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Remedial Action Implementation Plan for the Lower Three Runs Integrator Operable Unit Upper Subunit (U)

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximate, approximately
>, ≥	greater than, greater than or equal to
<	less than
ac	acre
ARAR	applicable or relevant and appropriate requirement
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulation
EA	Exposure Area
EALUCIP	Early Action Land Use Control Implementation Plan
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	feet
ft^2	square feet
ft^3	cubic feet
ha	hectare
HASP	Health and Safety Plan
Hg	mercury
IOU	Integrator Operable Unit
IROD	Interim Record of Decision (Interim ROD)
km	kilometer
km^2	square kilometer
LLC	Limited Liability Company
LLWF	Low Level Waste Facility
LOD	limits of disturbance
LOE	limits of excavation
LTR	Lower Three Runs
LUC	Land Use Controls
LUCIP	Land Use Control Implementation Plan
m	meter
m^2	square meter
m^3	cubic meter
mi^2	square mile
mi	mile
MNR	monitored natural recovery
MNREMP	Monitored Natural Recovery Effectiveness Monitoring Plan
msl	mean sea level
pCi/g	picocurie per gram
PCR	Post Construction Report
PP	Proposed Plan
PTSM	principal threat source material

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

QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAIP	Remedial Action Implementation Plan
RAO	remedial action objective
RCOC	refined constituent of concern
RI	Remedial Investigation
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SEMS	Superfund Enterprise Management System
SOW	Statement of Work
SRNS	Savannah River Nuclear Solutions
SRS	Savannah River Site
STR	Subcontract Technical Representative
SWPPP	Storm Water Pollution Prevention Plan
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency

1.0 GENERAL DESCRIPTION

1.1 Purpose and Scope

This post-Record of Decision (ROD) document provides the following items for the implementation of the selected remedial action (RA) established in the *Record of Decision for the Lower Three Runs Integrator Operable Unit* (Savannah River Nuclear Solutions [SRNS] 2021a) for the Upper subunit of the Lower Three Runs Integrator Operable Unit (LTR IOU):

- A general description of the location and history of the site, description of the constituents of concern to be remedied and an overview of the selected RA;
- A summary of any associated study (if applicable) and the application of its results in the remedial design;
- An outline of the necessary design tasks;
- A design summary highlighting the results of each of the design tasks performed to accomplish the objectives of the selected RA;
- A summary of the construction strategy addressing critical components of construction activities required to implement the remedial design;
- Requirements for health and safety, waste management, contamination control, decontamination, quality assurance, quality control inspections, performance verifications (sampling, testing/analysis, when applicable), post-construction operations, maintenance and land use controls, project closeout, post-construction monitoring; and a forecast schedule for implementation of the RA; and
- A forecast schedule and brief discussion of the contents of the upcoming post-ROD documents required by the Federal Facility Agreement (FFA 1993) for the Savannah River Site (SRS).

The scope of this Remedial Action Implementation Plan (RAIP) is limited to the Upper subunit of the LTR IOU. As stated in the ROD, the Middle and Lower subunits require only the land use controls (LUCs) described in the Early Action Land Use Control Implementation Plan (EALUCIP) for the LTR Tail Portion (SRNS 2013) which have already been implemented.

1.2 General Description and History of the Unit

The LTR watershed is located in the southeastern portion of SRS (Figure 1). LTR is a large blackwater stream that originates in the northeast portion of SRS and follows a southerly direction for approximately (~) 40-kilometers (km [24.5-miles {mi}]), discharging into the Savannah River. The LTR watershed drains about 460 square kilometers (km^2 [180square miles {mi^2}]).

For administrative purposes, the LTR IOU is delineated into Upper, Middle, and Lower subunits (Figure 2). The IOU is defined as surface water bodies (e.g., stream, lakes, and ponds) and associated wetlands/floodplains including surface water, sediment/soil (stream channel/floodplain sediment and floodplain/wetland soil), and related biota. The Upper subunit of the LTR IOU is located upgradient of the PAR Pond Dam, while the Middle and Lower subunits are located below the PAR Pond Dam that includes an area with a narrow land buffer referred to as the "tail" section of the LTR IOU. This document describes the implementation of the selected remedy for the Upper subunit.

The Upper subunit of the LTR IOU includes a 1,068-hectare (ha [2,640-acre {ac}]) mainstream impoundment (PAR Pond), several smaller ponds (pre-cooler ponds), and canal systems including P-Area Discharge Canal, R-Area Discharge Canal, and the Old R-Area Discharge Canal (Joyce Branch) (Figure 3) that received thermal discharges from the cooling water systems associated with the P- and R-Reactors. Liquid releases to the PAR Pond canal system included process leaks, reactor disassembly basin purges, thermal discharges, and makeup cooling water that contained low levels of metals and radionuclides, primarily cesium-137 (Cs-137), but also cobalt-60 (Co-60) in smaller quantities. Effluent discharges from R-Reactor and P-Reactor ceased in 1964 and 1987,

respectively. A history of the operation of these cooling water discharges is provided in the ROD (SRNS 2021a).

In March 1991, during an inspection of the PAR Pond Dam, a small surface depression was noted on the downstream face which necessitated a detailed structural investigation and initiated a precautionary drawdown of the reservoir. From June through September 1991, the level of PAR Pond was lowered from 60-meter (m) to 54-m (200-feet [ft] to 181-ft) above mean sea level (msl) to reduce the risk and consequences of an unlikely event of dam failure. A Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Interim Record of Decision (IROD) for PAR Pond was issued in 1995 to address potential exposure to the Cs-137 contaminated sediment/soil that was exposed following water level drawdown of the PAR Pond reservoir during repair of the dam (WSRC 1995).

Potential sources of contamination to the LTR IOU have been evaluated and mitigated or determined to require No Further Action. A list of historic sources of contamination is provided in the ROD (SRNS 2021a).

For the Upper subunit of the LTR IOU, the *Remedial Investigation/Baseline Risk Assessment (RI/BRA) for the Lower Three Runs IOU* (SRNS 2017) summarizes the data associated with the unit, describes the nature and extent of the contamination in affected media, and evaluates the potential risk to human and ecological receptors. The *Feasibility Study (FS) for the Lower Three Runs Integrator Operable Unit* (SRNS 2020a) outlines potential remedial alternatives and screens remedial technologies. The FS also includes a detailed remedial alternative analysis that was used to support the selection of the final remedy for the Upper subunit described in the approved ROD (SRNS 2021a).

1.3 Nature and Extent of Contamination

The Upper subunit of the LTR IOU was evaluated through the CERCLA remedial process to determine the actual or potential impact to human health and the environment. The RI/BRA (SRNS 2017) contains detailed information and analytical data for the characterization investigations conducted and samples collected in the media assessment

of the Upper subunit of the LTR IOU. Due to the large scale of the LTR IOU and the environmental conditions, the media assessment of the Upper subunit was performed on nine individual exposure areas (EAs). The EAs are identified in Figure 3 and are listed below.

- EA1 includes Pond A and the R-Area Discharge Canal. Pond A, is ~2.6 ha (6.4 ac), and received water from the R-Area Discharge Canal that subsequently discharged to Pond B. The canal from R-Reactor to Pond A is ~645-m (2,116.1-ft) long. The canal from the R-Discharge Canal to Joyce Branch is 233-m (764.4-ft) long.

- EA2 consists of the section of the canal system between Pond A and Pond B and is ~2,837-m (9,307.7-ft) long. The canal flow area (i.e., where contaminants most likely have been deposited) is ~3.0-m (9.8-ft) across the base of the canal.

- EA3 includes Pond B and the overflow canal connecting Pond B to Pond C. Pond B is ~82.1 ha (202.8 ac) and received water from the R Area which subsequently discharged to PAR Pond. Pond B generally maintains its water level from year to year. The overflow canal from Pond B is ~547-m (1,794.6-ft) long.

- EA4 consists of the section of the canal system between Pond B and the North Arm of PAR Pond and is ~2,305-m (7,562.3-ft) long. The canal flow area (i.e., where contaminants most likely have been deposited) is ~3.0-m (9.8-ft) across the base of the canal.

- EA5 consists of Joyce Branch (also known as the Old R-Area Discharge Canal) which is ~2,533-m (8,310.3-ft) long. Flow from the R-Reactor cooling water system was directed along Joyce Branch to LTR from 1953 until the diversion structure was built in 1958. The diversion structure eliminated direct reactor discharges to Joyce Branch. The flow area (i.e., where contaminants most likely have been deposited) is ~3-m (9.8-ft) across the base of the stream channel.

- EA6 consists of PAR Pond. PAR Pond is ~1,068.3 ha (2,640 ac) and received water from the R Area and P Area discharges.

- EA7 includes Pond 2 and the Discharge Canal between P Area and Ponds 4 and 5. Pond 2 is ~7.9 ha (19.6 ac) and received water from P Area and subsequently discharged to Ponds 4 and 5. The canal from P Area to Pond 2 is ~3,582-m (11,751.9-ft) long. The canal from Pond 2 to Ponds 4 and 5 is ~2,081-m (6,827.4-ft) long. The canal flow area (i.e., where contaminants most likely have been deposited) is ~3-m (9.8-ft) across the base of the canal.

- EA8 includes Ponds 4 and 5 and the Discharge Canal between Ponds 4 and 5 to Pond C. Pond 4 is ~14.3 ha (35.3 ac) and received water from P Area and subsequently discharged to Pond 5. Pond 5 is ~4.0 ha (9.9 ac) and received water from Pond 4 and subsequently discharged to Pond C via an 1,887-m (6,190.9-ft) long canal. The canal flow area (i.e., where contaminants most likely have been deposited) is ~3-m (9.8-ft) across the base of the canal.

- EA9 consists of Pond C. Pond C is ~53.5 ha (132.4 ac) and received water from the R Area discharged directly from Joyce Branch and P Area through the canal system. Water from Pond C flows to PAR Pond through a reverse riser (commonly referred to as the "bubble-up"). As long as PAR Pond is above 59.5-m (195.25-ft) msl, Pond C and PAR Pond will maintain the same water level. If PAR Pond drops below 59.5-m (195.25-ft) msl, Pond C will remain at 59.5-m (195.25-ft) msl unless the drain gate is opened to release water.

In 2009/2010, extensive sampling of the Upper subunit was undertaken to augment previously collected data to support the risk evaluation. The sampling was performed as outlined in the approved Sampling and Analysis Plans (SRNS 2010, SRNS 2016) and included sampling of sediment/soil, surface water, and fish (i.e., biota). The sampling included the canals, pre-cooler ponds, PAR Pond, and the LTRs stream system below PAR Pond dam. Stream channel/floodplain sediment and floodplain/wetland soil (i.e., sediment/soil) are combined as a single medium and referred to as "sediment/soil." The results of the characterization activities and human health and ecological risk evaluations are documented in the RI/BRA (SRNS 2017).

Human health risks were evaluated based on an onsite worker (wetland researcher) for all EAs and a hypothetical recreational fisherman scenario for the EAs that can sustain populations of consumable fish (EA3, EA6 and EA9). As detailed in the FS and RI/BRA, the refined constituents of concern (RCOCs) are Cs-137 and, to a lesser degree Co-60, in sediment/soil media. In addition, Cs-137 and mercury (Hg) were identified as RCOCs in fish tissue; however, the presence of Hg is the result of atmospheric deposition and from the use of the elevated levels of Hg in Savannah River water as part of the river water distribution system, not from SRS operations.

All EAs (EA1 through EA9) present a problem warranting RA due to the potential exposure to Cs-137 (+D), and to a lesser extent, Co-60 in the sediment/soil within the canals and ponds. Figure 4 shows the sample locations that had concentrations above the cleanup levels. Cs-137 (+D) and Hg were found in fish tissue at levels that warrant RA. RAs associated to this exposure scenario are applicable for EA3, EA6 and EA9, which can sustain populations of consumable fish. Surface water was determined not to be a media of concern.

No problems warranting action were identified for ecological receptors.

A principal threat source material (PTSM) evaluation was conducted and summarized in Appendix D of the RI/BRA (SRNS 2017). The source material from all depth intervals is preliminarily considered to be PTSM if the cumulative risk exceeds one of the following toxicity threshold criteria:

- Carcinogens: greater than (>) 1.0E-03 IOU onsite worker risk, and
- Non-carcinogens: IOU onsite worker hazard index >10.

As determined via a screening process using the maximum detected concentration of all constituents, a cumulative analysis using the exposure point concentrations of constituents that exceeded the screening process, and a refinement/uncertainty analysis as presented in the approved RI/BRA, neither of the criteria listed above was exceeded for the onsite worker receptor scenario. Therefore, n~~N~~o PTSM RCOCs were formally identified for any EA within the LTR IOU~~; however~~ even though, EA1, EA3 and EA5 had specific locations

where Cs-137 levels were above the PTSM threshold (144 pCi/g) (Figure 5). At EA1, one submerged location had five separate sample results above the PTSM threshold. This location has been shown in previous documents as identified in Figure 6. During design of the RA, it was discovered that this location has been mis-represented due to an error within the mapping application. The correct sample location was discovered to be upstream at the location identified on Figure 7. This location was confirmed via a review of map coordinates and interviews with samplers. As depicted on Figure 7, samples along transects upstream and downstream of R-1 had Cs-137 concentrations below the PTSM threshold.

At EA3, two submerged locations had sample results above the threshold. Two periodically submerged locations within EA5 had sample results above the threshold.

1.4 Document Format

The format of this RAIP is consistent with the FFA protocol format approved by the United States Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC) in March 2003.

1.5 Remedial Action

As stated in the ROD, the selected RA for the Upper subunit of LTR IOU includes multiple elements. Some elements of the remedies are only applicable to specific EAs. The selected RA associated with the applicable EAs is as follows:

Land Use Controls (LUCs) with Monitored Natural Recovery (MNR) is the selected RA for all nine EAs (EA1 through EA9).

Excavation, Treatment, and Disposal of PTSM Sediment/Soil is the selected RA for the PTSM location in EA1 (Pond A – Including R-Area Discharge Canal) to reduce exposure and mitigate sediment/soil migration;

Maintain Water in Ponds is the selected alternative for EA3 (Pond B) and EA6 (PAR Pond) to maintain water levels in Pond B, PAR Pond, and Pond C to reduce exposure and mitigate sediment/soil migration.

The following subsections describe each of the RAs. Table 1 lists applicable or relevant and appropriate requirements (ARARs) associated with the RA. A conceptual site model (Figure 8) illustrates how implementation of the RA breaks the exposure pathways.

1.5.1 LUCs with MNR

LUCs with MNR is the selected RA for the entire Upper subunit (all nine EAs) and was selected because the remedy is effective in reducing exposure of contaminated media to human receptors for the entire Upper subunit and will achieve the remedial action objectives (RAOs) by:

- Preventing contact, removal, or excavation of sediment/soil within the LTR IOU.
- Prohibiting the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playgrounds.
- Preventing fishing within the LTR IOU.

Key elements of the LUCs include the following:

- Administrative/Worker Access Controls including Institutional Controls (i.e., administrative measures) and use restrictions for onsite workers as implemented under the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls/work packages that include worker training, pre-work briefings, and health and safety requirements.

- SRS access controls to prevent exposure to trespassers, as described in the 2013 Resource Conservation and Recovery Act Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

- Signage posted at LTR IOU Upper subunit access points. The *Land Use Control Implementation Plan (LUCIP) for the Lower Three Runs Integrator Operable Unit (Upper Subunit)* (LUCIP) (SRNS 2022a) provides figures with the sign locations. Signage includes Access Control Warning and No Unauthorized Fishing wording, as well as a map of the LUC boundary.

For Joyce Branch (EA5), PTSM is present in two locations (Figure 9). EA5 is located interior to the site ~7.2 km (4.5 mi) from the SRS boundary, remotely located from site operations, and is not accessible to the public (i.e., trespassers). To address the PTSM in these locations, more robust LUCs will be applied at EA5 in the form of additional signage along the bank near the PTSM locations and the installation of barrier gates across roads leading to the two PTSM locations. For Pond B (EA3) the two PTSM locations (Figure 5) are covered by 5.2 m (17 ft) and 9.1 m (30 ft) of water; therefore, no additional signage or barrier gates are needed to prevent exposure.

The specific locations of the signs and gates are provided in the LUCIP (SRNS 2022a). Inspection criteria and frequency are included in the LUCIP.

The MNR portion of the remedy will be implemented via an effectiveness monitoring plan (MNREMP) (SRNS 2022b). This plan includes a strategy for long term monitoring to ensure that natural recovery processes of radiological decay and continued sediment/soil deposition will reduce bioavailability of contaminants. The MNREMP includes sampling of all EAs on a periodic basis. Data collected will be reviewed during the five-year remedy review and will be used to document the effectiveness of the remedy. The plan is being issued as a separate document due to the long-term monitoring requirements and because the sampling technology may evolve over time resulting in revisions to the plan. Additionally, the need for continued monitoring will be re-evaluated after Cs-137 concentrations in the Upper subunit decay below the PTSM threshold.

1.5.2 Excavation, Treatment and Disposal of PTSM Sediment/Soil

Excavation, Treatment, and Disposal of PTSM Sediment/Soil was selected for EA1. Concentrations of Cs-137 were found above the PTSM threshold at a location adjacent to

the access road along the R-Area Discharge Canal. This remedy is estimated to shorten the timeframe for radioactive decay to reach cleanup levels from 290 years to 225 years in EA1 by removing the PTSM at the designated location. Combined with LUCs with MNR, this RA will achieve the RAOs by eliminating potential exposure to PTSM sediment/soil and preventing access as described in Section 1.5.1.

Key elements of this RA include:

- sampling to delineate the extent of PTSM contamination;
- removal and disposal of vegetation within the contaminated area and access areas;
- excavation of sediment/soil that is contaminated with Cs-137 above the PTSM threshold;
- treatment of the excavated sediment/soil by adding a drying agent prior to shipment;
- disposal in the SRS E-Area Low Level Waste Facility (LLWF); and,
- post-excavation sampling to confirm the remaining sediment/soil concentrations of Cs-137 are below the PTSM threshold.

1.5.3 Maintain Water in Ponds

Maintain water in ponds is the selected remedy for Pond B (EA3), PAR Pond (EA6), and Pond C (EA9). Pond C (EA9) is hydrologically connected to PAR Pond (EA6) and maintains an equivalent level with PAR Pond (EA6). The reverse riser structure associated with Pond C (EA9) allows water to flow from Pond C (EA9) into PAR Pond (EA6) using hydraulic pressure to stabilize water elevation between the two ponds. Therefore, the water level in Pond C will be maintained through implementation of this RA at PAR Pond (EA6). Maintaining water in these ponds minimizes access and breaks a direct contact pathway that limits potential exposure to submerged, contaminated sediment/soil within the ponds (Figure 8). The existing dam structures provide the infrastructure to retain water in the ponds at historically consistent water levels.

Key elements of this RA include annual inspections and routine maintenance of the following:

- Pond B earthen dam
- PAR Pond dam

If inspections or maintenance activities identify structural inadequacies of the dams, appropriate regulatory actions will be pursued. This remedy will be reviewed during the five-year remedy reviews.

