United States Department of Energy

Savannah River Site

H Area Inactive Process Sewer Line (HIPSL) Closure Plan and Closure Certification

SRNS-RP-2009-01055

Revision 0

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DISCLAIMER

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REVISION HISTORY

H-AREA INACTIVE PROCESS SEWER LINE (HIPSL)

CLOSURE PLAN and CLOSURE CERTIFICATION

REVISION	DATE SUBMITTED	DATE APPROVED
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[1] No approval required. Rev. 0 of this document is a re-print of Rev. 22 to the 1992 RCRA Part B Permit Application Volume V.

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Closure Plan
for
H Area Inactive Process Sewer Line
(HIPSL)

EXECUTIVE SUMMARY

The Savannah River Site (SRS), located in South Carolina, produces nuclear materials for national defense, other government programs, and for some civilian purposes. The site is owned by the U.S. Department of Energy (USDOE).

This appendix to the permit application presents the Closure Plan for the H-Area Hazardous Waste Management Facility (HWMF) Inactive Process Sewer Lines (HIPSLs). The plan is being submitted in accordance with the schedule for implementation of the Phase 2 corrective action measures for the H-Area HWMF. The Closure Plan herein summarizes the characterization of contamination, identifies the contaminants of concern and their respective concentration/activity limits, presents a description of the proposed closure and post-closure requirements, and provides for coordination of the closure with an adjoining facility that is being remediated in accordance with an approved Record of Decision (ROD).

The HIPSLs consist of underground vitrified clay pipe (VCP) sewer lines and a high-density polyethylene (HDPE) pipe in H Area. Vitrified clay sewer lines were used from 1955 until 1982 to transport radioactive and hazardous waste from the processing and separation facilities to the H-Area Seepage Basins. In 1982 and 1983, these vitrified clay lines were abandoned in place and replaced with HDPE pipes due to concerns about possible leakage from the vitrified clay pipes. In 1991, the seepage basins were closed and the associated HDPE pipe was abandoned in place.

Various characterization reports have been issued for the HIPSLs. The reports reflect investigations into the nature and extent of soil and groundwater contamination. This document combines all of that data. Soil analyses indicate that the radionuclide activities and concentrations of metals and nitrate exceeded published soil background levels and, in some cases, exceeded preliminary remediation goal (PRG) values or risk based-activity (RBA) concentrations. Based on Toxicity Characteristic Leaching Procedure (TCLP) analytical results, none of the constituent concentrations exceeded the Resource Conservation and Recovery Act (RCRA) hazardous waste limits.

Results of groundwater monitoring around the HIPSLs indicate that only tritium has been noted as having concentrations routinely above the maximum contaminant level (MCL). The concentrations have been declining in most of the monitoring wells and data indicates the source for the tritium appears to be upgradient of the HIPSLs.

As a result of the nature and extent of contamination associated with the HIPSLs, the primary focus of this Closure Plan is to provide corrective measures to make these areas protective of human health and the environment. The measures selected for closure of the HIPSLs are a combination of activities that includes excavation, in-place grouting of pipe sections and manholes, placement of an engineered cover system over selected sections of remaining vitrified clay pipe to control infiltration, and post-closure care requirements.

An approved ROD for the General Separations Area Consolidation Unit (GSACU) selects a remedy for action that includes excavation and placement of contaminated soils from Warner's Pond (WP) into the Old Radioactive Waste Burial Ground (ORWBG).

The remedial action described in this Closure Plan will take place in conjunction with the GSACU remedial action. The GSACU is a remedial action that combines the scope of four former SRS Federal Facility Agreement (FFA) projects into a single, cost-effective remedy that will accelerate remedial activities and reduce risk. The project consists of four subunits: H-Area Retention Basin (HRB), WP (including the two site evaluation units), HP-52 Ponds (HP-52), and the ORWBG.

A portion of the HIPSL vitrified clay pipe (within WP) will be removed with material excavated for the GSACU and placed in the ORWBG or grouted in place. This Closure Plan, along with the Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) for the GSACU, describes the coordination of the RCRA Closure remedial action with the corrective measures (excavation and RCRA/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial action) for the HIPSLs within WP.

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LIST OF ACRONYMS

ACL	alternate concentration level
ASTM	American Society for Testing and Materials
bls	**below land surface**
cm/sec	centimeters per second
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI/RAIP	Corrective Measures Implementation/Remedial Action Implementation Plan
FFA	Federal Facility Agreement
GA	Gordon aquifer
GCL	geosynthetic clay liner
GDL	geocomposite drainage layer
GSA	General Separations Area
GSACU	General Separations Area Consolidation Unit
GSAEGOU	General Separations Area Eastern Groundwater Operable Unit
GWPS	groundwater protection standard
HAGOU	H-Area Groundwater Operable Unit
HDPE	High Density Polyethylene
HIPSL	H-Area Inactive Process Sewer Line
HP-52	HP-52 Ponds
HRB	H-Area Retention Basin (281-3H)
HWMF	Hazardous Waste Management Facility
LAZ	lower aquifer zone
LUCIP	Land Use Controls Implementation Plan
M^2per sec	square meter per second
MCL	maximum contaminant level
msl	mean sea level
O&M	Operations and Maintenance
ORWBG	Old Radiological Waste Burial Ground
pCi/g	picocurie per gram
pCi/L	picocurie per liter
PE	Professional Engineer
PPE	**Personal Protective Equipment**
PRG	preliminary remediation goal
PTSM	principal threat source material
RBA	risk-based activity
RCRA	Resource Conservation and Recovery Act of 1976
RFI/RI/BRA	RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
TCLP	Toxicity Characteristic Leaching Procedure
UAZ	upper aquifer zone
USDOE	U. S. Department of Energy
USEPA	U.S. Environmental Protection Agency
UTRA	Upper Three Runs Aquifer
WP	Warner's Pond
WSRC	Westinghouse Savannah River Company
VCP	**vitrified clay pipe**
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 Background

The Savannah River Site (SRS) (Figure 1-1) is located in portions of Aiken, Barnwell, and Allendale Counties of South Carolina. The site is owned by U.S. Department of Energy (USDOE).

The H-Area Inactive Process Sewer Line (HIPSL) is located in H Area and is depicted on Figure 1-2. Vitrified clay pipe (VCP) sewer lines were used from 1955 to 1982 to transport radioactive and hazardous waste from the processing and separation facilities to the H-Area Process Seepage Basins. Waste effluent included cooling water, spent cleaning solutions, rinse water from nuclear materials facilities, purge water from fuel and target storage basins, surface runoff from tank farms, and distillate from the evaporation of various processes and waste streams. In 1982 and 1983, these vitrified clay lines were abandoned in place and replaced with high density polyethylene (HDPE) pipes due to concerns about possible leakage from the vitrified clay pipes. The HDPE lines are parallel to, and generally 20 ft laterally away from, the abandoned clay lines at depths ranging from 3 to 15 ft below ground surface. A section of the HDPE line was placed north and west of Warner's Pond (WP) and the vitrified clay line.

Characterization and assessment was performed along the length of the abandoned vitrified clay process sewer line from the H-Area Hazardous Waste Management Facility (HWMF) boundary to the H-Area Separations Facility boundary (approximately 3,120 ft) in 1988-89, 1992-93, and in 1998. Characterization was performed to determine whether leaks from the vitrified clay process sewer line had contaminated soil in the area. Soil cores were obtained at sampling sites adjacent to the vitrified clay sewer line and from background areas in the vicinity of each pipeline. Sampling sites were selected to focus on areas of known collapse and repair and on other areas possessing a high potential for deterioration and/or leakage (i.e., manhole structures). The characterization report, which reflects the characterization performed in 1989-90, was submitted as an attachment to the Part B Permit Renewal Application. A screening baseline risk assessment was performed on the 1993-94 data and was submitted to South Carolina Department of Health and Environmental Control (SCDHEC) in 1994. The characterization data from 1998 are attached to this document (Appendix D). Tables that reflect the maximum concentration data and comparisons to either the Preliminary Remediation Goal (PRG) or risk-based activity (RBA) values are included at the end of Section 3.0. Figures denoting the location of the sampling points are found at the end of Section 3.0. Based on Toxicity Characteristic Leaching Procedure (TCLP) analytical results (Appendix D-6), none of the contaminant concentrations exceeded the Resource Conservation and Recovery Act (RCRA) hazardous waste limits.

In 1998, a HIPSL Phase III Groundwater Assessment was completed. This assessment included Hydropunch™ groundwater sampling along several transects perpendicular to and down-gradient from the sewer lines in H Area, almost entirely in the Upper Three Runs watershed.

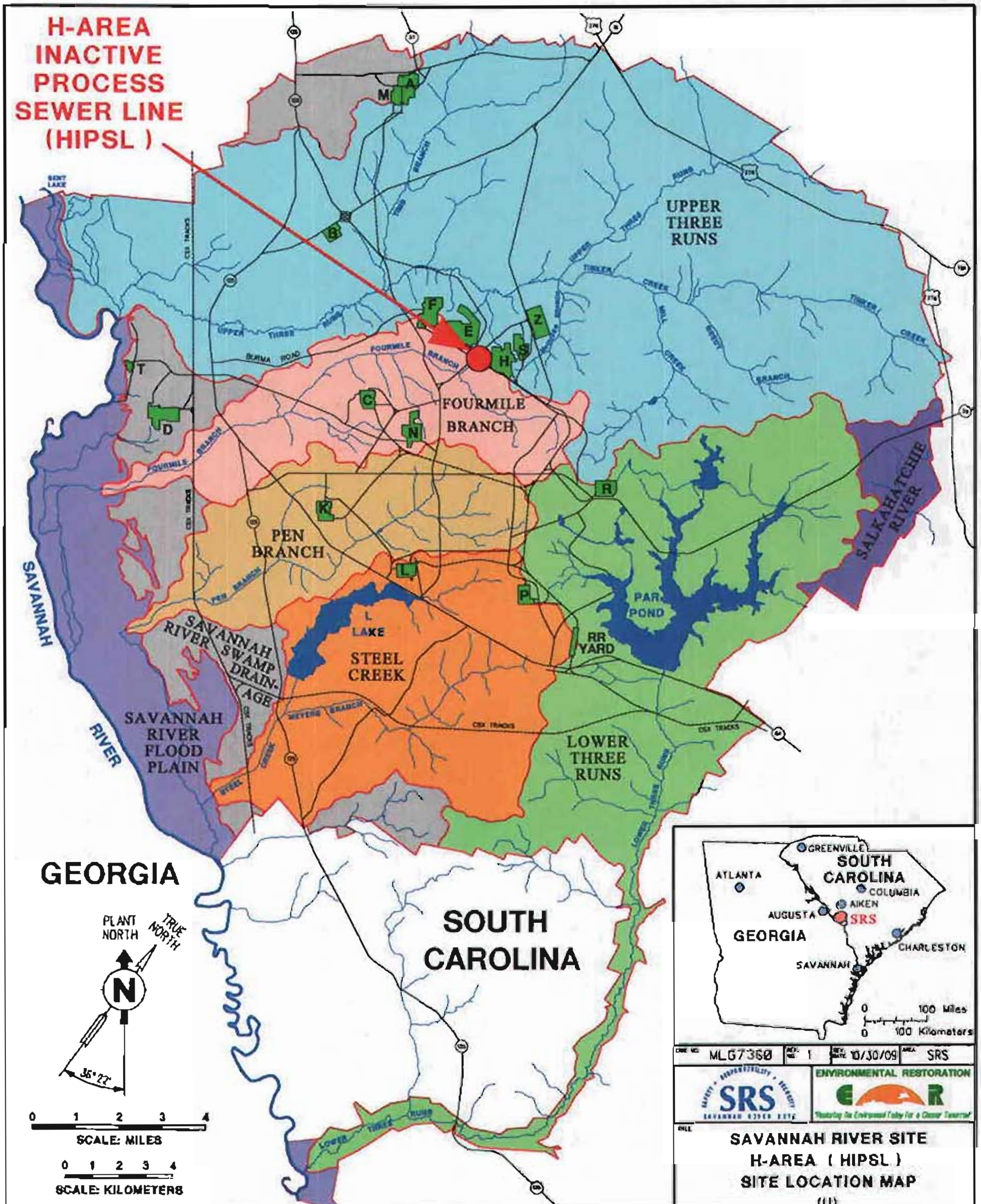

Figure 1-1. Map of SRS Showing the Location of H Area

Groundwater samples were collected from five horizons, two within the upper aquifer zone (UAZ) and three within the lower aquifer zone (LAZ) of the Upper Three Runs aquifer (UTRA). Analysis of these samples indicated the presence of elevated levels of nitrate-nitrite, radionuclide indicators, tritium, and some metals. The results of this characterization are included in the final report for this activity (WSRC 1998). Section 3.0 contains a discussion of the data and a map depicting the sampling points.

