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Statement of Basis/Proposed Plan for the G-Area Oil Seepage Basin (GOSB) (761-13G) Operable Unit (OU) (U)

SEMS Number: 93

SRNS-RP-2018-00460

Redline Revision ~~0~~1

~~June~~ October 2018

DISCLAIMER

Printed in the United States of America

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

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximate, approximately
ARAR	applicable or relevant and appropriate requirement
ARF	Administrative Record File
bgs	below ground surface
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cm	centimeter
CM	contaminant migration
CMS	Corrective Measures Study
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
ERA	ecological risk assessment
FFA	Federal Facility Agreement
ft	feet
FS	Feasibility Study
GOSB	G-Area Oil Seepage Basin
HQ	hazard quotient
in.	inches
IOU	Integrator Operable Unit
km	kilometer(s)
L	liter
LLC	Limited Liability Company
LUCs	land use controls
m	meter
m^3	cubic meter
mi	mile(s)
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
OU	Operable Unit
PCB	polychlorinated biphenyl(s)
PTSM	principal threat source material
RAO	Remedial Action Objective
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RGO	Remedial Goal Option
RI	Remedial Investigation
ROD	Record of Decision
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SEMS	Superfund Enterprise Management System

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

SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SVOC	semi-volatile organic compound(s)
TCR	total cumulative risk
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSRC	Washington Savannah River Company, LLC
yd^3	cubic yards

I. INTRODUCTION AND BACKGROUND

Introduction

This Statement of Basis/Proposed Plan (SB/PP) is being issued by the United States Department of Energy (USDOE), which functions as the lead agency for Savannah River Site (SRS) remedial activities, with concurrence by the United States Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). The purpose of this SB/PP is to describe the preferred remedial alternative(s) for the G-Area Oil Seepage Basin (GOSB) Operable Unit (OU), and to provide for public involvement in the decision-making process.

SRS occupies approximately (~) 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is located ~40.2-kilomenters (km [25-miles {mi}]) southeast of Augusta, Georgia, and 32.2-km (20-mi) south of Aiken, South Carolina.

SRS is owned by the USDOE. Management and operating services are provided by Savannah River Nuclear Solutions (SRNS). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are byproducts of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), are currently present in the environment at SRS.

The GOSB is located at the SRS in Barnwell County, South Carolina (Figure 1). A remedial action is needed at the GOSB OU because pesticides/fungicides are present in the sediment and surface water in the basin interior that may potentially pose a threat to human health and the environment. The pesticides/fungicides entered the basin through normal storm water and wastewater flow and included chlordane, dichlorodiphenyltrichloroethane (DDT) (and breakdown products), and silver. Chlordane (banned in 1988) to control termites and ants, and DDT (banned in 1972) as an insecticide, were commonly used in agricultural applications and at SRS up until the time they were banned for use. Note that dichlorodiphenyldichloroethylene (DDE) is a breakdown product of DDT. In addition, silver has been a registered pesticide since 1954 and continues to be a common element in the chemical formulations of disinfectants, sanitizers and fungicides.

The preferred remedial alternative for the GOSB OU is to backfill the basin and manage surface water (Alternative A-4), because it is effective in ~~reducing~~ preventing exposure of contaminated media to human and ecological receptors. Following backfill of the basin, the future land use for the GOSB OU will be unrestricted.

SRS Compliance History

SRS manages certain waste materials that are regulated under the Resource Conservation and Recovery Act (RCRA), a comprehensive law requiring responsible management of hazardous waste. The GOSB OU is a solid waste management unit under RCRA Section 3004(u). SRS received a RCRA hazardous waste permit from the SCDHEC, which was most recently renewed on February 11, 2014 (SC1 890 008 989). Module VIII of the Hazardous and Solid Waste Amendments portion of

the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21, 1989, SRS was included on the National Priorities List. The inclusion created a need to integrate the established RCRA Facility Investigation (RFI) program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 U.S.C. § 9620, USDOE has negotiated a Federal Facility Agreement (FFA) (FFA 1993) with the USEPA and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements. The FFA lists the GOSB OU as a RCRA/CERCLA unit requiring further evaluation using an investigation/assessment process that integrates and combines the RFI process with the CERCLA Remedial Investigation (RI) process to determine the actual or potential impact to human health and the environment of releases of hazardous substances to the environment.

Both RCRA and CERCLA require the public to be given an opportunity to review and comment on the draft RCRA permit modification and proposed remedial alternatives. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA 42 U.S.C. § 9613 and 9617. These requirements include establishment of an Administrative Record File (ARF) that documents the investigation and selection of remedial alternatives and allows for review and comment by the public regarding those alternatives (See Section II). The ARF must be established at or near the facility at issue. The SRS FFA Community Involvement Plan (WSRC 2011) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action.

SCHWMR R.61-79.124 requires that a brief description and response to all significant comments be made available to the public as part of the RCRA Administrative Record. Community involvement in consideration of this evaluation of alternatives for the GOSB is strongly encouraged. All submitted comments will be reviewed and considered. Following the public comment period, a Responsiveness Summary will be prepared to address issues raised during the public comment period. The Responsiveness Summary will be made available with the final RCRA permit modification and the Record of Decision (ROD).

The final remedial decision will be made only after the public comment period has ended and all the comments have been received and considered. The final remedial decision under RCRA will be in the form of a final permit modification, which is made by SCDHEC. Selection of the remedial alternative that will satisfy the FFA requirements will be made by USDOE, in consultation with USEPA and SCDHEC. It is important to note that the final action(s) may be different from the preferred alternative discussed in this plan depending on new information or public comments. The alternative chosen will be protective

of human health and the environment and comply with all Federal and State laws.

II. COMMUNITY PARTICIPATION

The FFA ARF, which contains the information pertaining to the selection of the response action, is available at the following locations:

US Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina – Aiken
471 University Parkway
Aiken, South Carolina 29803
(803) 641-3504

Thomas Cooper Library
Government Information and Maps Department
University of South Carolina
1322 Green Street
Columbia, South Carolina 29208
(803) 777-4841

Hard copies of the SB/PP are available at the following locations:

Reese Library
Government Information Department
Augusta University
2500 Walton Way
Augusta, Georgia 30904
(706) 737-1744

Asa H. Gordon Library
Savannah State University
2200 Tompkins Road
Savannah, Georgia 31404
(912) 358-4324

The RCRA ARF for SCDHEC is available for review by the public at the following locations:

The South Carolina Department of Health and Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, South Carolina 29201
(803) 898-2000

The South Carolina Department of Health and Environmental Control
Aiken Environmental Affairs Office
206 Beaufort Street, Northeast
Aiken, South Carolina 29801
(803) 642-1637

The public will be notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to citizens in South Carolina and Georgia, and through notices in the *Aiken Standard*, *The Augusta Chronicle*, *The People-Sentinel*, and *The State* newspapers. The public comment period will also be announced on local radio stations.

USDOE will provide an opportunity for a public meeting during the public comment period if significant interest is expressed. The public will be notified of the date, time, and location. At the meetings, the proposed action will be discussed, and questions about the action will be answered.

To request a public meeting during the public comment period, to obtain more information concerning this document, or to submit written comments, contact one of the following:

Janet Griffin
Savannah River Nuclear Solutions, LLC
Public Involvement
Savannah River Site
Building 730-1B
Aiken, South Carolina 29808
(803) 952-8467
janet.griffin@srs.gov

The South Carolina Department of Health and Environmental Control
Attn: David Scaturo, P.E., P.G., Director
Division of Waste Management
Bureau of Land and Waste Management
2600 Bull Street
Columbia, South Carolina 29201
(803) 898-2000

Following the public comment period, a ROD will be signed, and a final decision for the SRS RCRA permit will be issued. The ROD and RCRA permit will detail the remedial alternative chosen for this OU and include responses to oral and written comments received during the public comment period in the Responsiveness Summary.

III. OPERABLE UNIT BACKGROUND

The GOSB OU is located southeast of N Area (Central Shops) in relatively flat terrain, ~54-meters (m) (180-feet [ft]) south of the railroad tracks, which run adjacent to Central Shops (Figure 2). The area surrounding the GOSB OU is wooded with heavy underbrush and contains no stressed vegetation or other visual indications of contamination (Figure 3).

The basin is ~45-m (150-ft) long and ~28.5-m (95-ft) wide. The basin is ~3-m (10-ft) deep around the edges of the basin with berms on the northern and southern sides (0.9-m [3-ft] and 0.6-m [2-ft] high, respectively). The remaining two sides of the basin are roughly even with the surrounding grade. The deepest part of the basin, near the center, is ~4.8-m (16-ft) below ground surface (bgs) (Figure 4). Depth to groundwater is ~9- to 12-m (30- to 40-ft) bgs and ~6- to 7.5-m (20- to 25-ft) below the basin bottom. Approximately 57 m (190 ft) of buried 30-centimeters (cm [12-inches {in.}]) vitrified clay pipe (previously abandoned in place) runs to the inlet side of the basin. On the outlet side of the basin, ~153 m (510 ft) of buried 30-cm (12-in.) vitrified clay pipe discharges southeast of the basin into an intermittent stream. Both inlet and outlet pipes are buried to a depth of ~1.8- to 2.4-m (6- to 8-ft) bgs.

The GOSB was initially used for liquid waste disposal during SRS plant construction (1951-1956) and later for receipt of effluent from sanitary wastewater treatment plants in Central Shops. The basin may have received unknown liquid waste from the time of plant construction until the early 1960s. However, there are no records indicating that disposal of radioactive or hazardous materials at the GOSB occurred. Prior to 1983, the basin received effluent from a smaller sanitary wastewater treatment facility. The designation of the basin as an oil seepage basin may be a misnomer, as there is no information available to support the specific use of the basin for management and disposal of waste oils. The GOSB was also known as the N-Area Oil Seepage Basin (761-13N) on early SRS engineering drawings.

The basin received effluent from the Central Shops sanitary wastewater treatment plant from 1983 until 1992. The discharge of the effluent from the Central Shops wastewater treatment plant to the GOSB OU was regulated under a National Pollutant Discharge Elimination System (NPDES) permit. An analysis of sanitary wastewater effluent discharged to the basin was included in the NPDES permit application on June 30, 1988. Detected concentrations of metals (i.e., aluminum, barium, copper, magnesium, and iron) were reported in the effluent. Chromium, lead, and silver were reported as not detected. Bromoform and chloroform were the only volatile organic compounds (VOCs) detected in the effluent sample, and no pesticides or semi-VOCs (SVOCs) were detected (WSRC 1991). Two surface water samples and one sediment sample were collected from the basin in February 1989. Barium, chromium, lead, silver, and chlordane were detected in the sediment sample at higher concentrations than other

inorganics. Bromoform, 1,3-dichlorobenzene, and 1,2-dichlorobenzene were detected in the surface water samples (WSRC 1991).

The basin has received no discharges since it was isolated from the active system in the early 1990's. The basin was drained and the sewer line was plugged as part of the isolation. Since the isolation, rainwater continues to accumulate and be retained in the basin due to normal rainfall, with the quantity fluctuating throughout the year. Currently, sediment in the basin is covered with ~20 cm (8 in.) of leaf debris and decayed organic material. The amount of rainwater in the basin varies with an estimated maximum of 1,567,160 liters (L [414,000 gallons {gal}]). Sandy clay underlies the decayed organic material.

For evaluation purposes, the GOSB OU was segregated into the following four subunits: 1) GOSB Interior, 2) GOSB Berm, 3) Pipeline, and 4) Effluent Discharge (Figure 2). Groundwater is not a subunit of the GOSB OU and will be addressed as part of the Central Shops Groundwater OU. Characterization of the GOSB was conducted in 2009 and 2016-2017. The sampling locations are shown in Figure 5.

Basin Interior Subunit

In 2009, ten composite basin floor/wall sediment samples were collected from the 0- to 0.3-m (0- to 1-ft) and 0.3- to 1.2-m (1- to 4-ft) intervals and analyzed for inorganics (metals), pesticides, polychlorinated biphenyls (PCBs), VOCs, SVOCs and radiological indicators (gross alpha/ nonvolatile beta). Constituents detected in these sediment samples include inorganics (metals), pesticides, VOCs, SVOCs (i.e., polycyclic aromatic hydrocarbons), and radionuclides.

In 2009, five surface water samples were collected from within the basin and analyzed for inorganics (metals), pesticides, PCBs, VOCs, SVOCs, and radiological indicators. Constituents detected in these surface water samples included inorganics (metals), pesticides, VOCs, and radiological indicators.

In 2016, six surface water samples were collected from the within the GOSB and analyzed for inorganics (metals), VOCs, SVOCs, and radiological indicators. Constituents detected in these surface water samples included inorganics (metals), VOCs, and radiological indicators.

Groundwater is not a part of the GOSB OU, but the decision was made to collect groundwater samples in the vicinity of the basin to determine whether or not a past release to the shallow aquifer had occurred. In 2017, filtered and unfiltered groundwater samples were collected from eight piezometers and were analyzed for inorganics (metals), pesticides, PCBs, VOCs, SVOCs, and radiological indicators. Constituents detected in these groundwater samples included inorganics, (metals), pesticides, SVOCs/VOCs, and radiological indicators.

