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Field Sampling Plan for the Wetland Area at Dunbarton Bay of the Steel Creek Integrator Operable Unit (U)

SEMS Number: 71

SRNS-RP-2018-00480

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SAVANNAH RIVER SITE • AIKEN, SOUTH CAROLINA

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U.S. Department of Energy
and
Savannah River Site Nuclear Solutions, LLC
Aiken, South Carolina

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximate, approximately
≤	less than or equal to
ac	acre
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CM	contaminant migration
CMS/FS	Corrective Measures Study/Feasibility Study
CRDL	Contract Required Detection Limit
FFA	Federal Facility Agreement
FSP	Field Sampling Plan
ft	feet
ha	hectare
IOU	Integrator Operable Unit
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
MCL	maximum contaminant level
mi	mile(s)
mi^2	square mile(s)
PAB	P-Area Ash Basin
PTSM	principal threat source material
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RG	remedial goal
RGO	remedial goal option
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SEMS	Superfund Enterprise Management System
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
STR	subcontract technical representative
USDOE	United States Department of Energy
WADB	Wetland Area at Dunbarton Bay

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1.0 INTRODUCTION

This Field Sampling Plan (FSP) was prepared in accordance with the *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site (U)* (SRNS 2014). The Sampling and Analysis Plan (SAP) is implemented following excavation activities and provides the overall confirmation sampling strategy for coal and/or ash related waste units. This FSP provides the unit specific sampling information for the Wetland Area at Dunbarton Bay (WADB) as dictated by the SAP.

1.1 Purpose for Sampling

This FSP has been developed for the WADB, a subunit of the Steel Creek Integrator Operable Unit (IOU), SEMS 71. The reason for sampling per this FSP is to ensure remedial goals (RGs) have been achieved upon completion of the remedial action at the WADB. The remedial action at WADB includes the removal of ash and contaminated soil from the boundary of the P-Area Ash Basin to a 30-m (100-ft) buffer boundary around the Dunbarton Bay.

1.2 Sampling Unit Location

The WADB is located within the boundaries of the Savannah River Site (SRS) in South Carolina. The SRS is owned and operated by the United States Department of Energy (USDOE). SRS occupies approximately (~) 803 km^2 (310 mi^2) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located ~40-km (25-mi) southeast of Augusta, Georgia, and 32-km (20-mi) south of Aiken, South Carolina, on property adjacent to the Savannah River. The WADB is located southeast of the P-Area Ash Basin (PAB) within the Steel Creek IOU boundary near the headwaters of Meyers Branch and extends into Dunbarton Bay, which is located south of Powerline Road (also referred to Ash Flow Road or SRS Road 74-28). The dominant feature of the WADB is a Carolina Bay called Dunbarton Bay (Figure 2).

1.3 Sampling Unit Characterization History

The PAB was an unlined, earthen containment basin that received ash discharge from a sluice from the P-Area Coal Fired Power Plant from 1951 to 1991. During the years of 1973 to 1974, significant amounts of ash within the basin were removed and placed around the perimeter of the basin and to the north along the access road that led to the basin, including in the vicinity of Outfall P-007, which is located north of the PAB. Additionally, the Outfall P-007 received releases of contaminants (cesium-137) from process line discharges that originated from the P-Area Disassembly Basin. In the summer of 2010, an area of ash overflow outside the established basin was discovered during the removal activities at the PAB.

The ash overflow area begins at the southern edge of the PAB and extends ~762 m (2,500 ft) into Dunbarton Bay, which is located south of the Powerline Road (Figure 3). The overflow followed natural and, to a lesser extent, man-made contours from the source of the overflow to Dunbarton Bay. Dunbarton Bay has been designated as wetlands. The powerline road across which the ash flowed has been raised to ~1.2- to 1.5-m (4- to 5-ft) above the surrounding grade, and culverts were installed during the process. The culverts now divert flow under the road from the north to the south of the area. There are three culverted areas, one each located outside the east and west boundaries of the identified ash sediment area and one near the center.

Representatives from the United States Environmental Protection Agency, South Carolina Department of Health and Environmental Control, and USDOE met on August 5, 2010 to discuss and evaluate the need for a remedial action with regard to the ash overflow area at Dunbarton Bay. The three agencies agreed that this additional area was outside the scope of the remedial action for the PAB. The newly discovered ash overflow area in Dunbarton Bay was administratively assigned as a subunit of Steel Creek IOU in the SRS Federal Facility Agreement (FFA) and named the WADB.

The FFA (FFA 1993) for SRS lists the WADB as a Resource Conservation and Recovery Act (RCRA) solid waste management unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit that required further evaluation.