1.6 Remedial Action Objectives

As stated in the ROD (SRNS 2021a), the RAOs for the Upper subunit of the LTR IOU are as follows:

- Protect IOU onsite workers from exposure to Cs-137 and Co-60 in sediment/soil that exceed 1.0E-06 risk threshold or background levels. The primary exposure route of concern is the external radiation pathway.
- Protect the recreational fisherman from exposure to Cs-137 and Hg in fish tissue that exceed risks of 1E-06 and hazard quotient of 1, respectively. The primary route of exposure is the ingestion of fish pathway.

1.7 Remedial Action Implementation Schedule

The LTR Upper subunit implementation schedule is provided in Figure 10.

1.8 Community Relations

The *Proposed Plan (PP) for the Lower Three Runs Integrator Operable Unit (U)* (SRNS 2021b) is part of the Administrative Record File and identifies the preferred RA for addressing hazardous substances existing at the LTR Upper subunit. The PP and associated fact sheet were made available for public comment. Public notification of the comment period was made 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 *Allendale Citizen Leader*, the Augusta Chronicle, the Barnwell People-Sentinel, and the State newspaper. The public comment period was also announced on local radio stations.

The 45-day public comment period for the *Proposed Plan for the Lower Three Runs Integrator Operable Unit* began on January 27, 2021, and ended on March 12, 2021. No comments were received from the public.

A fact sheet on the RA is attached as Appendix A to inform interested parties about activities related to the RA. An opportunity for a public briefing will be held before initiation of the RA.

2.0 REMEDIAL DESIGN

2.1 Design Strategy

The design strategy for the LTR Upper subunit pertains to the following RAs: LUCs with MNR and the Excavation, Treatment, and Disposal of PTSM Sediment/Soil. The RA, Maintain Water in Ponds, will rely on the established annual inspections and maintenance programs that are currently being conducted.

2.1.1 Design Strategy for LUCs with MNR

The design strategy for the LUCs with MNR RA includes the development of a LUCIP (SRNS 2022a) and the placement of access control warning signs and gates. The construction and placement of the signs will be performed by SRNS personnel or by a subcontractor. Locations of the signs are provided in the LUCIP. Two gates will be installed along the access roads leading to the portion of Joyce Branch (EA5) where two PTSM locations, identified on Figure 9, were identified. The design for the gate is provided in Attachment 1-1. The gates will be installed by SRNS or by subcontract. The design for the signs and gate will adhere to design standards that are typical of access control warning signs placed at other operable units as identified in Attachment 1-2.

For the MNR portion of the RA, an MNREMP (SRNS 2022b) has been developed to describe the collection and frequency of data to ensure that any unexpected changes to the system that would allow for human exposure to contaminated sediment/soil or fish will be identified and mitigated.

2.1.2 Design Strategy for Excavation, Treatment, and Disposal of PTSM Sediment/Soil

A multi-phased design strategy is planned for the Excavation, Treatment, and Disposal of PTSM Sediment/Soil. The first phase of this RA will include sampling to define the lateral and vertical extent of PTSM at the location identified on Figure 7. For evaluation purposes in the FS (SRNS 2020a), the volume of PTSM at the identified location was assumed to be 10 cubic meters (m^3 [353 cubic feet {ft^3}]). Contamination was assumed to be limited to 0.3-m (1-ft) deep. Based on these assumptions, an area of 37-m^2 (400-ft^2) by 0.3-m (1-ft) deep surrounding the PTSM sample location will be established as the minimum excavation area and depth. Sampling beyond the 37-m^2 (400-ft^2) area will be performed at step out locations as described in Appendix B to determine if Cs-137 is present above the PTSM thresholds beyond this boundary. Sampling to determine the extent of PTSM, as described in Appendix B, will be performed by SRNS or by subcontract personnel.

Once the extent of PTSM in the designated area has been determined, a land survey/layout will be performed to establish the limits of disturbance (LOD) for the excavation activities. The LOD will include areas necessary for equipment access and staging. The LOD will be surveyed by SRNS personnel and will be used to determine if a Storm Water Pollution Prevention Plan (SWPPP) is required. Land disturbances less than 0.4 ha (1 ac) do not require a SWPPP. Best management practices will be implemented to mitigate erosion and provide sediment control.

A statement of work (SOW) will be prepared to describe the project boundaries and extent of sediment/soil excavation. The Excavation, Treatment, and Disposal of PTSM Sediment/Soil will be executed per the SOW either by SRNS construction or subcontract. The method of excavation of the sediment/soil will be designed to minimize disruption to the canal (including surface water) and will be proposed by the subcontractor and approved by SRS as part of the bidding process. Following excavation within the SOW-defined boundaries, confirmation sampling will be performed in accordance with Appendix B. De-mobilization and site restoration will occur once the confirmation samples indicate that the Cs-137 concentrations in sediment/soil within the boundaries of the excavation area are below the PTSM threshold.

2.1.3 Design Strategy for Maintain Water in Ponds

Water is currently maintained and has been historically maintained at consistent levels in EA3, EA6 and EA9 by existing infrastructure. The infrastructure used to maintain the water includes an earthen dam with a sand toe drain system for Pond B (EA3), and an earthen dam with emergency spillway for PAR Pond (EA6). A reverse riser structure associated with Pond C (EA9) allows water to flow from Pond C (EA9) into PAR Pond (EA6) using hydraulic pressure to stabilize water elevation between the two ponds. Therefore, the water level in Pond C will be maintained through implementation of this RA at PAR Pond (EA6).

Inspection requirements are already established for SRS dams (SRS 2016, SRS 2020a, and SRS 2020b). Dams at the SRS are managed according to the Federal Emergency Management Agency's Federal Guidelines of Dam Safety. SRNS Site Infrastructure personnel inspect high hazard dams (includes PAR Pond dam) monthly and low hazard dams annually. Non-routine inspections are also conducted, by procedure (SRS 2020b), during or after heavy rainfall, changes in reservoir level over 0.6 m (2 ft), or seismic activity in the area.

The inspection frequency as described above will continue. Monitoring, inspections and maintenance will ensure that the water is maintained in the ponds to fulfill the RAOs.

2.2 Design Activities

The following is a list of design tasks necessary to implement the selected RAs.

LUCs with MNR

- Field locate access control warning signs and gate locations and obtain initial survey coordinates;
- Prepare site maps with sign locations to be included in the LUCIP;
- Prepare MNREMP.

Maintain Water in Ponds

- None.

Excavate, Treat, and Dispose of PTSM

- Prepare definitive site survey of the excavation area and other support areas;
- Establish excavation boundaries and LOD based on the results of the sampling as defined in Appendix B;
- Develop Health and Safety Plan;
- Develop Waste Management plan;
- Develop SOW for subcontract or SRNS construction project execution.

2.3 Design Deliverables

Design deliverables include excavation drawings and a SOW for execution.

2.4 Results of Data Acquisition

2.4.1 Evaluation of Studies

No treatability study was required for the implementation of the selected RAs. Data presented in the RI/BRA (SRNS 2017) were used to determine the LUC boundaries and the PTSM location requiring excavation. Sediment/soil sampling as described in Appendix B will be used to determine the excavation lateral and vertical limits of PTSM at the designated location in R-Area Discharge Canal (EA1).

2.5 Design Criteria

The design criteria include excavation of PTSM sediment/soil in the identified location within R-Area Discharge Canal of EA1. The extent of PTSM will be verified via sampling as described in Appendix B to establish the limits of excavation (LOE).

Excavation within the LOE will be performed either by mechanical dredging of the submersed sediment/soil or by dewatering the LOE and excavating the sediment/soil.

Containment of the sediment/soil will be required to mitigate migration of PTSM to other parts of the R-Area Discharge Canal. Sediment control will require the use of silt curtains or other SRNS approved silt barrier. Barrier controls, such as cofferdams made of wood, sandbags, water-filled tubes, etc., will be used to divert water Around the LOE. If necessary, water will be pumped from within the LOE to another portion of the canal implementing, ~~Other~~ other engineering controls (e.g., pump flotations, filters, etc.) ~~will be implemented if pumping is required to dewater the LOE~~ to mitigate the migration of sediment within the canal. ~~Barrier controls, such as cofferdams made of wood, sandbags, water-filled tubes, etc., will be used to divert water around the LOE.~~ If mechanical dredging is used, specialized equipment and controls will be specified in the SOW to methodically excavated the sediment/soil with overlapping cuts. Controls using specialized equipment to minimize resuspension will be required. Water will be allowed to drain back into the LOE from the specialized excavating equipment by pausing with the bucket just above the water surface and sediment tubes or filtering sacks may also be used at the boundary of the LOE to minimize sediment release and allow only water to drain back to the canal. The design criteria will include efforts to reduce the amount of water that is removed from the canal. Free liquids within the excavated sediments will be treated with a drying agent prior to shipment within SRS boundaries to the E-Area LLWF for disposal.

Verification sampling will be performed post excavation to confirm that Cs-137 levels are below the PTSM threshold in the excavation area. Results of the sampling will be presented in the Post Construction Report (PCR).

The design criteria for the LUCs are identified in the LUCIP (SRNS 2022a). Monitoring will be performed as described in the MNREMP (SRNS 2022b).

There are no design criteria for the Maintain Water in Ponds remedy.

2.6 Drawings

Attachment 1 provides a sketch of a typical design for signposts, gates, and a preliminary excavation site plan.

2.7 Design Technical Information

Design technical information will be provided in a standard SOW for construction. This SOW will be issued to the subcontractor (or SRNS site construction), along with the excavation boundary drawing to provide the details of the existing conditions and excavation requirements.

3.0 PERMITTING REQUIREMENTS

Permitting requirements include the following:

- SRS Site Clearance Permit (LUCs with MNR and Excavation, Treatment, and Disposal of PTSM Sediment/Soil RAs).

4.0 CONSTRUCTION

4.1 Construction Strategy

The construction strategy is applicable to the LUCs with MNR and the Excavation, Treatment, and Disposal of PTSM Sediment/Soil RAs. Each of these RAs will be implemented in phases:

For the LUCs with MNR RA, the access control warning signs and gates will be installed per the LUCIP and the design drawings in Attachment 1. Once the signs have been installed, as-built drawings will be prepared. Inspections and maintenance will be performed per the LUCIP. The MNR portion of the remedy will be implemented per the monitoring strategy as detailed in the MNREMP (SRNS 2022).

The construction strategy for the Excavation, Treatment, and Disposal of PTSM Sediment/Soil RA will be implemented in phases. The first phase will include sampling to delineate the extent of PTSM at the designated location in the R-Area Discharge Canal and characterize the waste for disposal. The design layout as depicted in Attachment 1-3 will be updated, if necessary, based on the results of the sampling. The next phase will include

the development of a SOW and procurement of subcontract services or establishment of a work agreement with SRS site forces to perform the excavation. Following execution of the excavation, confirmation sampling will be performed to ensure the design criteria have been met and the concentration of Cs-137 in the sediment/soil is below the PTSM threshold (144 pCi/g).

4.2 Construction Activities

Construction activities will be executed by SRS personnel and/or by a subcontractor. The general construction activities include, but are not limited to, the following:

1) Implementation of the LUCs at all EAs;
2) Pre-excavation sampling to determine the PTSM extent at the identified location in EA1 (referred to as the "hot spot");
3) Project layout – surveying – for the LOE and LOD;
4) Installation of erosion and sediment control measures;
5) Clearing and grubbing of laydown yards and access road improvements (subcontract execution);
6) Mobilization of excavation equipment;
7) Installation of silt curtains and dewatering/water diversion activities;
8) Excavation of contamination vegetation and sediment/soil within the LOE;
9) Treatment of sediment/soil with a drying agent;
10) Disposal of contaminated media in the E-Area LLWF;
11) Post Excavation sampling to confirm Cs-137 is below PTSM within the LOE;
12) Demobilization/site restoration.

4.3 Remedial Design Change Control

A subcontract technical representative (STR) will be assigned by SRNS to interface with any subcontractors performing the remediation and the SRNS project engineers and other

project team members. Subcontractors will be required to promptly notify the STR of observed irregularities or nonconformance of work or products. Any requested deviations from the SOW and design documents must be formally documented by the subcontractor and approved by SRNS. The United States Department of Energy (USDOE) will notify USEPA and SCDHEC within a reasonable time frame if significant problems arise regarding any aspect of the Remedial Design/RA process. In particular, scheduling, budget and implementability/technical issues will be brought to the attention of the regulators as soon as they are identified. Notifications will follow established protocols for major and minor changes during construction. If the change is considered major, National Oil and Hazardous Substances Pollution Contingency Plan §300.435(c)(2)(i) or (ii) will be followed for public participation requirements. Section 300.435(c)(2)(i) applies to Explanation of Significant Difference for RODs and (ii) applies to ROD amendments.

4.4 Waste Disposal and Transport

Excavated sediment/soil must not contain free liquids, (i.e. free liquids cannot exceed 1% of the waste volume in a disposal container), for disposal in the LLWF. As a result, the excavated sediment will be treated with a drying agent, Waste Lock 770 or SRNS approved equivalent, to absorb the water from the excavated material prior to shipping to the E-Area LLWF. Sediment/soil and contaminated vegetation (excavated from the R-Area Discharge Canal) will be placed into lined roll-off containers or skid pans staged near the excavation area. If roll-off containers are used, they will be partially filled to ensure the gross weight of 16,323 kilograms (36,000 pounds) is not exceeded for transportation.

4.5 Quality Assurance

Any portions of the RA that are performed by a subcontractor will require an approved project-specific Quality Assurance Project Plan (QAPP). The QAPP will be submitted to SRNS for review and approval prior to the commencement of any field work. At a minimum, the QAPP will address the following elements:

- Management and Organization;
- Personnel Qualification and Training;
- Procurement Document Control;
- Document Control;
- Implementation of Work Processes;
- Testing and Inspections;
- Control of Measuring and Test Equipment;
- Handling, Storage and Shipping;
- Control of Subcontractor Requested Changes; and
- Quality Assurance Records.

4.6 Non-Conformances

All non-conformances will be evaluated, resolved, or rectified as described in the pertinent sections of this document and per the subcontract documents where applicable. Design changes from the resolution of non-conforming conditions will be processed per Section 4.3, Remedial Design Change Control.

4.7 Health and Safety Plan (HASP)

A Site-Specific Health and Safety Plan (HASP) will be prepared in accordance with 29 Code of Federal Regulation (CFR), Part 1910, Section 120, Occupational Safety and Health Administration and will be implemented by the construction team. The HASP will be approved in accordance with SRS procedures, and a copy will be available at the jobsite at all times.

The plan will describe the following:

- Required actions by the facility personnel in case of fires, explosions, or any unplanned releases of hazardous waste;
- Arrangements with onsite security, fire department, medical facility, and emergency response teams to coordinate emergency services;
- Names, addresses, and phone numbers (office and home) of all persons qualified to act as emergency coordinators;

- Emergency equipment available at the facility; and
- Evacuation plan for facility personnel.

5.0 POST CONSTRUCTION

5.1 Post-Construction Monitoring

Confirmation sampling will be performed as described in Appendix B. If sampling results indicate that the excavation area is above the PTSM threshold for Cs-137, additional sediment/soil will be excavated.

Monitoring as required for the MNR portion of the remedy will be implemented as described in the MNREMP (SRNS 2022b).

5.2 Contingency Plan Implementation Strategy

All field construction activities performed by the subcontractor will be overseen by an SRNS STR. The STR is responsible for ensuring that construction/excavation activities are performed in accordance with the contract requirements and for interfacing with the subcontractor and other SRNS project team members. If sampling results indicate that Cs-137 concentrations in the excavation area are above the PTSM threshold, the STR will direct the subcontractor to excavate additional sediments.

5.3 Operations, Maintenance, and Institutional Control

Maintenance of dams will be performed as needed on the Pond B dam and the PAR Pond dam. Maintenance will be performed by SRNS Site Infrastructure. Annual inspections and periodic maintenance of the physical attributes (i.e., dams, weirs, control gates, etc.) that make water retention viable are already in place per SRS procedures and the Federal Energy Regulatory Commission guidelines.

A LUCIP will be issued. The LUCIP will identify maintenance and institutional controls in accordance with the requirements defined in the ROD and will remain in effect unless and until modified as needed to be protective of human health and the environment.

5.4 Requirements for Project Closeout

Completion of construction will be verified by the SRNS project team. The SRNS project team will perform periodic surveillance of construction activities and will compile the results of the confirmation sampling in the PCR. As-builts of the sign locations and gates will be prepared to document the access controls associated with the LUCs.

Monitoring and reporting of the MNR portion of the remedy will be performed as described in the MNREMP (SRNS 2022b).

5.5 Schedule for Federal Facility Agreement Deliverables

A schedule of the FFA milestones is provided in Figure 10. The LTR IOU Upper subunit PCR will be submitted in accordance with the requirements for submittal of regulatory documents as identified in the FFA. The PCR is scheduled to be prepared and submitted to the USEPA and SCDHEC within 160 calendar days of completion of the RA. The PCR will include items such as a chronology of events, performance standards and construction quality control information, a description of the construction activities, final inspections, project as-built drawings, a summary of project costs, and the results of the confirmation sampling.