Basin Berm Subunit

In 2009, 39 soil samples were collected from 13 locations along the basin perimeter at 15-m (50-ft) intervals. At each sampling location, soil samples were collected from the 0- to 0.3-m (0- to 1-ft), 0.3- to 1.2-m (1- to 4-ft), and 2.4- to 3-m (8- to 10-ft) intervals and analyzed for inorganics (metals), pesticides, PCBs, VOCs, SVOCs, and radiological indicators. Constituents detected in the berm soil samples were inorganics (metals), pesticides, PCBs, VOCs, SVOCs, and radiological indicators. No data gaps were

identified for the Basin Berm Subunit and no new data was collected for this subunit during the 2016-2017 sampling event.

Pipeline Subunit

In 2009, soil sampling occurred at 29 locations, which were spaced ~7.6-m (25-ft) along both sections of the pipeline. The data objective was to characterize the impact of any leaks from the pipeline. All pipeline samples were collected from the 2.4- to 3-m (8- to 10-ft) depth interval along the buried clay pipe and analyzed for Target Compound List VOCs, SVOCs, and PCBs, Target Analyte List inorganics, and radiological indicators. Detected soil constituents included inorganics (metals), VOCs, and SVOCs. No data gaps were identified for the Pipeline Subunit and no new pipeline data was collected during the 2016-2017 sampling event.

Effluent Discharge Subunit

In 2009, effluent discharge sampling occurred at three locations at depth intervals of 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft). The data objective was to characterize the impact of GOSB pipeline effluent on the shallow soil. Samples were analyzed for VOCs, SVOCs, and pesticides/PCBs, inorganics (metals), tritium, and radiological indicators/gamma spectroscopy. Detected soil constituents included inorganics (metals), pesticides, VOCs, and SVOCs. In 2016, six additional soil samples were collected from three locations at intervals of 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft) near the end of the pipeline to better characterize the nature and extent of contaminants. Detected soil constituents included VOCs, pesticides, PCBs, inorganics (metals), and radiological indicators.

Results of the characterization efforts are documented in the RFI/RI/Baseline Risk Assessment (BRA)/ Corrective Measures Study (CMS)/Feasibility Study (FS) (Rev. 1), March 2018 (SRNS 2018). This document has been submitted to the USEPA and SCDHEC for review and approval.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

Due to the complexity and size of multiple waste units located in different areas of the SRS, the Site is divided into watersheds for the purpose of managing a comprehensive cleanup strategy. The SRS is segregated into six watersheds: Upper Three Runs, Lower Three Runs, Fourmile Branch, Steel Creek, Pen Branch, and the Savannah River and Floodplain Swamp. In addition, the SRS also identifies six Integrator Operable Units (IOUs) which are the surface water bodies and associated wetlands that correspond to the six respective watersheds. Waste units within a watershed may be evaluated and remediated individually or grouped with other waste units and evaluated as part of a larger Area OU. Upon disposition of all the waste units within a watershed, a final comprehensive ROD for the corresponding IOU (i.e., surface water and associated wetlands) will be pursued with additional public involvement. The GOSB OU is located within the Pen Branch watershed (Figure 1).

V. SUMMARY OF SITE RISKS

This section identifies the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial actions. Additional information pertaining to the risk

assessment can be found in the RFI/RI/BRA/CMS/FS (SRNS 2018).

Summary of Human Health Risk Assessment

The human health risk assessment evaluates the potential for adverse effects associated with exposure to constituents present at the GOSB. The assessment for each subunit estimates the risk potential in the absence of any remedial action and provides a basis for determining whether or not a remedial action is necessary.

The GOSB OU is in an area currently designated for industrial use. No current or projected future development of the basin unit is planned, nor is the current land use expected to change. Nevertheless, to support the risk management decision-making, both the residential (unrestricted) and industrial land use scenarios are evaluated.

The hypothetical receptors evaluated include future resident and future industrial worker. A description of each is presented below.

The *future resident* receptor scenario evaluates long-term risks to individuals assumed to have unrestricted use of the area that consists of the GOSB subunits. This scenario considers residents (adults and children) that hypothetically live on the subunits and are exposed chronically, both indoors and outdoors, to subunit contaminants. The standard exposure assumptions are 26 years, 350 days per year, and 24 hours per day. Exposure routes associated with soil include inhalation of particulates and vapors, external exposure to radiation, dermal absorption, and incidental ingestion.

The future resident receptor scenario is also evaluated for the surface water media. This includes a comparison of constituents to surface water threshold levels based on regulatory-based limits (i.e., maximum contaminant levels) or risk-based threshold values, as appropriate.

The *future industrial worker* scenario is a standard USEPA exposure scenario, which addresses long-term risks to workers who are exposed to subunit contaminants within an industrial setting. The standard exposure assumptions are 25 years, 250 days per year, and 8 hours per day. This receptor is referred to as "composite worker" by USEPA and is analogous to the term "industrial worker" used herein. The future industrial worker scenario considers an adult who hypothetically works on-unit in an outdoor setting for the majority of time. Exposure routes include inhalation, external exposure to radiation, dermal absorption, and incidental ingestion to soil.

Refined constituents of concern (RCOCs) are those constituents that are retained following a weight-of-evidence evaluation and require consideration of remedial actions. There were no human health RCOCs for the Pipeline Subunit, Basin Berm Subunit, or the Effluent Discharge Subunit. The human health RCOCs for the Basin Interior Subunit are as follows:

- RCOCs identified in sediment for the future resident scenario include alpha-chlordane (risk = 2.6E-06), gamma-chlordane (risk = 6.4E-06), DDE (risk = 2.3E-06), dieldrin (risk = 1.0E-05) and heptachlor epoxide (risk = 9.1E-06) with a total cumulative risk (TCR) = 3.0E-05 (Figure 6).
- RCOCs identified in sediment for the future industrial worker scenario include gamma-chlordane (risk = 1.4E-06), dieldrin (risk =

2.4E-06), and heptachlor epoxide (risk = 1.9E-06) with a TCR associated with these pesticide RCOCs = 5.7E-06 (Figure 7).

Summary of Ecological Risk Assessment

The ecological risk assessment (ERA) consists of steps designed to provide a scientifically based and defensible evaluation of exposure and hazard to ecological resources that will support a risk management decision regarding Site remediation.

Ecological risk is associated with the potential for harmful effects to ecological systems resulting from exposure to an environmental stressor. A stressor is any physical, chemical, or biological entity that induces an environmental response. Stressors may adversely affect specific natural resources or entire ecosystems, including plants and animals, as well as the environment with which they interact. There were no ERA RCOCs for the Pipeline Subunit, Basin Berm Subunit, or the Effluent Discharge Subunit. The ERA RCOCs for the Basin Interior Subunit are as follows:

- Alpha-chlordane (HQ = 100), gamma-chlordane (HQ =148), DDD (HQ = 50), DDE (HQ =278), dieldrin (HQ = 12), heptachlor epoxide (HQ = 12), and silver (HQ = 40) within the 0- to 0.3-m (0- to 1-ft) depth interval pose risk to benthic organisms (Figure 8).

  ERA RCOCs for surface water in the Basin Interior Subunit are as follows:

- Alpha-chlordane (HQ = 9), gamma-chlordane (HQ = 9) and silver (HQ = 30) are present at levels that exceed an HQ = 1 for aquatic organisms (Figure 9).

Summary of Contaminant Fate and Transport Analysis

To determine the potential for groundwater contamination, a contaminant migration (CM) analysis was performed to assess the migration potential of residual vadose zone contaminants. It was concluded that the contaminants are not present in any soil that would leach to groundwater at concentrations greater than drinking water standards within 1,000 years, and no CM RCOCs were identified.

Groundwater samples collected as part of the 2017 sampling effort confirmed there were no contaminant releases from the basin, and corroborate the conclusions of the CM analysis.

Principal Threat Source Material (PTSM)

An evaluation for source materials that could potentially migrate to groundwater or are highly toxic was conducted as part of the PTSM assessment in the RFI/RI/BRA/CMS/FS document (SRNS 2018). The quantitative evaluation concluded that there are no contaminants that constitute PTSM at the GOSB OU.

Conclusion

As determined in the RFI/RI/BRA/CMS/FS (SRNS 2018), the Basin Interior Subunit located within the GOSB OU was identified as having problems warranting action under the potential future resident and industrial worker scenarios. The basin interior also poses a potential threat to ecological receptors for benthic and aquatic organisms.

Actual or threatened releases of hazardous substances from this waste unit, if not addressed by the Preferred Alternative or one of the other active measures

considered, may present a current or potential threat to public health, welfare, or the environment.

No RCOCs for either the future resident or the future industrial worker scenario were identified for the Basin Berm, Pipeline, or Effluent Discharge subunits.

VI. REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are media- or OU-specific objectives for protecting human health and the environment. RAOs usually specify potential receptors and exposure pathways, and are identified during project scoping once the conceptual site model is understood. RAOs describe what the remediation must accomplish and are used as a framework for developing remedial alternatives. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure.

The GOSB OU is in an area currently designated for industrial use with the USDOE maintaining control of the land. Following implementation of the preferred remedial action, the future land use at the GOSB OU will be unrestricted.

The following RAOs have been identified for the GOSB Basin Interior Subunit sediment media:

- Protect the future resident receptor from exposure to alpha-chlordane, gamma-chlordane, DDE, dieldrin, and heptachlor epoxide in sediment within the 0 to 0.3 m (0 to 1 ft) interval that exceeds 1E-06 risk based threshold level. Also, protect the future industrial worker receptor from exposure to the pesticides gamma-chlordane, dieldrin, and heptachlor epoxide in sediment within the 0- to 0.3-m (0- to 1-ft) interval that exceeds 1E-06 risk based threshold level. The primary route of exposure for both scenarios is the incidental ingestion pathway.

- Protect ecological receptors from exposure to alpha-chlordane, gamma-chlordane, DDD, DDE, dieldrin, heptachlor epoxide and silver in sediment that exceed an HQ = 1. The primary route of exposure is the direct contact pathway.

Based on the problem warranting action, the following RAO applies for GOSB Interior Subunit surface water media:

- Protect ecological receptors from exposure to alpha-chlordane, gamma-chlordane, and silver in surface water that exceed an HQ = 1. The primary route of exposure is the direct contact pathway.

Remedial Goal Options (RGOs)

RGOs serve to provide a range of cleanup goals for each RCOC and are typically identified along with the RAOs. These cleanup goals are either concentration levels that correspond to a specific risk or hazard or are based on Applicable, or Relevant and Appropriate Requirements (ARARs). Following public comment and approval of the SB/PP, the RGOs for the selected remedy are documented as final cleanup goals or remedial goals in the ROD.

The RFI/RI/BRA/CMS/FS for the GOSB OU (SRNS 2018) presents a range of human health RGOs corresponding to target cancer risks of 1E-06 through 1E-04. RGOs were calculated for the residential and industrial worker scenarios as well as ecological receptors and are presented in Table 1.

Applicable or Relevant and Appropriate Requirements

ARARs are cleanup standards, standards of control and other substantive requirements, criteria or limitations promulgated under Federal, State, or local environmental laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Section 121(d) of CERCLA, as amended by the Superfund Amendments Reauthorization Act, requires that remedial actions comply with requirements and standards set forth under Federal and State environmental laws.

Three categories of ARARs are identified to clarify how to identify and comply with environmental requirements. They include action-specific, location-specific, and chemical-specific requirements:

- Action-specific ARARs control or restrict the design, performance, and other aspects of implementation of specific remedial activities;
- Location-specific ARARs reflect the physiographic and environmental characteristics of the unit or the immediate area, and may restrict or preclude remedial actions depending on the location or the characteristics of the unit:
- Chemical-specific ARARs are media-specific concentration limits promulgated under Federal or State law.

The potential ARARs for the remedial alternatives are summarized in Table 2.

VII. SUMMARY OF REMEDIAL ALTERNATIVES

The range of alternatives includes an option that involves little or no treatment yet provides protection to human health and the environment by preventing or controlling exposure through land use controls (LUCs). Remedial alternatives were developed for the Basin Interior Subunit to address pesticide contamination in the sediment and surface water. A detailed cost analysis for all alternatives is provided in Appendix A.

No action is needed for the Basin Berm, Pipeline, or Effluent Discharge Subunits.

Alternative A-1. No Action

The No Action alternative is required by the National Contingency Plan (NCP) to serve as a baseline for comparison with other remedial alternatives. Contaminated media would remain in place and no LUCs or active remediation would be conducted to control current and/or future potential risk; to treat or remove contaminated media; or to reduce toxicity, mobility, or volume of the contaminated media. The No Action alternative would not address the risk to residents or industrial workers to the contaminated sediments or the risks to benthic and aquatic organisms via exposure to the contaminated sediments and surface water. This alternative does not include a five-year remedy review.

Summary of Costs

Capital Cost	$0
Operations and Maintenance (O&M)	$0
Total Present-Worth Cost	$0

Alternative A-2. Land Use Controls

LUCs that include institutional controls (i.e., administrative measures) and engineering controls (i.e., signs, fences, etc.) are not appropriate as a stand-alone remedy for the GOSB Interior Subunit as it does not address the RAO for protection of ecological receptors. Therefore, LUCs as a standalone remedy were not retained for a detailed analysis.