The WADB was evaluated through an investigation process that integrates and combines the RCRA corrective action process with the CERCLA remedial process to determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment.

The Focused Corrective Measures Study/Feasibility Study (CMS/FS) Report (SRNS 2013) was developed to evaluate remedial alternatives for hazardous substances existing at the WADB. The goals of the remedial actions are to protect human health and the environment and to mitigate the effects of contamination. The focused CMS/FS developed the remedial action objectives and remedial goal options (RGOs) for the remedial actions. The CMS/FS for the WADB (SRNS 2013) contains detailed information and analytical data for all the characterization investigations conducted and samples taken in the media assessment of the WADB. The human health and ecological risk assessments, principal threat source material (PTSM) and contaminant migration (CM) evaluations are presented in the CMS/FS.

The *Record of Decision Remedial Alternative Selection for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit* (U) (SRNS 2018a) was developed to present the selected remedial action for the WADB in support of the Steel Creek IOU. The response action selected in the Record of Decision (ROD) is protective of the public health and welfare and the environment from actual or threatened releases of hazardous substances into the environment.

Arsenic, cesium-137 (+D), potassium-40, radium-226(+D), and uranium-238 (+D) were identified as human health refined constituents of concern (RCOCs) for both the future resident scenario and the future industrial worker scenario. Arsenic, cesium-137 (+D), potassium-40, and radium-226 (+D) were identified as human health RCOCs for both the IOU onsite worker and the trespasser. No PTSM RCOCs were identified for the ash/soil media at Dunbarton Bay (SRNS ~~2018b~~2013).

The CMS/FS also concluded that the naturally-occurring trace metals, associated with the coal ash that are present in the Dunbarton Bay ecosystem, do not pose an unacceptable risk to representative populations inhabiting or utilizing the area or to special species of concern. Therefore, no ecological RCOCs were identified and there are no problems warranting action from an ecological risk perspective (SRNS ~~2018b~~2013).

No constituents were identified at the WADB that would have the potential to migrate to the aquifer and exceed maximum contaminant levels (MCLs), or regional screening levels/preliminary remediation goals in the absence of a MCL, within 1,000 years. Therefore, no CM RCOCs have been determined for the ash/soil media (SRNS ~~2018b~~2013).

During execution of the remedial action in support of the ROD, a 30-m (100-ft) buffer will be enforced at the Dunbarton Bay to be protective of the environment of the bay, thus preventing damage and destruction to its sensitive ecosystem during remedial activities at the WADB (SRNS 2014).

The future land use of the WADB where contaminated ash/soil media is excavated (4.8 hectare [ha {12 acre } {ac}]) will be unrestricted (i.e., no land use controls) when the RGs for the area are met as verified through execution of this FSP.

1.4 Statement of Broad Objectives for the Sampling

Objectives for sampling are to ensure contaminated ash/soil media is removed such that soil sample results indicate that the RGs are met. This will ensure a residential risk of ≤1E-06 or a RCOC concentration ≤ SRS background concentrations, whichever is greater. The soil will be analyzed for the previously identified human health RCOCs. The subunit ROD (SRNS ~~2018b~~2018a) identifies arsenic, cesium-137 (+D), potassium-40, radium-226 (+D), and uranium-238 (+D) as human health RCOCs. With the exception of cesium-137(+D), each of these constituents is addressed in the *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site* (U) (SRNS 2014). The data quality objectives and the sampling design and rationale contained within the subject report (SRNS 2014) apply to cesium-137 (+D) as well as the other radionuclides. Table 1 contains the Summary of RGs for the WADB.

The ~~most likely~~selected RGs in Table 1 consider a comparison to local background levels. The selected RG is the most restrictive risk-based RG if it is greater than background concentrations; if the most restrictive risk-based RG is less than the background concentration, then the selected RG defaults to a SRS background value. With the exception of cesium-137 (+D), RCOCs identified for the ash/soil media are also common constituents in SRS background soil at similar

concentrations. Because of the inherently conservative nature of the risk assessment and RG calculations, it is possible for the risk-based RGs to be less than what occurs naturally in background soil. In order to practically achieve the cleanup level for these common constituents, the RG is set as the 95th percentile concentration in SRS background soil. For cesium-137 (+D), the 95th percentile detected in SRS background soils is 0.34 pCi/g, which is low when compared to "typical" anthropogenic fallout levels generally recognized at 1 pCi/g or less. To account for the variability in background concentrations of cesium-137 (+D) and for consistency with generally recognized fallout levels, the RG for cesium-137 (+D) is set at two times (2X) the 95th percentile of SRS background soil represented at 0.68 pCi/g.