6.0 REFERENCES

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

SRNS, 2010. *Sampling and Analysis Plan for the Lower Three Runs Stream, Floodplain, and Headwaters*, SGCP-SAP-2009-0003, Rev. 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Early Action Land Use Control Implementation Plan (EALUCIP) for the Lower Three Runs Integrator Operable Unit Tail Portion (Middle and Lower Subunits) (U),* SRNS-RP-2013-00046, Rev. 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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SRNS, 2021b. *Proposed Plan for the Lower Three Runs Integrator Operable Unit (U)*, SRNS-RP-2019-00058, Rev. 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022a. *Land Use Control Implementation Plan (LUCIP) for the Lower Three Runs Integrator Operable Unit (Upper Subunit) (U)*, SRNS-RP-2022-00017, Rev. 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022b. *Monitored Natural Recovery Effectiveness Monitoring Plan for the Lower Three Runs Integrator Operable Unit Upper Subunit (U)* SRNS-RP-2022-00085, Rev. 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRS, 2016 SRS Procedure Manual Y10.10 Site Infrastructure and Services Manual (U), Procedure 9-38044, "Low Hazard Dam Inspection", Savannah River Site, Aiken. SC"

SRS, 2020a. SRS Procedure Manual Y10.10 Site Infrastructure and Services Manual (U), Procedure 9-38002, "Monthly High Hazard Dam Inspection 685-G PAR Pond Dam and 686-G Steel Creek Dam", Savannah River Site, Aiken. SC"

SRS, 2020b. SRS Procedure Manual Y10.10 Site Infrastructure and Services Manual (U), Procedure 9-38027, "Inspection and Prevention Maintenance of PAR Pond Dam, 685-G Conduit and Sluice Gate", Savannah River Site, Aiken. SC"

WSRC, 1995. *Interim Action Record of Decision, Remedial Alternatives Section (U)*, PAR Pond Unit, WSRC-RP-93-1549, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

7.0 APPENDICES

Appendix A Fact Sheet

Appendix B Field Sampling Plan for Pre and Post PTSM Excavation

8.0 ATTACHMENTS

Attachment 1-1 Typical Gate Design

Attachment 1-2 Access Control Warning Sign Design

Attachment 1-3 PTSM Excavation Preliminary Layout Design

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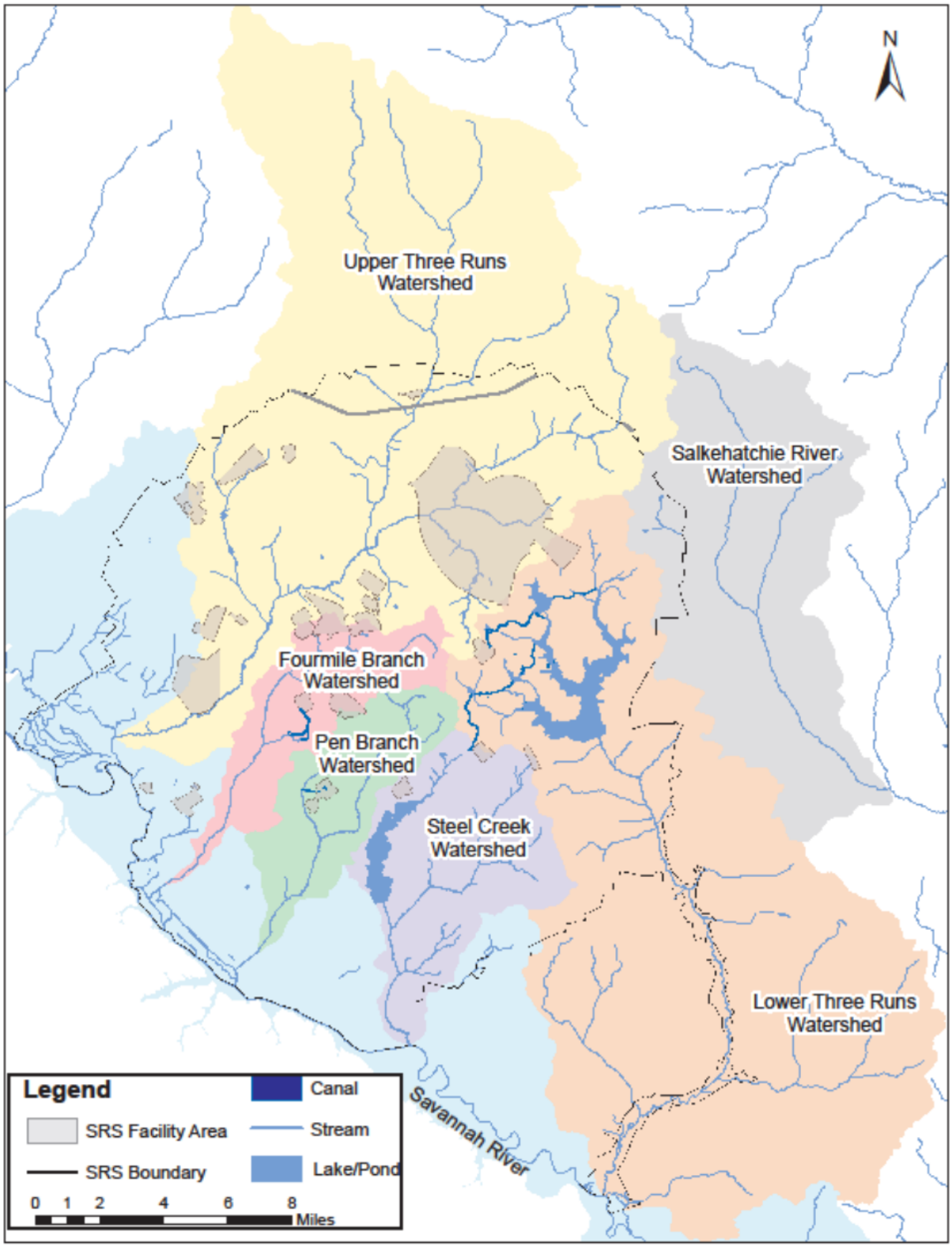


Figure 1. Location of the LTR Watershed

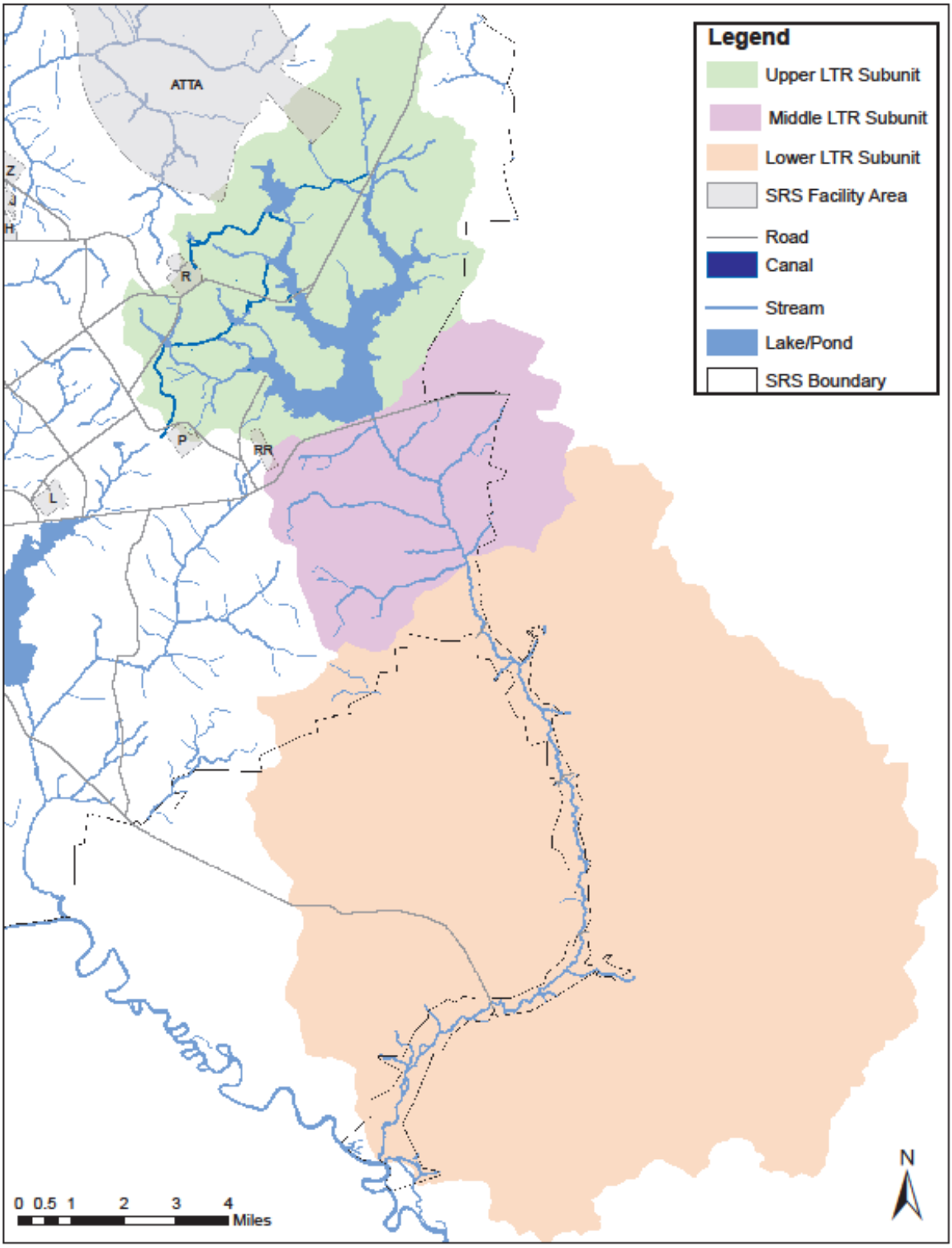


Figure 2. LTR Subunits

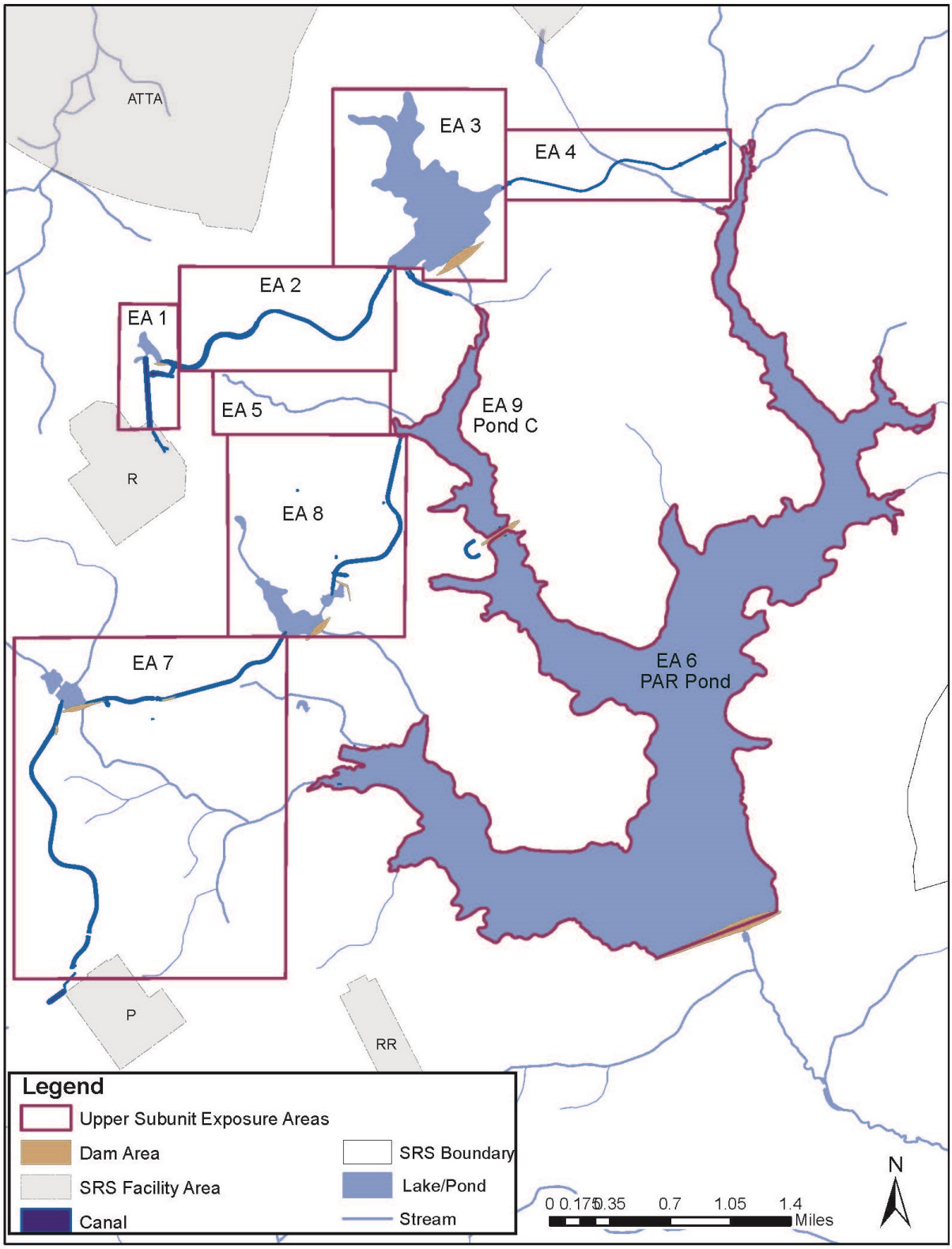


Figure 3. Exposure Areas of the Upper Subunit of the LTR IOU

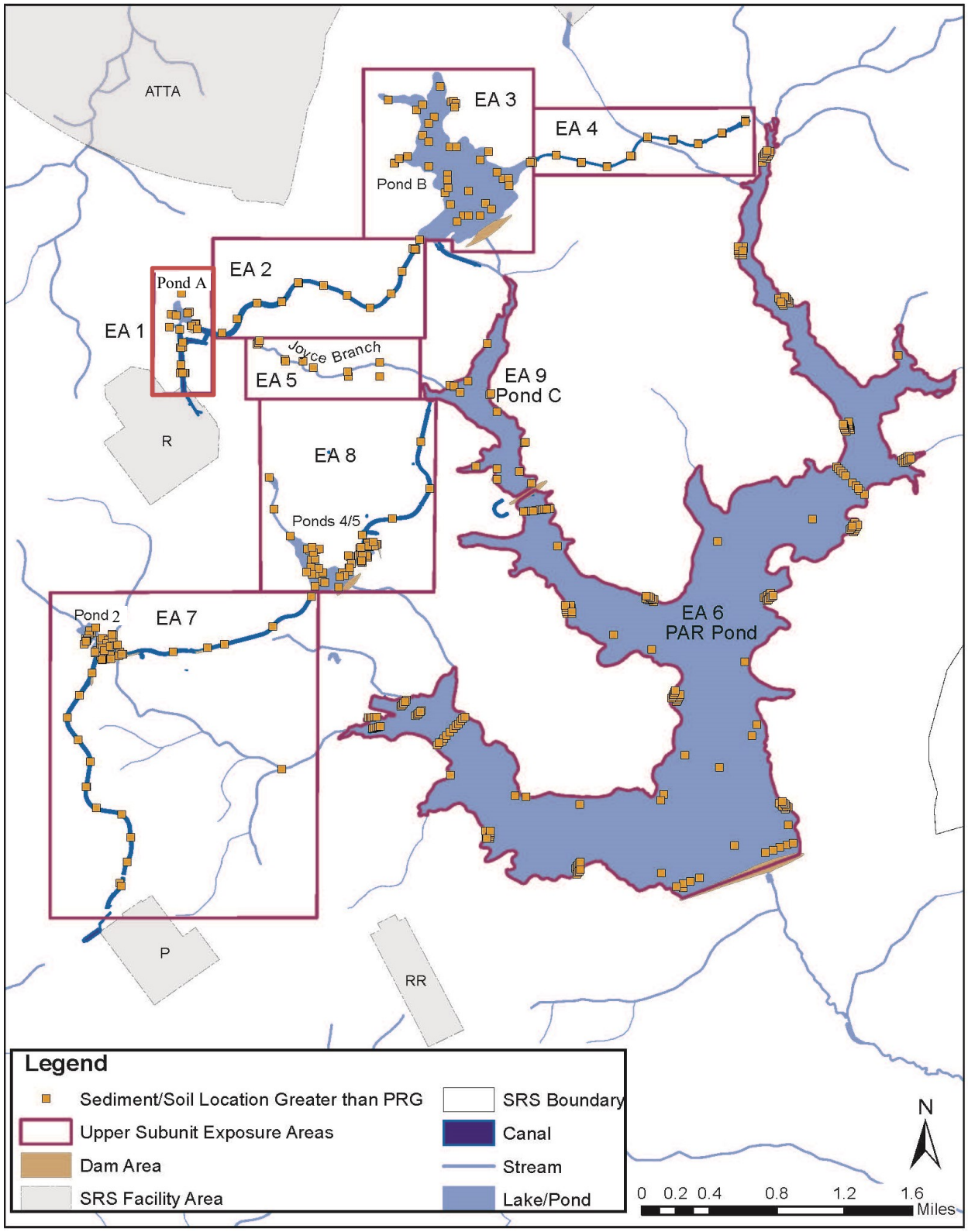


Figure 4. Sample Locations that Exceed the Cleanup Levels in the Upper Subunit of the LTR IOU