Alternative A-3. Place 0.6-m (2-ft) Clean-Fill Layer and Manage Surface Water

Alternative A-3 was carried forward for a detailed analysis. Alternative A-3 consists of placing 0.6-m (2-ft) of clean fill over the impacted basin-bottom sediments to break the direct exposure pathway. Specifically, this remedial alternative includes dewatering of the basin, site clearing for equipment staging, installation of temporary erosion control measures, and road improvements for the purpose of hauling and placing ~466 m^3 (610 yd^3) of clean fill to cover the basin bottom sediments. Sampling of rainwater collected in the basin after remedial action completion would be necessary to confirm the effectiveness of the remedy. Alternative A-3 would require LUCs and five-year remedy reviews.

Summary of Costs

Capital Cost	$1,427,970
O&M	$1,643,599
Total Present-Worth Cost	$3,071,569

Alternative A-4. Backfill Basin and Manage Surface Water

Alternative A-4 was also carried forward for a detailed analysis. This alternative entails backfilling of the basin by a controlled compaction method with clean fill, and construction of a vegetative cover. The thickness of the required fill material, a minimum of 3.05 m (10 ft) in the shallow end of the basin and a minimum of 4.9 m (16 ft) in the deeper end of the basin, will prevent exposure to pesticides buried at depth. Specific activities associated with this remedial alternative include dewatering of the basin, clearing ~0.27 ha (0.67 ac), excavation of the berms, backfilling the basin with ~4,460 m^3 (5,834 yd^3) of clean soil and berm soil, compacting fill material to mitigate subsidence followed by compaction testing, and grading and construction of a soil and vegetated cover over the basin footprint. Temporary erosion control measures such as silt fencing along the haul roads and as necessary to protect nearby outfalls will be used during construction activities. This alternative will require site clearing for equipment staging and road improvements to accommodate the high volume of truck traffic for hauling in soil backfill. For the purpose of developing a cost estimate, dewatering of the basin is assumed to be by pumping and spray irrigating.

Alternative A-4 would not require LUCs or five-year remedy reviews.

Summary of Costs

Capital Cost	$1,811,848
O&M	$15,217
Total Present-Worth Cost	$1,827,066

Alternative A-5. Excavate and Manage Surface Water

Alternative A-5 was carried forward for a detailed analysis. This alternative consists of excavation of the contaminated sediments in the basin with off-site disposal. Specifically, this remedial alternative

includes dewatering of the basin, clearing ~0.27 ha (0.67 ac), installation of erosion control measures such as silt fencing along portions of the haul roads and where needed to protect nearby outfalls, excavation and hauling of ~566 m^3 (740 yd^3) of contaminated basin sediments, located 1.2-m (4-ft) below the basin bottom, to an off-site solid waste disposal facility.

No debris is anticipated based on observations of the basin when it was drained in the early 1990's. Offsite disposal of any debris encountered will be managed as CERCLA waste and disposed of at an approved waste disposal facility. Trees cleared to gain access to the basin will be pushed aside and left near the site.

Post-excavation confirmation samples will be collected and analyzed to confirm that the remedial goals have been achieved. For estimating purposes 10 post-excavation confirmation samples (pesticides and metals) and 10 waste characterization samples (Toxicity Characteristic Leaching Procedure) were assumed to be necessary.

Alternative A-5 would not require LUCs or five-year remedy reviews.

Summary of Costs

Capital Cost	$1,700,711
O&M	$15,217
Total Present-Worth Cost	$1,715,929

VIII. EVALUATION OF ALTERNATIVES

This section summarizes the results of the evaluation of the remedial alternatives in the GOSB CMS/FS.

The NCP (40 Code of Federal Regulations [CFR] 300.430(e)(9)) requires that potential remedial alternatives undergo detailed analysis using relevant evaluation criteria that will be used to select a final remedy. USEPA has established nine evaluation criteria to address the statutory requirements under CERCLA. The criteria fall into categories of: threshold criteria, primary balancing criteria, and modifying criteria. The nine evaluation criteria are detailed in Table 3.

Comparative Analysis of Alternatives

The potential remedial alternatives have been evaluated against the threshold and primary balancing criteria. Modifying criteria (i.e. state or support agency acceptance and community acceptance) will be evaluated after the public comment period on the SB/PP. Provided below is a summary of the comparison of the alternatives against the CERCLA evaluation criteria. Key advantages and disadvantages for each alternative relative to one another and in relation to the two threshold criteria and five primary balancing criteria are discussed below and summarized in Table 4.

Overall Protection of Human Health and the Environment

Alternative A-1 — No Action does not address the risk to the future industrial worker or resident to contaminated sediments or risk to aquatic and benthic organisms via exposure to contaminated sediments and surface water. Therefore, Alternative A-1 is not protective of human health and the environment.

Alternative A-3 — Place 0.6-m (2-ft) Clean Fill Layer and Manage Surface Water) provides protection of human health and the environment and would achieve RAOs in a short period (several months) of time. This alternative consists of placing 0.6-m (2-ft) of clean fill over the impacted basin-bottom sediments to break the

direct exposure pathway to human and ecological receptors. Prior to placing the fill, the surface water within the basin will be spray irrigated to the land surface; an additional evaluation that examines the risk posed by any short-term or cross-media impacts due to spray irrigation of the water to the land surface is provided in Appendix B. In addition, risk-based protective levels for the RCOCs in the surface water at the point of land application are derived in Appendix B. The conservative evaluation concludes that land application of the GOSB surface water does not pose a threat to human or terrestrial ecological receptors.

Alternative A-4 — Backfill Basin and Manage Surface Water provides protection of human health and the environment and would achieve RAOs in a short period (several months) of time. This alternative entails backfilling of the basin by a controlled compaction method with clean fill and construction of a vegetative cover to break the direct exposure pathway to human and ecological receptors. Prior to backfilling the basin, the surface water within the basin will be spray irrigated to the land surface; an additional evaluation that examines the risk posed by any short-term or cross-media impacts due to spray irrigation of water to the land surface is provided in Appendix B. In addition, risk-based protective levels for the RCOCs in the surface water at the point of land application are derived in Appendix B. The conservative evaluation concludes that land application of the GOSB surface water does not pose a threat to human or terrestrial ecological receptors.

Alternative A-5 — Excavate and Manage Surface Water physically removes the source of contamination and provides protection of human health and the environment and would achieve RAOs in a short period (several months) of time. This alternative consists of excavation of the contaminated sediments in the basin to break the direct exposure pathway to human and ecological receptors. Prior to excavation, the surface water within the basin will be spray irrigated to the land surface; an additional evaluation that examines the risk posed by any short-term or cross-media impacts due to spray irrigation of water to the land surface is provided in Appendix B. In addition, risk-based protective levels for the RCOCs in the surface water at the point of land application are derived in Appendix B. The conservative evaluation concludes that land application of the GOSB surface water does not pose a threat to human or terrestrial ecological receptors.

Compliance with ARARs

There are no ARARs associated with Alternatives A-1; however, there are action-specific ARARs for Alternatives A-3, A-4, and A-5 associated with basin water management, particulate air emissions, storm water control, and disposal of solid waste to an off-unit permitted landfill.

Short-Term Effectiveness

Alternative A-1 does not meet the RAOs and will continue to adversely affect the environment.

Alternative A-3 can be completed in a short timeframe while posing no risk to the community. Remedial workers have the greatest risk of exposure during construction activities. Initial protection against the threats associated with exposure to contaminated sediments would be achieved in less than six months from the commencement of construction activities.

Alternate A-4 can be completed in a short timeframe while posing no risk to the community. Initial protection against the threats associated with exposure to contaminated sediments and achievement of the RAOs would be achieved in less than 6 months from the commencement of construction activities. Remedial workers will have the greatest risk of exposure during construction activities. Use of best management practices during construction and strict adherence to the project-specific health and safety plan will prevent worker exposure to hazardous substances and will minimize risk to surrounding communities while activities are performed.

Alternative A-5 can be completed in a short timeframe while posing no risk to the community. Initial protection against the threats associated with exposure to contaminated sediments and achievement of the RAOs would be achieved in less than 6 months from the commencement of construction activities. Use of best management practices during construction and transportation of contaminated media off-site will minimize any risk to surrounding communities. Remedial workers will have the greatest risk of exposure during excavation and hauling activities. Strict adherence to the project-specific health and safety plan will mitigate worker exposure to hazardous while activities are performed.

Long-Term Effectiveness and Permanence

Alternative A-1 does not provide for long-term effectiveness or permanence because residual risk to human health and the environment under future conditions at the GOSB OU would remain unchanged.

Alternative A-3 will break the exposure pathway; however, the long-term effectiveness of Alternative A-3 is uncertain because of the contaminants remaining beneath the 0.6-m (2-ft) soil layer that could affect future rainwater collected in the basin. Sampling of accumulated water and engineering controls to monitor and maintain an adequate cover over contaminants would be necessary to ensure continued long-term effectiveness.

Alternative A-4 will provide long-term effectiveness with no associated long-term O&M requirements. Residual risks will be ~~mitigated~~ reduced by the placement of a clean soil layer ranging in thickness from ~3.05 m to 4.90 m (10 ft to 16 ft). The thickness of the clean fill layer will ensure that exposure to contaminated sediments will be eliminated with no requirement to monitor and maintain. Additionally, this alternative eliminates the physical hazards associated with an open basin with steep slopes, and eliminates the need for LUCs and five-year remedy reviews.

Alternative A-5 permanently removes and safely disposes of the contaminated surface water and sediments and offers long-term protection. No contaminants would be left in place; therefore, there would be no remaining risk, and LUCs and five-year remedy reviews would not be required.

Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives employs any treatment to reduce the toxicity, mobility, or volume of the contaminated media.

Implementability

Implementability is not a consideration for Alternative A-1 since this alternative requires no action.

Alternative A-3 ~~is~~ requires initial dewatering of the basin and placement of clean fill over the impacted basin-bottom sediments. ~~administratively feasible and only a non-discharge permit for the land application of the basin water is needed.~~ The alternative is technically feasible in that dewatering and earth work can be achieved with standard, readily available equipment. SRS has extensive experience in dewatering and earth moving activities.

Alternative A-4 requires initial dewatering of the basin and backfilling the basin~~, which is administratively feasible in that the only permits required would be a non-discharge permit for the land application of the basin water. Non-discharge permits have been granted for past remedial activities at SRS involving the land application of water.~~ Alternative A-4 is ~~also~~ considered to be technically feasible in that dewatering can be achieved with standard equipment and backfilling can be implemented with standard earth-moving equipment, materials, and conventional construction methods. There is ample forested area adjacent to the basin to receive irrigation from the dewatering effort. SRS has extensive experience in dewatering and earth moving activities. Because this alternative requires a total of 4,205 m^3 (5,500 yd^3) of clean fill and top soil, and placement of sod, this alternative will require road improvements to accommodate the increased construction traffic.

Alternative A-5 requires initial dewatering of the basin and backfilling the basin~~, which is considered to be administratively feasible in that the only permits required would be a non-discharge permit for the land application of the basin water. Non-discharge permits have been granted for past remedial activities at SRS involving the land application of water.~~

Alternative A-5 is ~~also~~ considered to be technically feasible in that dewatering can be achieved with standard equipment and excavation and disposal are implemented with standard earth-moving equipment, materials, and conventional construction methods. There is ample forested area adjacent to the basin to receive irrigation from the dewatering effort. SRS has extensive experience in dewatering and earth moving activities. This alternative will require improvements to the access road to the GOSB OU to accommodate truck traffic for waste disposal staging and hauling. An estimated 566 m^3 (740 yd^3) of excavated soil and sediment will be generated during excavation, sampled for waste acceptance criteria, managed on-site pending laboratory results, and ultimately hauled to the Three Rivers Landfill for disposal.

Cost

The total present-worth cost for each of the alternatives is provided below:

Alternative A-1	**No Action**	***$0***
Alternative A-3	Place 0.6-m (2-ft) Clean Fill Layer and Manage Surface Water	*$3,072,000*
Alternative A-4	Backfill Basin and Manage Surface Water	*$1,827,100*
Alternative A-5	Excavate and Manage Surface Water	*$1,716,000*

IX. PREFERRED ALTERNATIVE

Alternative A-4, Backfill Basin and Manage Surface Water, was identified as the preferred alternative because the remedy is effective in ~~reducing~~ preventing exposure of contaminated media to human and ecological receptors, and does not require LUCs or a

five-year remedy review. A comparative alternative ranking of all alternatives is provided in Table 5.

Alternative A-4 consists of controlled compaction backfill of the basin to the natural grade with clean soil and construction of a soil and vegetated cover over the basin footprint soil. The thickness of the required fill material, a minimum of 3.05 m (10 ft) in the shallow end of the basin and a minimum of 4.9 m (16 ft) in the deeper end of the basin, will prevent exposure to pesticides buried at depth. Specific activities associated with this remedial alternative include dewatering of the basin, clearing ~0.27 ha (0.67 ac), excavation of the berms, backfilling the basin with ~4,460 m^3 (5,834 yd^3) of clean soil and berm soil, compacting fill material to mitigate subsidence followed by compaction testing, and grading and construction of a soil and vegetated cover over the basin footprint. Temporary erosion control measures such as silt fencing along the haul roads and as necessary to protect nearby outfalls will be used during construction activities. There is ample forested area adjacent to the basin to receive irrigation from the dewatering effort.