1.2 Regulatory Basis for Closure

The HIPSL closure pertains only to those areas outlined in this closure plan. The HIPSL is a portion of the H-Area HWMF. Closure design is based upon and conducted in accordance with Regulation R.61-79.264, Subpart K of the South Carolina Hazardous Waste Management Regulations (SCHWMR). Generally this Closure Plan calls for removing the vitrified clay pipe at WP, installing a cover system over the extent of the remaining HIPSL, and grouting the manholes of the HDPE pipe. Groundwater in this area is managed under the General Separations Area Eastern Groundwater Operable Unit (GSAEGOU).

A copy of the approved Closure Plan and all revisions will be maintained at SRS until facility closure is completed and certified in accordance with SCHWMR 61-79.264.115. If changes that significantly affect the Closure Plan occur during design or closure activities, then the plan will be amended 60 days prior to the proposed change or no later than 30 days after an unexpected event occurs.

The bulk of the HIPSL within WP will be excavated along with other material being removed as part of the General Separations Area Consolidation Unit (GSACU) remedial action. The GSACU is a contaminated soil removal project that combines the scope of four former SRS Federal Facility Agreement (FFA) projects into a single, cost-effective remedy that will accelerate remedial activities and reduce risk. The project consists of four subunits: H-Area Retention Basin (HRB), WP (including the two FFA site evaluation units), HP-52 Ponds (HP-52), and the Old Radioactive Waste Burial Ground (ORWBG) (see Figure 1-3). The remedy to remediate the units has been selected and approved in a Record of Decision (ROD) (WSRC 2002) and the implementation plans for the action are documented in the GSACU Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) (WSRC 2003). The GSACU CMI/RAIP describes the coordination of the remedial action with the corrective measures (excavation and cover system) for the HIPSLs within WP.

The scope of GSACU project is to excavate contaminated materials, i.e., principal threat source material (PTSM), from HRB, WP, and HP-52, transport the materials to the ORWBG, unload and consolidate the materials in designated areas of the ORWBG, and construct a low-permeability geo-synthetic cover over the entire ORWBG. PTSM is defined as material having a human health risk greater than 10^{-3}. Along with removal of contaminated soil at WP, approximately half of the HIPSL pipeline itself will be removed. The removal involves the length of the HIPSL that traverses the long dimension of the WP, approximately in the middle of the eastern half.

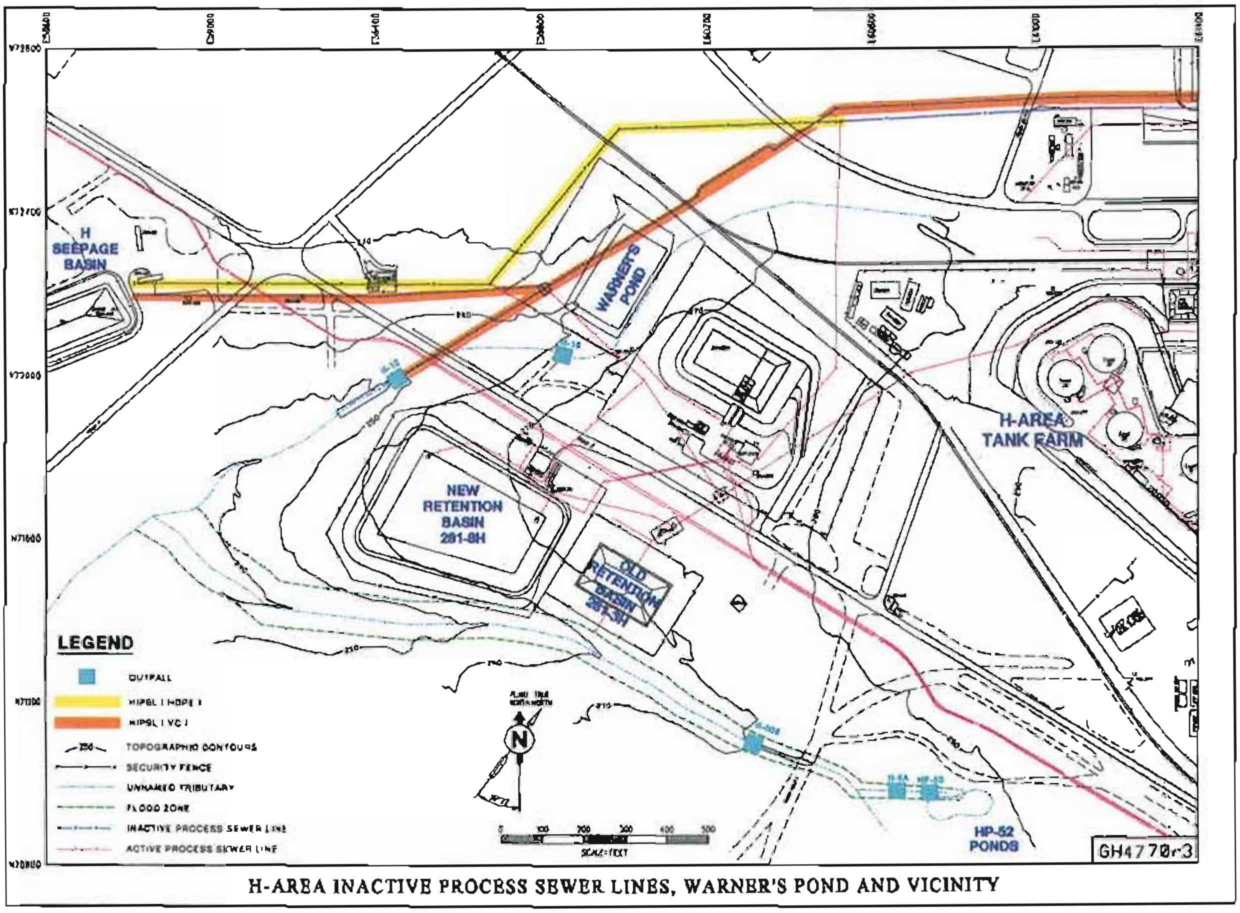

Figure 1-2. Map of the General Separations Area Showing the Location of the HIPSL

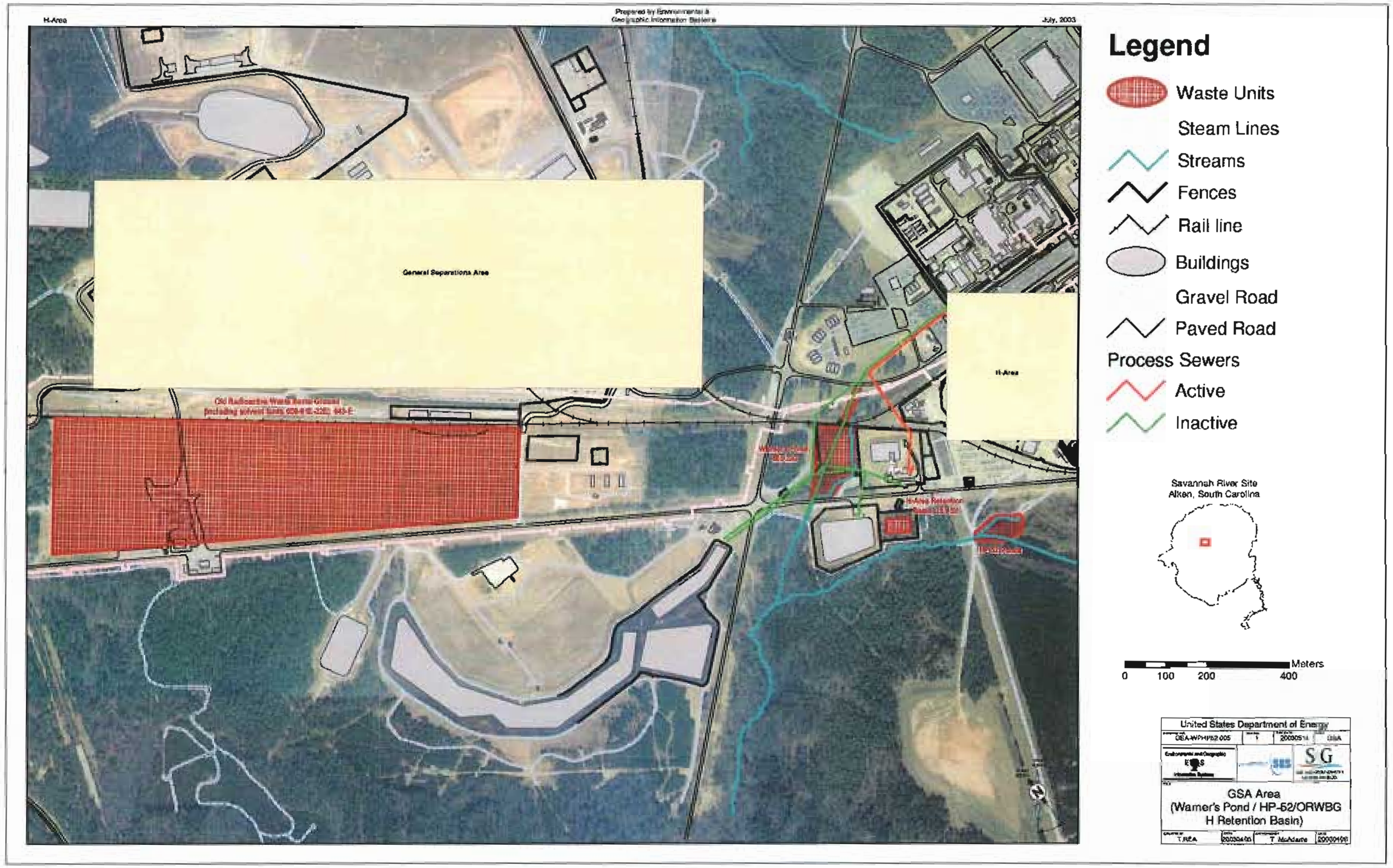

Figure 1-3. Map of the General Separations Area Showing the Locations of the H-Area Retention Basin, Warner's Pond, the HP-52 Ponds, and the Old Radioactive Waste Burial Ground

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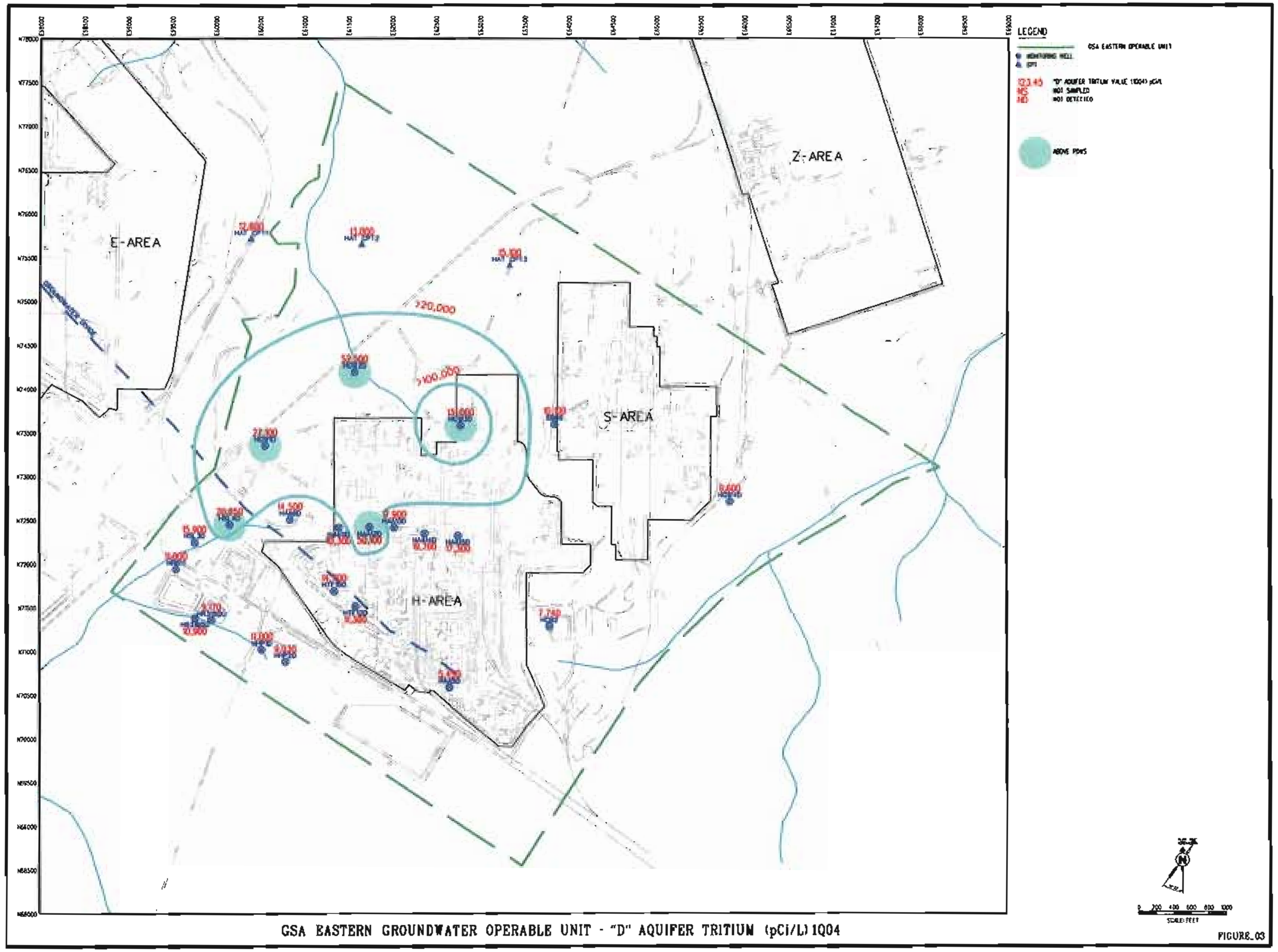