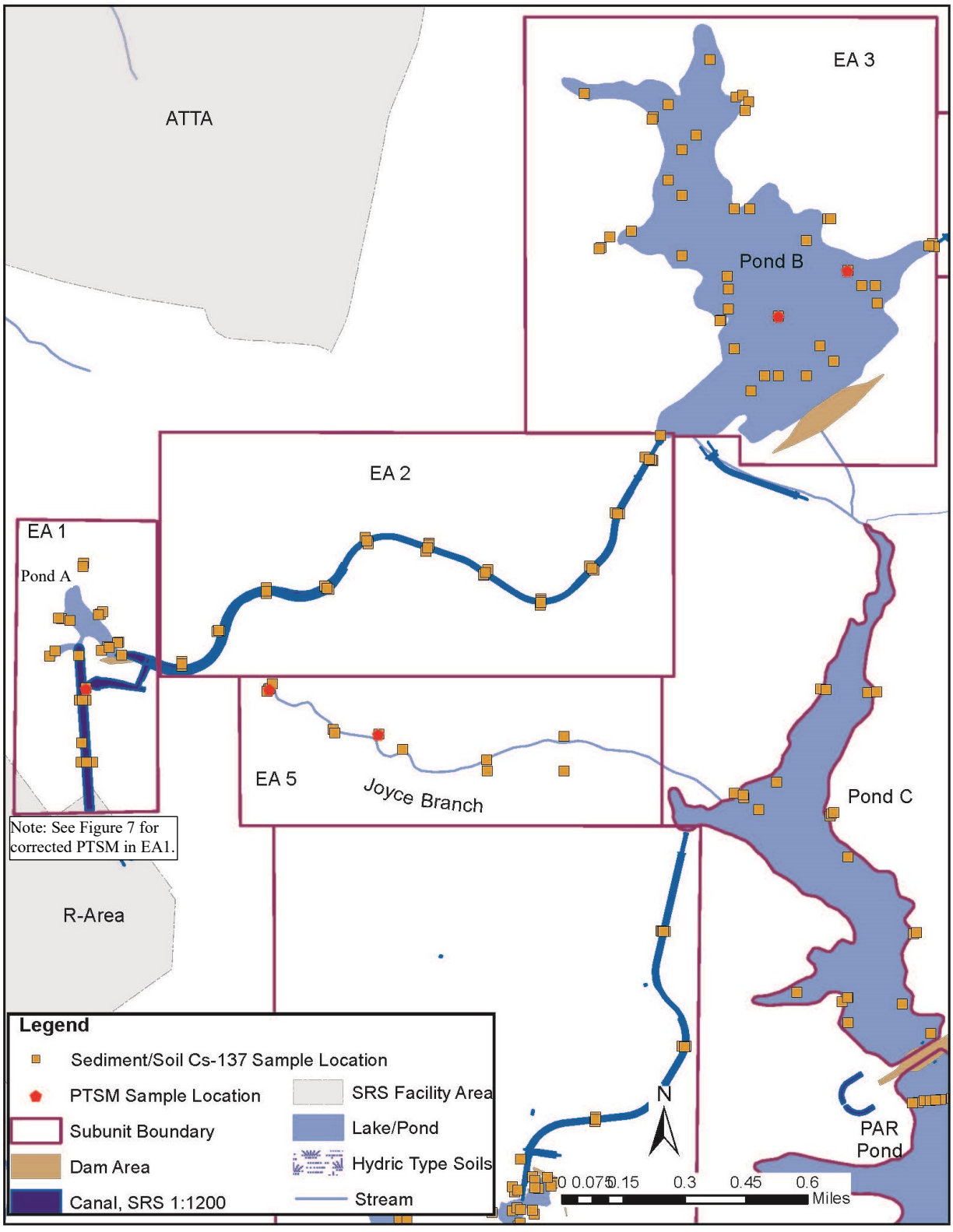


Figure 5. PTSM Locations for the Upper Subunit of the LTR IOU

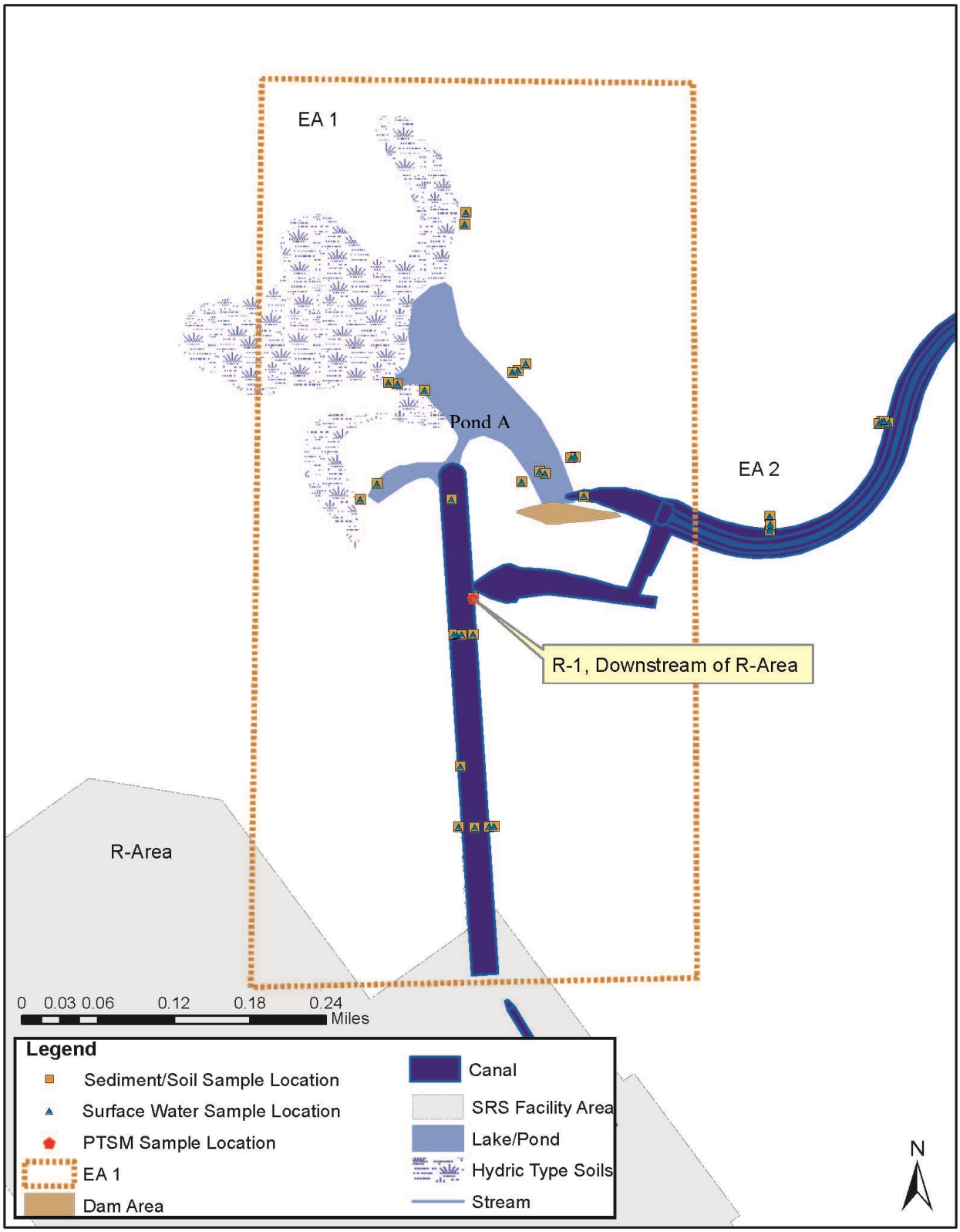


Figure 6. Previously Depicted PTSM Location for EA1 in the Upper Subunit of the LTR IOU

~~R Discharge Canal~~
~~Sampling Results for Cs-137 (decay corrected)~~

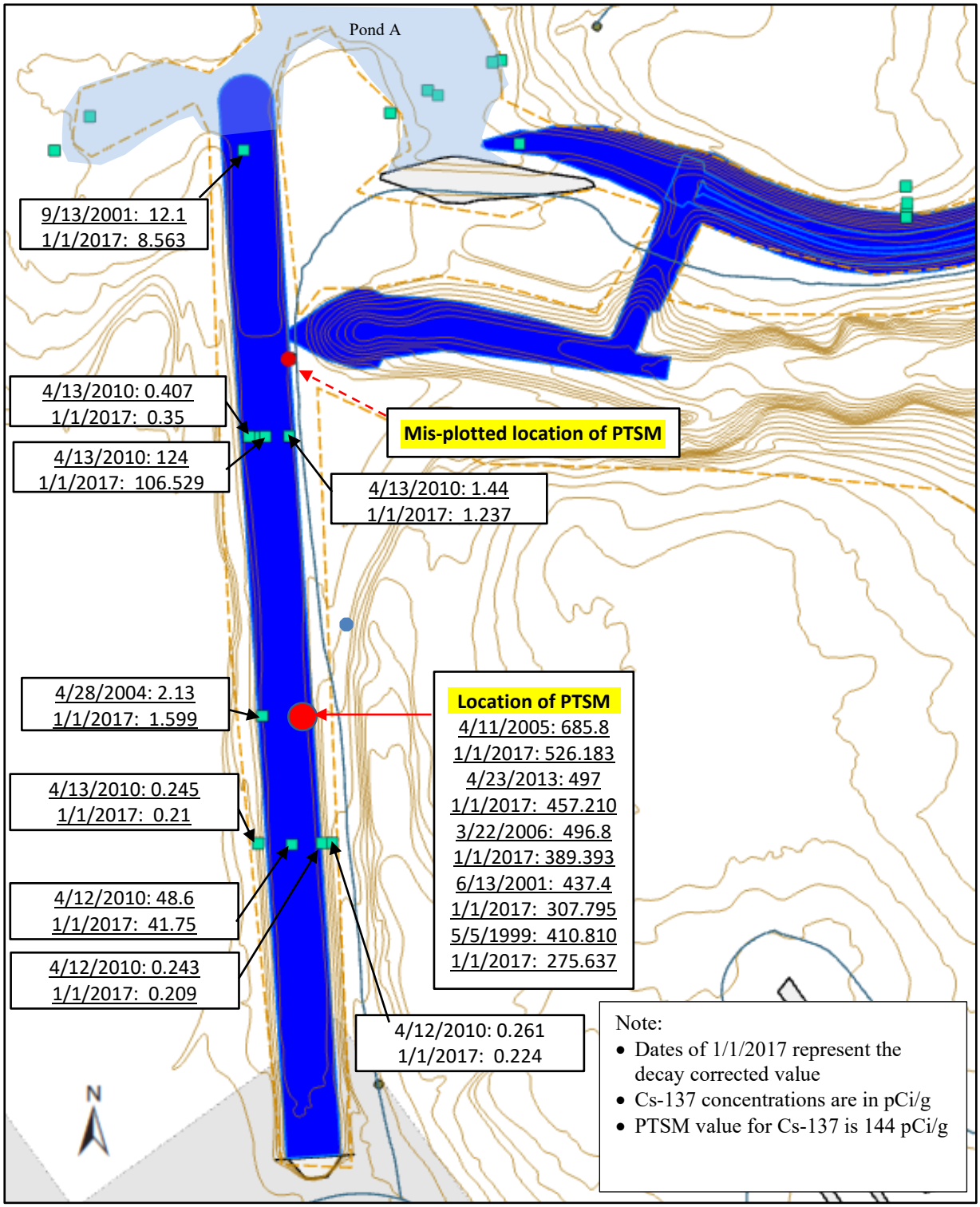


Figure 7. PTSM Location for EA1 in the Upper Subunit of the LTR IOU

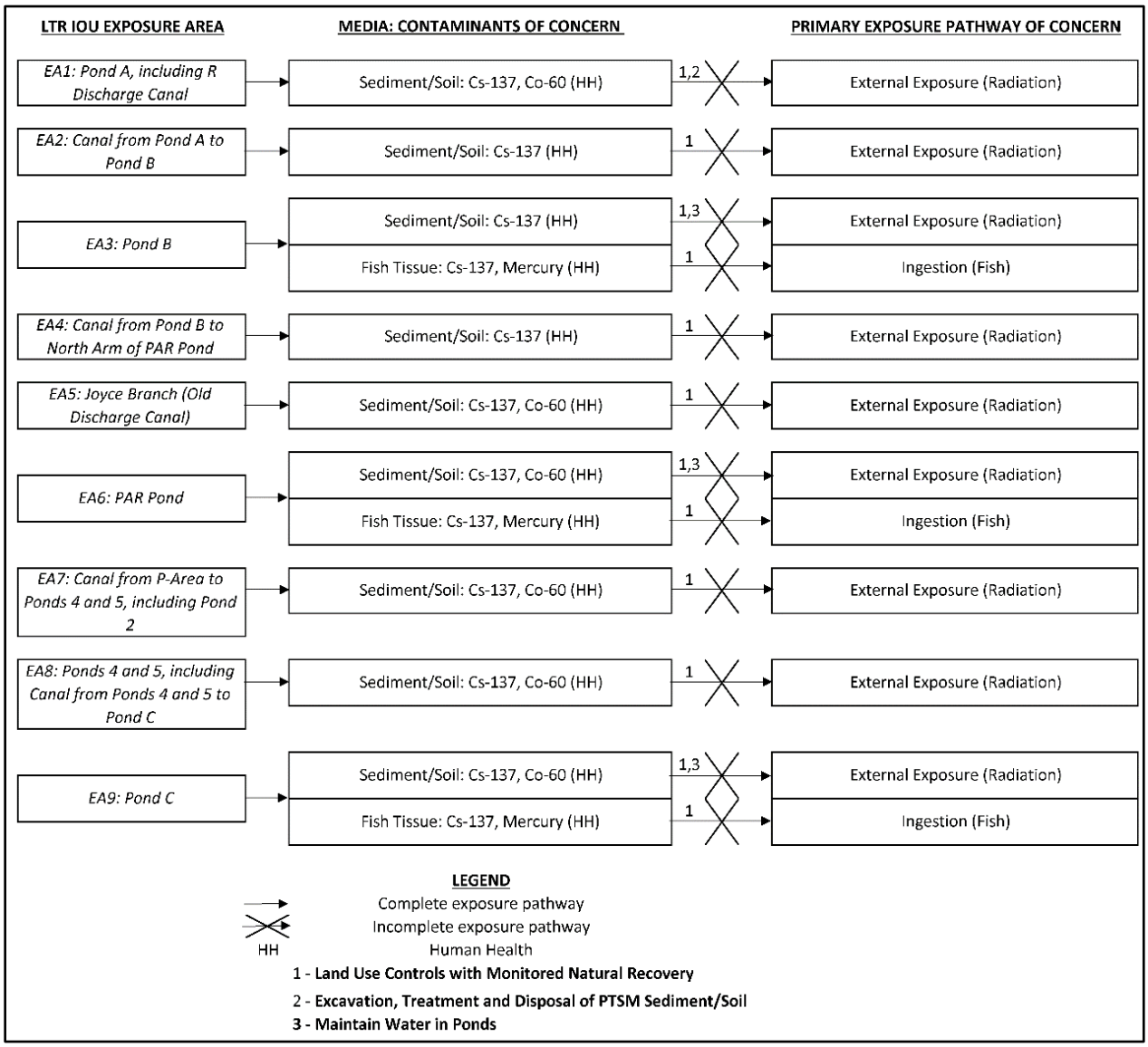


Figure 8. Conceptual Site Model Following Implementation of the Remedial Actions

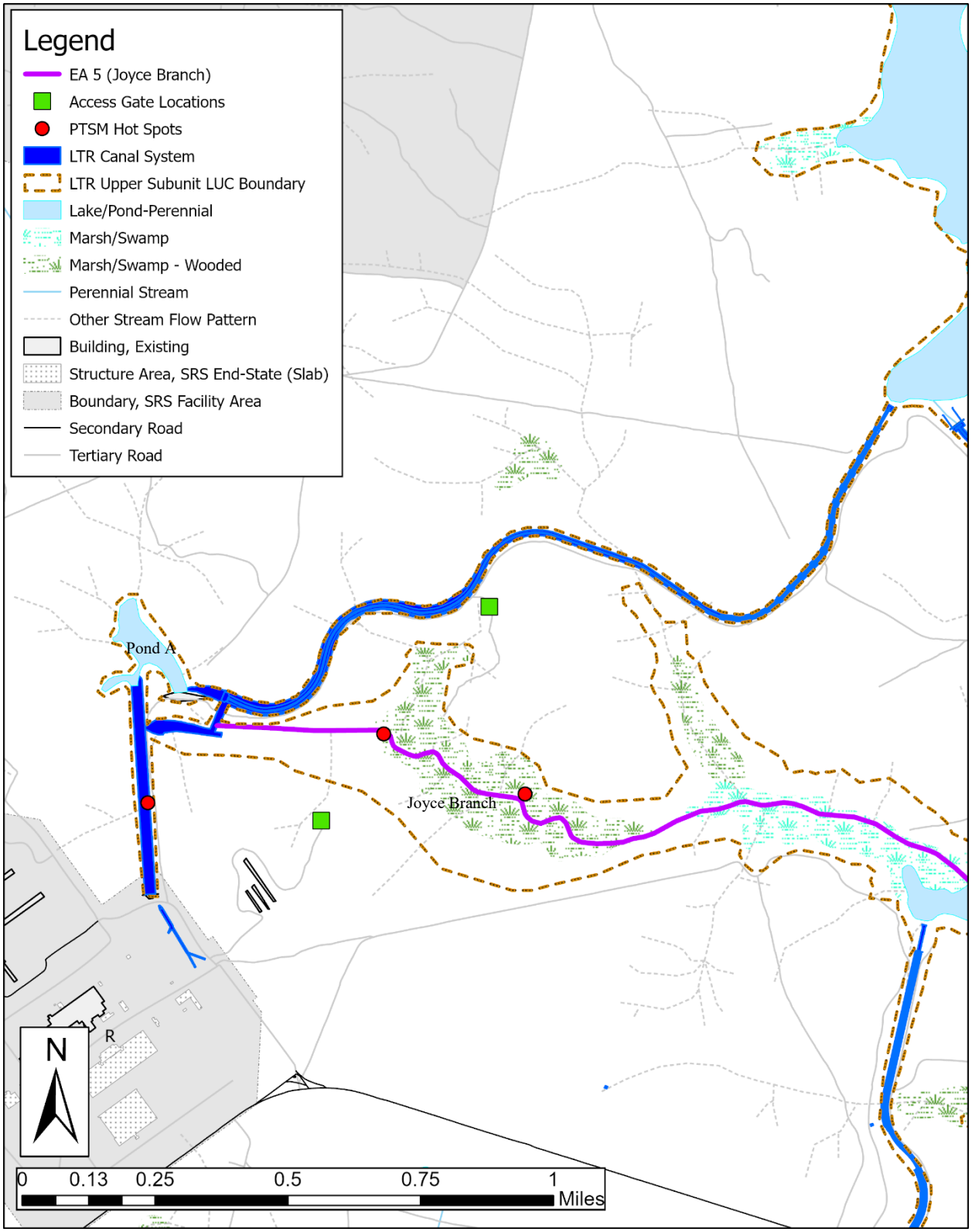
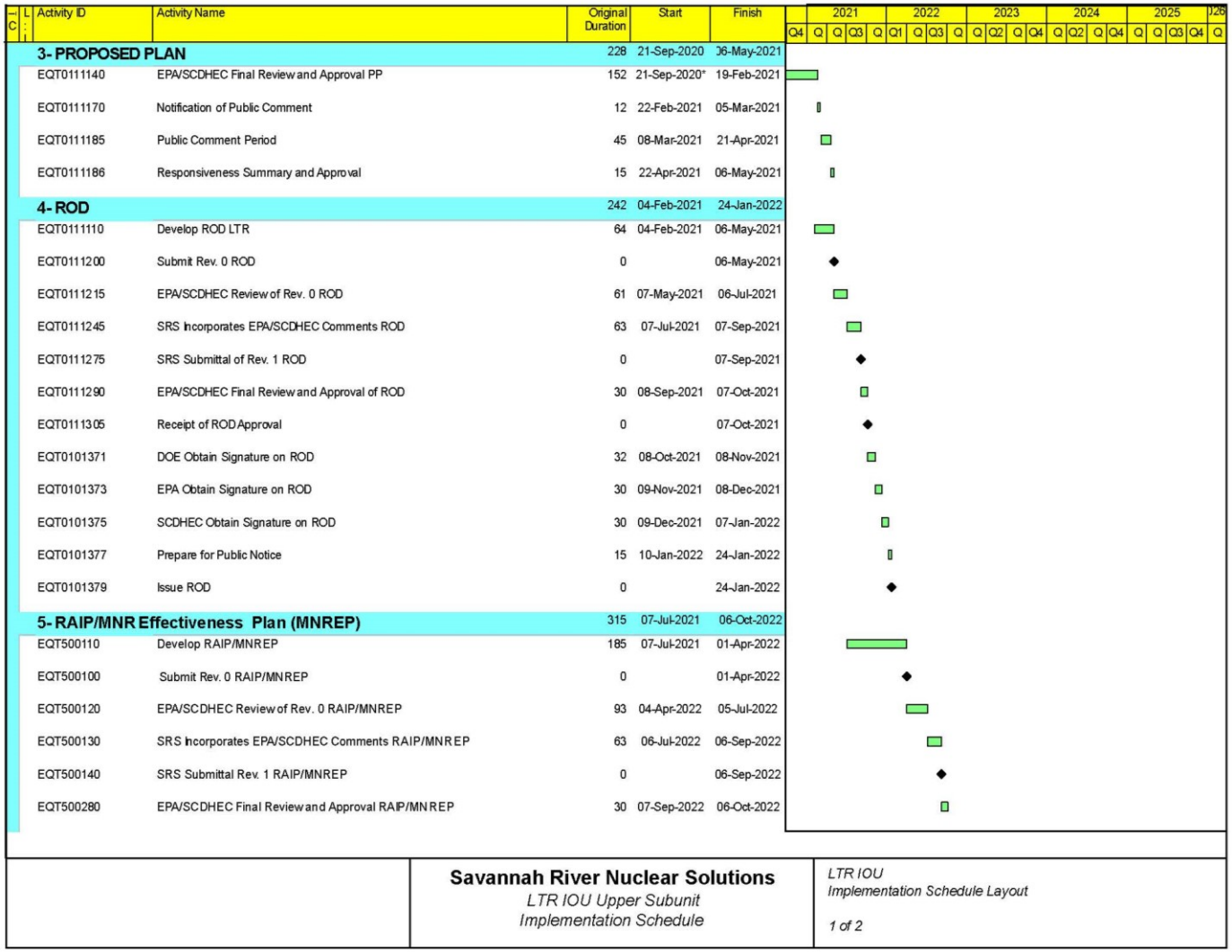
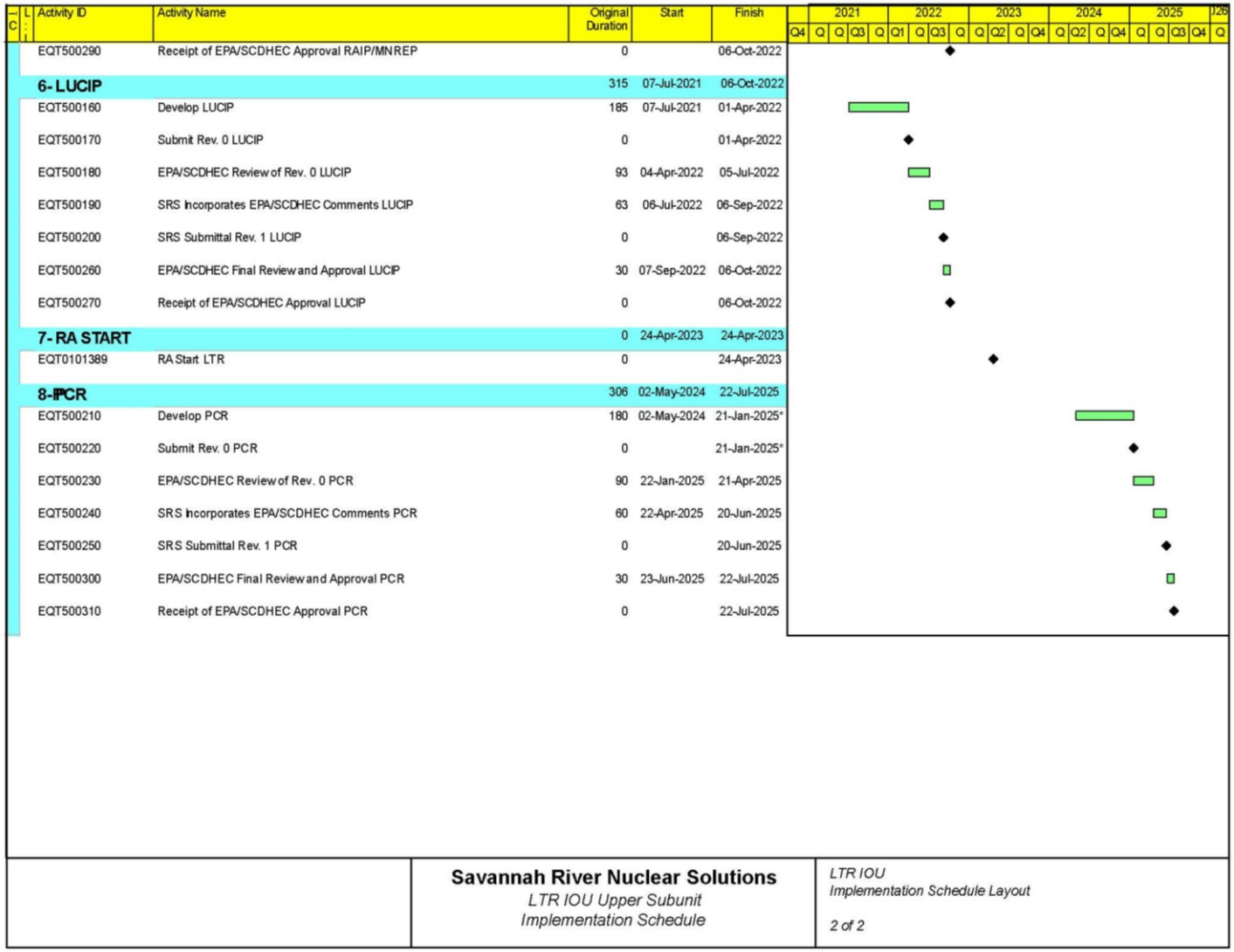