Controlled compaction is expected to be adequate to mitigate settlement and erosion; however, additional construction techniques such as the use of an aggregate bridging material layer may be used if the sediment is determined to be unstable. Clean fill will be verified in accordance with the approved SRS protocol for verification of fill and cover material. No debris is anticipated based on observations of the basin when it was drained in the early 1990's. However, any debris encountered will be managed as CERCLA waste and disposed of at an approved waste disposal facility. Trees cleared to gain access to the basin will be pushed aside and left near the site. Disturbance of the fill material and vegetative cover at the GOSB OU will ~~be prevented by existing~~not occur as long as administrative site use procedures that prohibit unauthorized excavations at SRS are in place.

Alternative A-4 would not require LUCs or five-year remedy reviews and a Land Use Control Implementation Plan is not needed.

Based on information currently available, the lead agency believes that backfilling the basin to the natural grade and surface water management provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. The selected remedy has the highest short-term effectiveness of all the alternatives. It ranks similarly to the other alternatives with respect to long-term effectiveness and cost (Table 4).

The USDOE expects the Preferred Alternative to 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.

X. POST-ROD SCHEDULE

Deliverable	Submittal Date
Submit Rev. 0, Record of Decision	January 28, 2019
Issuance of the Record of Decision	September 30, 2019
Submit Rev. 0, Corrective Measures Implementation/Remedial Action Implementation Plan	September 5, 2019
~~Submit Rev. 0, Land Use Control Implementation Plan~~	~~September 5, 2019~~
Remedial Action Start	September 30, 2020

XI. REFERENCES

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

SRNS, 2018. *Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the G-Area Oil Seepage Basin (GOSB) (U)* Revision 1, SRNS-RP-2017-00218, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC (April).

WSRC, 1991. *RCRA Facility Investigation/Remedial Investigation Plan for the G-Area Oil Seepage Basin (U)*, WRSC-RP-91-200, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

WSRC, 2011. *Savannah River Site Federal Facility Agreement Community Involvement Plan (U)*, Revision 7, WSRC-RP-96-120, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC (February).

XII. GLOSSARY

Administrative Record File (ARF): A file that is maintained and contains all information used to make a decision on the selection of a response action under the Comprehensive Environmental Response, Compensation and Liability Act. This file is to be available for public review, and a copy is to be established at or near the Site, usually at one of the information repositories. Also a duplicate file is held in a central location, such as a regional or state office.

Applicable, or Relevant and Appropriate Requirements (ARARs): Refers to the federal and state requirements that a selected remedy will attain. These requirements may vary from site to site.

Baseline Risk Assessment (BRA): Analysis of the potential adverse health effects (current or future) caused by hazardous substance release from a site in the absence of any actions to control or mitigate these releases.

Characterization: The compilation of all available data about the waste units to determine the rate and extent of contaminant migration resulting from the waste site, and the concentration of any contaminants that may be present.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 1980: A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act.

Federal Facility Agreement (FFA): The legally binding agreement between regulatory agencies (USEPA and SCDHEC) and regulated entities (USDOE) that sets the standards and schedules for the comprehensive remediation of the SRS.

Land Use Controls (LUCs): Legal and/or administrative mechanisms as well as physical installations that modify or guide human behavior at operable units where residual contamination remains in place. Institutional controls and engineering controls are types of land use controls.

Media: Pathways through which contaminants are transferred. Five media to which a release of contaminants may occur are groundwater, soil, surface water, sediments, and air.

National Priorities List: USEPA's formal list of the nation's most serious uncontrolled or abandoned waste sites, identified for possible long-term remedial response, as established by CERCLA.

Operable Unit (OU): A discrete action taken as one part of an overall site cleanup. The term is also used in USEPA guidance documents to refer to distinct geographic areas or media-specific units within a site. A number of operable units can be used in the course of a cleanup.

Operation and Maintenance (O&M): Activities conducted at a site after a response action occurs to ensure that the cleanup and/or systems are functioning properly.

Overall Protection of Human Health and the Environment: The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

Proposed Plan (PP): A legal document that provides a brief analysis of remedial alternatives under consideration for the site/operable unit and proposes the preferred alternative. It actively solicits public

review and comment on all alternatives under consideration.

Record of Decision (ROD): A legal document that explains to the public which alternative will be used at a site/operable unit. The record of decision is based on information and technical analysis generated during the remedial investigation/ feasibility study and consideration of public comments and community concerns.

Resource Conservation and Recovery Act (RCRA), 1976: A Federal law that established a regulatory system to track hazardous substances from their generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

Responsiveness Summary: A summary of oral and/or written comments received during the proposed plan comment period and includes responses to those comments. The responsiveness summary is a key part of the ROD, highlighting community concerns.

Statement of Basis (SB): A report describing the corrective measures/remedial actions being conducted pursuant to South Carolina Hazardous Waste Management Regulations, as amended.

Superfund: The common name used for CERCLA; also referred to as the Trust Fund. The Superfund program was established to help fund cleanup of hazardous waste sites. It also allows for legal action to force those responsible for the sites to clean them up.

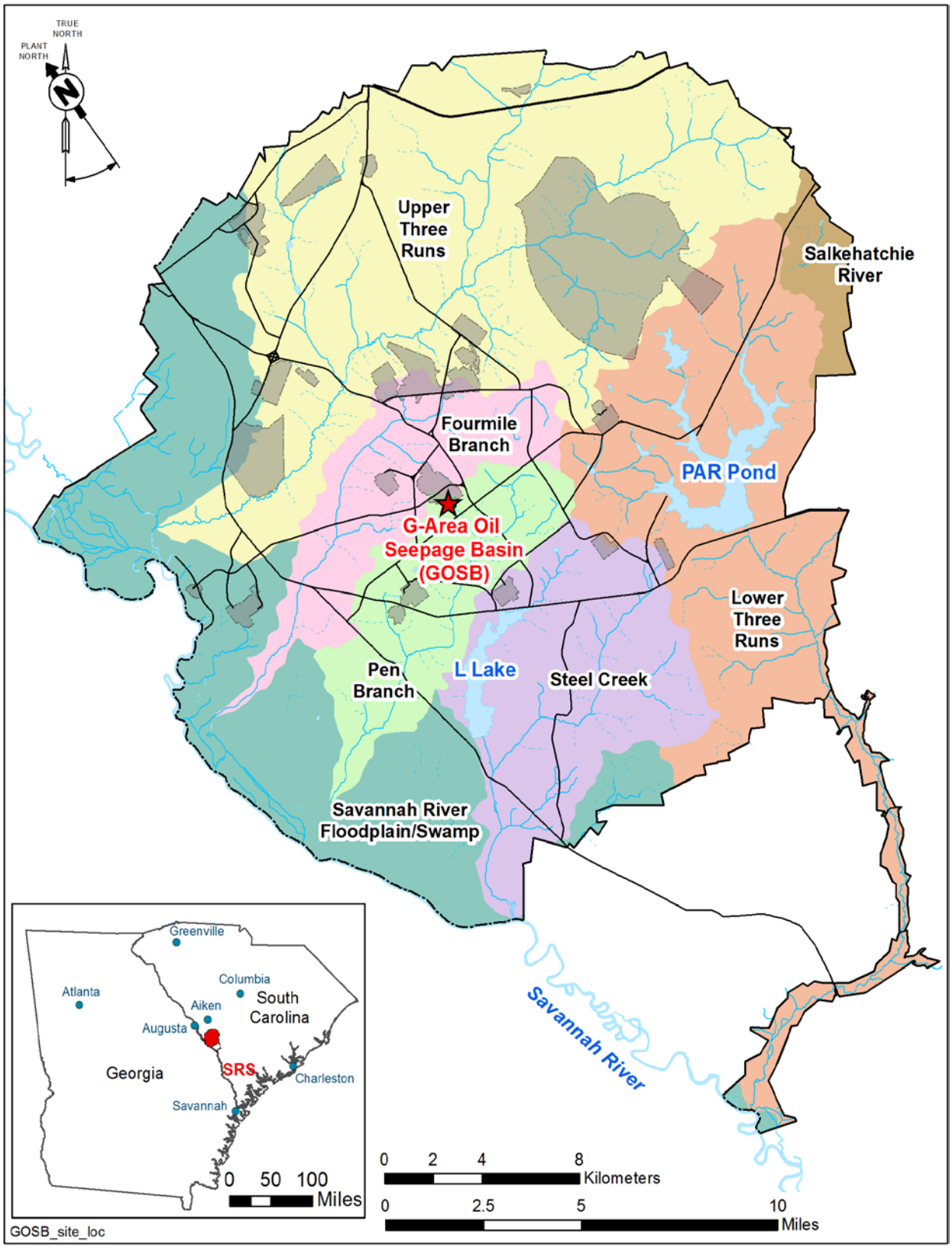

Figure 1. Location of the GOSB within the Savannah River Site

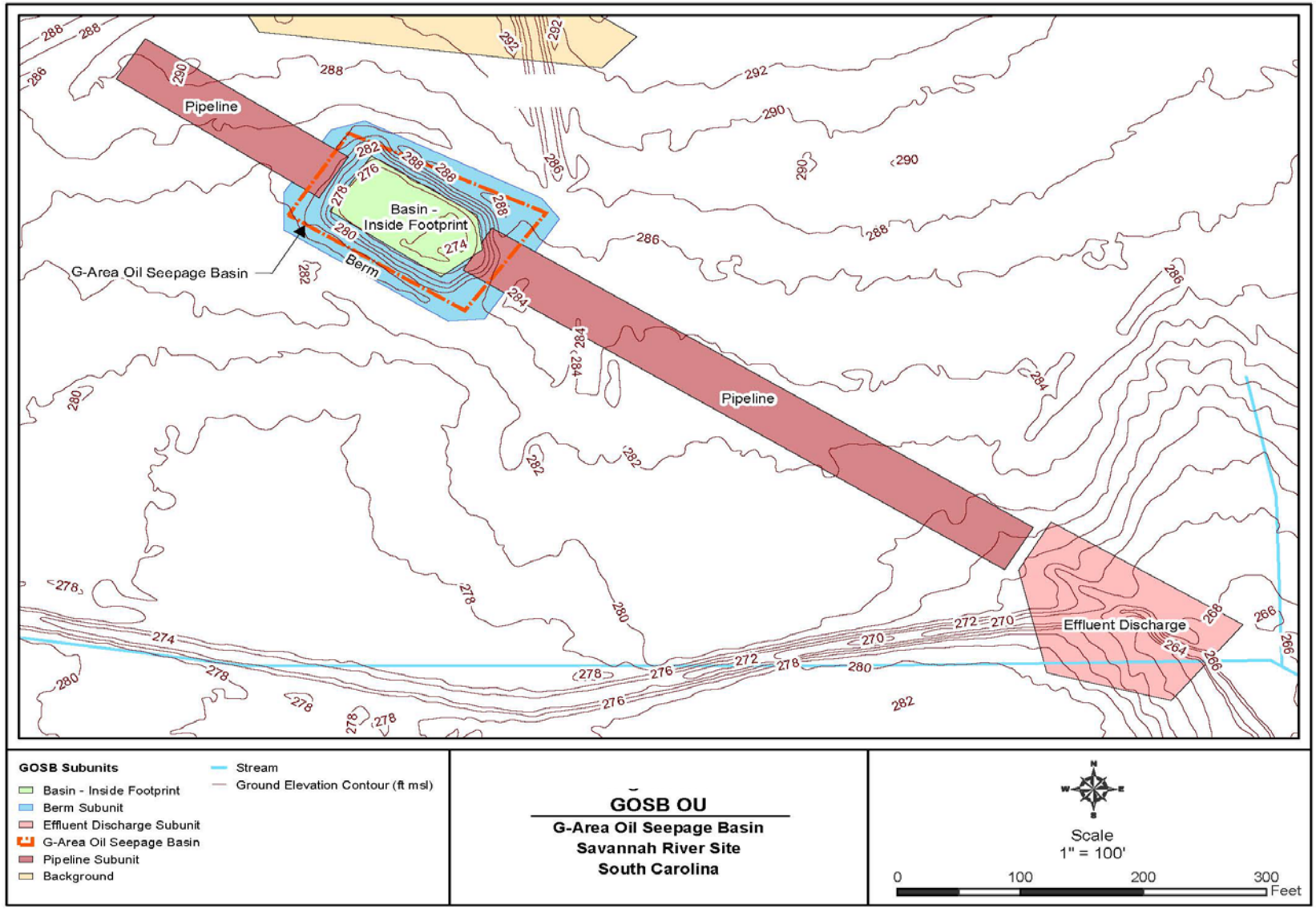

Figure 2. Layout of the GOSB

Figure 3. Photograph of the GOSB (February 2017)