Figure 1-4. GSA Eastern Groundwater Operable Unit – "D" Aquifer Tritium (pCi/L) 1Q04

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Where the PTSM and pipe have been removed, the area will be filled with clean fill and then overlain with an engineered cover system to preclude contaminant migration. Portions of the pipe underlying the railroad, the steam line north of the railroad, and portions underlying the SRS highways will be grouted in place. The removal action of the WP portion of the HIPSL as covered in the GSACU will be coordinated with the activities associated with the Closure Plan for the HIPSL. The radiological contaminated soils from WP and the remedial activities for the soil removal and grouting sections of the VCP HIPSL within WP are specifically covered in the CMI/RAIP for the GSACU (WSRC 2003). The soil will be removed from WP during the same time period that it is removed at the other units so the material to be removed will be handled and transported as few times as possible. Any contaminant migration issues associated with removal and exposure of the contaminated soil to rainfall and infiltration will be mitigated by removal of the contaminated soil and the placement of an engineered cover system. The manholes and the diversion box within WP will be removed and included in the consolidated wastes at the ORWBG. In the area north of WP (north of the H-Area entrance road), portions of the VCP HIPSL will be grouted, left in place, and a low permeability geosynthetic cover will be installed. At locations where it is not practicable to excavate or cover the VCP HIPSL (i.e., under the railroad tracks, under the inter-area transfer line, under the steam lines), the sewer line will be grouted and abandoned in place. Under site roadways, the cover system will be tied into the asphalt or a concrete apron will be used as a cover. The area where the HIPSL is to be removed is shown on Sketch SK-C-53188.

The soil within the WP area is being removed as it is determined to be PTSM based upon the concentration of cesium-137 that poses a risk to human health and the environment greater that 10^{-3}. Additionally, strontium-90 is being removed because it poses a contaminant migration threat to groundwater. The cesium-137 and strontium-90 at WP are the primary risk drivers. Their footprint of contamination overlaps those of the other constituents. When the removal is performed for the cesium-137 and strontium-90, the other constituents that also pose a risk will also be removed. A TCLP analysis has been performed for the vitrified clay pipe and surrounding soils. The results of this analysis show that the pipe and surrounding soils are not RCRA hazardous (see Appendix D, Soils, TCLP).

Table 1.1 depicts the relationship between this RCRA Closure Plan and the GSACU Record of Decision (ROD)/RAIP documentation. In essence, this Closure Plan authorizes removal and grouting of the pipeline within WP; and the performance of the soil removal, grouting, and cover system activities at WP are contained within the GSACU CMI/RAIP.

Figure 1-4 (WSRC 2000) illustrates the groundwater plume associated with the GSAEGOU. No definable plumes have been determined to emanate from the HISPL, although monitoring and assessment activities will continue.

1.3 Contiguous Facilities

The closure design of the HIPSL will interface with the contaminated soil removal activity at WP and other physical facilities. Cesium-137 contaminated soil adjacent to the HIPSL vitrified clay pipe will be removed from WP. Concentrations of cesium-137 in soils are identified as PTSM for human health risk, and strontium-90 has the potential to leach to groundwater above groundwater protection standards (GWPS) concentrations in less than 1,000 years. Because of their contaminant concentration footprint, these two constituents are utilized as the measures of where the contaminated soil is to be removed at WP and subsequently covered by the engineered cover system. Their footprint encompasses the footprints of the other contaminants. Both the contaminated soil and the HIPSL vitrified clay pipe from WP will be disposed of at the ORWBG in accordance with the CMI/RAIP for the GSACU. Table 1.1 shows the documents in which the activities for the HIPSL and WP are captured.

Table 1.1 Documentation of Activities at HIPSL and Warner's Pond

Scope Item	RCRA Closure Plan	GSACU ROD/RAIP
Characterization	• Summary of '89, '93 results, and all '98 results • TCLP (metals) Vitrified Clay Pipe	• HRB *RFI/RI/BRA project risks • Warner's Pond/HP-52 Work Plan (nature and risk) • CMI/RAIP WP/ HP-52 extent data (includes TCLP pipe).
Pipeline/Diversion Box/Manholes	• All items in Closure Plan	• Non-hazardous material from the pipeline can be placed in ORWBG • Reference Closure Plan for disposition of pipeline materials
Soil	• All soils outside of WP • Reference RAIP for disposition of soils inside WP	• Establishes RGs for soils within WP • Sample and analysis plan for remaining soils consistent with RGs
Cover System	• Design and installation requirements for all areas outside of WP • Reference RAIP for completion of cover inside WP	• Design and installation requirements for all areas within WP
Certification of Completion/Post Closure	• **PE certification of all pipeline actions • PE certification of all cover system installation, including WP • Institutional control of areas inside and outside WP (***O&M) • Reference GSACU Post Construction Report • Post-Closure Plan submitted with Closure Plan	• Post-Construction Report documents completion of action within WP • Includes all remaining soil data and cover system data • References Closure Plan for disposition of pipe materials • Institutional control requirements for WP area (****LUCIP) • Five-year ROD reviews • Institutional Controls meet the post-closure requirements of RCRA

*RFI/RI/BRA RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment
**PE Professional Engineer
***O&M Operations and Maintenance
****LUCIP Land Use Control Implementation Plan

2.0 CLOSURE PERFORMANCE STANDARD

The H-Area HWMF (of which the HIPSL is a portion) will be closed in a manner that (a) minimizes the need for further maintenance; and (b) controls, minimizes or eliminates contamination to the extent necessary to prevent threats to human health and the environment, post-closure escape of hazardous waste or hazardous waste constituents to the groundwater, surface water or to the atmosphere. The closure will also satisfy SCHWMR Regulation R.61-79.264.228(a)(2)(iii) pertaining to surface impoundments. To meet these objectives, a final cover will be placed over the length of the VCP HIPSL. The final cover will provide long-term minimization of liquid migration through the soils immediately underlying the vitrified clay pipeline. The cover will also function with minimum maintenance; promote drainage and minimize erosion or abrasion of the final cover; accommodate settling and subsidence so that the cover's integrity is maintained; and have a permeability less than or equal to the permeability of surrounding natural soils.

Post-closure requirements contained in Subpart G Section 264.117-264.120 will be met by maintaining the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events; maintaining and monitoring the groundwater monitoring system and complying with all other applicable requirements of Section 264 Subpart F; and preventing run-on and run-off from eroding and otherwise damaging the final cover.

To meet these objectives, SRS plans to take the following actions:

1) remove the HIPSL vitrified clay pipe and associated contaminated soil within the WP Area, as practicable, and grout all sections, to the extent practicable, of the VCP HIPSL that are not removed;

2) install an engineered cover system with a geocomposite drainage layer (GDL) over the area where the soil is above the contaminant migration threshold values at WP;

3) grout the manholes and trebler pit associated with the abandoned vitrified clay pipe;

4) install an engineered cover system over the remainder of the vitrified clay portion of the HIPSL that is not covered with asphalt or concrete;

5) grout the manholes and trebler pit associated with the abandoned HDPE to prohibit human intrusion;

6) install an engineered cover system around the perimeter of all HIPSL manholes and trebler pits;

7) install access control signs along the length of the pipeline after all the above have transpired, denoting that the site was a former radioactive and HWMF.

The engineered cover systems will minimize infiltration of stormwater through the contaminated soils, thereby reducing migration of remnant contaminants to groundwater.

Both treblers, the one on the HDPE line and the one on the vitrified clay pipe HIPSL, will be grouted. Equipment associated with the treblers, including piping, pumps, handrails, grating, etc., will be dismantled and put into the trebler, if possible. The trebler pit will then be filled with grout. The GCL will be placed around the perimeter of both treblers to prevent infiltration of surface water to the underlying soil.

The closed facility will not be fenced because of the configuration of the unit, i.e., the facility is a pipeline and has a long narrow footprint. Future use of the site after release from post-closure will be controlled by a notice in the deed to the property that states that the site is a former radioactive and HWMF. Postings will be regularly spaced along the length of the closed facility (pipeline), denoting that the site is a former radioactive and HWMF. Access to the site and future use of the site will be controlled since the site is located in a secure area operated by the USDOE.

Groundwater monitoring will be used to evaluate releases of hazardous and radioactive constituents from the site. It is expected that the USDOE will maintain institutional control of the site until at least the year 2038, approximately 30 years following the closure of the HIPSL.

3.0 BACKGROUND DATA

3.1 Site Description

The HIPSL at the SRS was used to transport liquid waste from processing and separation facilities to unlined earthen seepage basins in H Area. Waste effluent included cooling water, spent cleaning solutions, rinse water from nuclear materials facilities, purge water from fuel and target storage basins, surface runoff from tank farms, and distillate from the evaporation of various processes and waste streams.

The original sewer lines were constructed of vitrified clay and were used from 1955 to 1982. Due to deterioration and leakage, the vitrified clay lines were abandoned in place in 1982 and were replaced with HDPE lines. The HDPE lines were used until 1988, at which time the use of the seepage basins was discontinued. The lines were then flushed and abandoned in place. Inside the H-Area security fence, the inactive process sewer line is subject to RCRA/CERCLA in accordance with the FFA. The H-Area Seepage Basins and sections of sewer line that lie outside the H Area security fences and extend to the seepage basins are subject to RCRA.

The HIPSL originates on a topographic ridge beneath which shallow groundwater diverges toward Upper Three Runs Creek to the north and Fourmile Branch to the south. The extensive network of wells near the H-Area Seepage Basin and along the HIPSL monitor shallow groundwater that discharges to Fourmile Branch, and Upper Three Runs.

3.2 General Hydrogeological Information

The HIPSL originates the groundwater divide between the watershed of the Upper Three Runs Creek and the Fourmile Branch. The groundwater drainage along the reach of the HIPSL is towards Fourmile Branch. The Upper Three Runs Creek is incised to an elevation of approximately 150 ft above mean sea level (msl), and its drainage system is the primary controlling influence on groundwater flow direction in the lower zone of the UTRA and the Gordon aquifer (GA) in the northern portion of the HIPSL. Fourmile Branch is incised to an elevation of approximately 200 ft above msl in this region. It influences groundwater flow in the upper zone of the UTRA only, and not in the deeper GA. Just north of WP, the groundwater in the upper zone of the UTRA flows toward Upper Three Runs Creek. South of that area the groundwater in the upper zone of the UTRA flows toward the Fourmile Branch.