Figure 9. PTSM Locations for Joyce Branch (EA5) in the Upper Subunit of the LTR IOU



Activity ID	Activity Name	Original Duration	Start	Finish
3- PROPOSED PLAN		228	21-Sep-2020	06-May-2021
EQT0111140	EPA/SCDHEC Final Review and Approval PP	152	21-Sep-2020*	19-Feb-2021
EQT0111170	Notification of Public Comment	12	22-Feb-2021	05-Mar-2021
EQT0111185	Public Comment Period	45	08-Mar-2021	21-Apr-2021
EQT0111186	Responsiveness Summary and Approval	15	22-Apr-2021	06-May-2021
4- ROD		242	04-Feb-2021	24-Jan-2022
EQT0111110	Develop ROD LTR	64	04-Feb-2021	06-May-2021
EQT0111200	Submit Rev. 0 ROD	0		06-May-2021
EQT0111215	EPA/SCDHEC Review of Rev. 0 ROD	61	07-May-2021	06-Jul-2021
EQT0111245	SRS Incorporates EPA/SCDHEC Comments ROD	63	07-Jul-2021	07-Sep-2021
EQT0111275	SRS Submittal of Rev. 1 ROD	0		07-Sep-2021
EQT0111290	EPA/SCDHEC Final Review and Approval of ROD	30	08-Sep-2021	07-Oct-2021
EQT0111305	Receipt of ROD Approval	0		07-Oct-2021
EQT0101371	DOE Obtain Signature on ROD	32	08-Oct-2021	08-Nov-2021
EQT0101373	EPA Obtain Signature on ROD	30	09-Nov-2021	08-Dec-2021
EQT0101375	SCDHEC Obtain Signature on ROD	30	09-Dec-2021	07-Jan-2022
EQT0101377	Prepare for Public Notice	15	10-Jan-2022	24-Jan-2022
EQT0101379	Issue ROD	0		24-Jan-2022
5- RAIP/MNR Effectiveness Plan (MNREP)		315	07-Jul-2021	06-Oct-2022
EQT500110	Develop RAIP/MNREP	185	07-Jul-2021	01-Apr-2022
EQT500100	Submit Rev. 0 RAIP/MNREP	0		01-Apr-2022
EQT500120	EPA/SCDHEC Review of Rev. 0 RAIP/MNREP	93	04-Apr-2022	05-Jul-2022
EQT500130	SRS Incorporates EPA/SCDHEC Comments RAIP/MNREP	63	06-Jul-2022	06-Sep-2022
EQT500140	SRS Submittal Rev. 1 RAIP/MNREP	0		06-Sep-2022
EQT500280	EPA/SCDHEC Final Review and Approval RAIP/MNREP	30	07-Sep-2022	06-Oct-2022

Figure 10. Post ROD Schedule



Activity ID	Activity Name	Original Duration	Start	Finish
EQT500290	Receipt of EPA/SCDHEC Approval RAIP/MNREP	0		06-Oct-2022
6- LUCIP		315	07-Jul-2021	06-Oct-2022
EQT500160	Develop LUCIP	185	07-Jul-2021	01-Apr-2022
EQT500170	Submit Rev. 0 LUCIP	0		01-Apr-2022
EQT500180	EPA/SCDHEC Review of Rev. 0 LUCIP	93	04-Apr-2022	05-Jul-2022
EQT500190	SRS Incorporates EPA/SCDHEC Comments LUCIP	63	06-Jul-2022	06-Sep-2022
EQT500200	SRS Submittal Rev. 1 LUCIP	0		06-Sep-2022
EQT500260	EPA/SCDHEC Final Review and Approval LUCIP	30	07-Sep-2022	06-Oct-2022
EQT500270	Receipt of EPA/SCDHEC Approval LUCIP	0		06-Oct-2022
7- RA START		0	24-Apr-2023	24-Apr-2023
EQT0101389	RA Start LTR	0		24-Apr-2023
8-PCR		306	02-May-2024	22-Jul-2025
EQT500210	Develop PCR	180	02-May-2024	21-Jan-2025*
EQT500220	Submit Rev. 0 PCR	0		21-Jan-2025*
EQT500230	EPA/SCDHEC Review of Rev. 0 PCR	90	22-Jan-2025	21-Apr-2025
EQT500240	SRS Incorporates EPA/SCDHEC Comments PCR	60	22-Apr-2025	20-Jun-2025
EQT500250	SRS Submittal Rev. 1 PCR	0		20-Jun-2025
EQT500300	EPA/SCDHEC Final Review and Approval PCR	30	23-Jun-2025	22-Jul-2025
EQT500310	Receipt of EPA/SCDHEC Approval PCR	0		22-Jul-2025

Savannah River Nuclear Solutions
LTR IOU Upper Subunit
Implementation Schedule

LTR IOU
Implementation Schedule Layout
2 of 2

Figure 10. Post ROD Schedule (*Continued/End*)

Table 1. ARARs for the Selected Remedial Alternatives for the LTR IOU

LOCATION-SPECIFIC ARARs/TBC				
Location Characteristics	**Requirements**	**Prerequisite**	**Citation**	**Reason for Inclusion**
Presence of Wetlands as Defined in 10 *CFR* 1022.4	Avoid, to the extent possible, the long- and short-term adverse effects associated with destruction, occupancy, and modification of wetlands and floodplains.	USDOE actions that involve potential impacts to, or take place within, wetlands – applicable.	10 *CFR* 1022.3(a)	Applicable to excavation activities in R-Area Discharge Canal
	Take action, to extent practicable, to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.		10 *CFR* 1022.3(a)(7) and (8)	Applicable to excavation activities in R-Area Discharge Canal
	Undertake a careful evaluation of the potential effects of any new construction in wetlands. Identify, evaluate, and as appropriate, implement alternative actions that may avoid or mitigate adverse impacts on wetlands.		10 *CFR* 1022.3(b) and (d)	Applicable to excavation activities in R-Area Discharge Canal
	Measures that mitigate the adverse effects of actions in a wetland including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically-sensitive areas.		10 *CFR* 1022.13(a)(3)	Applicable to excavation activities in R-Area Discharge Canal
	If no practicable alternative to locating or conducting the action in the wetland is available, then before taking action, design or modify the action in order to minimize potential harm to or within the wetland, consistent with the policies set forth in E.O. 11990.		10 *CFR* 1022.14(a)	Applicable to excavation activities in R-Area Discharge Canal
Location Encompassing Aquatic Ecosystem as Defined in 40 *CFR* 230.3(c)	Except as provided under section Clean Water Act (CWA) 404(b)(2), no discharge of dredged or fill material is permitted if there is a practicable alternative that would have less adverse impact on the aquatic ecosystem or if it will cause or contribute to significant degradation of the waters of the United States. Except as provided under section CWA 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem. 40 CFR 230.70 *et seq*. identifies such possible steps.	Action that involves the discharge of dredged or fill material into *waters of the United States* including jurisdictional wetlands – relevant and appropriate.	40 *CFR* 230.10(a) and (c) 40 *CFR* 230.10(d)	Applicable to excavation activities in R-Area Discharge Canal

Table 1. ARARs for the Selected Remedial Alternatives for the LTR IOU *(Continued)*

LOCATION-SPECIFIC ARARs/TBC *(cont'd)*				
Location Characteristics	**Requirements**	**Prerequisite**	**Citation**	**Applicability**
Nationwide Permit (NWP) Program	Must comply with the substantive requirements of the NWP 38, General Conditions, as appropriate.	Discharge of dredged or fill material into *waters of the United States*, including jurisdictional wetlands – relevant and appropriate.	Nationwide Permit (38) – Cleanup of Hazardous and Toxic Waste 33 *CFR* 323.3(b)	Applicable to excavation activities in R-Area Discharge Canal
Presence of Wetlands	Requires Federal agencies to evaluate action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance beneficial values of wetlands.	Actions that involve potential impacts to, or take place within, wetlands – To Be Considered (TBC).	Executive Order 11990 – *Protection of Wetlands* – Section 1(a)	Applicable to excavation activities in R-Area Discharge Canal
Presence of Floodplains	Shall consider alternatives to avoid, to the extent possible adverse effects and incompatible development in the floodplain.	Federal actions that involve potential impacts to, or take place within, floodplains –TBC.	Executive Order 11988 – Floodplain Management – Section 2(a)(2)	Applicable to excavation activities in R-Area Discharge Canal
Presence of Migratory Birds and Their Habitats	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 may be permitted under the terms of a valid permit.	If action is likely to impact migratory birds – applicable.	16 *USC* 703-704 – Migratory Bird Treaty Act	LUCs with MNR, Maintain Water in Dams, Excavation of PTSM sediments in R-Area Discharge Canal
Presence of Archeological or Cultural Artifacts	No person may excavate, remove, damage, or otherwise alter or deface, or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands unless such activity is pursuant to a permit issued under § 7.8 or exempted by § 7.5(b) of this part. Note: Prior to removal activities existing Site Use process requires approval by the Savannah River Archaeological Research Program (SRARP). The SRARP is a division of the South Carolina Institute of Archaeology and Anthropology at the University of South Carolina. The SRARP manages the archaeological and other historic resources for the USDOE.	Excavation and/or removal of archaeological resources from public lands – applicable.	43 *CFR* Part 7 – implementing the Archaeological Resources Protection Act of 1979.	Applicable to excavation activities in R-Area Discharge Canal

Table 1. ARARs for the Selected Remedial Alternatives for the LTR IOU *(Continued/End)*

LOCATION-SPECIFIC ARARs/TBC *(cont'd)*				
Location Characteristics	**Requirements**	**Prerequisite**	**Citation**	**Applicability**
Presence of Historically Significant Resources	Federal agencies must take into account the effects of their projects on historic and culturally significant properties. USDOE must determine whether the proposed action is an "undertaking" as defined in 36 *CFR* 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If such potential effects exist, USDOE must comply with the further obligations under this Part.	Potential presence of historical or cultural resources – applicable.	36 *CFR* Part 800 – implementing the National Historic Preservation Act of 1966, as amended.	LUCs with MNR, Maintain Water in Dams, Excavation of PTSM sediments in R-Area Discharge Canal
Location Encompassing Navigable Waters	Activities shall not block or obstruct navigation or the flow of any waters unless specifically authorized herein. No spoil, dredged material, or any other fill material shall be placed below the mean high water or ordinary highwater elevation, unless specifically authorized herein. Shall make every reasonable effort to perform the authorized work in a manner to minimize adverse impact on fish, wildlife, or water quality.	Actions that involve any dredging, filling, or construction or alteration activity in, on, or over a navigable water, as defined in R.19-450.2.C, or in, or on the bed under navigable waters, or in, or on lands or waters subject to a public navigational servitude under Article 14 Section 4 of the South Carolina Constitution and 49-1-10 of the 1976 S.C. Code of Laws including submerged lands under the navigable waters of the state, or for any activity significantly affecting the flow of any navigable water – relevant and appropriate.	SCDHEC R. 19-450.4(7) SCDHEC R. 19-450.4(8)	Applicable to excavation activities in R-Area Discharge Canal

APPENDIX A

FACT SHEET

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Remedial Action Lower Three Runs (LTR)
Integrator Operable Unit (IOU)
Upper Subunit

Location

The LTR watershed is located in the southeastern portion of Savannah River Site (SRS). LTR is a large blackwater stream that originates in the northeast portion of SRS and follows a southerly direction for approximately >40 kilometers (km [24.5 miles {mi}]), discharging into the Savannah River. The LTR IOU consists of an Upper, Middle, and Lower subunit. The Upper subunit is located upgradient of the PAR Pond Dam and includes PAR Pond and the pre-cooler ponds and canal system. The Upper subunit is the subject of this Remedial Action Implementation Plan.

History

Residual sediment/soil contamination is present in the LTR IOU stream corridor due to historical reactor operations. R-Reactor began operations in 1953 and was followed by P-Reactor in 1954. Both reactors received cooling water from the Savannah River via the river water distribution system. For purposes of investigation, the stream corridor in the Upper subunit was segregated into the following nine individual Exposure Areas (EAs):

- EA1: Pond A – Including R-Area Discharge Canal
- EA2: Canal from Pond A to Pond B
- EA3: Pond B – Including canal to Pond C
- EA4: Canal from Pond B to North Arm of PAR Pond
- EA5: Joyce Branch (Old Discharge Canal)
- EA6: PAR Pond
- EA7: Canal from P-Area to Ponds 4 and 5 – Including Pond 2
- EA8: Ponds 4 and 5 – Including canal from Ponds 4 and 5 to Pond C
- EA9: Pond C

R-Reactor initially discharged reactor effluent directly into Joyce Branch, while P-Reactor discharged reactor effluent directly into Steel Creek. In 1958, PAR Pond, along with a series of pre-cooler ponds and a connecting canal system, were constructed to address the cooling water requirements of both P- and R-Reactor. Effluent from R-Reactor was routed to the R-Area

Discharge Canal and pre-cooler Pond B where it discharged into the north arm of PAR Pond. This effluent pathway was used for R-Reactor discharge from 1961 until the reactor was shut down in 1964. Since the shutdown of R-Reactor, R-Area Discharge Canal and Pond B have remained essentially undisturbed.

PAR Pond also served as a heat exchange/cooling reservoir for P-Reactor until 1988. Heated water was released through a series of man-made canals and smaller impoundments into the pre-cooler Pond C and released into PAR Pond. Effluent discharges from P-Reactor ceased in 1987 with the shutdown of the reactor. As with the R-Area Discharge Canal, the associated canal system and pre-cooler ponds have remained essentially undisturbed. Releases from P-Reactor and R-Reactor operations included process leaks, reactor disassembly basin purges, and thermal discharges that contained primarily Cs-137.

The results of the investigation identified Cs-137 and, to a lesser degree Co-60, as refined constituents of concern (RCOCs) in sediment/soil media. In addition, Cs-137 and mercury (Hg) were identified as RCOCs in fish tissue; however, the presence of Hg is the result of atmospheric deposition and from the use of the elevated levels of Hg in Savannah River water as part of the river water distribution system, not from SRS operations. EA1, EA3 and EA5 had specific locations were identified where Cs-137 levels were above the Principal Threat Source Material (PTSM) threshold of 144 picocuries per gram, however no PTSM RCOCs were formally identified for any EA within the LTR IOU.

Remedial Action

Due to the complexity of the Upper subunit, multiple remedies were selected to address the nature and extent of contamination within the LTR IOU system. Land Use Controls (LUCs) with Monitored Natural Recovery (MNR) was the selected remedy for the entire Upper Subunit (EA1 through EA9). In addition, Excavation, Treatment, and Disposal of PTSM Sediment/Soil was selected to address the single location in EA1 in the R-Area Discharge Canal that exceeded the PTSM threshold, and the Maintain Water in Ponds remedy was selected to provide additional exposure protection for EA3 (Pond B), EA6 (PAR Pond) and EA9 (Pond C).

LUCs include engineering controls such as signs and gates at access points and administrative measures (i.e., deed restrictions and worker protection programs) to effectively reduce exposure of contaminated media to human receptors. MNR is a remedy that uses the ongoing, naturally-occurring process to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment/soil. The MNR remedy component will assess the natural decay of Cs-137 in the Upper subunit over time. Cs-137 levels are expected to decay below the PTSM threshold in the Upper subunit in approximately 50 years, and the need to continue with the MNR component of the remedy will be reevaluated at that time.

For EA1, Excavation, Treatment, and Disposal of PTSM Sediment/Soil will be implemented to remove the single PTSM location in the R-Area Discharge Canal. The PTSM location is in relatively shallow water and is accessible for standard excavation practices. The excavated sediment/soil will be treated with a drying agent to reduce contaminant mobility during transportation and on-site disposal.

EA5 (Joyce Branch) contains two PTSM locations in shallow water. EA5 (Joyce Branch) is located interior to the site approximately 7.2 km (4.5 mi) from the SRS boundary, is remotely located from site operations, and is not accessible to the public (i.e., trespassers). Because PTSM is present in EA5 (Joyce Branch) in two locations, LUCs will be augmented in the form of additional signage at access roads and utility corridors in addition to gates across the access roads leading toward the two PTSM locations. Also, additional signs will be installed along the banks near the PTSM locations.