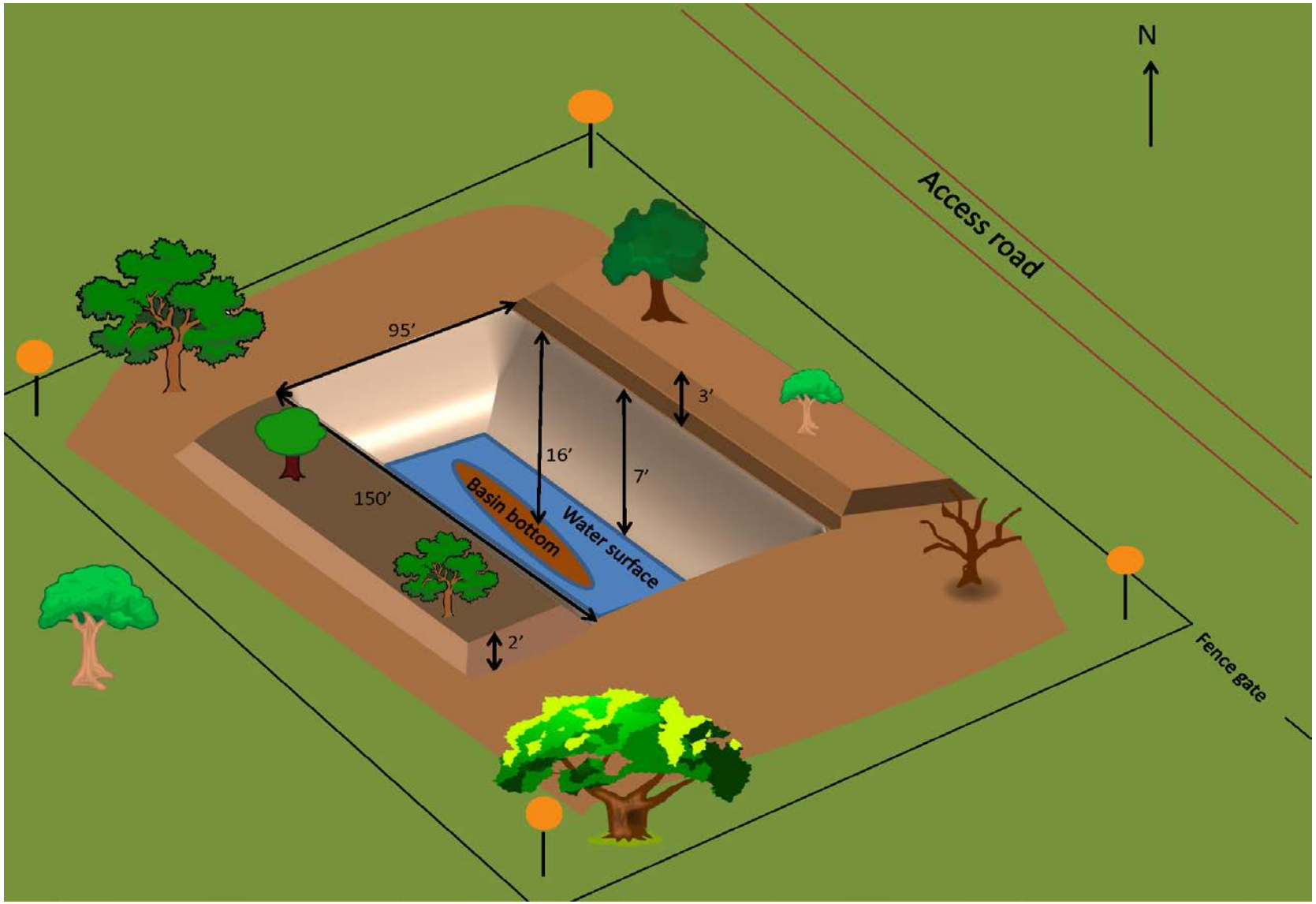

Figure 4. Schematic of the GOSB

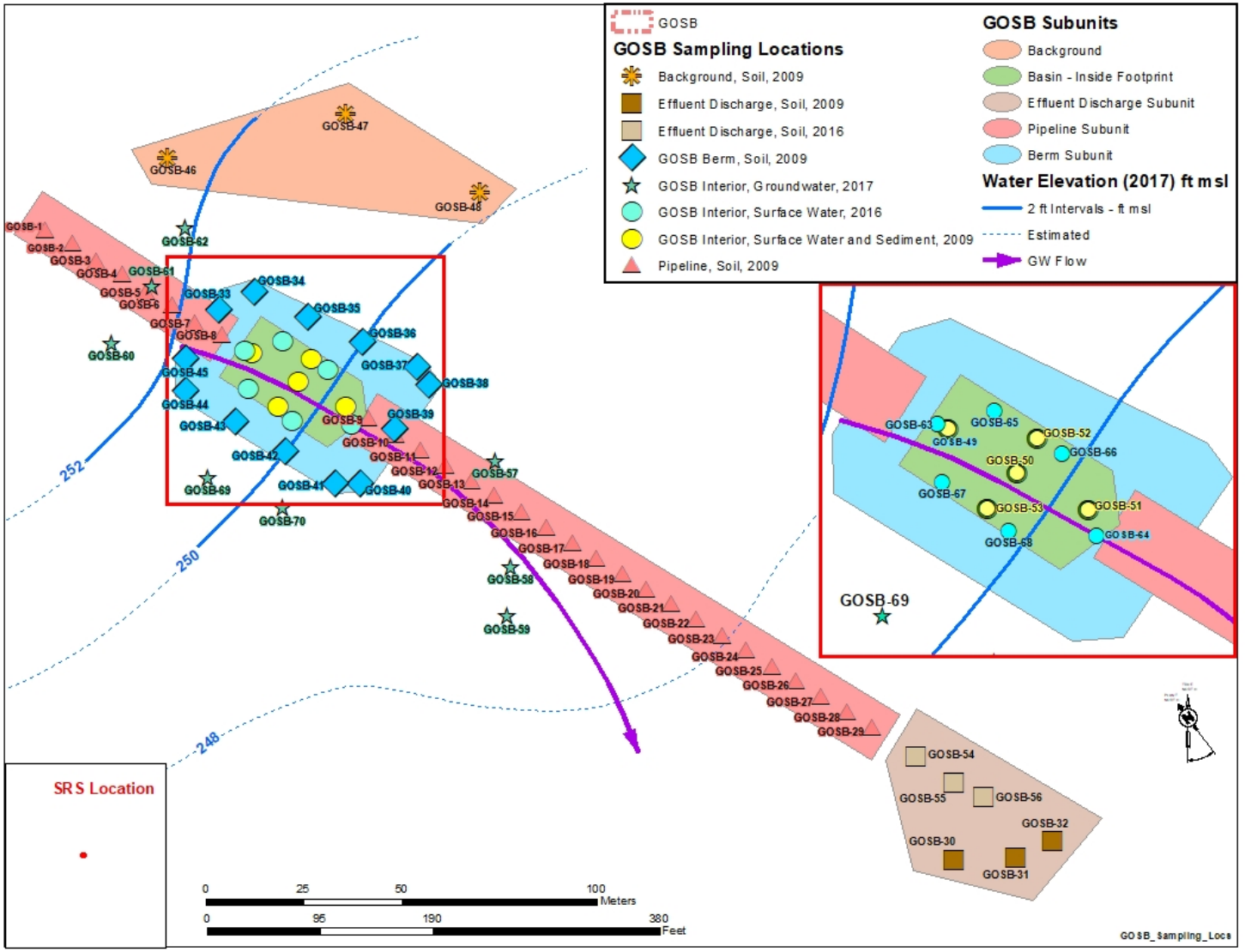

Figure 5. GOSB Subunits and Sampling Locations

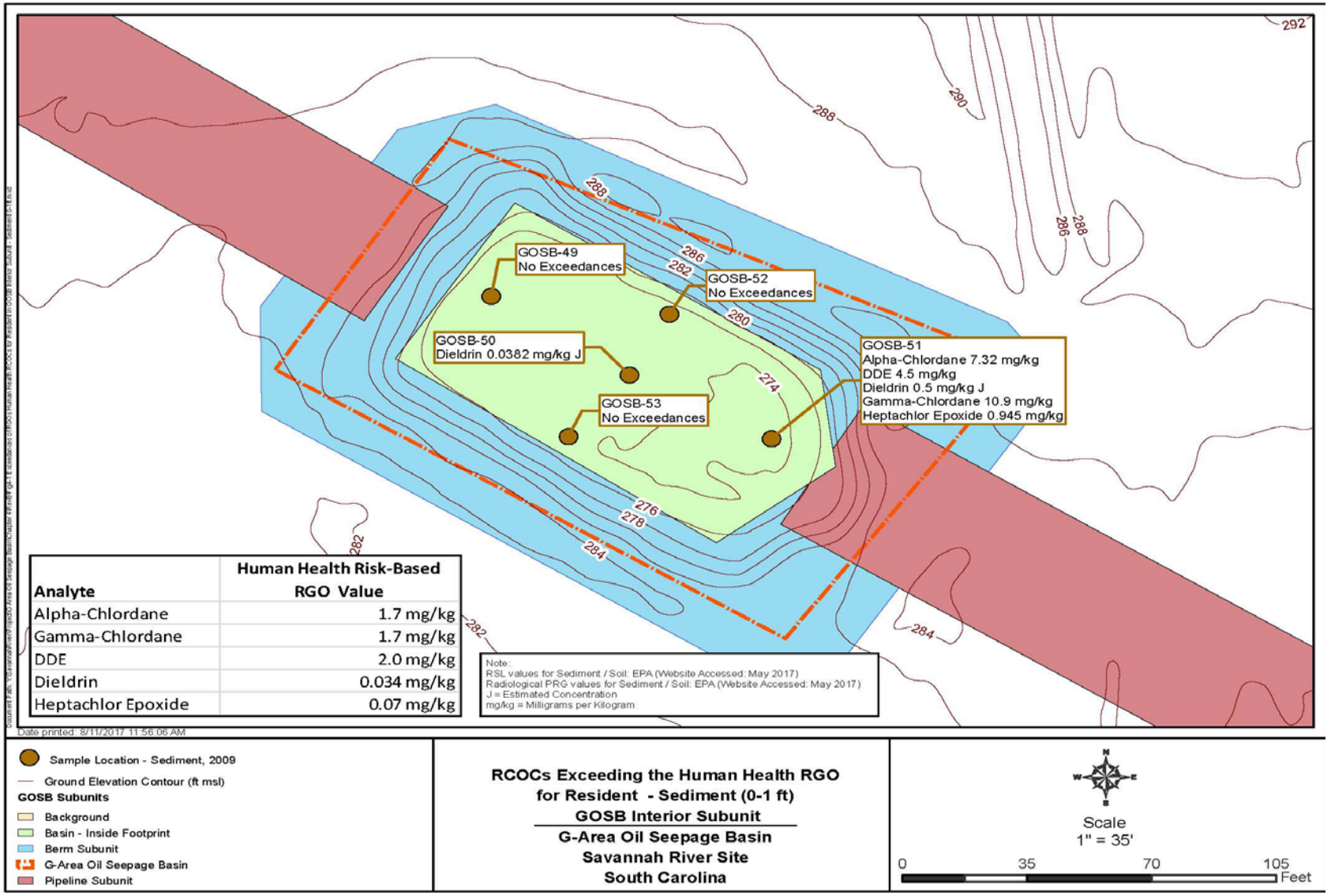

Figure 6. RCOCs Exceeding the Human Health RGO for Resident – Sediment (0 to 1 ft)

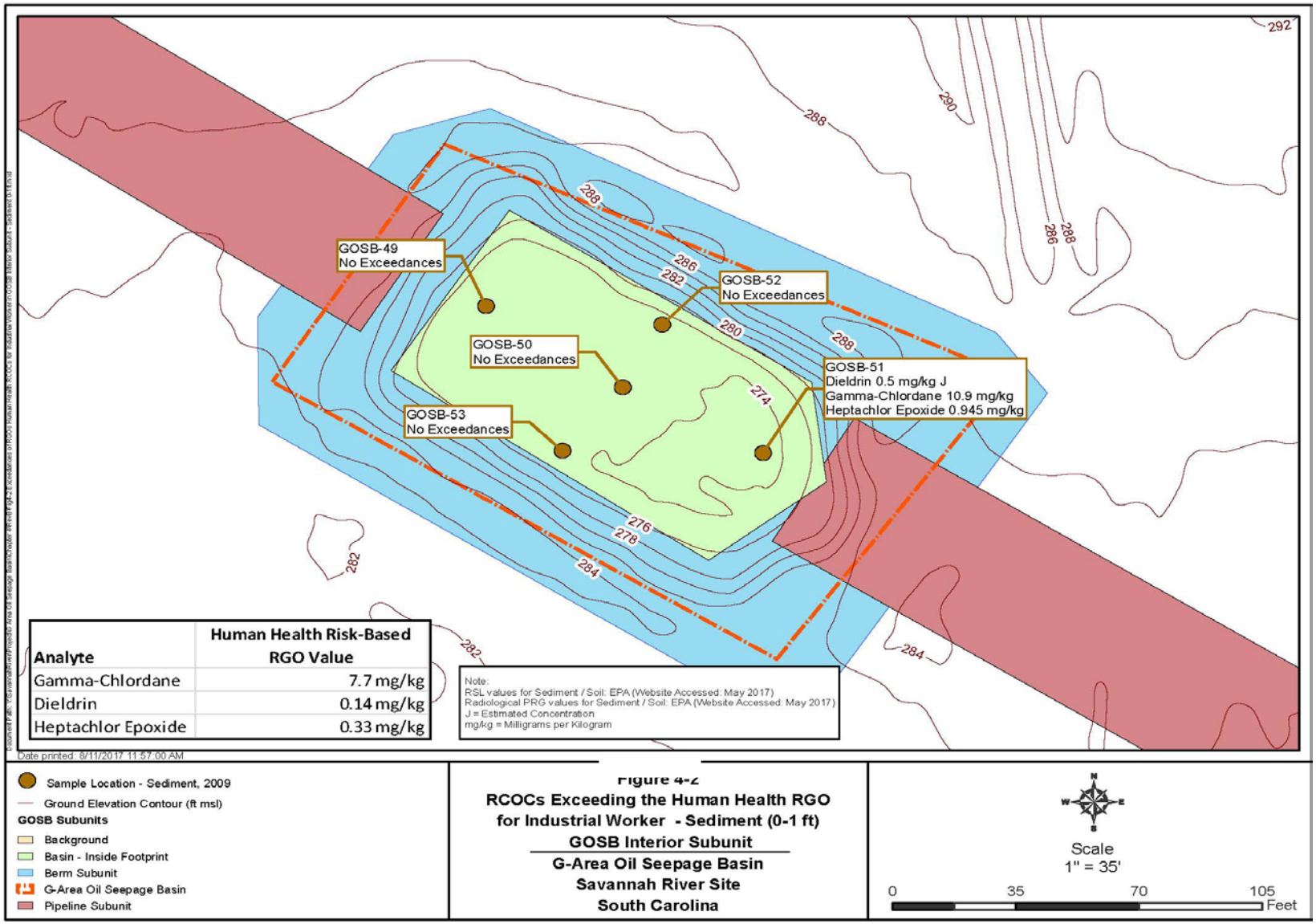

Figure 7. RCOCs Exceeding Human Health RSL/PRG for Industrial Worker – Sediment (0 to 1 ft)