2.0 ANALYTICAL PLAN

The *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site (U)* (SRNS 2014) establishes a general rule of one (1) sample per acre; the area to be remediated at WADB is ~5 ha (12 ac). Sampling will not occur until ash deposits are no longer visible in the excavated areas. An inspection by SRNS Engineering and the SRNS subcontract technical representative (STR) will be performed after the subcontractor has excavated to the planned depths as defined in the Corrective Measures Implementation/Remedial Action Implementation Plan (SRNS 2018b). The inspection will include a field walkdown/reconnaissance of the excavated area. If the soil is stained or grey and the soil texture and grain size distribution are indicative of ash after excavation, additional excavation will be performed until all ash has been removed. After visual inspection that all the ash has been removed, samples from the 0- to 0.3-m (0- to 1-ft) soil interval will be collected from ~~twelve~~ thirteen (~~12~~13) locations within the excavation area as identified in Figure 4. The sampling grid for the WADB is consistent with the frequency of confirmation sampling conducted at other coal and ash removal areas at SRS and is tailored to the excavation pattern and the ash distribution that followed the topographic contours as verified during characterization sampling. The confirmation samples will be ~~and~~ analyzed for arsenic, cesium-137 (+D), potassium-40, radium-226 (+D), and uranium-238 (+D). Table 2 contains the analytical specifications for the WADB. Table 2 is in lieu of the analytical specifications contained in the SAP (SRNS 2014). Refer to the *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site (U)* (SRNS

2014) for the data quality objectives, field analytical sampling, quality assurance/quality control methods, and field implementation equipment.

The analytical portion of the confirmation exercise is meant to corroborate the visual inspection conclusion that no coal and/or ash remains. The sampling is being conducted as a second level of confirmation/verification that the coal and/or coal ash has been removed and the remaining soil concentrations meet RGs. The analytical results from the thirteen (13) samples (mean concentration/activity) will be statistically compared (i.e., hypothesis testing performed) to the RGs as a second level of verification/confirmation that no coal and/or ash related hazardous constituents exceeding residential risk levels or SRS background levels remain at the waste unit following the initial visual inspection. If the mean concentration from the dataset exceeds RGs, the locations of the individual sample result exceedances will be re-examined and considered for additional excavation. Results of the verification sampling will be presented in the Post Construction Report /Remedial Action Completion Report.

2.1 Sample Matrix Table

Table 3 is the sample matrix table for the WADB subunit. The table provides the following information.

A) Sample Count
B) Unit Location
C) Sample Station
D) Sample Number
E) Top Depth
F) Bottom Depth
G) Sample Type
H) Sample Media
I) Collection Method
J) Analyte Code

2.2 Sample Location Map

Figure 4 shows the proposed grid locations for samples to be collected at the WADB ash overflow area. Samples will be taken from each of ~~twelve~~ thirteen designated grid locations; ~~six~~ seven locations in the north ash remediation area (i.e. N-01, N-02,… N-~~06~~07) and six locations in the south ash remediation area (S-~~07~~08, S-~~08~~09,… S-~~12~~13). This sample grid is consistent with the segmentation of the remediation design into the north ash and south ash remediation areas. The design for the north ash remediation area and south ash remediation area have unique sedimentation control measures and construction activities within these areas will be worked in a particular sequence to manage stormwater and to mitigate erosion. The design and construction

aspects of the remediation are described in the Corrective Measures Implementation/Remedial Action Implementation Plan (SRNS 2018b).

Samples shall be from random locations within each designated grid location as determined in the field by the ~~subcontract technical representative (~~STR~~)~~. This strategy will allow for some variation in the boundaries of the excavated area, which is expected, without precluding a predesignated or unforeseen sample location. If the limits of excavation differ from what is shown in Figure 4, the Northing and Easting grid lines will determine inclusion of additional area(s) into a particular grid. A sample location, if deemed appropriate by the STR due to the discovery of additional ash outside of the current ash extent boundary, may be designated outside the boundaries as shown in Figure 4, but in an excavation area determined necessary during field work. The STR shall determine and record coordinates for each actual sample location.