The Maintain Water in Ponds remedy selected for EA3 (Pond B) and EA6 (PAR Pond), will minimize access and limit exposure to submerged, contaminated sediment/soil within the ponds. A reverse riser structure associated with Pond C (EA9) allows water to flow from Pond C (EA9) into PAR Pond (EA6) using hydraulic pressure to stabilize water elevation between the two ponds. Therefore, the water level in Pond C will be maintained through implementation of this remedial action at PAR Pond (EA6). This remedy consists of maintaining dam structures for water retention, allows for natural fluctuation of water levels, and controls sediment movement downstream of the PAR Pond Dam. Annual inspections and periodic maintenance of the physical

attributes (i.e., dams, weirs, control gates, etc.) that make water retention viable are already in place per SRS procedures and the Federal Energy Regulatory Commission guidelines.

APPENDIX B

Field Sampling Plan (FSP) for ~~Field Sampling Plan for~~ Pre and Post PTSM Excavation for the R-Area Discharge Canal of Exposure Area 1 (EA1)

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APPENDIX B
LIST OF ABBREVIATIONS AND ACRONYMS

Acronym	Meaning
<	less than
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRDL	Contract Required Detection Limit
DQO	Data Quality Objectives
EA	Exposure Area
ERDMS	Environmental Restoration Data Management System
FSP	Field Sampling Plan
IDW	Investigation Derived Waste
IOU	Integrator Operable Unit
LLC	Limited Liability Company
LOE	Limits of Excavation
LTR	Lower Three Runs
MDA	Minimum Detected Activity
MDL	Minimum Detection Limit
MPC	Measurement Performance Criteria
PRG	Preliminary Remediation Goal
PTSM	Principal Threat Source Material
QASA	Quality Systems for Analytical Services
RA	Remedial Action
RCOC	Refined Constituents of Concern
RI/BRA	Remedial Investigation/Baseline Risk Assessment
RPD	Relative Percent Difference
ROD	Record of Decision
RSL	USEPA Regional Screening Level
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
ssEQL	Sample specific estimated Quantitation Limit
TN	Transect North
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VV	Verified and Validated

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1.0 INTRODUCTION

This field sampling plan (FSP) was prepared in accordance with the United States Environmental Protection Agency (USEPA) *Uniform Federal Policy for Quality Assurance Project Plans* (USEPA, et al, 2005) and the *Area Completion Projects Programmatic Quality Assurance Project Plan for Environmental Data Collection and Management* (Savannah River Nuclear Solutions [SRNS] 2012).

1.1 Purpose for Sampling

The purpose for the FSP is to describe the pre- and post-excavation sampling in the R-Area Discharge Canal, which is part of Exposure Area (EA) 1 of the Lower Three Runs (LTR) Integrator Operable Unit (IOU). The remedial action (RA) selected in the Record of Decision (ROD) (SRNS 2021a) for the LTR IOU includes Excavation, Treatment and Disposal of known Potential Threat Source Material (PTSM) Sediment/Soil. As part of the design for this remedy the limits of excavation (LOE) at the designated location in R-Area Discharge Canal will be determined by sampling the sediment at step out locations from the initial excavation boundary. The initial excavation boundary has been identified as a 37 m^2 (400 ft^2) area surrounding the sampling location where Cs-137 concentrations have exceeded the PTSM threshold, 144 picocuries per gram (pCi/g). The volume of sediments exceeding the PTSM threshold was estimated to be 10 cubic meters (SRNS 2020). Sediments exceeding the PTSM threshold are assumed to be less than 0.3 m (1 ft) deep.

Post excavation sampling will be performed within the established LOE (determined via sampling) to verify that the excavation criteria have been met.

1.2 Sampling Unit Location

Figure B1 shows the location of the PTSM hot spot in EA 1 where the sampling will occur. Figure B2 shows the initial (minimum) LOE with the approximate step out sampling locations for the pre-excavation sampling. All locations immediately adjacent to the LOE will be sampled for Cs-137. If any results exceed 144 pCi/g (the PTSM threshold),

additional samples will be screened along a transect (e.g., transect north [TN]) with spacing or approximately 3 m (10 ft). If the screening level is triggered the samples will be collected and sent for laboratory analysis. If the results are below 144 pCi/g for the first sample in the transect (e.g., TN-01), no additional samples will be collected along that transect.

Figure B3 shows the sampling location for the post-excavation sampling. The post excavation sampling will be a composite sample collected from approximately 4 to 5 locations within the LOE. If the excavation boundary increases significantly, the number of composite samples will increase.

1.3 Statement of Broad Objectives for the Sampling

The objective of the pre-excavation sampling event is to delineate the LOE for PTSM sediments in the area identified in the R-Area Discharge Canal. In addition, the objective of the post-excavation sampling is to measure performance of the remedial activity and confirm that the remaining Cs-137 concentration in the sediments at the identified location in the R-Area Discharge Canal is below the PTSM threshold, 144 pCi/g.

The data collected will consist of screening level data used to make field decisions that will be supported by laboratory analysis. The laboratory data will be used to document the acceptance of the remedy.

2.0 SAMPLING UNIT BACKGROUND

2.1 Sampling Area Physical and Geographical Description and Operational History

The R-Area Discharge Canal is a manmade structure that received effluent from the R-Reactor. Since the shutdown of R-Reactor in 1964, the R-Area Discharge Canal has remained essentially undisturbed. There are no point sources that discharge water to the canal. Water levels are maintained by shallow groundwater and precipitation. In the area of the PTSM hot spot, samplers have reported that there is a layer of organic material on

the canal bottom, followed by a soft sediment layer of less than 0.3 m (1 ft) and then a compacted clay layer.

2.2 Previous Investigations/Regulatory Actions

The R-Area Discharge Canal was investigated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process and evaluated in the Remedial Investigation/Baseline Risk Assessment (RI/BRA) (SRNS 2017) as part of EA1. The approved ROD for the LTR IOU selected Excavation, Treatment, and Disposal of PTSM Sediment/Soil at a location within the R-Area Discharge Canal where Cs-137 concentrations in sediment samples have been detected at concentrations above the PTSM threshold, 144 pCi/g. A summary of the previous investigations and the RA selections can be found in the Proposed Plan (SRNS 2021a) and the ROD (SRNS 2021b).

2.3 Summary of Existing Data Compared to Risk-Based Thresholds

Figure B4 summarizes the Cs-137 concentrations that have been detected (and decay-corrected values) in the R-Area Discharge Canal as compared to the preliminary remedial goal (PRG) of 0.144 pCi/g and the PTSM threshold (144 pCi/g). Table B1 provides a summary of the results from all samples collected in EA1 which includes the R-Area Discharge Canal and Pond A. Contaminant concentrations were compared to USEPA Preliminary Remediation Goals (PRGs) for radiological contaminated media. Decay-corrected values were used to develop the exposure point concentrations for the PTSM uncertainty evaluation.

As described in the RI/BRA (SRNS 2017), no refined constituents of concern (RCOCs) were identified in the surface water associated with the R-Area Discharge Canal.

3.0 PROJECT DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. It is both flexible and iterative, and applies to both decision making (e.g., compliance/non-

compliance with a standard) and estimation (e.g., ascertaining the mean concentration level of a contaminant). The DQO process is used to establish performance and acceptance criteria. Use of the DQO process leads to efficient and effective expenditure of resources; consensus on the type and quantity of data needed to meet the sampling goals; and the full documentation of actions taken during the development of the sampling effort. The DQO process is a series of seven planning steps based on the scientific method (Sections 3.1.1 to 3.1.7 below) and is detailed in United States Environmental Protection Agency (USEPA) Guidance (USEPA 2006).

3.1 R-Area Discharge Canal Sediments

3.1.1 State the Problem

Cs-137 concentrations have been detected in samples at one location within the R-Area Discharge Canal at levels that exceed the PTSM threshold (144 pCi/g). The extent of the contamination at this location was estimated to be approximately 37-m^2 (400-ft^2) and 0.3-m (1-ft) deep. Although sample results in transects upstream and downstream of the "hot spot" have Cs-137 concentrations below the PTSM threshold, a delineation of the extent of PTSM contamination is necessary to execute the selected remedy for EA1 as described in the ROD (SRNS 2021b).

Once the PTSM sediments have been excavated from the established LOE, confirmation sampling will be required to demonstrate acceptance of the remedy. Excavation and subsequent sampling will continue, if necessary, until confirmation sample results indicate that the area is below the PTSM threshold.

3.1.2 Identify Goals of the Study

The goals of the sampling are to delineate the LOE for PTSM excavation and to confirm successful completion of the excavation.

3.1.3 Identify Information Inputs

Because the RA has already been selected, the inputs for decision making include the PTSM threshold for Cs-137 as established in the ROD. The RA is limited to excavating sediments that are above the PTSM threshold for Cs-137 (144 pCi/g).

3.1.4 Define the Boundaries of the Study

This sampling event is limited to the extent of PTSM in the R-Area Discharge Canal where previous sampling results for Cs-137 were above the PTSM threshold. The initial/minimum excavation boundaries as well as the planned sample transects beyond the assumed excavation boundary are depicted in Figure B2.

3.1.5 Develop the Analytical Approach

The sampling described in this FSP is being performed to refine the RA that has been selected in the ROD. Sampling is only to determine the extent of PTSM and to confirm the absence of PTSM after excavation.

The decision rules are:

Step out samples will be collected, screened, and analyzed. The LOE will be adjusted to extend to sample locations that have Cs-137 concentrations above the PTSM level of 144 pCi/g.

For confirmatory sampling, if the activity of Cs-137 from the composite sediment samples collected from within the excavated zone is less than 144 pCi/g, then the removal action is complete. Otherwise, the excavation and sampling will continue within the established LOE.

3.1.6 Specify Performance or Acceptance Criteria

In the LTR IOU Feasibility Study (SRNS 2020), the volume of PTSM was estimated to be approximately 10 m^3 (13 cubic yards [cy]) and was limited to the vicinity of the R-1 sampling location. These assumptions were based on the presence of Cs-137 at lower

concentrations in the R-Area Discharge Canal as demonstrated by the sampling results shown on Figure B4.

Based on the field conditions and sample results at other locations, Cs-137 concentrations at PTSM levels are believed to be limited to 0-0.3 m (0-1 ft) in depth. The initial LOE has been delineated as a 37 m^2 (400 ft^2) area surrounding the sampling location where Cs-137 concentrations have exceeded the PTSM threshold, 144 pCi/g.

A deterministic approach to collect samples along transects emanating from the boundary of the LOE is an acceptable method for data collection to refine the extent of PTSM at the specified location in the R-Area Discharge canal. This approach provides a practical method for designating sample locations. Therefore, there are no probabilistic tolerance limits on the decision errors for this RA, however, measurement performance criteria (MPC) will be assigned for acceptance criteria of the data.

3.1.7 Develop the Plan for Obtaining the Data (Project Quality Objectives)

Table B2 (DQO Summary Worksheet) summarizes the DQOs for this FSP. The quality objectives are as follows:

1. Screening tools to measure gamma radiation in the field will be used to establish the step out locations.
2. Samples exceeding the screening criteria will be sent to the laboratory for analysis.
3. Only laboratory data will be used to determine if the excavation area is below the PTSM level for Cs-137.
4. All laboratory data will be verified and validated.

Examples of PQO statements in terms of MPC statements are as follows:

- RPD (relative percent difference) less than (<) 35% between regular soil sample and field duplicate when result greater than or equal to (≥) Sample-Specific Estimated Quantitation Limit (ssEQL) for precision data quality indicator

- RPD <200% when soil sample result ≥ MDL but < ssEQL for accuracy/bias for precision data quality indicator
- ssEQL <144 pCi/g for sensitivity data quality indicator
- MDA (minimum detected activity) <10 pCi/g for field Cs-137 measurements
- MDA <0.15 pCi/g for laboratory Cs-137 measurements
- 5% of the samples will be split samples for the comparability data quality indicator
- 95% of samples sent to laboratory have useable (non-rejected) results for completeness data quality indicator
- The objective for the representativeness data quality indicator is qualitative and will be met by properly documenting field and analytical protocols. In the event these methods are not able to be implemented, the appropriate corrective action documentation should encompass the impact on the representativeness of the information. When review of the data and documentation determines the data to be nonrepresentative, the information is qualified for use or is not used by the project.

4.0 ANALYTICAL PLAN

The analytical method for Cs-137 is a proprietary method developed by the subcontractor laboratory based on gamma spectroscopy. The analytical method used by subcontract laboratory is proprietary since there is no national standard analytical method for Cs-137 and the laboratory has developed its own unique method. All subcontract laboratories and analytical methods are audited annually by DOECAP and comply with the requirements of Quality Systems for Analytical Services (QASA).

The MDA for every sample is different. The subcontract laboratories regularly attain an MDA which is typically 0.15 pCi/g for Cs-137 in soil or sediment which is well below the excavation criteria of 144 pCi/g, the PTSM threshold. Typical soil MDAs for radionuclides are provided in Table B4.

4.1 Field Analytical Sampling Quality Assurance/Quality Control

Field measurements of Cs-137 concentrations in sediment will be obtained using a portable gamma spectrometer.

Routine analytical Quality Assurance/Quality Control (QA/QC) indicators for the gamma detector include the following:

1. Annual energy & efficiency calibration
2. Daily gain adjustment
3. Daily energy
4. Establishment of MDA

For collection and analysis of laboratory data, field quality assurance/quality control (QA/QC) samples for this project will include:

A. Field Duplicates B. Rinsate/Equipment Blanks C. Split Samples

QA/QC requirements for field analytical sampling can be found on Tables B3 and B5. Field QA/QC sampling requirements for this project are described below:

1. Field Duplicate (co-located) Samples: Two or more independent samples collected from side-by-side locations at the same point in time and space so as to be considered identical. These separate samples are intended to represent the same population and are carried through all steps of the sampling and analytical procedures in an identical manner. These samples are used to assess precision of the total method, including sampling, analysis, and site heterogeneity. Field duplicate samples are planned at a combined minimum rate of 5% or typically 1 per 20 samples and analyzed for the same parameters as the associated samples.
2. Rinsate/Equipment Blank: A sample of water free of measurable contaminants poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. The purpose of this blank is to assess the adequacy of the decontamination process. Also called rinse blank or rinsate blank. Equipment blanks are typically planned at a rate of 1 blank per 40 samples.
3. Split Samples: Two or more representative portions from a sample in the field, analyzed by at least two different laboratories and/or methods. Prior to splitting, a

sample is mixed (except volatiles, oil and grease, or when otherwise determined) to minimize sample heterogeneity. These are quality control samples used to assess precision, variability, and data comparability between laboratories. Split samples are planned at a combined minimum rate of 5% or typically 1 per 20 samples and analyzed for the same parameters as the associated samples.

4.2 Sample Matrix Table

A Sampling Matrix Table is provided in Table B6.

4.3 Sample Location Map

Figure B2 that illustrates the proposed step out locations with contingency sample locations. Figure B3 provides the proposed confirmation sampling locations with the LOE.

5.0 FIELD IMPLEMENTATION

5.1 List of Sampling/Collection Equipment

This section lists type of sampling/collection equipment needed to execute the Field Implementation Plan. Examples include:

- Hand augers
- Hand scoops
- Field screening gamma detector
- Global Positioning System Unit
- KIJ-5 Radio
- Sample bottles
- Coolers

5.2 Investigation Derived Waste

Investigation Derived Waste (IDW) will be managed according to the site-specific IDW management plan developed for the project.

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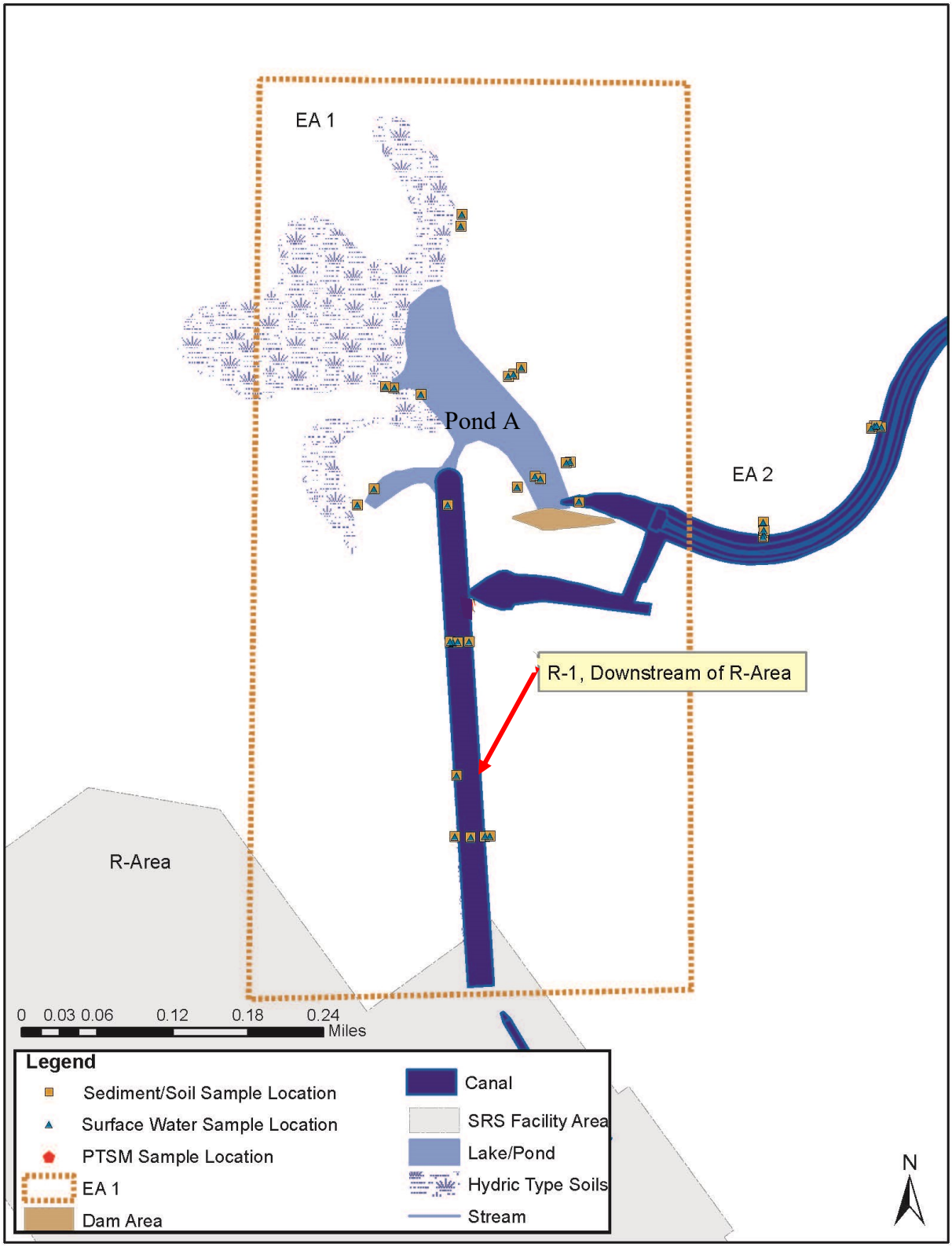