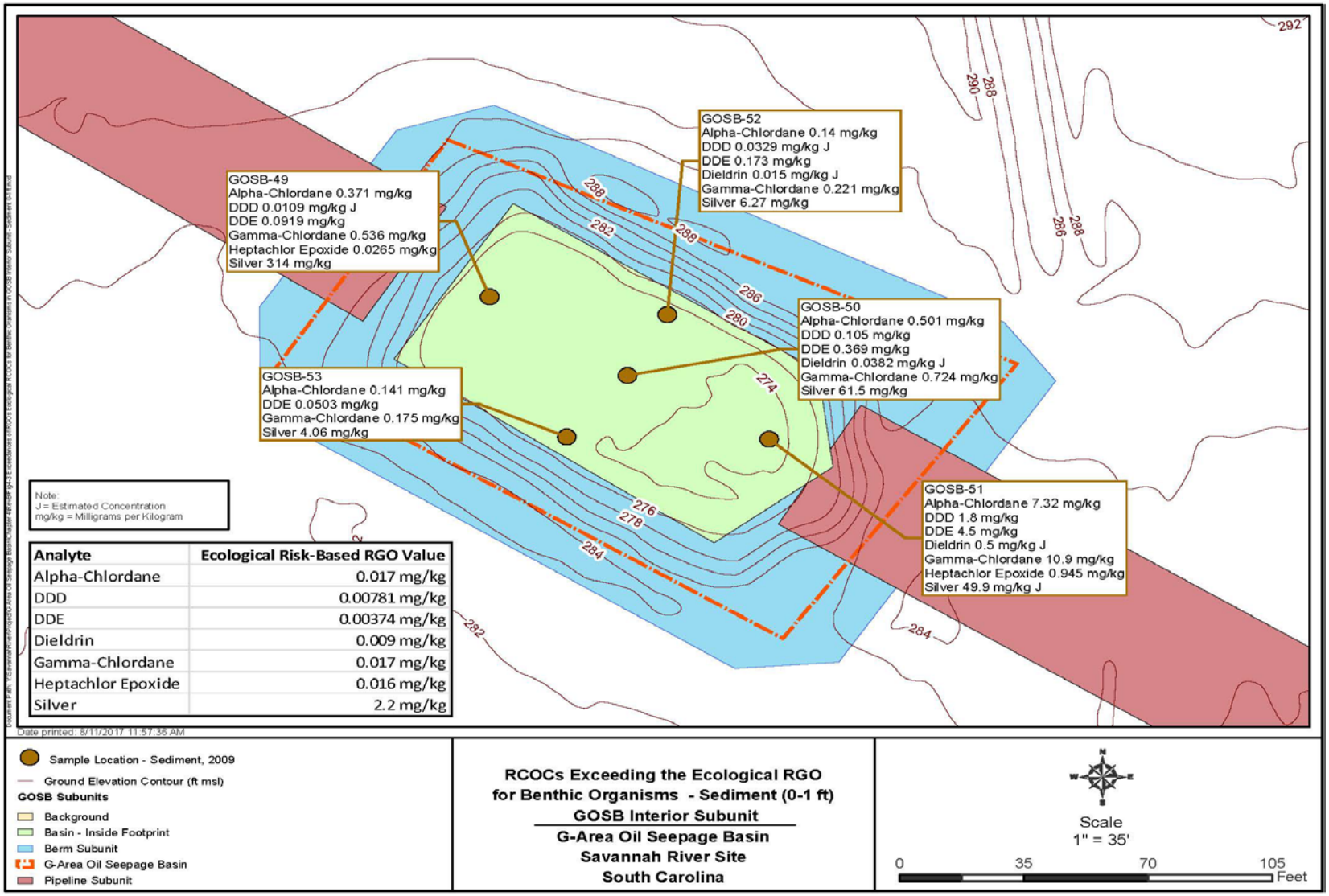

Figure 8. RCOCs Exceeding the Ecological RGO for Benthic Organisms – Sediment (0 to 1 ft)

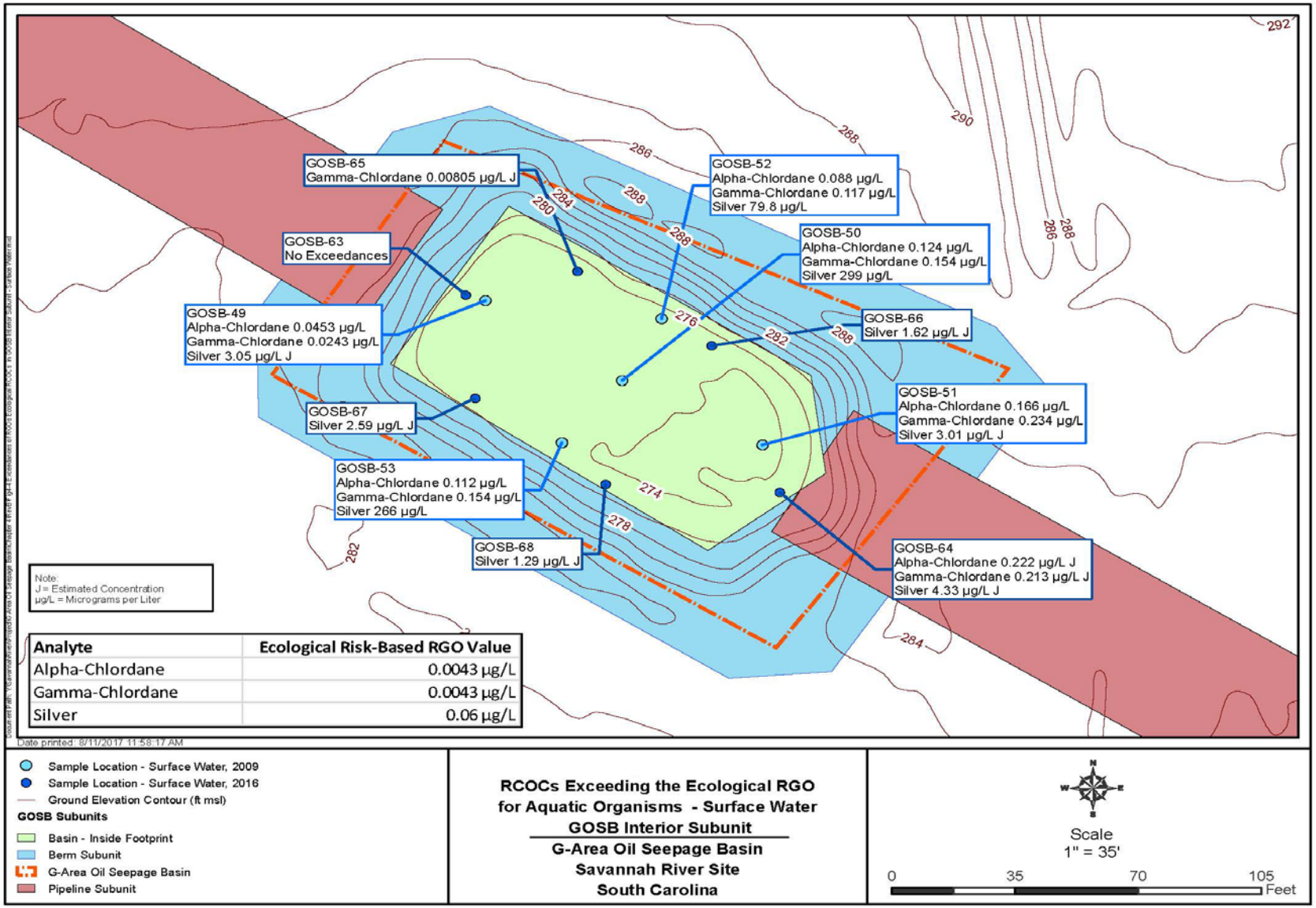

Figure 9. RCOCs Exceeding the Ecological RGO for Aquatic Organisms – Surface Water

Table 1. Most Restrictive RGOs

Medium	Constituent	Receptor	HH RGO Range[1] *(mg/kg)*	Ecological RGO[2] *(mg/kg or µg/L)*	Background[3] *(mg/kg or µg/L)*	MR RGO[4] *(mg/kg or µg/L)*
Sediment	Alpha-chlordane	Resident	1.7 - 170		NA	0.017
		Benthic Organism		0.017		
	DDD	Benthic Organism		0.00781	NA	0.00781
	DDE	Resident	2 - 200		NA	0.00374
		Benthic Organism		0.00374		
	Dieldrin	Resident	0.034 – 3.4		NA	0.009
		Industrial Worker	0.14 - 14			
		Benthic Organism		0.009		
	Gamma-chlordane	Resident	1.7 - 170		NA	0.017
		Industrial Worker	7.7 - 770			
		Benthic Organism		0.017		
	Heptachlor epoxide	Resident	0.07 - 7		NA	0.016
		Industrial Worker	0.33 - 33			
		Benthic Organism		0.016		
	Silver	Benthic Organism		2.2	0.24 – 1.96	2.2
Surface Water	Alpha-chlordane	Aquatic Organism		0.0043	NA	0.0043
	Gamma-chlordane	Aquatic Organism		0.0043	NA	0.0043
	Silver	Aquatic Organism		0.06	NA	0.06

1 HH RGO Range = concentration set at risk range 1E-06 through 1E-04
2 Ecological RGO = concentration set at HQ = 1
3 Background = range from minimum detect to maximum detect from Background Soils Statistical Summary Report for the Savannah River Site, Appendix B-2 (all depths interval) (WSRC 2006)
4 MR RGO = most restrictive RGO is the lesser of the HH or ecological RGOs
NA = not available

Table 2. Potential ARARs for the Preferred Remedial Alternative for the GOSB OU

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 involving two (2) acres or less of actual land disturbance – **applicable**	S.C. R. 72-305.B.(1)
	The stormwater management and sediment control plan shall contain at a minimum the information provided in the following subsections:	Land disturbance activities involving two (2) acres or less which are not part of a larger common plan of development or sale – **applicable**	S.C. R. 72-307 H – *South Carolina Storm Water Management and Sediment Reduction Regulations*
	A sketched plan to accompany the narrative which shall contain: a) A site location drawing of the proposed project, indicating the location of the proposed project in relation to roadways, jurisdictional boundaries, streams and rivers; b) The boundary lines of the site on which the work is to be performed; c) The location of temporary & permanent vegetative & structural stormwater management and sediment control measures.		S.C. R. 72-307 H.(5)(a) S.C. R. 72-307 H.(5)(b) S.C. R. 72-307 H.(5)(d)
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.	Activities that will generate fugitive particulate matter (Statewide) – **applicable**	S.C. R. 61-62.6 Section III(a)- *Control of Fugitive Particulate Matter Statewide*
Disposal of Wastes (e.g. trees, bushes, etc.)			
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 NOTE: All waste generated from this remedial action will be managed as non-hazardous, due to the known characteristics of the operable unit.	Generation of solid waste intended for off- SRS disposal – **applicable**	SCDHEC R. 61-107.15

Table 2. Potential ARARs for the Preferred Remedial Alternative for the GOSB OU *(Continued)*

