greenglobeinc.com
(720) 838 - 7107

Envirocon

1999 Broadway
Suite 800
Denver, CO 80202
P: 303.215.0187

August 10, 2018

To: Mr. Don Baston, PE
SRNS Engineering

From: Mike Beardsley, PE
EI/GGE Field Engineer

Subject: Field Engineer Certification: SRNS 488-1D Ash Basin and 489-D Coal Pile Runoff Basin Closure Project, Subcontract No. 0000258194

Hello Don:

It has been my pleasure to revisit the subject site this past week. I was subcontracted by Envirocon, Inc. to serve as the South Carolina Licensed Field Engineer, for the above referenced project from August 06, 2018 through August 10, 2018 so that Mr. Patrick Tinnes, the regular Envirocon Field Engineer, could take a vacation.

During this past week as I fulfilled the role of Field Engineer, I oversaw and verified that all construction activities, inspections, and testing were performed in accordance with the contract specifications and that all items were built to the contract drawings, SDDR's, RFI's and field directives. I, or my authorized designee under my responsible charge, observed the construction activities, geotechnical and materials inspections, storm water inspections, fill placement and compaction reports, and surveying activities for compliance with the contract documents.

Based on these observations of the construction, testing technicians, and surveyors, I hereby certify that all construction activities performed in association with the project have been completed in accordance with the contract documents during my visit. I am certifying all construction activities from August 06th, 2018 through August 10th, 2018, which was the time period during which I filled in as the Field Engineer.

Sincerely,

Mike Beardsley, PE
Field Engineer
mbeardsley@greenglobeinc.com
(720) 838 - 7107

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