Figure B1. Location of the Sampling Unit

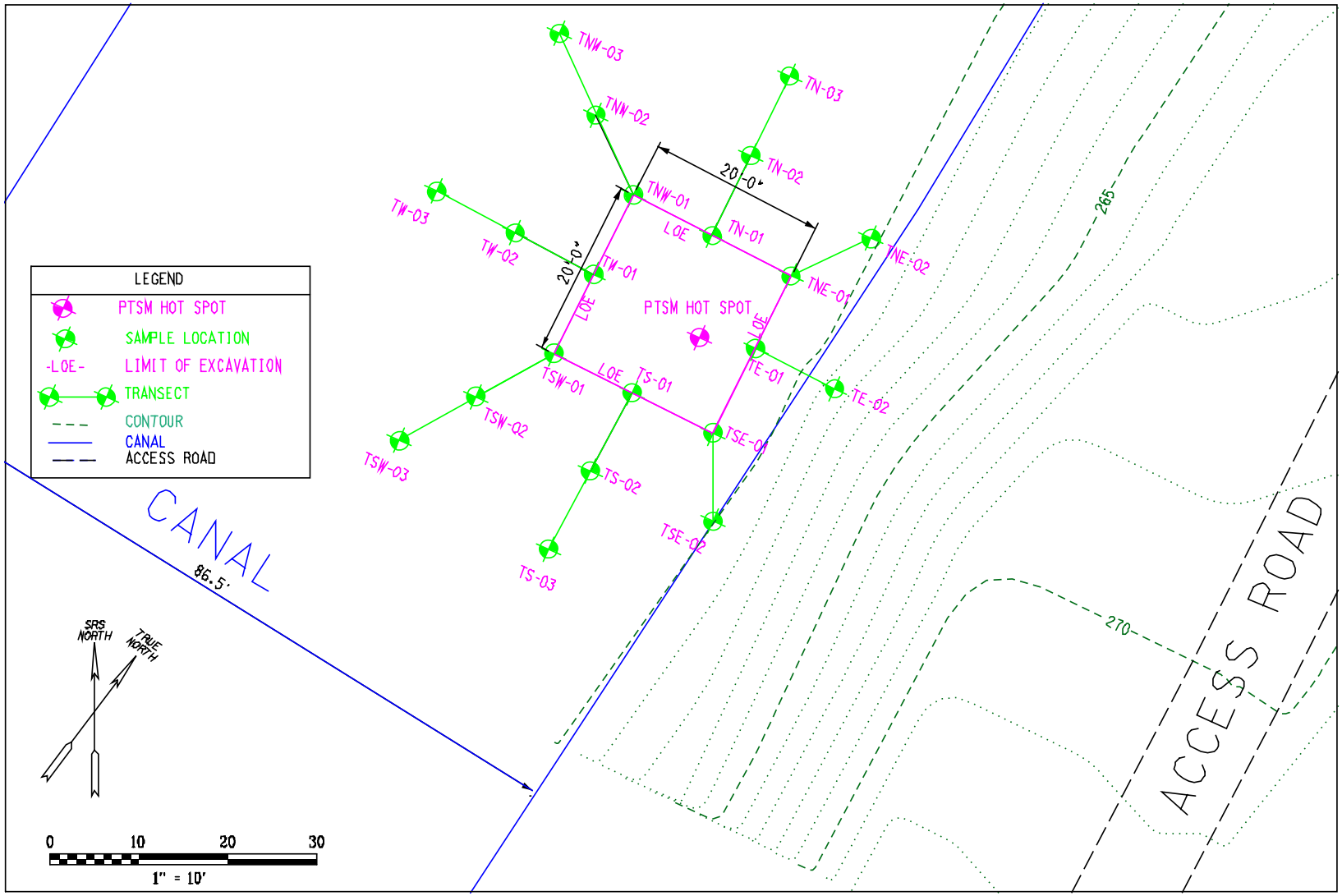

Figure B2. Sampling Locations to Refine the LOE

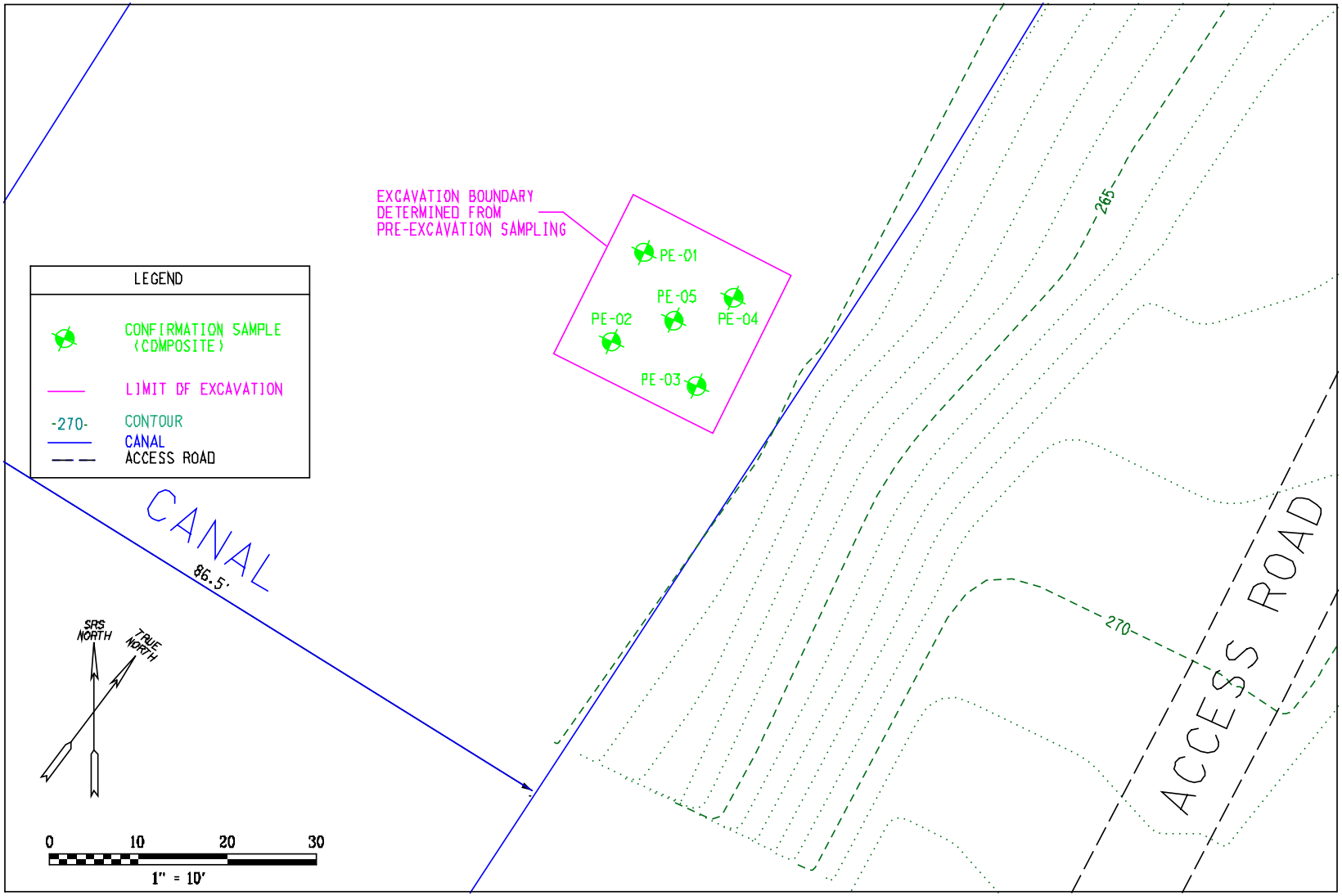

Figure B3. Post Excavation Sample Locations to Confirm PTSM has been Excavated

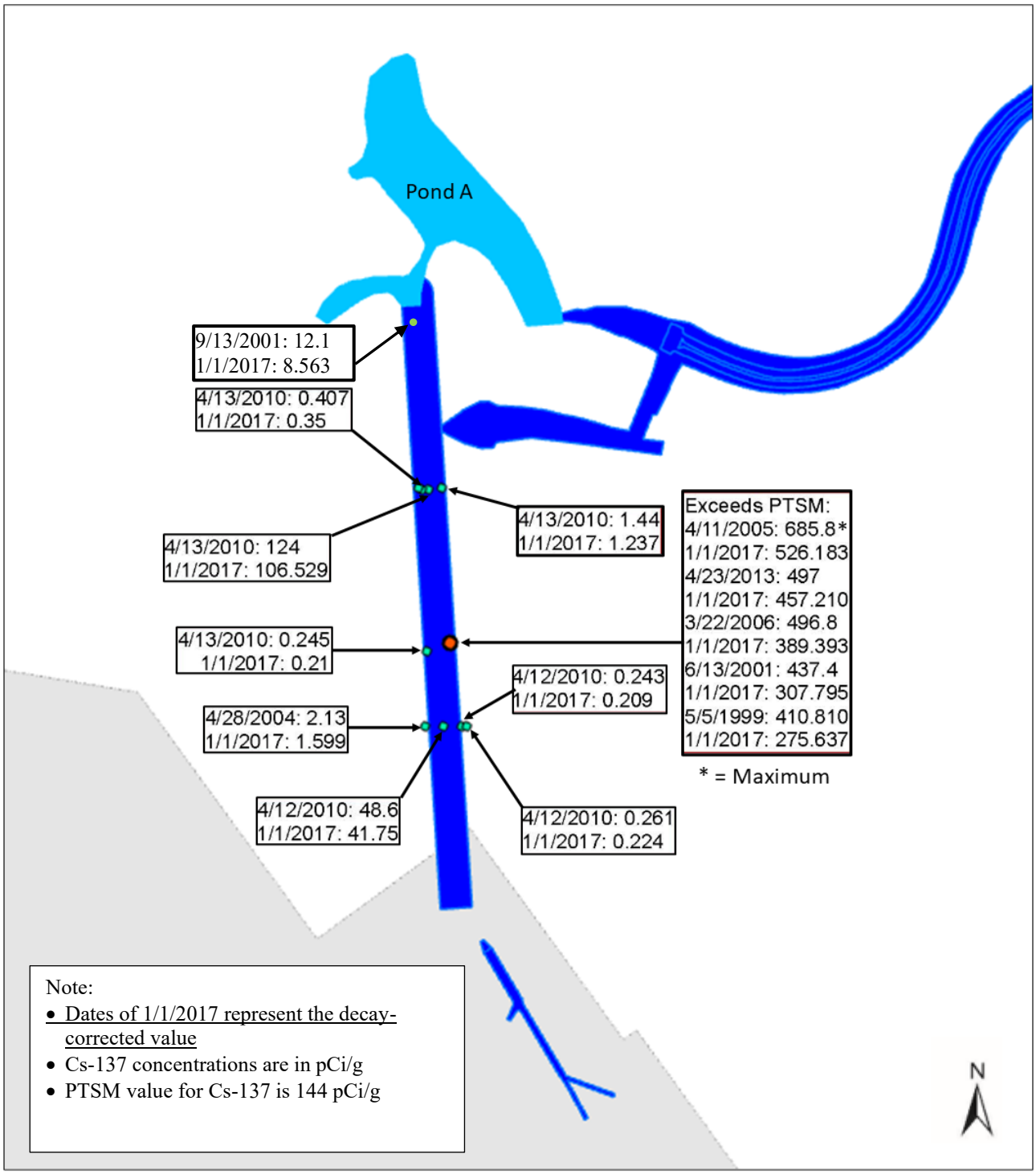

Figure B4. Sampling Results from Locations within R-Area Discharge Canal

Table B1. Sediment Concentration Statistical Summary for EA1

Table A.1.1.1.1__Statistical Summary Table: EA1 / Sediment and Soil Media (0-1ft)

EA	Fraction	Analyte	Units	Samples	Non-Detects	Detects	J-Detects	Distri-bution	UCL Method	Mean	95% UCL of Mean	Min	Max	RME	Max Location	Qualifier of Max
1	Inorganics	Cyanide	mg/kg	3	2	1	1			0.09705	NA	ND	0.223	0.223	LTROU-13	J
	Metals	Aluminum	mg/kg	12	0	12	2	N	1	5327.5	6584	1120	9020	6584	LTR ERDMS IOULTR2 Sampling Event: LTROU-01	NQ
		Antimony	mg/kg	12	8	4	4	X	5	0.2245625	0.251	ND	0.556	0.251	PAT1-2	J
		Arsenic	mg/kg	12	3	9	6	X	5	1.038875	1.423	ND	2.34	1.423	LTROU-13	NQ
		Barium	mg/kg	12	0	12	0	N	1	21.27416667	28.49	2.09	50.9	28.49	LTR ERDMS IOULTR2 Sampling Event: LTROU-01	NQ
		Beryllium	mg/kg	12	3	9	8	G	2	0.124741667	0.219	ND	0.372	0.219	PAT1-3	J
		Cadmium	mg/kg	12	8	4	4	X	3	0.0398375	0.0515	ND	0.0616	0.0515	RDC001-001	J
		Calcium	mg/kg	12	0	12	4	N	1	186.35	254.6	15.1	446	254.6	PAT1-5	NQ
		Chromium	mg/kg	12	0	12	0	N	1	7.7675	9.792	1.43	15	9.792	PAT1-5	NQ
		Cobalt	mg/kg	12	2	10	4	X	5	0.610625	0.904	ND	1.99	0.904	PAT1-5	NQ
		Copper	mg/kg	12	0	12	5	N	1	3.21925	4.125	0.441	6.69	4.125	PAT1-5	NQ
		Iron	mg/kg	12	0	12	1	N	1	3921.166667	5810	814	13300	5810	LTROU-13	NQ
		Lead	mg/kg	12	0	12	0	N	1	4.2425	5.345	1.04	8.54	5.345	PAT1-5	NQ
		Magnesium	mg/kg	12	0	12	1	L	6	124.2416667	232.5	27.1	467	232.5	PAT1-5	NQ
		Manganese	mg/kg	12	0	12	0	G	2	50.16	109.6	3.76	177	109.6	LTROU-13	NQ
		Mercury	mg/kg	12	1	11	5	X	5	0.022114583	0.0271	ND	0.0358	0.0271	PAT1-2	NQ
		Nickel	mg/kg	12	2	10	0	X	5	1.304916667	1.735	ND	2.92	1.735	PAT1-5	NQ
		Potassium	mg/kg	12	0	12	4	G	2	72.2	112.4	17.1	218	112.4	PAT1-5	NQ
		Selenium	mg/kg	12	7	5	2	X	5	0.546833333	0.851	ND	1.89	0.851	PAT1-5	J
		Sodium	mg/kg	12	11	1	1			7.232083333	NA	ND	21.9	21.9	PAT1-5	J
		Vanadium	mg/kg	12	0	12	0	G	2	18.48	32.1	2.28	61.4	32.1	RDC001-001	NQ
		Zinc	mg/kg	12	0	12	3	L	6	7.335833333	16.98	1.19	26.8	16.98	RDC001-001	NQ
	Pesticides/PCBs	DDD	mg/kg	12	11	1	1			0.000226625	NA	ND	0.000632	0.000632	PAT1-5	J
		DDE	mg/kg	12	8	4	2	X	5	0.000939083	0.0016	ND	0.0038	0.0016	RDC001-003	NQ
		DDT	mg/kg	12	11	1	0			0.000557083	NA	ND	0.0025	0.0025	RDC001-005	NQ
		PCB-1260	mg/kg	12	10	2	2	X	5	0.002642917	0.0025	ND	0.0035	0.0025	PAT1-3	J
	Radionuclides	Actinium-228	pCi/g	29	1	28	0	G	2	1.145792938	1.306	ND	2.5	1.306	PAT3-2	NQ
		Americium-241	pCi/g	17	2	15	2	G	2	0.222125471	0.671	ND	1.84	0.671	R-Area Downstream of R-1	NQ
		Americium-243	pCi/g	5	3	2	0	X	3	0.1261	0.332	ND	0.277	0.277	RDC002-001	NQ
		Bismuth-212	pCi/g	13	6	7	0	X	5	0.733767466	0.987	ND	1.3095	0.987	R-Area Downstream of R-1	NQ
		Bismuth-214	pCi/g	32	0	32	0	G	2	0.934291131	1.093	0.24165	3.41	1.093	PAT2-5	NQ
		Californium-244	pCi/g	2	1	1	0			0.087	NA	ND	0.174	0.174	R-Area Downstream of R-1	NQ
		Carbon-14	pCi/g	5	2	3	1	X	5	0.9784	2.016	ND	2.69	2.016	PAT1-5	J
		Cesium-137	pCi/g	45	1	44	4	G	2	87.33528789	148	ND	685.8	148	R-Area Downstream of R-1	NQ
		Cobalt-60	pCi/g	45	30	15	2	X	5	0.110919583	0.144	ND	0.648	0.144	R-Area Downstream of R-1	NQ
		Curium-244	pCi/g	9	2	7	0	X	4	0.015458244	0.0289	ND	0.04455	0.0289	R-Area Downstream of R-1	NQ
		Curium-245 and Curium-246	pCi/g	4	2	2	0	X	3	0.1255	0.385	ND	0.269	0.269	RDC002-001	NQ
		Gross Alpha	pCi/g	26	0	26	7	L	6	18.94230769	24.78	4.94	42	24.78	RDC002-005	NQ
		Lead-212	pCi/g	32	0	32	0	N	1	1.093340244	1.209	0.19953	2.16	1.209	PAT3-2	NQ
		Lead-214	pCi/g	33	1	32	0	X	5	0.993981336	1.173	ND	3.71	1.173	PAT2-5	NQ
		Non-volatile Beta	pCi/g	25	1	24	9	X	7	39.5326	67.06	ND	232	67.06	RDC002-001	NQ
		Plutonium-238	pCi/g	23	4	19	1	G	2	0.079272858	0.138	ND	0.486	0.138	R-Area Downstream of R-1	NQ
		Plutonium-239	pCi/g	17	1	16	0	G	2	0.22166833	0.823	ND	2.16	0.823	R-Area Downstream of R-1	NQ
		Plutonium-239 and Plutonium-240	pCi/g	7	1	6	2	X	5	0.433525714	0.716	ND	1.18	0.716	PAT1-5	NQ
		Potassium-40	pCi/g	32	12	20	8	X	7	1.297523291	3.897	ND	4.15	3.897	PAT3-2	NQ
		Radium-226	pCi/g	6	0	6	0	N	1	1.358833333	2.259	0.55	3.41	2.259	PAT2-5	NQ
		Radium-228	pCi/g	4	0	4	0	N	1	1.13	1.419	0.94	1.48	1.419	PAT2-5	NQ
		Strontium-89 and Strontium-90	pCi/g	18	4	14	0	G	2	0.283373343	0.54	ND	1.5363	0.54	R-Area Downstream of R-1	NQ
		Thallium-208	pCi/g	33	0	33	3	N	1	0.391376636	0.437	0.0756	0.729729	0.437	R-Area Downstream of R-1	NQ
		Thorium-228	pCi/g	8	0	8	1	N	1	1.5605	2.206	0.635	3.7	2.206	R-Area Downstream of R-1	NQ
		Thorium-230	pCi/g	8	0	8	1	N	1	0.89825	1.191	0.343	1.6	1.191	PAT3-2	NQ
		Thorium-232	pCi/g	8	0	8	0	N	1	1.407625	2.015	0.44	3.32	2.015	R-Area Downstream of R-1	NQ
		Uranium-233 and Uranium-234	pCi/g	6	0	6	1	N	1	0.928333333	1.339	0.369	1.64	1.339	PAT2-5	NQ
		Uranium-234	pCi/g	12	1	11	0	X	5	0.893423986	1.256	ND	2.78	1.256	R-Area Downstream of R-1	NQ
		Uranium-235	pCi/g	18	8	10	0	G	2	0.049761931	0.0571	ND	0.137	0.0571	R-Area Downstream of R-1	NQ
		Uranium-238	pCi/g	18	1	17	2	G	2	0.845591156	1.198	ND	2.73	1.198	R-Area Downstream of R-1	NQ
	Semivolatiles	Bis[2-ethylhexyl]phthalate	mg/kg	12	10	2	1			0.331552083	NA	ND	3.57	3.57	LTROU-13	NQ
	Volatiles	Acetone	mg/kg	12	3	9	4	X	4	0.0596125	0.337	ND	0.4	0.337	LTROU-13	J
		Ethylbenzene	mg/kg	12	11	1	1			0.000275125	NA	ND	0.000647	0.000647	PAT1-2	J