Action	Requirements	Prerequisite	Citation
Dewatering/Irrigation of G-Area Oil Seepage Basin Contained Stormwater			
On-site Land Application	The regulatory provisions contained in R.61-9.122 and 124 implement the National Pollutant Discharge Elimination System (NPDES) Program under sections 318, 402, and 405 of the Clean Water Act (CWA) (Public Law 92□500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117, and Pub. L. 100-4; 33 U.S.C. 1251 et seq.) and the South Carolina Pollution Control Act, S.C. Code Ann. 48-1-10, et seq.	Land application of pollutants (including toxic substances) in the State of South Carolina – **relevant and appropriate**	S.C. R. 61-9 122.1(a)(1)
	~~The Land Application permit and State permit program requires permits for the discharge of pollutants from any source directly or indirectly into groundwaters of the State and to the land of the State. The terms "Land Application permit," "State permit," "pollutant," "source," "groundwaters of the State," and the "land of the State" are defined in section 505.2.~~	~~Section 48-1-90(a), S.C. Code of Laws (1976), provides that "it shall be unlawful for any person, directly or indirectly, to throw, drain, run, allow to seep, or otherwise discharge into the environment of the State organic or inorganic matter, including sewage, industrial wastes and other wastes, except as in compliance with a permit issued by the Department.~~ **relevant and appropriate**	~~S.C. R. 61-9 505.1(b)(1)~~ ~~S.C. R. 61-9 505.1(g)(1)~~
	Information Requirements: 1) Provide location of the WWTP and land disposal sites: Provide a map or maps showing the location of the WWTP and land disposal site(s). 2) Provide description of waste to be land applied: Provide a description of the wastewater or sludge to be land applied. State whether the waste is domestic and/or industrial wastewater. If the wastewater is not strictly domestic, give a detailed characterization of the wastewater. 3) Provide volume and quantity of waste to be land applied: Provide the volume in gallons per day and the quantity in pounds per day of the waste to be land applied to each disposal site. 4) Provide frequency of application: Provide the proposed frequency application in times per day, week or other period for each disposal site. 5) Provide site application rate(s): Provide the proposed application rate in inches per week, pounds per acre per day (use annual rates for crop uptake) for sludge disposal, or other units as appropriate for each disposal site, whichever is the limiting factor.		S.C. R. 61-9 505.21(f)(9) S.C. R. 61-9 505.21(f)(10) S.C. R. 61-9 505.21(f)(11) S.C. R. 61-9 505.21(f)(12) S.C. R. 61-9 505.21(f)(13) S.C. R. 61-9 505.21(f)(16)

Table 2. Potential ARARs for the Preferred Remedial Alternative for the GOSB OU *(Continued)*

Action	Requirements	Prerequisite	Citation
Dewatering/Irrigation of G-Area Oil Seepage Basin Contained Stormwater – cont'd			
	6) Provide hazardous substances: Identify whether or not the discharge contains a substance that could be considered hazardous as defined under section 101(14) of CERCLA. Provide the substance name, concentration and source.		
	Irrigation of treated wastewater including methods of surface application, including but not limited to, fixed gun application, travelling or mobile gun application, or center pivot application.	Additional conditions applicable to specified categories of Land Application permits and State permits for irrigation of treated wastewater. **relevant and appropriate**	S.C. R. 61-9 505.42(b)
	Spray field slopes shall not exceed 10 percent unless approved by the Department. The Department may require that slopes be less than 10% based on site conditions.		S.C. R. 61-9 505.42(b)(1)
	~~Effluent distribution systems shall be designed so that the distribution pattern maximizes uniform application.~~		~~S.C. R. 61-9 505.42(b)(2)~~
	~~The application rate may be limited based on pollutant loading including any pollutant required for monitoring under effluent guidelines (40 CFR Part 136; Subchapter N (40 CFR Parts 400 through 402 and 404 through 471).~~		~~S.C. R. 61-9 505.42(b)(4)(iv)~~
	The new or expanding spray field shall be at least 200 feet from surface waters of the State, occupied buildings and potable water wells. The new or expanding spray field shall be at least 100 feet from the property boundary.		S.C. R. 61-9 505.42(b)(8)
	~~A dike or berm around the perimeter of the spray field may be required as necessary to prevent potential surface runoff from entering or leaving the spray site. The Department may consider alternate methods of runoff controls that may be proposed by the applicant.~~		~~S.C. R. 61-9 505.42(b)(9)~~
	~~Additional parameters may be required in the initial background groundwater analysis and subsequent monitoring thereafter, but such needs will be assessed on an individual project basis. Any pollutant required for monitoring under effluent guidelines (40 CFR Part 136; Subchapter N (40 CFR Parts 400 through 402 and 404 through 471)) may be required (in a permit) to be monitored in groundwater.~~		~~S.C. R. 61-9 505.42(b)(12)~~

Table 2. Potential ARARs for the Preferred Remedial Alternative for the GOSB OU *(Continued/End)*

Action	Requirements	Prerequisite	Citation
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*

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
CWA = Clean Water Act of 1972
EPA = U.S. Environmental Protection Agency
NPDES = National Pollutant Discharge Elimination System
RCRA = Resource Conservation and Recovery Act of 1976
S.C. = South Carolina Department of Health and Environmental Control

Table 3. Description of CERCLA Evaluation Criteria

Threshold Criteria:
• *Overall Protectiveness of Human Health and the Environment* determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
• *Compliance with ARARs* evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site. There are no ARAR RCOCs identified for media (i.e., soil, sediment, or surface water) within the GOSB OU. .
Primary Balancing Criteria:
• *Long-Term Effectiveness and Permanence* considers the ability of an alternative to maintain protection of human health and the environment over time. It evaluates magnitude of residual risk and adequacy of reliability of controls.
• *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment* evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
• *Short-Term Effectiveness* considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
• *Implementability* considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
• *Cost* includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
Modifying Criteria:
• *State Support/Agency Acceptance* considers whether USEPA and SCDHEC agree with the analyses and recommendations by the USDOE. Approval of the Record of Decision constitutes approval of the selected alternative by the regulatory agencies.
• *Community Acceptance* considers whether the local community agrees with the Preferred Alternative. Comments received on the Statement of Basis/Proposed Plan during the public comment period are an important indicator of community acceptance. Comments from the public are considered in the final remedy selection in the Record of Decision.

Table 4. Comparison of Alternatives against the CERCLA Evaluation Criteria

Criteria	Alternative A-1 No Action	Alternative A-3 Place 0.6-m (2-ft) Clean Fill Layer and Manage Surface Water	Alternative A-4 Backfill Basin and Manage Surface Water	Alternative A-5 Excavate and Manage Surface Water
Overall protection of human health and the environment				
Protection of Human Health	Not protective	Protective.	Protective	Protective.
Protection of the Environment	Not protective	Protective	Protective	Protective.
Compliance with ARARs				
Chemical-specific	Not ~~applicable~~preferred	None identified	None identified	None identified
Action-specific	Not ~~applicable~~preferred	Yes	Yes	Yes
Location-specific	Not ~~applicable~~preferred	Yes	Yes	Yes
Long-term effectiveness and permanence				
Magnitude of Residual Risks	Not applicable. Risk remains unchanged.	Effective in reducing risk of exposure to contaminated media by breaking exposure pathway.	Effective in reducing risk of exposure to contaminated media by breaking exposure pathway.	Risks are removed by complete removal of contaminated media.
Adequacy of Controls	Not adequate	Adequate	Adequate	Adequate
Permanence	Not permanent	Permanent	Permanent	Permanent
Reduction of toxicity, mobility, or volume through treatment				
Treatment Process	No treatment	No treatment	No treatment.	No treatment
Degree of Expected Reduction in Toxicity, Mobility, or Volume	None	None	None.	None
Short-term effectiveness				
Risk to Remedial Workers	Not applicable; no remedial action involved.	None	Remedial workers managing surface water would be exposed to contaminated media.	Remedial workers removing sediment and managing surface water would be exposed to contaminated media.
Risk to Community	Not applicable; no remedial action involved.	None	None.	None
Risk to Environment	Not applicable; no remedial action involved.	None	None	None
Estimated Time Frame to Achieve RAOs or RGs	Not applicable; no remedial action involved.	Months	Months	Months

Table 4. Comparison of Alternatives against the CERCLA Evaluation Criteria *(Continued/End)*

Criteria	Alternative A-1 No Action	Alternative A-3 Place 0.6-m (2-ft) Clean Fill Layer and Manage Surface Water	Alternative A-4 Backfill Basin and Manage Surface Water	Alternative A-5 Excavate and Manage Surface Water
Implementability				
Availability of materials, equipment, and skilled labor	No implementation	Readily implemented	Readily implemented.	Readily implemented
Ability to construct and operate remedial technology	Not Applicable	Readily available.	Readily available.	Readily available.
Ability to obtain permits/approvals from Agencies	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ease of undertaking additional actions	Compatible	Compatible	Compatible	Compatible
Time to implement	Readily Implementable	Months	Months	Moths
Cost				
Total Present-Worth Costs	$0	$3,072,000	$1,827,000	$1,716,000
State Support/Agency Acceptance	Not ~~acceptable~~preferred.	Not ~~acceptable~~preferred.	Alternative under consideration for EPA and SCDHEC review and approval	Not ~~acceptable~~preferred.
Community Acceptance	This criterion will be completed following public review.	This criterion will be completed following public review.	This criterion will be completed following public review.	This criterion will be completed following public review.

Table 5. Comparative Alternative Analysis for the GOSB OU Basin Interior Subunit (Sediment and Surface Water)

Response Action	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Performance	Reduction of Toxicity, Mobility or Volume Through Treatment	Short-Term Effectiveness	Implement anility	Cost	Overall Ranking (1-16)
A-1 No Action	No	No	1	1	1	4	($0)	7
A-3 Place 0.6-m (2-ft) Clean Fill Layer and Manage Surface Water	Yes	Yes	2	1	3	3	($3.1M)	9
A-4 Backfill Basin and Manage Surface Water	Yes	Yes	3	1	4	2	($1.8M)	10
A-5 Excavate and Manage Surface Water	Yes	Yes	4	1	1	1	($1.7M)	7

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APPENDIX A

DETAILED COST ESTIMATES

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GOSB Basin Interior Alternative A-3 - Place 0.6-m (2-ft) Clean Fill Layer and Manage Surface Water Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
Direct Capital Costs				
Subcontractor Mobilization/demobiliaztion	1	ea	$ 29,010.00	$ 29,010.00
Site surveys	1	ea	$ 4,325.00	$ 4,325.00
Clearing ~~and Grubbing~~	0.67	acres	$ 4,197.00	$ 2,811.99
Access Roads Improvements	3200	lf	$ 33.96	$ 108,672.00
Dewatering rainwater	415,000	gals	$ 0.60	$ 249,000.00
Install BMPs	1000	ft	$ 5.00	$ 5,000.00
Excavation of Berms and stockpilling	334	BCY	$ 9.53	$3,183.02
Clean fill soil sampling & analyses	1	ea	$ 1,500.00	$ 1,500.00
Hauling of backfill from SRS borrow	466	BCY	$ 10.72	$ 4,995.52
Placement of backfill	466	BCY	$ 10.00	$ 4,660.00
Land Use Controls				
Posting of Warning Signs	2	ea	$ 100.00	$ 200.00
Land Use Control Implementation Plan	1	ea	$ 7,500.00	$ 7,500.00
Subtotal - Direct Capital Cost				$420,858 *
Mobilization/Demobilization	25%	of subtotal direct capital		$105,214 *
Site Preparation/Site Restoration	25%	of subtotal direct capital		$105,214 *
Total Direct Capital Cost		(sum of * items)		**$631,286**
Indirect Capital Costs				
Engineering & Design	14%	of direct capital		$88,380
Project/Construction Management	25%	of direct capital		$157,822
Health & Safety	6%	of direct capital		$37,877
Overhead	30%	of direct capital + indirect capital		$274,610
Contingency	20%	of direct capital + indirect capital		$237,995
Total Indirect Capital Cost				**$796,683**
Total Estimated Capital Cost				**$1,427,970**
Direct O&M Costs	-0.3%	real interest rate	from OMB Cirular No. A-94[2]	
Confirmation Sampling of Accumulated rain water	5	years O&M		
Sampling and Analysisof rainwater	1	ea	$3,000	$3,000
Access contorls (Existing System during Post-Rod and Sampling)	1	ea	$1,000	$1,000
Subtotal - Annual Costs		1		$4,000
Present Worth Annual Sampling (-0.3% Discount Rate)				$20,181
Annual Costs (Institutional Controls)	30	years O&M		
Access Controls	1	ea	$1,000	$1,000
Annual Inspections/Maintenance (additional soil)	1	ea	$7,500	$7,500
Subtotal - Annual Costs				$8,500
Present Worth Annual Costs (-0.3% Discount Rate)				$267,247
Five Year Costs	6			
Remedy Review	1	ea	$20,000	$20,000
Subtotal -Five Year O&M Costs				$20,000
Present Worth Five Year Costs (-0.3% Discount Rate)				$121,270
Total Present Worth Direct O&M Cost				**$408,698**
Indirect O&M Costs				
Project/Admin Management	151%	of direct O&M		$617,134
Health & Safety	18%	of direct O&M		$73,566
Overhead	30%	of direct O&M + indirect O&M		$329,819
Contingency	15%	of direct O&M + indirect O&M		$214,383
Total Present Worth Indirect O&M Cost				**$1,234,901**
Total Estimated Present Worth O&M Cost				**$1,643,599**
TOTAL ESTIMATED COST				**$3,071,569**

1. Managing the surface water includes dewatering the basin prior to excavation and constructing a spray field
2. Interest rate from OMB Circular No. A-94 (December 12,2016)