The UTRA includes the Eocene-age clastic and carbonate sediments of the Tinker/Santee, Clinchfield, Dry Branch, and Tobacco Road Formations, which were deposited in shallow marine environments (Aadland et. al 1995). Average horizontal conductivity values of 7.5 ft/day for the upper zone and 7.1 ft/day for the lower zone of the UTRA have been reported (WSRC 1997b). The upper and lower zones of the UTRA are divided by the moderately continuous to discontinuous "tan clay confining zone" of the Dry Branch Formation. Beneath the study area, this clay zone consists of interbedded clay and sand, ranges from five to more than 10 ft thick, and typically exhibits vertical hydraulic conductivity values on the order of 10^{-3} ft /day (Flack and Harris 1997; Smits et al, 1997; WSRC 1997b). The UTRA is underlain and separated from the GA by clay-rich Eocene-age marine sediments of the Warley Hill Formation. Hydrostratigraphically, this formation is the Gordon confining unit. The GA includes Paleocene and Eocene-age marine and marginal marine sediments of the Snap, Fourmile, and Congaree Formations (Aadland et. al. 1995). An average horizontal conductivity of 38 ft/day has been reported for the GA (WSRC 1997b).

Underlying the area of the HIPSL, hydraulic head differences across the Gordon confining unit create the potential for downward migration of groundwater. However, because the Gordon confining unit is a relatively competent confining unit in the General Separations Area (GSA), there is little actual downward movement. Based on aquifer testing and modeling, leakance coefficients of 10^{-5}/day have been calculated for the Gordon confining unit in the GSA (GeoTrans 1992; CH2M Hill 1989).

More detailed descriptions of the geology and hydrostratigraphy of the GSA are available in many documents (e.g., Aadland et. al. 1995; Flack and Harris 1997; Smits et. al. 1997; WSRC 1996, 1997a).

3.3 Waste Unit Characterization

3.3.1 Waste Characterization

The HIPSL vitrified clay pipelines were used from 1955 until 1982 to transport radioactive and hazardous waste from the processing and separation facilities to the H-Area Seepage Basins. Waste effluent included cooling water, spent cleaning solutions, rinse water from nuclear materials facilities, purge water from fuel and target storage basins, surface runoff from the tank farms, and distillate from the evaporation of various process and waste streams. A description of the waste going to the basins can be found in Section C.1.7.1 of the 1992 Part B Permit Application.

3.3.2 Soil Characterization

During 1989 and 1990, characterization and assessment of the soils were performed along the length of the abandoned vitrified clay process sewers from the H-Area HWMF boundary to the H-Area Separations Facility boundary (approximately 3,120 ft). Samples were obtained from various depths at thirteen locations along the length of the HIPSL. Sample locations were biased to focus on areas of known sewer line collapse and repair, and other areas possessing a high potential for deterioration and/or leakage (i.e., manhole structures). The results of this investigation were included in a report as an attachment to the H-Area HWMF Closure Plan, Rev. 0, submitted to SCDHEC as a portion of the Part B Permit Application. The sampling locations are depicted on Figure 3-1. Tables 3.1 and 3.2, comparing the maximum concentrations found in this sampling event to the current primary remedial goals (PRGs) and RBA values, are presented at the end of this chapter.

In a 1992-1993 sampling event, locations adjacent to the vitrified clay sewer lines were sampled continuously over 10 ft, starting at a 5-ft depth, which is the approximate level of the bottom of the abandoned pipeline. Those areas that were believed to possess a high potential for contamination were characterized by collecting samples from six boreholes (three on each side of the pipeline). These included the manholes and the areas where repairs have occurred or areas where the vitrified pipe had collapsed. Figure 3-1 depicts the location of the soil sampling that has been performed. A total of 60 boreholes were drilled along the HIPSL. Tables 3.3 and 3.4, which compare the maximum concentrations found in this sampling event to the current PRG and RBA values, are presented at the end of this chapter. The highest levels identified are within the WP footprint and will be excavated with the WP excavation of the PTSM.

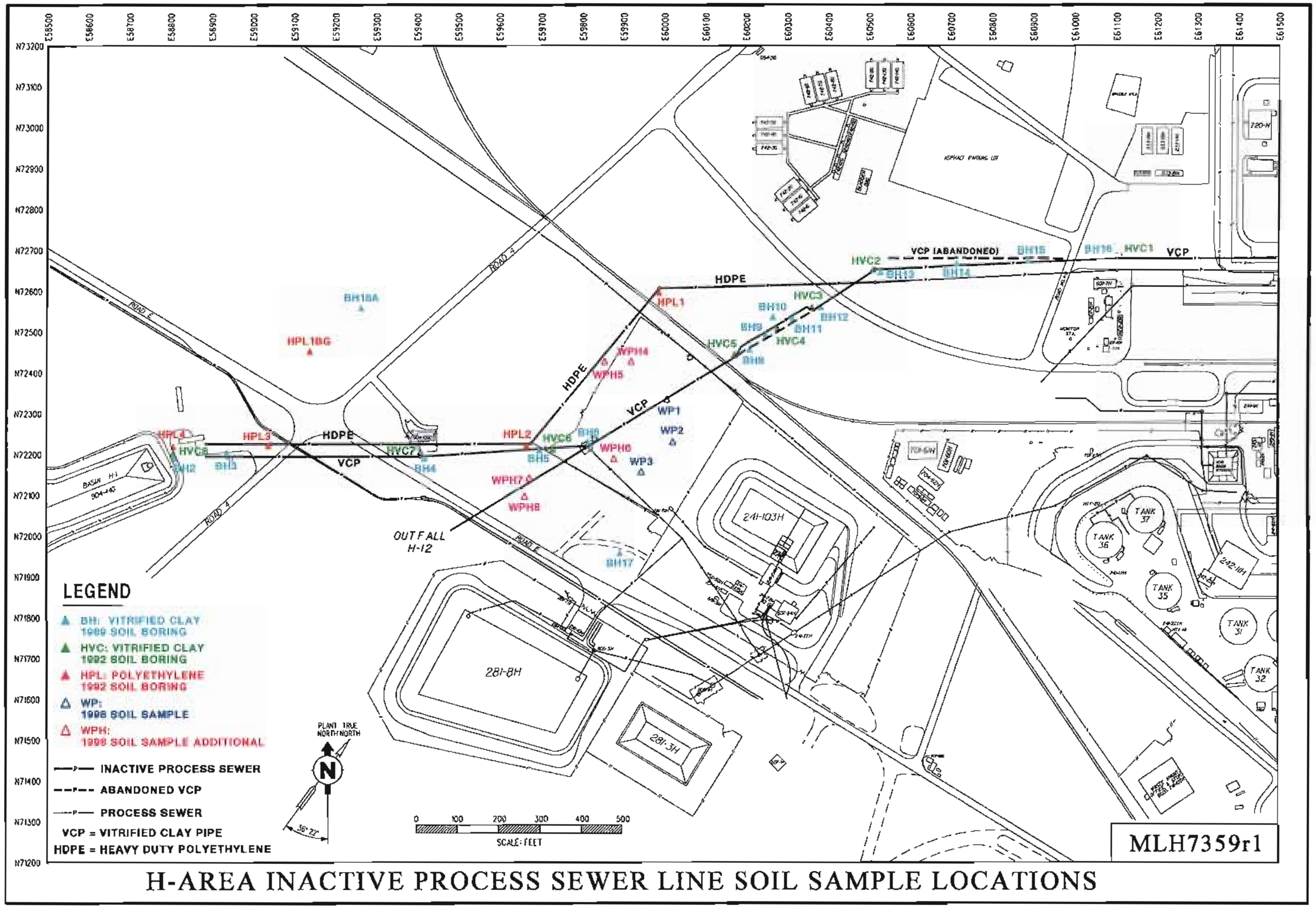

Figure 3-1. H-Area Inactive Process Sewer Line Soil Samples Locations

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In 1998, sampling along the vitrified clay portion of the HIPSL was performed to further characterize the soil that may have been contaminated by leakage from the abandoned process sewer line. The analysis for the supplemental sampling consisted of a comprehensive set of hazardous and radioactive constituents and also TCLP for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. In addition, gross alpha and gross beta analyses were performed. The sampling locations are depicted on Figure 3-1. A total of three boreholes were drilled along the HIPSL, all confined to the WP Area. Tables 3.5 and 3.6 compare the maximum concentrations found in this sampling event to the current PRG and RBA values and are located at the end of this chapter.

In 1998, additional sampling was performed in WP near the HIPSL and the HDPE line. The borings were sampled at multiple depths below the surface as well as at the surface. The maximum concentration of cesium-137 was 1290 pCi/g at WPH-6 (1998 additional sampling at WP, see Table 3.8). The next highest value for cesium-137 was at WP-2 at 422 pCi/g. Both of these concentrations were detected in surface samples (see Figure 3-1). In addition, the highest value for strontium-90, at 131 pCi/g, was found at WP-2 in the sample from 1 ft to 4 ft below the surface. WPH-6 was the next highest occurrence for strontium-90 at 60 pCi/g in the surface sample. Both of these sample locations are near where the pond was previously located. A copy of the data from this characterization can be found in Appendix D. See also Tables 3.7 and 3.8 at the end of the section.

The characterization that was performed along the HDPE focused on the manholes and was performed in 1992. The sampling performed is depicted on Figure 3-1. No RCRA hazardous waste limits or PRGs were exceeded. Samples were obtained at depths at least 3 ft below land surface. Tables 3.9 and 3.10, comparing the maximum concentrations that were found in this sampling event to the current PRG or RBA values are located at the end of this chapter.

A comparison of the maximum constituent concentration detected at the vitrified clay (HIPSL) from all four investigations (i.e., 1989-1990, 1993-1994, 1998, and the 1998 additional sampling) is found in Tables 3.9 and 3.10. The same comparison is performed for the HDPE sampling in Tables 3.11 and 3.12. Copies of the data from all the characterization activities can be found in Appendix D. Recent characterization (WSRC 2003) for the Remedial Investigation Work Plan for the GSACU to delineate the extent of the cesium-137 and strontium-90 contamination in WP is detailed in the CMI/RAIP for the GSACU. TCLP analyses of the soil and pipeline were also performed, with none of the results exceeding the TCLP values (see Appendix D).

3.3.3 Groundwater Characterization

The HIPSL Phase III Groundwater Assessment results indicate that metals, gross alpha, nitrate, non-volatile beta, total radium, strontium-90, and tritium have exceeded groundwater protection standards. Sampling locations both CPT and monitoring well in the vicinity of the HIPSL are depicted on Figure 3-2.