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Table B1. Sediment Concentration Statistical Summary for EA1 (*Continue/End)*

Table A.1.1.1.1__Statistical Summary Table: EA1 / Sediment and Soil Media (0-1ft)

EA	Fraction	Analyte	Units	Samples	Non-Detects	Detects	J-Detects	Distri-bution	UCL Method	Mean	95% UCL of Mean	Min	Max	RME	Max Location	Qualifier of Max
		Isopropylbenzene	mg/kg	12	11	1	0			0.000441708	NA	ND	0.00259	0.00259	PAT1-5	NQ
		Methyl acetate	mg/kg	12	11	1	1			0.001630417	NA	ND	0.00391	0.00391	PAT1-3	J
		Methyl ethyl ketone	mg/kg	12	6	6	6	X	3	0.00416875	0.0128	ND	0.0242	0.0128	LTROU-13	J
		Toluene	mg/kg	12	5	7	6	X	4	0.001783542	0.011	ND	0.0124	0.011	LTR ERDMS IOULTR2 Sampling Event: LTROU-01	NQ

J = Estimated Value
NA = Not Available
ND = No Detect
NQ = No Qualifier

Distribution Code:
G Gamma Distribution
L Log Normal
N Normal Distribution
X Non-Parametric

UCL Method Code (as determined by ProUCL):
1 Students-t UCL
2 95% Approximate Gamma UCL
3 95% Chebyshev (Mean, Sd) UCL
4 95% KM (Percentile Bootstrap) UCL
5 95% KM (t) UCL
6 95% H-UCL
7 95% KM H-UCL

Table B2. Data Quality Objectives Worksheet for Sediment/Soil Media

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering/ Physical Processes	Field Activities Including Removal and Characterization	Parameters	Selected Remedial Action
Sediment/ Soil	Sediment/soil may be contaminated from previous effluent discharges	Ingestion, inhalation, or dermal contact with contaminated sediment/soil in the canal	Determine the linear extent of impacted sediment/soil Evaluate effectiveness of RA by ensuring that residual sediments/soil, post excavation, are below the PTSM threshold for Cs-137 (144 pCi/g)	Sediment/soil sampling to be conducted at the sample location where results from previous events have been above the PTSM threshold for Cs-137 (144 pCi/g) Use linear-judgmental sampling design to collect sediment samples. Collect sediment/soil samples working from down-gradient to up-gradient so subsequent samples will not be contaminated from stream flow	Screening–level data will be used to select sample locations beyond initial excavation boundary. 5% splits 5% field duplicates Confirmation sampling will be a composite sample	Excavation, Treatment, and Disposal of PTSM Sediment/ Soil.

Table B3. Minimum Field Quality Control/Quality Assurance Sampling Requirements

Data Quality Level	Field Quality Control/Quality Assurance Samples	Frequency of Field Quality Control/ Quality Assurance Sample
UU	None	
VU	None	
VV	Co-located Field Duplicate	Minimum 5%
	Trip Blank	Minimum 1 per cooler
	Equipment Blank	1 per 40 samples
	Field Blank	Optional; 1 per 40 samples
	Split Sample	Minimum 5%
SD	Co-located Field Duplicate	Minimum 5%
	Equipment Blank	1 per 40 samples
	Field Blank	Optional; 1 per 40 samples
	Split Sample	Minimum 5%
	Co-located Field Duplicate	Minimum 5%
D	Equipment Blank	1 per 40 samples
	Field Blank	Optional; 1 per 40 samples
	Split Sample	Minimum 5%

Data Quality Levels
UU Data Unverified and Unvalidated Data (no errors from ERDMs database loading screens)
VU Data Verified and Unvalidated Data (includes missing data checks)
VV Data Verified and Validated Data (validated to automated criteria; equivalent to USEPA Screening Level Data)
SD Data USEPA Screening Level Data with 10% Definitive Confirmation
D Data USEPA Definitive Level Data

Table B4. Laboratory Analytical Specifications for Radiological Analytes in Soil/Sediment

Radionuclides	
Isotope	**Typical Soil MDAs**
Gamma Pulse Height Analyses	
Cesium-137	0.15

Note:
MDAs are sample-specific. The MDA represented above is a typical MDA as reported by the subcontract laboratories but is not always achievable.

Table B5. Preservatives, Holding Times, and Sample Containers

Parameter	**Preservatives**	**Holding Time**	**Containers**
	Solid	**Solid**	**Solid**
Cs-137	None/Cool to 4° C.	6 months	250 mL HDPE

Abbreviations used in Table:
HDPE – High-Density Polyethylene plastic bottle

Table B6. Sampling Matrix

Sample Count	Sample Station	Top Depth *(ft)*	Bottom Depth *(ft)*	Sample Type	Sample Media	Collection Method	Analyte	Proposed Sample Coordinates	
								SRS North	SRS East
1.	TNE-01	0	1	REG	Sediment	Hand auger	Cs-137	58251.91	76986.41
2.	TNE-01RB			RB			Cs-137	58251.91	76986.41
3.	TNE-02	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58256.18	76995.46
4.	TN-01	0	1	REG	Sediment	Hand auger	Cs-137	58256.48	76977.53
5.	TN-02	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58265.52	76981.86
6.	TN-03	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58274.49	76986.23
7.	TNW-01	0	1	REG	Sediment	Hand auger	Cs-137	58261.10	76968.64
8.	TNW-02	0	1	REG (Contingency*)	Sediment	Hand auger	Cs-137	58270.11	76964.42
9.	TNW-03	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58279.27	76960.28
10.	TW-01	0	1	REG	Sediment	Hand auger	Cs-137	58252.14	76964.16
11.	TW-02	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58256.80	76955.32
12.	TW-03	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58261.47	76946.47
13.	TSW-01	0	1	REG	Sediment	Hand auger	Cs-137	58243.23	76959.67
14.	TSW-02	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58238.36	76950.88
15.	TSW-03	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58233.36	76942.28
16.	TS-01	0	1	REG	Sediment	Hand auger	Cs-137	58238.80	76968.50
17.	TS-01FD	0	1	FD	Sediment	Hand auger	Cs-137	58238.80	76968.50
18.	TS-01SPL	0	1	SPL	Sediment	Hand auger	Cs-137	58238.80	76968.50
19..	TS-02	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58229.98	76963.79
19.	TS-03	0	1	REG (Contingency)*	Sediment	Hand auger	Cs-137	58221.16	76959.08
21.	TSE-01	0	1	REG	Sediment	Hand auger	Cs-137	58234.26	76977.61
22.	TSE-02	0	1	REG (Contingency)*	Soil	Hand auger	Cs-137	58224.26	76977.61
23.	TE-01	0	1	REG	Sediment	Hand auger	Cs-137	58243.78	76982.42
24.	TE-02	0	1	REG (Contingency)*	Soil	Hand auger	Cs-137	58239.24	76991.33
25.	PE-01-PE-05	0	1	REG (Composite)	Sediment	Hand auger	Cs-137	TBD	TBD

Regular and QA Sample Summary	
Regular Samples	**9**
Field Duplicates	**1**
Splits	**1**
Rinsate Blanks	**1**
Total Samples	**11**

***Not included in total.**

ATTACHMENT 1

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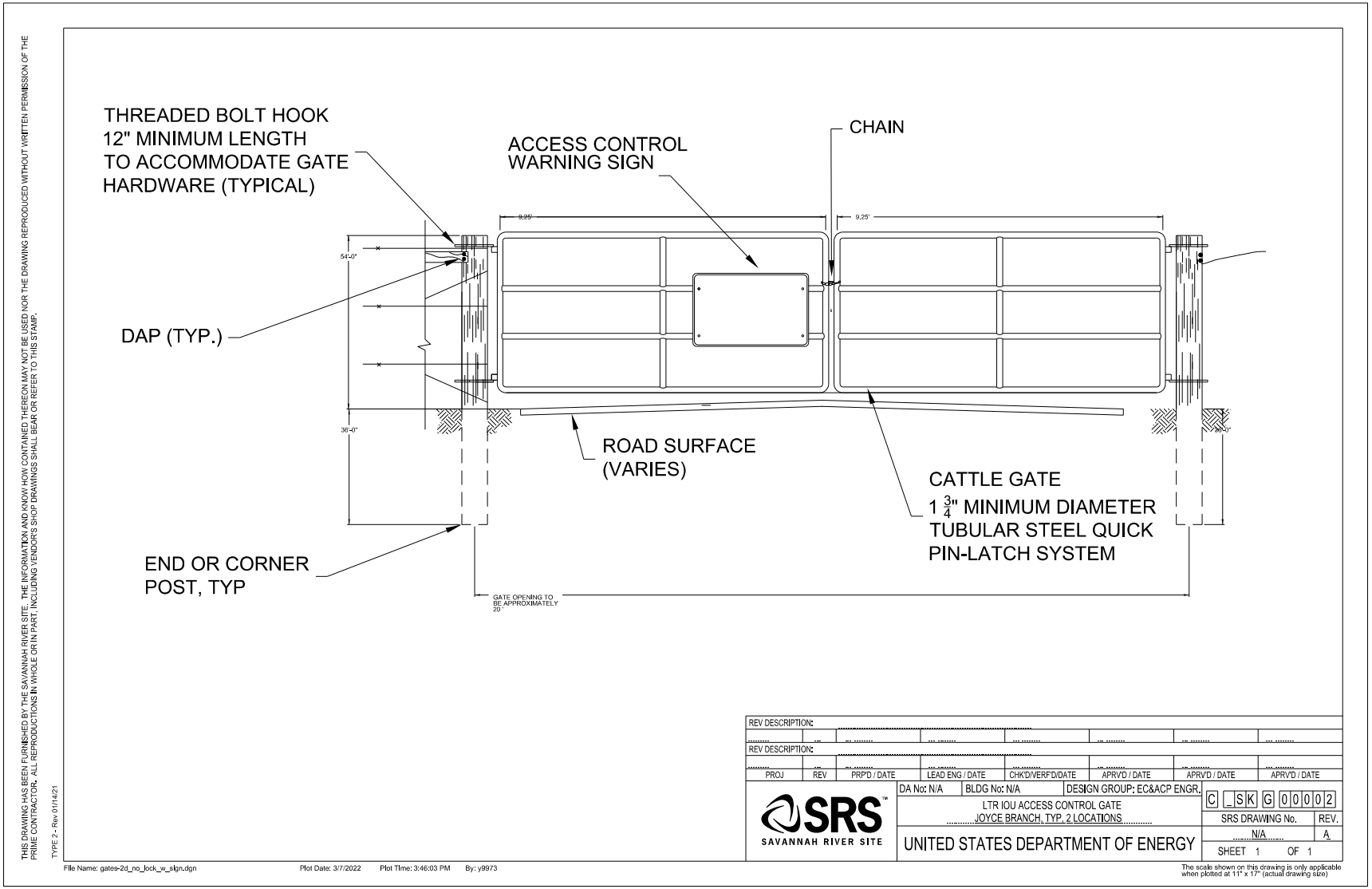
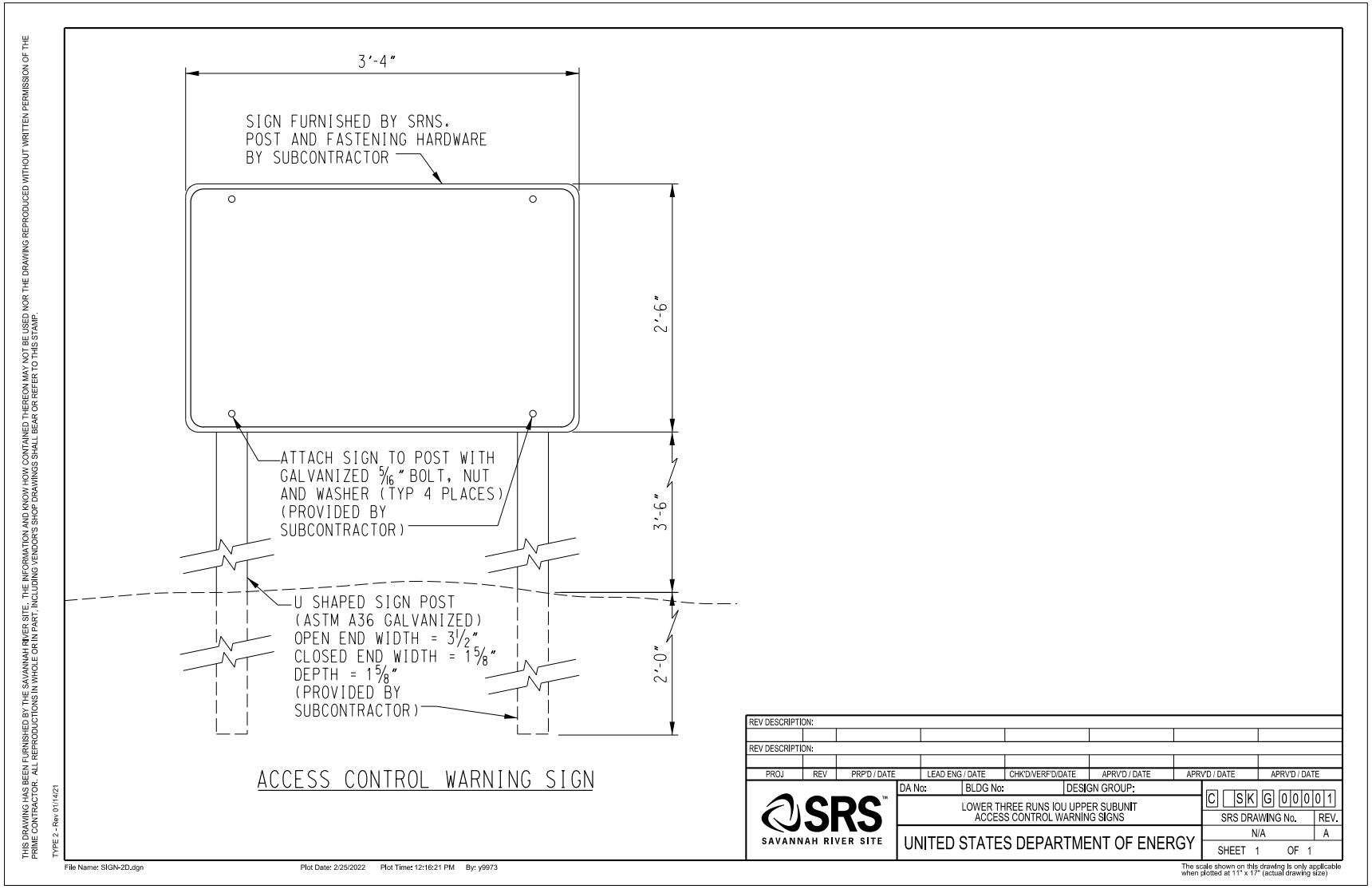
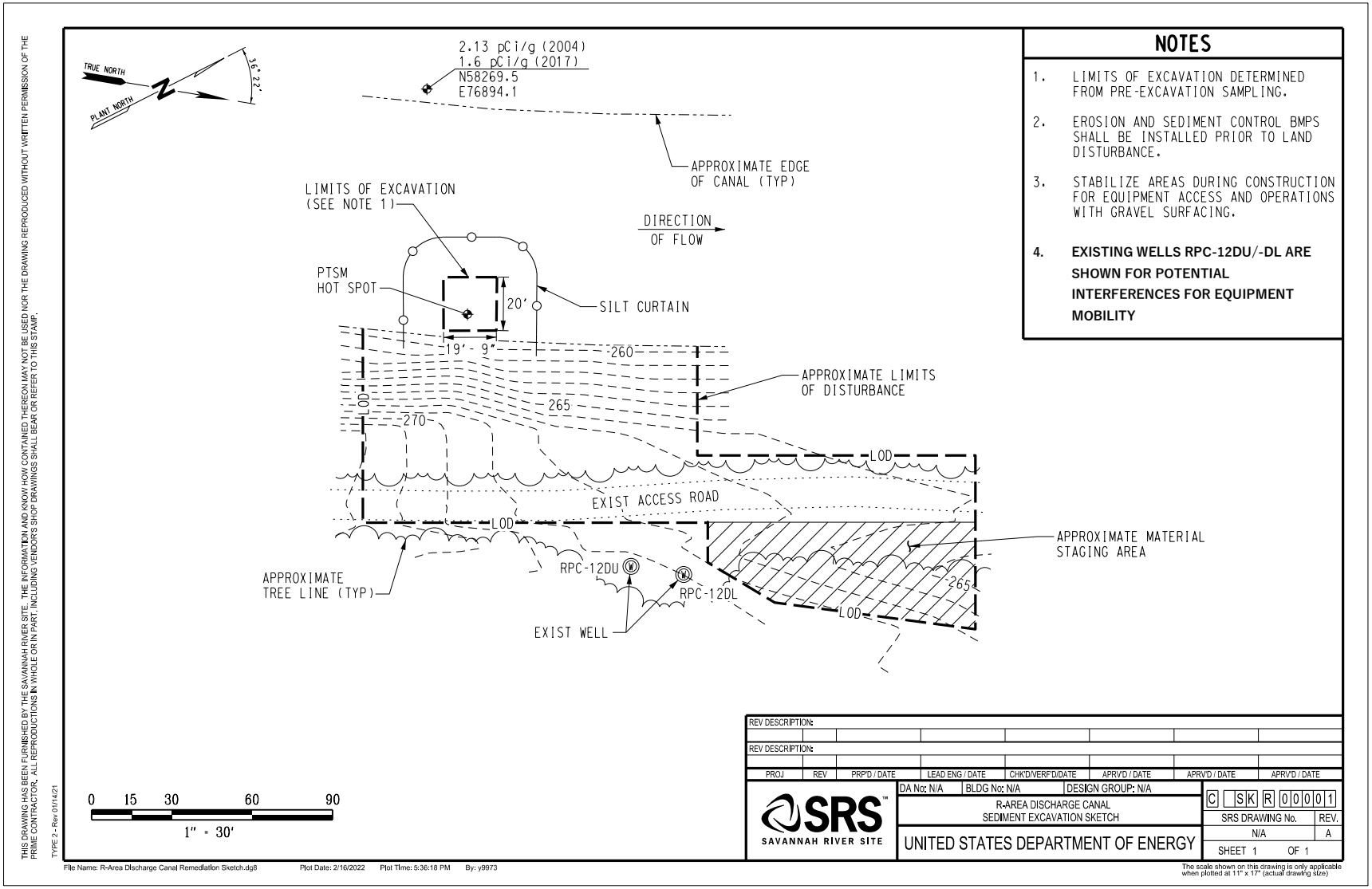


1. *Typical* Gate Design



2. *Typical* Access Control Warning Sign



3. Preliminary Design Sketch for Excavation of PTSM Sediments

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