3.0 REFERENCES

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

SRNS, 2013. *Focused Corrective Measures Study/Feasibility Study Report (CMS/FS) for the Wetland Area at Dunbarton Bay In Support of Steel Creek Integrator Operable Unit (U),* Rev. 1.1, SRNS-RP-2012-00252, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC (April)

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

SRNS, 2018a. *Record of Decision Remedial Alternative Selection for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (U),* Rev. 1, SRNS-RP-2013-00730, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC (April)

SRNS, 2018b. *Corrective Measures Implementation/Remedial Action Implementation Plan for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (U),* Rev. ~~1~~0, SRNS-RP-2018-00481, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC (June)

WSRC, 2006. *Background Soils Statistical Summary Report for Savannah River Site,* Rev. 1, ERD-EN-2005-0223, Washington Savannah River Company, Savannah River Site, Aiken, SC (October)

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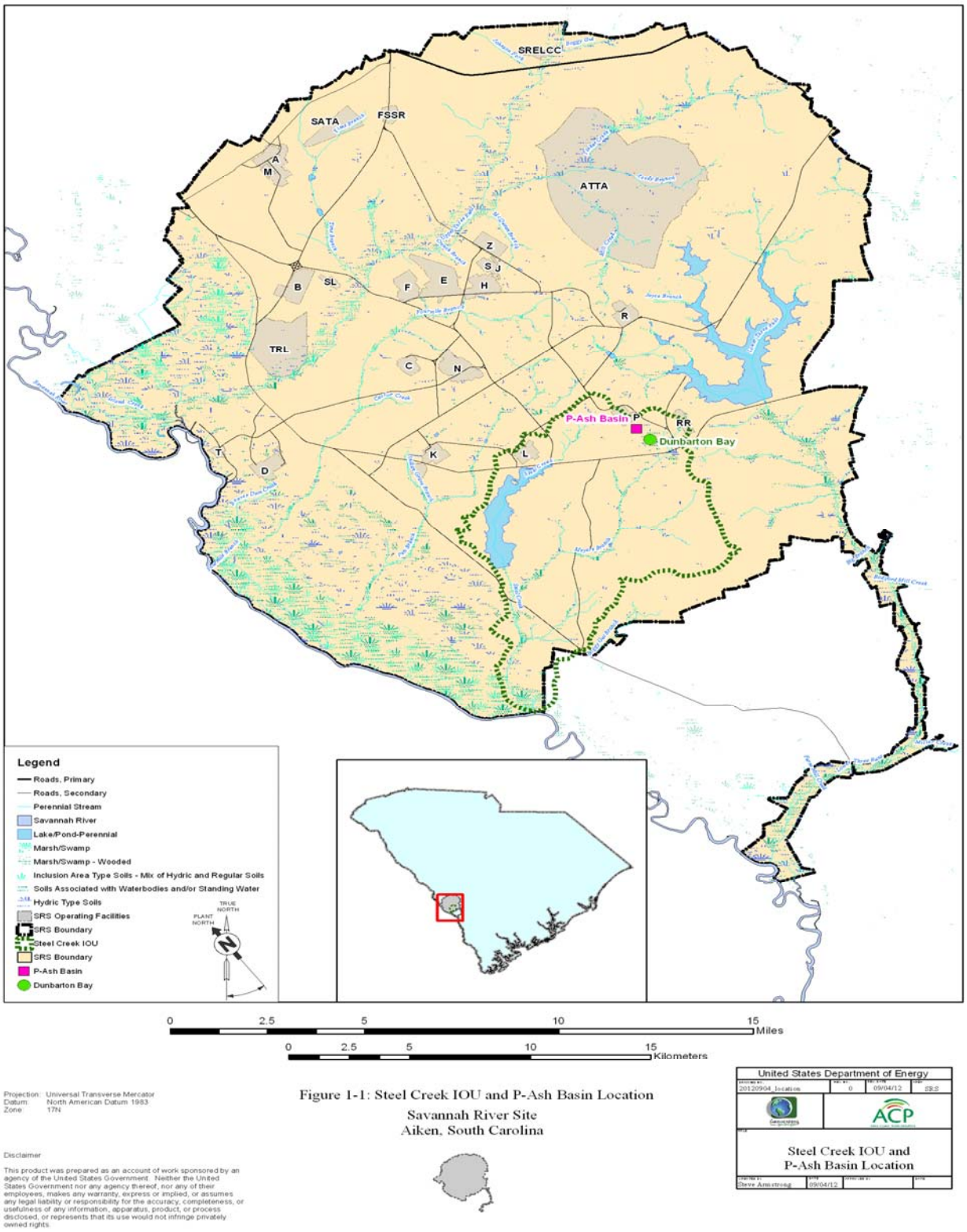