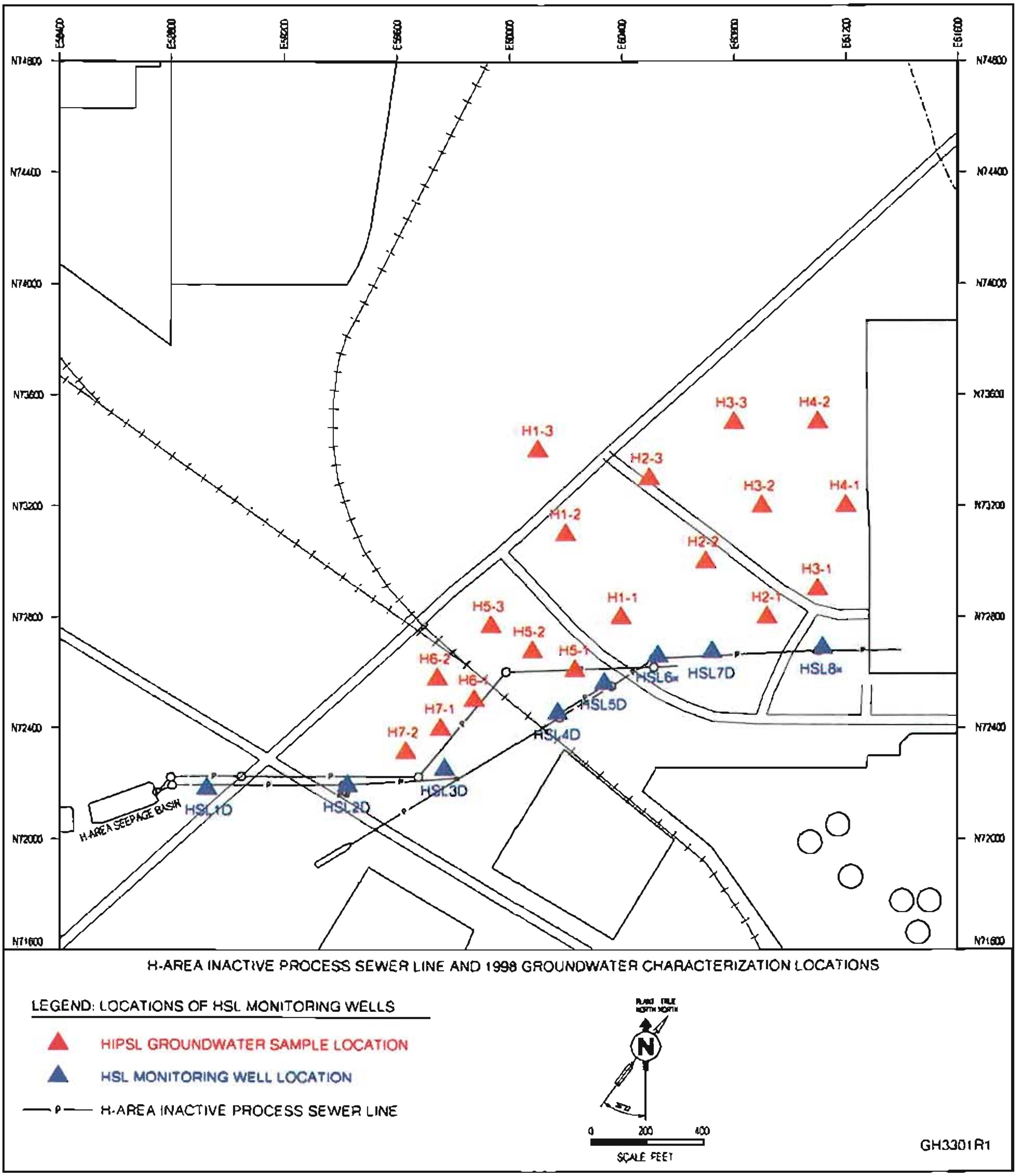

Figure 3-2. Groundwater Characterization 1998, Hydropunch/Monitoring Well Location Map

In H Area, lead concentrations in the UAZ suggest a source upgradient to the HIPSL. The distribution of gross alpha activity, non-volatile beta activity, strontium-90, and total radium all imply the HIPSL could be a potential source. However, lateral detection of these contaminants suggests other potential sources exist upgradient. Tritium activity appears, at least in part, to be related to an upgradient source. Table 3.13 depicts the maximum concentration of these analytes, where the maximum was detected, and compares this value to the GWPS. A copy of the groundwater assessment results can be found in Appendix D.

Along the extent of the HIPSL outside the H-Area facilities fence, monitoring wells were installed to monitor the groundwater in the vicinity of the HIPSL. These wells have the acronym HSL attributed to them as they were installed in the vicinity of the H-Area (process) sewer line (see Figure 3-2). Groundwater monitoring of these wells has taken place since at least the early 1990's. An analysis of the results from those monitoring wells from the upper member of the UTRA has indicated that the major contaminant is tritium. There are other constituents in the wells that have been sporadically detected above the MCL; however, they do not represent a discernable plume.

Tritium concentrations in the HSL monitoring wells have shown an overall decreasing trend since late 1992 or early 1993 (see Table 3.14). Generally, the values show some increases around late 1997 to early 1998, probably a function of a drop in the water table due to the drought conditions that began in June and have been prevalent to early 2003. Overall, the concentrations have declined since late 1997 or early 1998 when the increases occurred. Three of the HSL wells, HSL-3D, -4D and -5D, have in the most recent sampling seen minor increases in the tritium concentrations. The water table at these wells is shallow and can be affected by localized heavy downpours and droughts, especially if the wells are screened across the hard pan. Wells with high concentrations above the hard pan are generally not diluted as effectively as the water table drops.

HSL-8D, located adjacent to H-Area Separations facilities (see Figure 3-2), exhibited the highest maximum concentration of tritium of all the HSL monitoring wells. This well has declined overall with some fluctuations throughout time (see Table 3.14). The concentration values down-gradient to HSL-8D in the other HSL monitoring wells do not exhibit as high a maximum nor do they consistently maintain the high values noted in HSL-8D. The most recent value for tritium in this well is 36,800 pCi/L. This value is the highest concentration from the most-recent sampling event (see Table 3.14). Having a location that is adjacent to the H-Area Separations facilities with a history of consistently elevated tritium concentration values supports the theory, that the H-Area Separations facilities are the most likely source for the tritium groundwater contamination.

Other constituents that have exceeded GWPS since 1990 on at least one occasion are as follows: nonvolatile beta in HSL-4D; lead and strontium-90 in HSL-5D; gross alpha, lead and strontium-90 in HSL-6D; and gross alpha in HSL-7D. Nonvolatile beta in HSL-4D exhibits a decreasing trend and has since 1990. Currently the nonvolatile beta concentration is below GWPS. Lead in HSL-5D exhibits an erratic concentration profile. The values in May of 2002 and in September of 1993 were above the GWPS. None of the other values have been above the GWPS.

Strontium-90 concentrations in HSL-5D have generally not been above the GWPS of 8 pCi/L. The values generally are around 3 to 6 pCi/L range with values above 8 pCi/L in January 1998 and January of 1999. The most recent concentration of 9.2 pCi/L from the February 25, 2003 sampling event is also above the GWPS of 8 pCi/L. Gross alpha in HSL-6D also exhibited an erratic concentration profile. Only the values for February 2003, January 2001, and February 1993 exhibited concentrations that were above the GWPS. The rest of the other values were below the GWPS. Strontium-90 in HSL-6D has also been detected above the GWPS of 8 pCi/L. The values since January of 1993 have generally decreased from a maximum of 51.6 in June of 1993 and a low of 6.47 in May of 2002. The most recent value was 15.0 in February 2003. HSL-7D had one value of gross alpha above the GWPS in October of 1997. No other sample event resulted in a value that exceeded the GWPS. The data reflecting all these concentrations are located at the end of the groundwater section of Appendix D.

None of these contaminants exhibit a trend that represents a major threat. On the contrary, the majority of the contaminants exhibit a contaminant trend that has an occasional detectable value above the GWPS concentration or have had a history of being above the GWPS but are decreasing to values at or near the GWPS. None of the contaminants, other than tritium, appear to have a discernable plume. Tritium is exhibiting an overall decreasing trend; however, it remains above the GWPS for most of the monitoring wells.

In conjunction with the activities involved with the closure of the HIPSL and the remedial action activities at GSACU, a number of monitoring wells will be abandoned. A program plan will be submitted to SCDHEC in support of the well abandonment. Some monitoring wells will be abandoned and replaced after soil removal is complete. The wells to be replaced require sampling to be performed in accordance with either previous tri-party agreements or RCRA requirements. Sampling will be suspended until the construction activities are complete and the wells are replaced. The wells need to be removed or relocated from the areas of the GSACU because they will physically obstruct the soil removal or construction activities, or are in areas where a cover system will be installed. The RCRA wells are HSL-2D, HSL-3D, HSL-4D, HSL-5D, and HSL-6D.

The HIPSL and the groundwater associated with it are also included within the boundary of the General Separations Area Eastern Groundwater Operable Unit (GSAEGOU), FFA Appendix C. This was previously called the H-Area Groundwater Operable Unit (HAGOU). The objective of the GSAEGOU strategy is to monitor groundwater quality in the two uppermost aquifers that underlie the OU and that discharge to Upper Three Runs Creek, Fourmile Branch or their tributaries.

Many operating facilities and waste units exist within the boundaries of the GSAEGOU. Individually and collectively, these facilities and waste sites could contaminate the shallow aquifers that underlie the GSAEGOU. Because of the large number and wide aerial distribution of potential contaminant sources, there is and will continue to be some uncertainty regarding the source of contaminants in shallow groundwater. This is true for historic, ongoing, and future releases to groundwater. However the GSAEGOU monitoring strategy was carefully developed to provide multiple downgradient monitoring points in both the UTRA and GA, and to provide a system of early-warning (proximal) and contingency (distal) wells to monitor groundwater contamination. The nature and extent of current groundwater contamination and the existence of any definable contaminant plume are also somewhat uncertain. These uncertainties will be managed by monitoring the groundwater quality and adjusting the GSAEGOU well network, sampling frequency, and analyte list as necessary.

Table 3.1 HIPSL Soil Conc. Comparison (1988-1989 Data) Chemical Constituents

(Samples obtained form 3 feet below ground surface and deeper)

Analyte*	Maximum Conc. (in mg/kg)	SRS Background (1999) (Max. Conc. in mg/kg)	PRG Concentration $ Resident	Ind. Wkr.
Arsenic (nc)	3.6	101	22(nc)	260(nc)
Barium	46.6	540	5400	67,000
Beryllium	5.2	3.41	150	1,900
Cadmium	1.3	1.96	37	450
Chromium	64.0	139	120,000 220(VI)	1,500,000 2,500(VI)
Cobalt	12.8	14.4	1400	13,000
Copper	9.0	30.7	3100	41,000
Iron	24,200	79,700	23,000	310,000
Lead	7.0	2360	400	7,500
Mercury (nc)	5.5	2.2	23(nc)	310(nc)
Nitrate	21	0.721	No Value	No Value
Silver	1.9	2.41	390	5,100
Tin	37.6	NA	47,000	610,000
Vanadium	67.0	204	550	7,200
Zinc	11.4	58.1	23,000	310,000

* Name underlined if maximum is above residential PRG
nc – not carcinogenic $ Source WSRC 2001

Table 3.2 HIPSL Soil Conc. Comparison (1988-1989 Data) Radioactive Constituents

(Samples obtained from 3 feet below ground surface and deeper)

Analyte*	Maximum Conc. (in mg/kg)	SRS Background (1999) (Max. Conc in pCi/g)	RBA Soil Values $ Resident	Ind Wkr.
Am-241	5.2	2.17	1.33	5.13
Beta-Gamma	283.7	NA	No Value	No Value
Cm-244	1.1	0.57	4.37	17.6
Co-60	580	NA	4.67E-03	1.75E-02
Cs-137	6300	3.3	2.27E-02	8.52E-02
Gross Alpha	6.4	44.5	No Value	No Value
I-129	81.0	0.352	2.24	8.87
Pu-238	110.0	3.8	2.91	11.7
Pu-239	110.0	0.28	2.85	11.5
Radium (total)**	19.0	9.20	907E-02	7.19 E-02
Sr-90	22.0	6.24	1.92	7.4
Tc-99	36.0	2.34	90.4	361
Th-232	2.7	4.76	3.37	13.6
Tritium (in pCi/ml)	15,000	6.12	8580	34,600
U-234	8.3	3.4	4.92	19.8
U-235	0.3	0.407	0.104	0.392
U-238	4.6	4.62	0.448	1.69

* Name underlined if constituent maximum concentration is above Residential RBA value. Name underlined and bolded if constituent maximum concentration is above both Residential and Industrial RBA value.