GOSB Basin Interior Alternative A-4 - Backfill Basin and Manage Surface Water Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
Direct Capital Costs				
Subcontractor Mobilization/demobiliaztion	1	ea	$ 29,010.00	$29,010.00
Site surveys	1	ea	$ 4,325.00	$4,325.00
Clearing	0.67	acres	$ 4,197.00	$2,811.99
Access road improvements	3200	lf	$ 33.96	$108,672.00
Dewatering of 415,000 gals of rainwater	415,000	gals	$ 0.60	$249,000.00
Install BMPs	1000	ft	$ 5.00	$5,000.00
Excavation of Berms and stockpilling	334	BCY	$ 9.53	$3,183.02
Clean fill/top soil sampling & analyses	2	ea	$ 1,500.00	$3,000.00
Hauling/placement/compaction of backfill from SRS borrow	5200	BCY	$ 20.72	$107,744.00
Compaction testing/reporting	15	hrs	$150.00	$2,250.00
Hauling/Placement of top soil from off SRS	300	CY	$ 35.00	$10,500.00
Sod installation	1700	yd2	$ 5.00	$8,500.00
Subtotal - Direct Capital Cost				$533,996
Mobilization/Demobilization	25%	of subtotal direct capital		$133,499
Site Preparation/Site Restoration	25%	of subtotal direct capital		$133,499
Total Direct Capital Cost		(sum of * items)		**$800,994**
Indirect Capital Costs				
Engineering & Design	14%	of direct capital		$112,139
Project/Construction Management	25%	of direct capital		$200,249
Health & Safety	6%	of direct capital		$48,060
Overhead	30%	of direct capital + indirect capital		$348,432
Contingency	20%	of direct capital + indirect capital		$301,975
Total Indirect Capital Cost				**$1,010,854**
Total Estimated Capital Cost				**$1,811,848**
Direct O&M Costs	-0.3%	real interest rate	from OMB Cirular No. A-94[2]	
Annual Costs (Existing System during Post-ROD Design & Const)	5	years O&M		
Access Controls	1	ea	$750	$750
Subtotal - Annual Costs				$750
Present Worth Annual Costs (-0.3% Discount Rate)				$3,784
Total Present Worth Direct O&M Cost				**$3,784**
Indirect O&M Costs				
Project/Admin Management	151%	of direct O&M		$5,714
Health & Safety	18%	of direct O&M		$681
Overhead	30%	of direct O&M + indirect O&M		$3,054
Contingency	15%	of direct O&M + indirect O&M		$1,985
Total Present Worth Indirect O&M Cost				**$11,434**
Total Estimated Present Worth O&M Cost				**$15,217**
TOTAL ESTIMATED COST				**$1,827,066**

1. Managing the surface water includes dewatering the basin prior to excavation and constructing a spray field
2. Interest rate from OMB Circular No. A-94 (December 12,2016)

GOSB Basin Interior Alternative A-5 - Excavate and Manage Surface Water Savannah River Site

Item	Quantity	Units	Unit Cost	Total Cost
Direct Capital Costs				
Subcontractor Mobilization/demobiliaztion	1	ea	$ 29,010.00	$29,010.00
Site surveys	1	ea	$ 4,325.00	$4,325.00
Clearing	0.67	acres	$ 4,197.00	$2,811.99
Access road improvements	3200	lf	$ 33.96	$108,672.00
Dewatering of 415,000 gals of rainwater via spray field	415,000	gals	$ 0.60	$249,000.00
Install BMPs	1000	ft	$ 5.00	$5,000.00
Excavation and loading onto rolloffs for drying	740	BCY	$ 9.53	$7,052.20
Post Excavation confirmation sampling	10	samples	$ 600.00	$6,000.00
Waste characterization sampling	10	samples	$ 1,500.00	$15,000.00
Transportation of waste sediments	740	BCY	$ 15.00	$11,100.00
Disposal of waste sediments	1110	tn	$ 57.00	$63,270.00
Subtotal - Direct Capital Cost				$501,241 *
Mobilization/Demobilization	25%	of subtotal direct capital		$125,310 *
Site Preparation/Site Restoration	25%	of subtotal direct capital		$125,310 *
Total Direct Capital Cost		(sum of * items)		**$751,862**
Indirect Capital Costs				
Engineering & Design	14%	of direct capital		$105,261
Project/Construction Management	25%	of direct capital		$187,965
Health & Safety	6%	of direct capital		$45,112
Overhead	30%	of direct capital + indirect capital		$327,060
Contingency	20%	of direct capital + indirect capital		$283,452
Total Indirect Capital Cost				**$948,850**
Total Estimated Capital Cost				**$1,700,711**
Direct O&M Costs	-0.3%	real interest rate from OMB Cirular No. A-94[2]		
Annual Costs (Existing System during Post-ROD Design & Const)	5	years O&M		
Access Controls	1	ea	$750	$750
Subtotal - Annual Costs				$750
Present Worth Annual Costs (-0.3% Discount Rate)				$3,784
Total Present Worth Direct O&M Cost				**$3,784**
Indirect O&M Costs				
Project/Admin Management	151%	of direct O&M		$5,714
Health & Safety	18%	of direct O&M		$681
Overhead	30%	of direct O&M + indirect O&M		$3,054
Contingency	15%	of direct O&M + indirect O&M		$1,985
Total Present Worth Indirect O&M Cost				**$11,434**
Total Estimated Present Worth O&M Cost				**$15,217**
TOTAL ESTIMATED COST				**$1,715,929**

1. Managing the surface water includes dewatering the basin prior to excavation and constructing a spray field
2. Interest rate from OMB Circular No. A-94 (December 12,2016)

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APPENDIX B

Spray Irrigation to Land Surface Risk Evaluation

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The RFI/RI/BRA/CMS/FS (SRNS 2018) identified only ecological refined constituents of concern (RCOCs) in the surface water media within the Basin Interior subunit of the GOSB. Based on a comparison to maximum contaminant levels (MCLs), no human health (HH) RCOCs for surface water nor contaminant migration to groundwater concerns were identified. Therefore, land application of the GOSB surface water does not pose a contaminant migration to groundwater concern.

Ecological (ECO) RCOCs were identified in surface water media due to an unacceptable risk potential to aquatic organisms. Since land application of the surface water media will be conducted in such a manner as to prevent any surface runoff from entering or leaving the spray irrigation site, the threshold levels to protect aquatic organisms are no longer applicable (i.e., will not impact another surface water body). However, application of the surface water to the land surface introduces a potential risk concern to both human and terrestrial ecological receptors based on direct exposure to the soil media that needs to be evaluated. Table 1, as explained below, presents the Spray Irrigation Evaluation: Projected Soil Concentrations Compared to Human Health and Ecological Threshold Levels.

The evaluation employs a very conservative approach. The maximum detected concentration of each constituent in the GOSB surface water is used to estimate constituent concentrations in the soil media following land application of the water. The evaluation assumes that the concentration measured in the water would be found in the soil media (i.e., mg/L [ppm] water = mg/kg [ppm] soil). This is considered a conservative, worst-case scenario since any concentration adjustments in the soil media due to chemical or physical processes are not considered.

For the HH evaluation, the projected soil concentrations are compared to the residential Regional Screening Levels (RSLs) for soil media (USEPA 2018). No constituent concentrations exceeded the residential RSL. For the ECO evaluation, the projected soil concentrations are compared to the ecological refinement screening values (RSVs) for soil media from Appendix D, Ecological Risk Assessment, presented in the RFI/RI/BRA/CMS/FS for the GOSB OU (SRNS 2018). No constituents exceeded the ecological RSV for terrestrial receptors. Therefore, land application of the GOSB surface water does not pose a threat to human or ecological receptors. The concentrations of the RCOCs in surface water (prior to land application) that would be protective of human and ecological receptors for soil media after land application are derived in Table 2 and summarized below:

Protective concentration of alpha-chlordane = 1.7 mg/L (ppm); maximum detect in surface water = 0.000222 mg/L

Protective concentration of gamma-chlordane = 1.7 mg/L (ppm); maximum detect in surface water = 0.000234 mg/L

Protective concentration of silver = 26 mg/L (ppm); maximum detect in surface water = 0.299 mg/L

SRNS 2018. *Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment and Corrective Measures Study for the G-Area Oil Seepage Basin (GOSB) (U)*, Rev. 1, SRNS-RP-2017-00281, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USEPA 2018. *USEPA Regional Screening Levels*, U.S. Environmental Protection Agency, May 2018 https://www.epa.gov/risk/regional-screening-levels-rsls

Table 1. Spray Irrigation Evaluation: Projected Soil Concentrations Compared to Human Health and Ecological Threshold Levels

Analyte	Maximum Result Surface Water[1] (µg/L)	Maximum Result Surface Water Conversion[2] (mg/L)	Projected Soil Concentration[3] (mg/kg)	Human Health Residential RSL[4] (mg/kg)	Projected Soil Concentration > HH RSL?	Ecological RSV[5] (mg/kg)	Projected Soil Concentration > ECO RSV?
Inorganics							
Aluminum	3.32E+04	3.32E+01	3.32E+01	7.70E+04	no	NA	no
Antimony	3.62E+00	3.62E-03	3.62E-03	3.10E+01	no	2.40E+01	no
Barium	3.05E+02	3.05E-01	3.05E-01	1.50E+04	no	2.60E+02	no
Beryllium	1.40E+00	1.40E-03	1.40E-03	1.60E+02	no	2.50E+01	no
Cadmium	2.31E+01	2.31E-02	2.31E-02	7.10E+01	no	2.70E+00	no
Calcium	1.35E+04	1.35E+01	1.35E+01	NA[6]	no	NA[6]	no
Chromium	1.47E+02	1.47E-01	1.47E-01	3.00E-01	no	2.80E+02	no
Cobalt	1.36E+01	1.36E-02	1.36E-02	2.30E+01	no	1.30E+02	no
Copper	8.05E+02	8.05E-01	8.05E-01	3.10E+03	no	4.60E+01	no
Cyanide	5.27E+00	5.27E-03	5.27E-03	2.30E+01	no	1.00E+00	no
Iron	2.55E+04	2.55E+01	2.55E+01	5.50E+04	no	NA	no
Lead	1.31E+02	1.31E-01	1.31E-01	4.00E+02	no	2.80E+01	no
Magnesium	2.08E+03	2.08E+00	2.08E+00	NA[6]	no	NA[6]	no
Manganese	3.40E+02	3.40E-01	3.40E-01	1.80E+03	no	1.10E+03	no
Mercury	2.37E-01	2.37E-04	2.37E-04	1.10E+01	no	3.50E-03	no
Nickel	1.28E+02	1.28E-01	1.28E-01	8.20E+02	no	1.90E+01	no
Potassium	5.53E+03	5.53E+00	5.53E+00	NA[6]	no	NA[6]	no
Silver	2.99E+02	2.99E-01	2.99E-01	3.90E+02	no	2.60E+01	no
Sodium	8.70E+03	8.70E+00	8.70E+00	NA[6]	no	NA[6]	no
Vanadium	6.88E+01	6.88E-02	6.88E-02	3.90E+02	no	NA[6]	no
Zinc	3.80E+03	3.80E+00	3.80E+00	2.30E+04	no	4.80E+02	no
Organics							
Acetone	4.02E+00	4.02E-03	4.02E-03	6.10E+04	no	6.30E+00	no
Caprolactam	3.64E+01	3.64E-02	3.64E-02	3.10E+04	no	NA[6]	no
Toluene	5.06E+00	5.06E-03	5.06E-03	4.90E+03	no	2.30E+02	no
Pesticides/PCBs							
Alpha-Chlordane	2.22E-01	2.22E-04	2.22E-04	1.70E+00	no	2.70E+00	no
Alpha-Benzene Hexachloride	1.23E-02	1.23E-05	1.23E-05	2.10E-01	no	5.80E+02	no
Beta-Benzene Hexachloride	3.48E-02	3.48E-05	3.48E-05	2.10E-01	no	1.30E+00	no
DDD	4.08E-02	4.08E-05	4.08E-05	1.90E+00	no	3.30E-02	no
DDE	8.04E-02	8.04E-05	8.04E-05	2.00E+00	no	5.50E-01	no
DDT	2.28E-02	2.28E-05	2.28E-05	1.90E+00	no	2.20E-01	no
Dieldrin	1.16E-02	1.16E-05	1.16E-05	3.40E-02	no	9.00E-03	no
Gamma-Chlordane	2.34E-01	2.34E-04	2.34E-04	1.70E+00	no	2.20E+01	no

1 - Maximum detected concentration in GOSB Interior Subunit, surface water media
2 - Surface water conversion from ug/L to mg/L
3 - Projected soil concentration, assumes 1 mg/L (ppm) water = 1 mg/kg (ppm) soil
4 - HH residential RSL for soil media from USEPA Regional Screening Levels table, May 2018
5 - ECO refinement screening value (RSV) for soil media from Appendix D of the RFI/RI/BRA/CMS/FS for the GOSB OU (SRNS-RP-2017-00218) April 2018
6 - NA = not available; a screening threshold level is not available for this constituent

Table 2. Protective Levels for RCOCs in Surface Water

RCOC[1]	HH RSL[2] (mg/kg)	ECO RSV[3] (mg/kg)	Lesser of RSL/RSV (mg/kg)	Surface Water Threshold[4] (mg/L)
alpha-Chlordane	1.70E+00	2.70E+00	1.70E+00	1.70E+00
gamma-Chlordane	1.70E+00	2.20E+01	1.70E+00	1.70E+00
Silver	3.90E+02	2.60E+01	2.60E+01	2.60E+01

1 - Surface water RCOCs identified in RFI/RI/BRA/CMS/FS for the GOSB OU

2 - Human health (residential) regional screening level for soil media (USEPA 2018)

3 - Ecological refinement screening value for soil media (SRNS 2018)

4 - Surface water threshold assumes concentration in surface water (mg/L) = concentration in soil (mg/kg)

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