Figure 1. Steel Creek IOU and P-Ash Basin Location

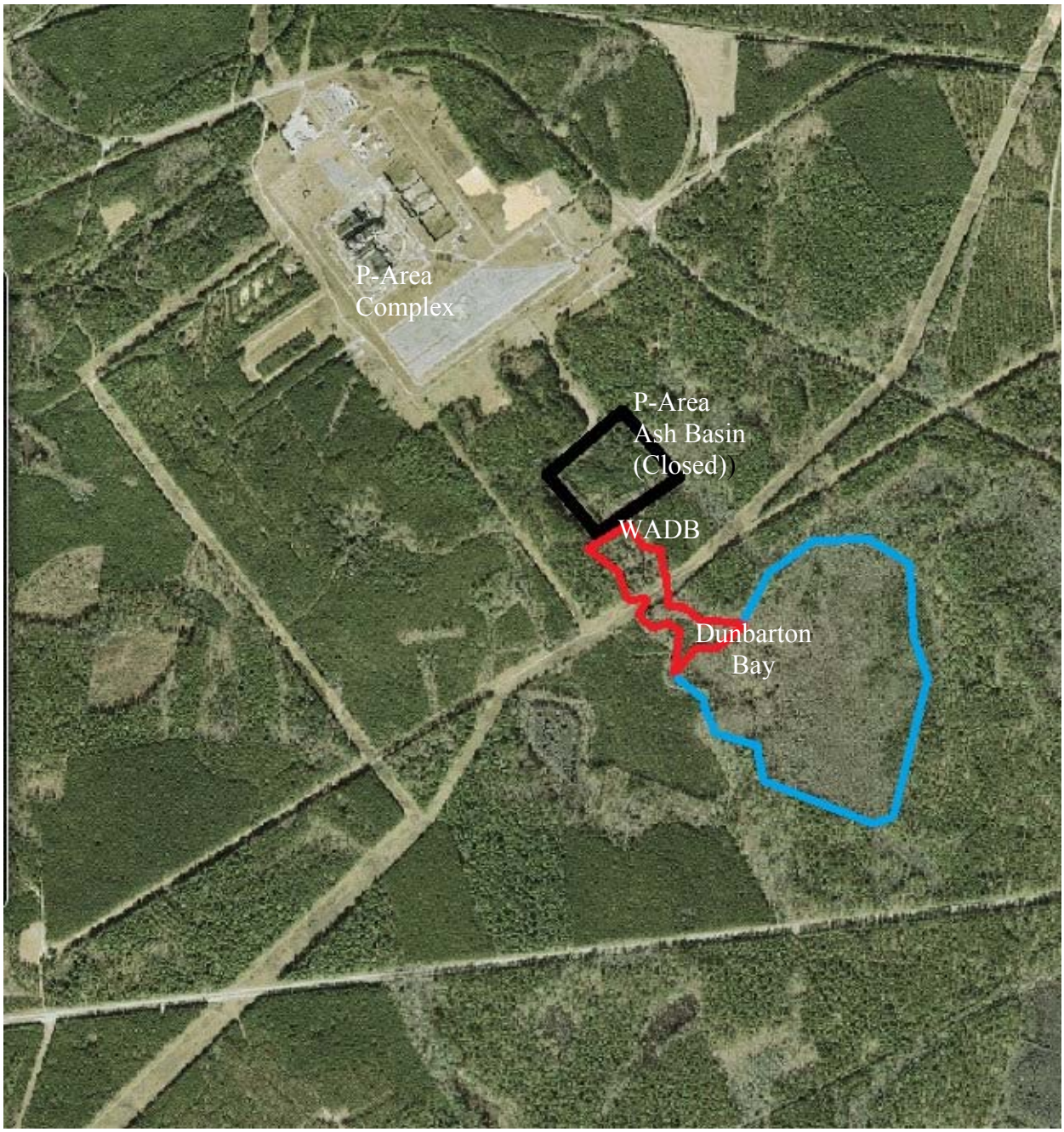

Figure 2. Location of the WADB in P-Area

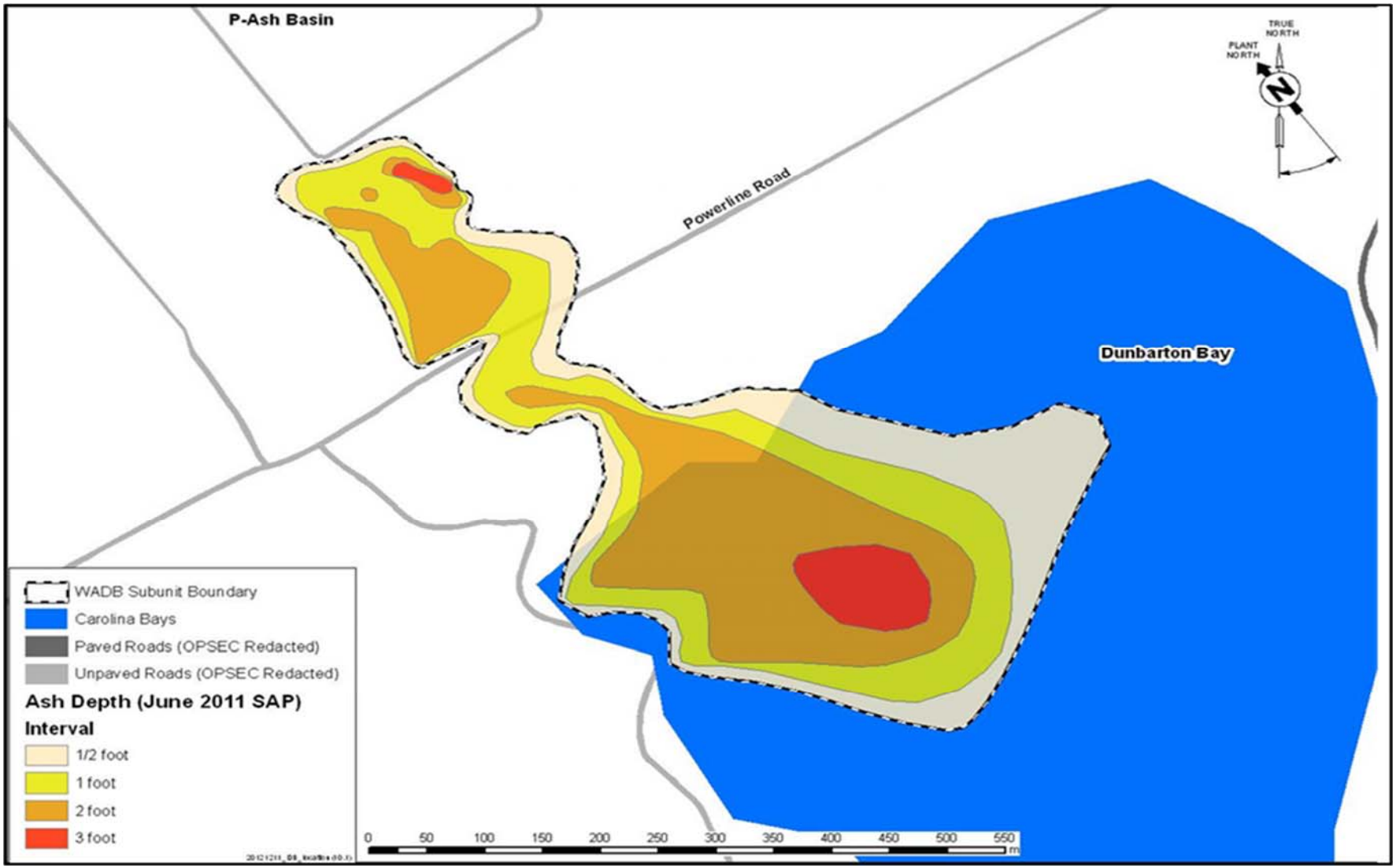

Figure 3. Ash Depths at WADB

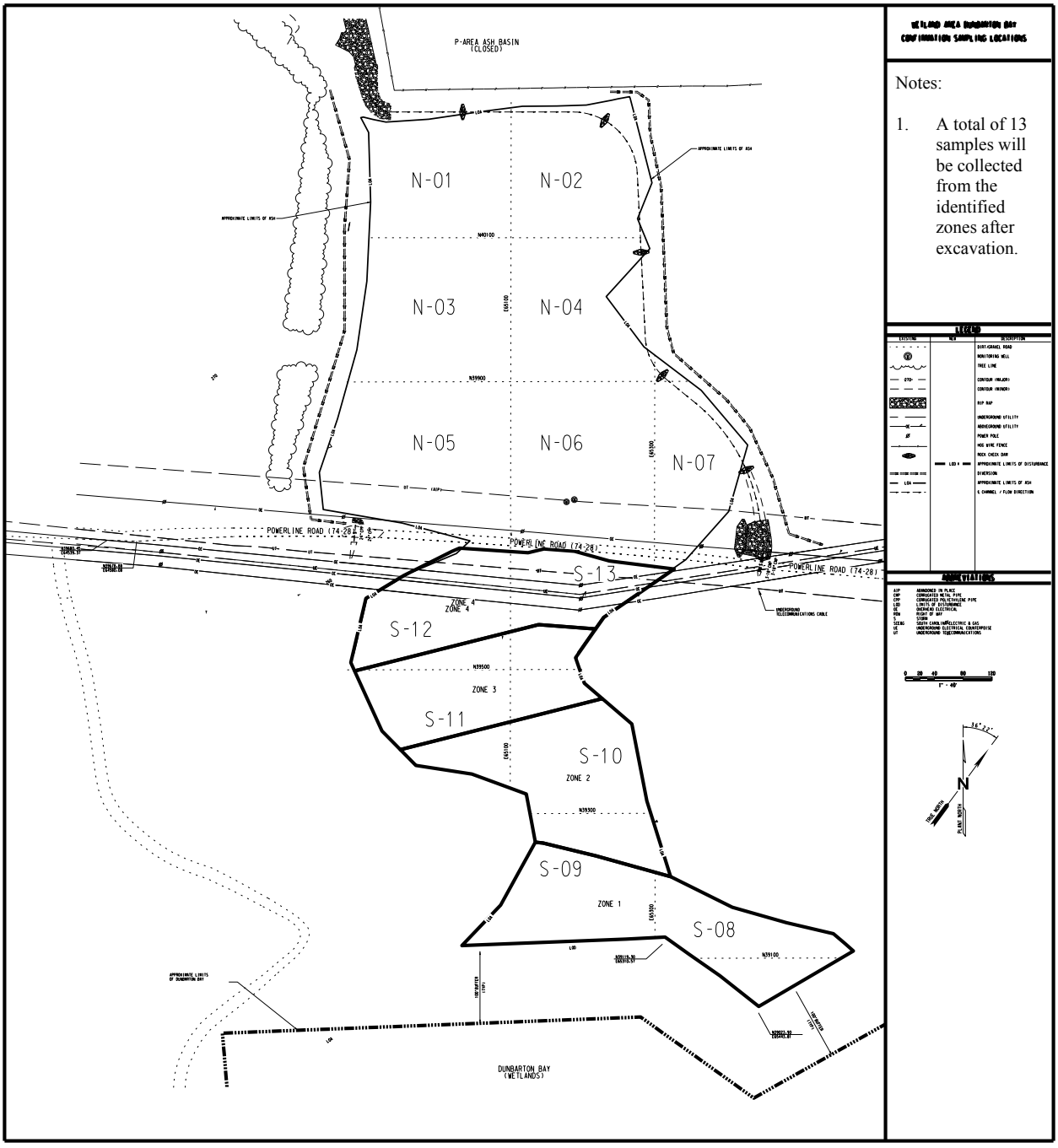

Figure 4. WADB Sampling Grid Locations

Table 1. Summary of the RGs for the Wetlands Area at Dunbarton Bay

Media	RCOC[1]	Unit	ARAR[2]	HHRA Future Resident[3]	HHRA Industrial Worker[4]	HHRA IOU Onsite Worker[5]	HHRA Adolescent Trespasser[6]	PTSM[7]	ERA[8]	CM[9]	Most Restrictive RGO[10]	SRS Background 95th %[11]	SRS Background Maximum[11]	~~Most Likely~~Selected RG[12]
Ash / Soil	Arsenic	mg/kg	---	0.39	1.6	3.3	7.1	---	---	---	0.39	*8.2*	22.9	8.2
	Cesium-137(+D)	pCi/g	---	0.0623	0.103	0.204	0.272	---	---	---	0.0623	0.34 *(0.68)*	3.3	0.68
	Potassium-40	pCi/g	---	0.150	0.265	0.552	0.819	---	---	---	0.150	*3.3*	8.5	3.3
	Radium-226(+D)	pCi/g	---	0.0127	0.0223	0.0464	0.0688	---	---	---	0.0127	*1.2*	1.7	1.2
	Uranium-238(+D)	pCi/g	---	0.725	1.49	NA[13]	NA[13]	---	---	---	0.725	*1.2*	1.9	1.2