$ Source of values USEPA Region IX dated 11/01

** RBA for Radium is estimated from the total of the two values for Ra 226+d and Ra 228+d

Table 3.3 HIPSL Soil Conc. Comparison (1992-1993 Data) Chemical Constituents

Analyte*	Maximum Conc. (in mg/kg)	SRS Background (1999) (Max. Conc. in mg/kg)	PRG Concentration $ Resident	Ind. Wkr.
Antimony	22.6	51.1	31	410
Arsenic (nc)	3.6	101	22(nc)	260(nc)
Barium	48.5	540	5400	67,000
Beryllium	1.2	3.41	150	1,900
Cadmium	3.0	1.96	37	450
Chromium	34.3	139	120,000 220(VI)	1,500,000 2,500(VI)
Cobalt	12.1	14.4	1400	13,000
Copper	10.1	30.7	3100	41,000
<u>Iron</u>	41,700	79,700	23,000	310,000
Lead	31.3	2360	400	7,500
Mercury (nc)	10.7	2.2	23(nc)	310(nc)
Nickel	17.2	23	1.6E+03	2.0E+04
Nitrate	18.7	0.721	No Value	No Value
Silver	104	2.41	390	5,100
Thallium	2.4	25.8	5.25	67.0
Tin	28.5	NA	47,000	610,000
Vanadium	87.9	204	550	7,200
Zinc	49.9	58.1	23,000	310,000

* Name underlined if above Residential PRG
nc – not carcinogenic
$ Source WSRC 2001

Table 3.4 HIPSL Soil Conc. Comparison (1992-1993 Data) Radioactive Constituents

Analyte*	Maximum Conc. (in pCi/g)	SRS Background (1999) (Max. Conc. in pCi/g)	RBA Soil Values $ Resident	Ind. Wkr.
<u>**Am-241**</u>	7.8	2.17	1.33	5.13
<u>**Co-60**</u>	18.9	NA	4.67E-03	1.75E-02
<u>**Cs-137**</u>	256	3.3	2.27E-02	8.52E-02
Eu-155	0.4	0.66	0.465	1.75
<u>I-129</u>	4.7	0.352	2.24	8.87
<u>**Pu-239**</u>	108	0.28	2.85	11.5
<u>**Radium (total)#**</u>	9.0	9.20	1.907E-02	7.19E-02
<u>**Radium-226**</u>	3.43	2.01	6.77E-03	2.55E-02
<u>**Sr-90**</u>	20	6.24	1.92	7.4
Tc-99	1.1	2.34	90.4	361
<u>Th-232</u>	6.35	4.76	3.37	13.6
Tritium	466	6.12	8580	34,600
U-234	4.2	3.4	4.92	19.8
<u>U-235</u>	0.2	0.407	0.104	0.392
<u>**U-238**</u>	3.8	4.62	0.448	1.69

* Name underlined if constituent maximum concentration is above Residential RBA value. Name underlined and bolded if maximum is above Residential and Industrial Worker RBA value.
$ Source of values USEPA Region IX dated 11/01
\# Radium (total) RBA value is the total of the values for Ra 226+d and Ra 228 +d

Table 3.5 HIPSL Soil Conc. Comparison (1998 Data) Chemical Constituents

Analyte*	Maximum Conc. (in mg/kg)	SRS Background (1999) (Max. Conc. in mg/kg)	PRG Concentration $ Resident	Ind. Wkr.
Arsenic (nc)	1.4	101	22(nc)	260(nc)
Barium	45.2	540	5400	67,000
Beryllium	0.514	3.41	150	1900
Bis2(ethylhexyl)phthalate	118	5.45	35	120
Chromium	39.3	139	120,000	1,500,000
			220(VI)	2500(VI)
Cobalt	2.1	14.4	1400	13,000
Copper	7.3	30.7	3100	41,000
Di(n)butylphthalate	0.0798	2.15	No Value	No Value
Iron	23,200	79,700	23,000	310,000
Lead	7.2	2360	400	7500
Manganese	111	3720	1800	19,000
Mercury (nc)	1.52	2.2	23(nc)	310(nc)
Nickel	7.0	23	1600	20,000
Toluene	0.0735	0.0732	520	520
Vanadium	61.7	204	550	7200
Zinc	16.9	58.1	23,000	310,000

* Name underlined if value is above Residential PRG Concentration
nc – not carcinogenic
$ Source WSRC 2001

Table 3.6 HIPSL Soil Conc. Comparison (1998 Data) Radioactive Constituents

Analyte*	Maximum Conc. (in pCi/g)	SRS Background (Conc. in pCi/g)	RBA Soil Values $ Resident	Ind. Wkr.
Actinium-228	2.01	4.17	1.28E-02	4.8E-02
Am-241/Cm-246	75.8	2.17	1.33	5.13 (lesser of the two)
Bis-214	1.6	1.74	7.74E-03	2.91E-02
Cm-243/244	42.4	0.57	4.37	17.6
Co-60	0.12	NA	4.67E-03	1.75E-02
Cs-137	422	3.3	2.27E-02	8.52E-02
Gross Alpha	229	44.5	No Value	No Value
Iodine-129	1.33	0.352	2.24	8.87
Lead-212	2.89	4.44	0.113	0.423
Neptunium-237	1.27	0.26	7.15E-02	2.69E-01
Nonvolatile Beta	742	121	NoValue	No Value
Potassium-40	5.98	14.7	7.22E-02	2.71E-01
Pu-238	88.3	3.8	2.91	11.7
Pu-239/240	4.46	0.28	2.85	11.5
Radium-226	2.87	2.01	6.77E-03	2.55E-02
Radium-228	17.3	53.5	1.23E-02	4.64E-02
Sr-90	131	6.24	1.92	7.4
Th-228	1.75	4.93	7.4E-03	2.78E-02
Th-230	1.63	9.32	3.72	14.9
Th-232	1.65	4.76	3.37	13.6
U-234	2.19	3.4	4.92	19.8
U-235	0.26	0.407	0.104	0.392
U-238	1.7	4.62	0.448	1.69

* Name underlined if constituent maximum concentration is above Residential RBA value.
Name bolded and underlined if constituent maximum concentration is above Industrial RBA Value.
$ Source of values USEPA Region IX dated 11/01

Table 3.7 Warner's Pond Soil Conc. Comparison (1998 Additional Sampling Data) Chemical Constituents

Analyte*	Maximum Conc. (in mg/kg)	SRS Background (Conc. in mg/kg)	PRG Concentration $ Resident	Ind. Wkr.
Arsenic (nc)	6.17	101	22(nc)	260(nc)
Barium	44	540	5400	67,000
Beryllium	0.302	3.41	150	1900
Bis2(ethylhexyl)phthalate	5.45	5.45	35	120
Chromium	50.5	139	120,000 220(VI)	1,500,000 2500(VI)
Cobalt	1.22	14.4	1400	13,000
Copper	10.6	30.7	3100	41,000
Di(n)butylphthalate	258	2.15	No Value	No Value
<u>Iron</u>	54,600	79,700	23,000	310,000
Lead	37.4	2360	400	7500
Mercury (nc)	0.109	2.2	23(nc)	310(nc)
Methyl Ethyl Ketone	0.00167	0.00833	7300	27,000
Nickel	4.46	23	1.6E+03	2.0E+04
Nitrate	1.03	0.721	No Value	No Value
Silver	2.08	2.41	390	5100
Vanadium	132	204	550	7200
Zinc	28.9	58.1	23,000	310,000

* Name underlined if above Residential PRG
nc – not carcinogenic
$ Source WSRC 2001

Table 3.8 Warner's Pond Soil Conc. Comparison (1998 Additional Sampling Data) Radioactive Constituents

Analyte*	Maximum Conc. (in pCi/g)	SRS Background (Conc. in pCi/g)	RBA Soil Values $ Resident	Ind. Wkr.
<u>Am-241/Cm-246</u>	3.03	2.17	1.33	5.13 (lesser of the two)
<u>Cm-243/244</u>	16.7	0.57	4.37	17.6
<u>Co-60</u>	4.35 E-2	NA	4.67E-03	1.75E-02
<u>Cs-137</u>	1290	3.3	2.27E-02	8.52E-02
Gross Alpha	92	44.5	No Value	No Value
Nonvolatile Beta	1090	121	NoValue	No Value
Pu-238	0.722	3.8	2.91	11.7
Pu-239/240	0.209	0.28	2.85	11.5
<u>Radium-226</u>	1.31	2.01	6.77E-03	2.55E-02
<u>Radium-228</u>	2.71	53.5	1.23E-02	4.64E-02
<u>Sr-90</u>	7.79	6.24	1.92	7.4
<u>Th-228</u>	2.55	4.93	7.4E-03	2.78E-02
Th-230	1.66	9.32	3.72	14.9
Th-232	2.42	4.76	3.37	13.6
Tritium (in pCi/g)	40.4	6.12	8580	34,600
U-234	1.13	3.4	4.92	19.8
U-235	6.42E-02	0.407	0.104	0.392
<u>U-238</u>	1.06	4.62	0.448	1.69

* Name underlined if constituent maximum concentration is above Residential RBA value.
Name bolded and underlined if constituent maximum concentration is above Industrial RBA Value.
$ Source of values USEPA Region IX dated 11/01

Table 3.9 HIPSL Soil Conc. Comparison (All Data, 1988-89, 1992-93, and 1998 Data) Chemical Constituents

Analyte*	Maximum Conc. (in mg/kg)	SRS Background(1999) Max.Conc. (in mg/kg)	PRG Concentration $ Resident	Ind. Wkr.
Antimony	22.6	51.1	31	410
Arsenic	6.17	101	22(nc)	260(nc)
Barium	48.5	540	5400	67,000
Beryllium	5.2	3.41	150	1900
Bis2(ethylhexyl)phthalate	0.118	5.45	35	120
Cadmium	3.0	1.96	37	450
Chromium	64.0	139	120,000 220(VI)	1,500,000 2500(VI)
Cobalt	12.8	14.4	1400	13,000
Copper	10.6	30.7	3100	41,000
Di(n)butylphthalate	0.258	2.15	No Value	No Value
Iron	54,600	79,700	23,000	310,000
Lead	37.4	2360	400	7500
Manganese	111	3720	1800	19,000
Mercury (nc)	10.7	2.2	23(nc)	310(nc)
Methyl Ethyl Ketone	0.00167	0.00833	7300	27,000
Nickel	17.2	23	1600	20,000
Nitrate	19	0.721	No Value	No Value
Silver	104	2.41	390	5100
Thallium	2.4	25.8	5.25	67.0
Tin	37.6	NA	47,000	610,000
Toluene	0.0735	0.0732	520	520
Trichloroethylene	0.0055	0.0055	0.053	0.11
Vanadium	132	204	550	7200
Zinc	49.9	58.1	23,000	310,000

$ Source WSRC 2001
* Underlined if above PRG Residential Value
nc – not carcinogenic

Table 3.10 HIPSL Soil Conc. Comparison (All Data, 1988-89, 1992-93, and 1998 Data) Radioactive Constituents

Analyte*	Maximum Conc. (in mg/kg)	SRS Background (1999) (Max. Conc. in pCi/g)	RBA Soil Values $ Resident	Ind Wkr.
Actinium-228	2 01 (1998 in pond)	4 17	1.28E-02	4.8E-02
Am-241/Cm-246	75.8 (1998 loc. in pond)	2.17	1.33	5.13 (lesser of the two)
Bismuth-214	1.6 (1998 loc. in pond)	1.74	7.74E-03	2.91E-02
Cm-243/244	42.4 (1998 loc. in pond)	0.57	4.37	17.6
Co-60	580 (1990 loc. 9B)	NA	4.67E-03	1.75E-02
Cs-137	6300 (1990 loc. 9B)	3.3	2.27E-02	8.52E-02
Europium-155	0.4 (1992-93, loc pipeline)	0.66	0.465	1.75
Gross Alpha	229 (1998 loc. in pond)	44.5	No Value	No Value
I-129	81 (1990 loc 9B)	0.352	2.24	8.87
Lead-212	2.89 (1998 loc. in pond)	4.44	0.113	0.423
Neptunium-237	1.27 (1998 loc. in pond)	0.26	7.15 E-02	2.69 E-01
Nonvolatile Beta	1090 (1998 loc. in pond)	121	NoValue	No Value
Potassium-40	5.98 (1998 loc. in pond)	14.7	7.22E-02	2.71E-01
Pu-238	110 (1990 loc. 9B)	3.8	2.91	11.7
Pu-239/240	110 (1990 loc. 9B)	0.28	2.85	11.5
Radium-226	5.9 (1992-93, loc pipeline)	2.01	6.77E-03	2.55E-02
Radium-228	17.3 (1998 loc. in pond)	53.5	1.23E-02	4.64E-02
Sr-90	131 (1998 loc. in pond)	6.24	1.92	7.4
Technitium-99	1.1 (1998 loc. in pond)	2.34	90.4	361
Th-228	1.62 (1998 loc. in pond)	4.93	7.4E-03	2.78E-02
Th-230	1.63 (1998 loc. in pond)	9.32	3.72	14.9
Th-232	6.35 (1992-93, loc pipeline)	4.76	3.37	13.6
Tritium (in pCi/ml)	15,000 (1990 loc. 9B)	6.12	8580	34,600
U-234	8.3 (1990 loc. 9B)	3.4	4.92	19.8
U-235	0.3 (1990 loc. 9B)	0.407	0.104	0.392
U-238	4.6 (1990 loc. 9B)	4.62	0.448	1.69

* Name underlined if constituent maximum concentration is above Residential RBA value.
Name bolded and underlined if constituent maximum concentration is above Industrial RBA Value.
$ Source of values USEPA Region IX dated 11/01

Table 3.11 HIPSL Soil Conc. Comparison (HDPE Pipeline Data) Chemical Constituents

Analyte	Maximum Conc. (in mg/kg)	SRS Background (Conc. in mg/kg)	PRG Concentration $ Resident	Ind. Wkr.
Antimony	28.5	51.1	31	410
Cadmium	3.8	1.96	37	450
Nickel	20.3	23	1600	20,000
Silver	104	2.41	390	5100
Vanadium	87.9	204	550	7200

$ PRG Source WSRC 2001

Table 3.12 HIPSL Soil Conc. Comparison (HDPE Pipeline Data) Radioactive Constituents

Analyte*	Maximum Conc. (in pCi/g)	SRS Background (1999) (Max. Conc. in pCi/g)	RBA Soil Values $ Resident	Ind. Wkr.
Cs-137	1.2	3.3	2.27E-02	8.52E-02
Gross Alpha	83	44.5	No Value	No Value
Eu-152	1.4	NA	1.09E-02	4.1E-02
Nonvolatile Beta	85	121	NoValue	No Value
Np-237	6.6	0.26	7.15E-02	2.69E-01
Pu-239	2.0	0.28	2.85	11.5
Radium (total)**	9.0	9.20	1.907E-02	7.19E-02
Sr-89	2.3	NA	5.95	22.8
Tritium (in pCi/g)	171	6.12	8580	34,600
U-234	5.0	3.4	4.92	19.8

* Name underlined if constituent maximum concentration is above Residential RBA value.
Name bolded and underlined if constituent maximum concentration is above Industrial RBA Value.
$ Source USEPA Region IX, dated 11/01
** RBA value for Radium (total) is estimated from the total of Ra 226+d and Ra 228+d

Table 3.13 HIPSL Groundwater Concentrations 1998 Characterization Data (Chemical and Radioactive Constituents that Exceeded GWPS)

Constituent	Maximum Conc. (location # on Figure 3-2)	GWPS	Units
Gross Alpha°	1376.9 (H 2 3 03)	15	pCi/L
Lead°	56.3 (H 7 2 02)	15	ug/L
Mercury°	2.8 (H 3 1 04)	2.0	ug/L
Nickel°	366 (H 3 1 05)	100	ug/L
Nitrate-Nitrite	14,000 (H 5 2 02)	Nitrate 10,000	ug/L
Nonvolatile Beta	760.8 (H 3 1 05)	50@	pCi/L
Radium (total)	66.0 (H 1 1 03)	5 (Radium-226 & -228)	pCi/L
Tritium	1,046,300 (H 5 1 04)	20,000 (MCL)	pCi/L

°Note: Metals and radiological concentrations are suspect due to high turbidity in samples.
@ 50 pCi/L is the trigger value at which analysis for the specific Beta emitting radionuclides is performed.
\# See Figure 3-2

Table 3.14 HIPSL, HSL Monitoring Wells Tritium Concentration Comparisons

Well Name	First Sampled	Conc.	Maximum	Date	Current Conc.	Date
HSL-1D	8/92	456,000 pCi/L	SAME	SAME	35,900 pCi/L	2/03
HSL-2D	9/92	578,000 pCi/L	SAME	SAME	11,000 pCi/L	2/03
HSL-3D	9/92	535,000 pCi/L	620,000 pCi/L	1/93	30,800 pCi/L	2/03
HSL-4D	9/92	17,200 pCi/L	57,100 pCi/L	9/93	25,700 pCi/L	2/03
HSL-5D	1/93	20,700 pCi/L	SAME	SAME	29,900 pCi/L	2/03
					(5,170 pCi/L	8/02)
HSL-6D	9/92	119,000 pCi/L	316,000 pCi/L	6/93	22,900 pCi/L	2/03
HSL-7D	9/92	54,100 pCi/L	83,800 pCi/L	12/92	17,800 pCi/L	2/03
HSL-8D	9/92	2,480,000 pCi/L	3,650,000 pCi/L	12/92	36,800 pCi/L	2/03.

Note: See Figure 3-2 for location of monitoring wells.

Table 3.15 Soil Sample Depths and HIPSL Depths

Sample Location	Approximate Depth, Top of VCP HIPSL (bls)	Depth Soil Samples Taken (bls)
HVC-1	4.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-2	4.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-3	7.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-4	4.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-5	5.0 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-6	3.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-7	3.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
HVC-8	3.5 ft	5'-7', 7'-9, 9'-11, 11'-13', 13'-15'
BH-1	Not on pipeline	
BH-2	3.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-3	3.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-4	3.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-5	3.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-6	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-7	Not on pipeline	
BH-8	5.0 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-9	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-10	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-11	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-12	7.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-13	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-14	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-15	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
BH-16	4.5 ft	5'-7', 7'-9, 9'-11, 13'-15'
WPH-07	6.0 ft	2'-0", 4'-0", 6'-0", 8'-0", 10'-0"
WPH-08	4.0 ft	2'-0", 4'-0"

Sample Location	Approximate Depth, Top of HDPE HIPSL (bls)	Depth Soil Samples Taken (bls)
HPL-1	5.5 ft	8'-10', 10'-12', 12'-14', 16'-18'
HPL-2	1.7 ft	3'-5', 5'-7', 7'-9', 11'-13'
HPL-3	4.0 ft	4'-6', 6'-8', 8'-10', 12'-14'
HPL-4	4.0 ft	3'-5', 5'-7', 7'-9', 11'-13'

bls: below land surface

It should be noted that characterization and pre-characterization data from all of H Area show that several volatile organic compounds (VOCs), radionuclides, and metals are present in the UTRA at levels that sometimes exceed maximum contaminant levels (MCLs). However, the values that exceed an MCL are temporally sporadic or geographically localized, and no definable plumes appear to emanate from any single operating facility or waste unit. Therefore, SRS believes that no groundwater remedial action or alternate concentration limit (ACL)/mixing zone is warranted at this time. It should also be noted that the VOC values that exceed their MCL are generally located to the east of the HIPSL.

4.0 COVER SYSTEM DESIGN

The HIPSL cover system will consist of a combination of two low-permeability engineered covers. These covers are a portion of the remedial action and will be utilized to retard infiltration, and contaminant migration, to the groundwater. The cover system design is based on contaminant migration calculations performed by SRS (located in Appendix B). Cross sectional views of the HIPSL cover systems are depicted in Sketch SK-C-53181 Details 1 and 2, Appendix A, and Sketch SK-C-53189 Detail A, Appendix A. Sketch SK-C-53181 Details 1 and 2, Appendix A, depict the cover system designs that are to be employed over the area of WP where the HIPSL is to be removed. Sketch SK-C-53189 Detail A, Appendix A, depicts the cover system that is to be employed over the remainder of the VCP HIPSL. The VCP HIPSL manholes will be collapsed, filled with concrete, and covered with the VCP cover system. A cover system similar to the design shown in Detail A of SK-C-53189, extending 10 feet from the component perimeter, will also be installed at all HIPSL treblers and HDPE HIPSL manholes that are not removed (insert attached). Trebler 904-109G is adjacent to an existing concrete pad that will serve as the cover for one side, with a continuous tie-in to the GCL cover. The components for closure identified in the sketches in Appendix A will meet the requirements established in SCHWMR R.61-79.264.111. Appendix A provides excavation sketches and details of the engineered cover system design, including SK-C-53180, SK-C-53181, SK-C-53182, SK-C-53183, SK-C-53184, SK-C-53188, SK-C-53189. Sketch SK-C-53180 also depicts where each cover system is to be installed. A corresponding table that denotes areas to numbers on the sketches is located at the end of this section (Table 4.1).

In the WP area, the engineered cover system will consist of the following:

1) foundation layer;

2) geosynthetic clay liner (GCL) having a hydraulic conductivity less than or equal to the natural soils present;

3) GDL to drain any water that infiltrates through the overlying vegetative layer;

4) vegetation/topsoil layer to maintain the integrity of the underlying materials.

At other areas along the length of the HIPSL, a GCL with a hydraulic conductivity less than or equal to the natural soils present will be installed. Up to 3 ft of soil will be excavated in the location where the GCL will be installed.

Excess soil excavated from the 2 ½ to 3 ft of soil overlying the HIPSL vitrified clay pipe prior to the placement of the GCL will be shipped to an appropriate SRS facility for dispositioning. Soil placed into the excavated areas will be clean material obtained from qualified on-site areas or from off-site suppliers. Clean soil from on/off site sources will be installed over the GCL, and the elevation will be brought back to original grade with a vegetative layer unless surface drainage needs to be improved. In areas where this is the case, the surface drainage work will be performed in conjunction or prior to the installation of the GCL. Roadways will not be excavated; instead the GCL will be installed up to the road or concrete apron with a suitable tie-in made to preclude breaks in the continuity of the material. The same is true for parking lots covered with asphalt. By placing the GCL under the soil, the need for maintenance of the GCL will be eliminated. In the areas where a manhole exists, the manhole will be brought down to the level of the actual excavation. Then the manhole will be grouted full prior to installation of the cover system. The elevation will be brought back to normal and the original slope maintained. Signs noting that contaminated soil may underlie the area will be strategically placed at regular distances. The areas where the different cover systems will be installed are depicted on Sketch SK-C-53180.

4.1 Design Objectives

The HIPSL closure is protective of human health and the environment, mitigates contaminant migration to groundwater, and provides access controls to the pipeline. The design objectives of the HIPSL closure will meet all applicable requirements specified in SCHWMR R.61-79.264.228(a)(2)(iii).

4.2 Cover System Performance

In accordance with SCHWMR R.61-79.264.111, Closure Performance Standards, the HIPSL will be closed in a manner that minimizes the need for further maintenance and controls. The HIPSL will also be closed in a manner that minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere. This closure will be accomplished specifically in accordance with requirements outlined in SCHWMR R.61-79.264.228(a)(2)(iii) that dictates that the final cover systems will be designed and constructed to minimize exposure to human health and the environment by

- providing long-term minimization of precipitation infiltration through the soil underlying and adjacent to the HIPSL,
- functioning with minimum maintenance,
- promoting drainage and minimize erosion or abrasion of the cover,
- accommodating settling and subsidence so that the cover's integrity is maintained, and

- having a permeability or hydraulic conductivity value that is less than or equal to the permeability of any bottom liner system or natural soils present.

Contaminant migration calculations have been performed on all of constituents that exceeded screening criteria for constituents of potential concern (see Appendix B). These calculations show that at the current baseline conditions beryllium, mercury, iodine-129, strontium-90 and uranium-235 all have the potential to migrate to groundwater in less than 1000 years at concentrations that are above the GWPS. Commonly available geosynthetic materials can easily provide a cover system that will control migration of these constituents and has a hydraulic conductivity less than the natural soils present (typically 10^{-5} to 10^{-7} cm/sec). Geosynthetic clay liners are typically manufactured to provide a hydraulic conductivity well below this range.

Soil sample results associated with the HDPE were observed as having exceedances from depths at least 3 ft below land surface. These results at depth do not indicate a surficial risk. In addition, the results obtained do not represent a contaminant migration risk. Therefore grouting the manholes for intruder protection and institutional controls represent an acceptable remedial alternative.

4.2.1 Subsidence of Waste/Vitrified Pipe

The cover design to be used over the VCP HIPSL, and around the HIPSL manholes and treblers, will consist of 6 inches of topsoil, 2 feet of compacted fill with a geosynthetic clay liner (GCL), and (for most of the VCP HIPSL) a minimum of 1.5 feet of undisturbed soil. Based on this design, potential collapse of the 18-inch VCP HIPSL will result in minimal or no settlement due to the small volume of the pipe and the bridging effect of the cover soils. However, to further mitigate any subsidence, all VCP that remains in-place will be grouted to the extent practicable.

4.3 Cover System Components

The cover system material will consist of layers that will be generally placed from bottom to top as depicted in the various views in Sketches SK-C-53189 Detail A and SK-C-53184 Details 1 and 2. All materials and their placement will meet the design requirements that also include provisions for the protection and integrity of the H-Area Retention Basin cover system and any existing parking lot(s). When the currently existing parking lot(s) have reached the end of their usefulness, then the cover system described below will be placed over those areas and tied into the cover system described below.

Uncertainties exist with the collapse of the clay pipes and existence of contaminated soils outside the pipeline. To manage this uncertainty, the selected design for the clay pipes and associated manholes will be a low permeability geosynthetic cover system. The cover system will generally be a three-layered system comprising the following from the bottom to top: a compacted foundation layer (typically 6 inches structural fill or equivalent), a low perm geosynthetic clay layer (composite GCL), and a vegetation/topsoil layer (18 inches of common fill typically with six inches topsoil). The configuration of these layers is shown on SK-C-53189 Detail A. It should be noted that the area at WP, where excavation of the PTSM is to occur south of the railroad tracks, will have a GDL installed above the GCL to promote removal of the water away from the GCL. At this location there will be four layers per SK-C-53184 Detail 1.