Surface Water	None	---	---	---	---	---	---	---	---	---	---			---
Groundwater	None	---	---	---	---	---	---	---	---	---	---			---

1. RCOC = refined constituent of concern
2. ARAR = applicable or relevant and appropriate requirement.
3. HHRA Resident = human health risk assessment. RGOs calculated for the future resident at a target risk of 1E-06 (SRNS 2013).
4. HHRA Industrial Worker = human health risk assessment. RGOs calculated for the future industrial worker at a target risk of 1E-06 (SRNS 2013).
5. HHRA IOU Onsite Worker = human health risk assessment. RGOs calculated for the IOU onsite worker at a target risk of 1E-06 (SRNS 2013).
6. HHRA Adolescent Trespasser = human health risk assessment. RGOs calculated for the adolescent trespasser at a target risk of 1E-06 (SRNS 2013).
7. PTSM = principal threat source material evaluation. No RCOCs identified (SRNS 2013).
8. ERA = ecological risk assessment. No RCOCs identified (SRNS 2013).
9. CM = contaminant migration analysis. No RCOCs identified (SRNS 2013).
10. Most Restrictive RGO = the lesser of the ARAR, HHRA, PTSM, ERA and CM RGOs.
11. SRS background 95th % and maximum = concentrations from the SRS Background Soils Statistical Summary Report, Appendix B-2 (all depths), October 2006 (WSRC 2006). Exception is cesium-137, which is from Appendix B-1 (0-1 ft). Two times (2x) the 95th %tile established as Most Likely RGO for cesium-137 since this is the generally accepted concentration for "typical" anthropogenic fallout.
12. ~~Most Likely~~Selected RG = the most restrictive risk-based RGO if it is greater than background concentrations. If the most restrictive risk-based RGO is less than the background concentration, then the RGO defaults to a SRS background value. Sources of the RGOs in this column are highlighted in italics in the table (SRNS 2018a).
13. NA = not applicable. Uranium-238(+D) not identified as a HH RCOC for the IOU onsite worker or adolescent trespasser receptor scenarios (2013).

Table 2. Laboratory Analytical Specifications of WADB Analytes in Soil and Sediment Media[a]

TAL Analytes				
Analyte	**Analyte ID**	**Preparation Method[a]**	**EPA Method[a]**	**CRDL[b] *(mg/kg)***
Arsenic	7440-38-2	3051A, 3052	EPA6010C	0.312

Radiological Analytes			
Analyte	**Analysis Method**	**Typical Soil Minimum Detection Limit**	**Recommended Standard Method**
Potassium-40	Gamma Pulse Height Analysis	1.0 pCi/g	ASTM C1402-04
Cesium-137(+D)	Gamma Pulse Height Analysis	0.1 pCi/g	ASTM C1402-04
Uranium-238 (+D)	Alpha Spectrometry	0.5 pCi/g	ASTM C1000-11
Radium-226 (+D)	Gamma Pulse Height Analysis	0.1 pCi/g	ASTM C1402-04

a This list is in lieu of that found in the Sampling and Analysis Plan (SRNS 2014)
b Extraction and preparation methods differ depending on media, concentration, laboratory, and analytical method. Preparation methods will also influence detection limits.
c CRDL is the Contract Required Detection Limit and is not always attainable. Laboratory is instructed to obtain the lowest possible method detection limit.

Table 3. Sampling Matrix Table

Sample Count	Unit Location	Sample Station	Sample Number	Top Depth	Bottom Depth	Sample Type	Sample Media	Collection Method	Analyte Code
1	WADB	WADB N-01	01	0	1	REG	Surface soil	Hand auger	1,2,3
2	WADB	WADB N-01	01RB	0	1	RB			1,2,3
3	WADB	WADB N-02	02	0	1	REG	Surface soil	Hand auger	1,2,3
4	WADB	WADB N-03	03	0	1	REG	Surface soil	Hand auger	1,2,3
5	WADB	WADB N-04	04	0	1	REG	Surface soil	Hand auger	1,2,3
6	WADB	WADB N-05	05	0	1	REG	Surface soil	Hand auger	1,2,3
7	WADB	WADB N-05	05FD	0	1	FD	Surface soil	Hand auger	1,2,3
8	WADB	WADB N-06	06	0	1	REG	Surface soil	Hand auger	1,2,3
9	WADB	WADB N-07	07	0	1	REG	Surface soil	Hand auger	1,2,3
~~9~~10	WADB	WADB S-~~07~~08	~~07~~08	0	1	REG	Surface soil	Hand auger	1,2,3
~~10~~11	WADB	WADB S-~~08~~09	~~08~~09	0	1	REG	Surface soil	Hand auger	1,2,3
~~11~~12	WADB	WADB S-~~08~~09	~~08SPL~~09SPL	0	1	SPL	Surface soil	Hand auger	1,2,3
~~12~~13	WADB	WADB S-~~09~~010	~~09~~10	0	1	REG	Surface soil	Hand auger	1,2,3
~~13~~14	WADB	WADB S-~~10~~11	~~10~~11	0	1	REG	Surface soil	Hand auger	1,2,3
~~14~~15	WADB	WADB S-~~11~~12	~~11~~12	0	1	REG	Surface soil	Hand auger	1,2,3
~~15~~16	WADB	WADB S-~~12~~13	~~12~~13	0	1	REG	Surface soil	Hand auger	1,2,3

Regular and QA Sample Summary	
Regular (REG) Samples	**12**
Field Duplicates (FD)	1
Split (SPL) Samples	1
Rinsate Blank (RB)	1
Total Samples	**~~15~~16**

Analyte Code: 1 = TAL Inorganics: As

Analyte Code: 2 = Alpha spectroscopy = U-238

Analyte Code: 3 = Gamma pulse height analysis = Cesium-137, Potassium-40, Radium-226 (Lead-214)

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