As minimum, the cover system performance goals are as follows:

- minimize contamination migration from the contaminated pipeline and associated soil to the clean area by vegetation growth and animal activity,
- minimize infiltration of precipitation into the contaminated pipes and contaminated soils around the pipes and mitigate contaminant migration to groundwater,
- minimize exposure to humans and wildlife from direct contact,
- provide access control to the pipeline,
- promote surface water movement away from contaminated pipe and associated soils,
- function with minimum maintenance,
- minimize erosion, and
- have a hydraulic conductivity less than or equal to the natural soils present.

The cover system configurations are shown in the construction drawings SK-C-53180 through SC-C-53184 (Appendix A). The cover system has the following features:

- maximum of a four-layer system (i.e., foundation layer, a GCL, a geo-composite drainage layer, and a vegetation/soil layer or soil cover graded for area infiltration control);
- integration with WP engineered cover system, as necessary for tie-in; and
- minimal impact on area operations and infrastructure.

The cover system shall be installed over the vitrified clay pipe and associated manholes as identified in SK-C-53189 Detail A except for the pipeline located under the Tritium Facility paved parking lot, under the railroad and under the SRS paved roads. The parking lot and roads will be maintained throughout their respective useful timeframe, and the cover system will be installed over those portions of the pipeline when the parking lot and roads are no longer used. The geosynthetic cover system shall be constructed below grade over the pipeline (see Sketch SK-C-53189), and the manholes will be brought down to the level of the excavation and grouted full. The geosynthetic cover system will be installed over both of them. The geosynthetic cover system will also be installed around the perimeter of the HDPE manholes, and around the perimeter of both treblers (except at the existing concrete pad).

4.3.1 Foundation Layer

After removal of the typical 2 and 1/2 ft of existing soil cover over the vitrified clay pipe, a minimum of 6 inches of clean structural fill material or equivalent will be placed as a sub-grade (foundation layer) for the cover. The excavation shall be performed in a manner that prevents possible cross contamination. Sub-grade materials can be obtained from on-site sources (North borrow site) in accordance with the design specification.

Prior to placement of the foundation layer, vibratory rolling will stabilize the existing soil over the length of the pipe. Once stabilized, the foundation layer material will be placed in horizontal layers and compacted.

The surface of the foundation layer must be smooth and free of vegetation, sharp-edged rocks, stones, sticks, and construction debris. The foundation surface should be rolled with a smooth-drum compactor to remove any ruts or footprints. The foundation layer provides structural support for the engineered cover system and is not intended to contribute to the hydraulic conductivity requirements.

An Independent Professional Engineer will certify that the HIPSL has been closed in accordance with this approved closure plan. A survey plat per Subpart G 264.116 will be provided. In addition, a certification of closure will be provided per Subpart G 264.115.

4.3.2 Geosynthetic Clay Liner

The USEPA-recommended low-hydraulic conductivity layer configuration consists of a multi-layer hydraulic barrier using a combination of geosynthetic material(s) and compacted clay soil layer (Design and Construction of RCRA/CERCLA Final Covers, USEPA/625/4-91/025, May 1991). The HIPSL closure cover system replaces the compacted clay soil and geosynthetic materials with the composite GCL. The composite GCL shall form the component of the low-hydraulic conductivity barrier and should be placed over the subgrade (foundation layer). Shipping, unloading, storage, installation, anchor trenching (if required), seaming, sealing around the penetration (if required), and tie in activities at the intersection with the roads and asphalt shall be performed per the manufacturer's recommendation and requirements specified in the design documents.

4.3.3 Geocomposite Drainage Layer (Warner's Pond area only)

The GDL will provide effective transport of water from the vegetative layer, resist biological fouling, resist erosion, provide structural support to the overlying layers and prevent slippage with the underlying GCL. Water that infiltrates through the top vegetative layer will be drained by gravity from the cover system by the GDL. The GDL will only be installed at the area in the portion of WP from which the PTSM will be removed (see Sketches SK-C-53180, SK-C-53188, and SK-C-53189).

Because the filter material is located above the GCL, the filter material is only in contact with clean soils and rainwater and is protected by the GCL.

4.3.4 Cover Layer – Soil Component

The soil component for the cover layer should be on-site material, if possible, and shall meet the following requirements:

- The cover layer will be a minimum thickness of 24 inches: 18 inches of common fill with 6 inches of topsoil to support vegetation.
- The first layer of common fill (minimum 9 inches) placed over the GCL should be free of angular stones or other foreign matter that could damage the GCL. Recommended cover soils typically have a particle-size distribution ranging between fine and 1 inch; however SRS will determine the requirements for the cover soil with respect to particle size, uniformity, and chemical compatibility.

The final cover layer will consist of soils capable of supporting a vegetative cover. The final cover will be free from substances that prevent satisfactory compaction and/or pose a potential to damage the uppermost surface of the underlying cover. The final cover will be placed in compacted lifts.

4.3.5 Topsoil Layer/Vegetation

Top Soil component

The topsoil component can be obtained from on-site or off-site sources and shall meet the following requirements:

- The layer should be typically 6 inches thick.
- In order to establish the vegetative layer, the characteristics of the topsoil shall promote rapid seed germination and plant root system development.
- The final surface of the vegetative layer over the pipe, manhole areas, and surrounding area (after allowance for settling and subsidence) shall have proper slope to promote movement of water away from the cover area.

Minimum compaction requirements for the cover soils shall be determined by SRS.

Vegetation component

The vegetation layer shall be seeded with locally adapted grasses at sufficient density to minimize soil erosion. (The area over the manholes can have sod installed instead of erosion control matting and seeding to minimize the erosion and repair.) The vegetation component should possess the following characteristics:

- Resistance to drought and temperature extremes
- Roots that will not disrupt the low permeability layer
- Ability to thrive in low nutrient soil with minimal nutrient additions
- Ability to survive and function with little or no maintenance
- Sufficient density to minimize cover soil erosion

The identified sources for the soil will be evaluated by SRS for suitability before they are used in this project.

4.4 Surface Drainage and Erosion Control

4.4.1 Drainage Design Concept

The drainage design will

- minimize run-on from adjacent areas,
- minimize the development of rills, gullies, or sheet erosion on the cover system,
- meet site drainage requirements, and
- minimize infiltration of stormwater runoff into any nearby waste disposal areas.

The drainage system will be improved prior to cover system placement, if necessary. The system will tie into existing stormwater conveyance systems to the extent shown on the drawings. The drainage systems may use the existing H-Area conveyance system. Sloped areas will divert runoff away from all closure areas.

4.4.2 Erosion Control

Erosion control will prevent erosion along all portions of the HIPSL and any nearby closure areas. Topsoil preparation and vegetation will reduce the potential for soil erosion.

Criteria used in the design of the cover system to reduce erosion include the following:

- Minimize top surface slopes typically between 3 and 5 percent, where feasible;
- Minimize side slope grades wherever possible;
- Establish a cover crop as quickly as possible.

4.4.3 Stormwater Management and Sediment Control

The H-Area Drainage design will provide for the conveyance of stormwater runoff from all designated closure areas.

All stormwater management and sediment control measures designed for the HIPSL closure to direct stormwater runoff and mitigate sediment migration will be in compliance with the South Carolina's Stormwater Management and Sediment Reduction A ct, R72-300. In addition they must also be in compliance with SCDHEC's National Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Construction Activities, SCR00001.

4.5 Post-Closure Activities

The post-closure care activities are outlined in Section I of the Part B permit application.

4.5.1 Inspection Activities

The condition of the vegetative layer overlying the cover system will be inspected throughout the post-closure care period. Inspection of the entire closure site will consist of periodic surveillance by site personnel to identify signs of subsidence or erosion. Identification and descriptions of the planned monitoring and maintenance activities and the frequency of performance, as well as the name, address, and phone number of the person to contact regarding the facility during the post-closure period, are outlined in Section I of the Part B Permit Application. Inspections will include documentation of the following:

- Signs of erosion or surface cracking, or indications of possible cover system deterioration
- Signs of standing water indicating subsidence

- Visible subsidence events

Both the cover system and surface conditions will be monitored in order that any necessary repairs to these will be made in a timely manner to maintain the integrity of the cover system.

4.5.2 Subsidence Monitoring

The cover system's monitoring program goal is to maintain the integrity of the closure cover system to mitigate expansion of groundwater contamination and to protect human health and the environment. The Post-closure Care Plan contained in the H-Area HWMF RCRA Part B Permit Application identifies the cover system subsidence monitoring system and the associated maintenance responses for breaches of the cover system integrity.

The objective of the monitoring, inspection, and surveys is to identify any of the following:

- erosion damage on and around the existing cover system;
- areas where ponding of water is occurring;
- areas where subsidence activity has permeated to the surface of the cover system;
- the formation of localized depressions; and
- breaches of the cover system by burrowing animals.

Because the GCL/GDL cover system is to be buried, any subsidence will be inferred from the routine visual inspections performed. The monitoring of the cover system will therefore consist of routine visual surface inspections and vegetation layer upkeep. Erosion damage, subsidence, and/or animal activity will be acted upon and corrected as appropriate. The normal subsidence monitoring system is the current operational practice used for closures and to date experience has demonstrated the effectiveness and reliability of the system. The composite geosynthetic materials used for the closure cover system design performance requirements optimize the hydraulic and structural-material properties, thus providing a greater overall factor of safety for the entire closure cover system.

When a potential failure is detected, the cover soil around the area in question will be repaired as required.

4.5.3 Control Benchmarks

Control benchmarks for the HIPSL cover boundaries will not be utilized for this application as the GCL/GDL will be placed below grade. However, benchmarks, in accordance with R.61-79.264.309(a), identifying the of the VCP and HDPE HIPSLs will be installed at endpoints and at all direction changes. The facility custodian will perform routine inspection and visual subsidence inspections at regular intervals during the post-closure care period. All inspection and maintenance records will be kept at SRS during the post-closure care period by the facility custodian and will be available for SCDHEC inspection.

4.5.4 Cover System Maintenance

Inspection will be used to indicate the need for cover system maintenance and/or repair. SRS will provide necessary repairs. All inspection and maintenance records will be kept at SRS during the post-closure care period by the facility custodian and will be available for SCDHEC inspection. Routine and preventive maintenance of the cover system includes upkeep of the vegetative layer, mowing, controlled burning of overgrowth, clearing of debris, removal of weeds and seedlings, and reseeding as necessary.

The repair for all geosynthetic cover system materials will be specified by the vendor requirements.

4.5.5 Post-Closure Care and Use of Property

Post-Closure care of the HIPSL will continue for at least 30 years after the date of completing the closure. The activities described will continue throughout the post-closure period unless a demonstration is made and accepted by SCDHEC indicating that certain post-closure activities are no longer necessary to provide protection for human health and the environment. Post-closure use of the property will not be allowed without approval from SCDHEC.

4.5.6 Groundwater Monitoring

The groundwater monitoring program has been developed for the HIPSL within the H-Area HWMF Part B Permit Application (WSRC 1993). The H-Area HWMF Part B Permit Application describes the monitoring program details including enforcement. In addition, the HIPSL is located in the confines of the GSAEGOU. Agreement has previously been reached as to which monitoring wells are to be sampled, the frequency, and analytes. This agreement will remain in effect throughout the excavation. However, because of logistics, some monitoring wells will have to be temporarily removed and then replaced after the construction activities have ceased. An abandonment program plan denoting this will be sent to SCDHEC. SRS will not take the wells out of service until approval is obtained from SCDHEC.

4.5.7 Site Access

Site Access during closure activities and post-closure care will be controlled and barricades will be posted during physical activities. Access to the area by the general public is prevented by the site security fences and the SRS security system. Signs will be placed along the length of the HIPSL at regular intervals, denoting that buried waste remains underground. Routine maintenance will be performed on the cover system and the signs.

Site warning signs will include the following:

H Area Inactive Process Sewer Line (HIPSL)

DANGER

Unauthorized Personnel Keep Out.

This subsurface piping was used to manage Hazardous Substances.

Do not dig or excavate.

Contact the Waste Site Custodian.

Custodian: Manager Post Closure Maintenance

Phone: (803) 952-6882

4.6 Other activities

The bulk of the excavated HIPSL is being removed at WP. This activity is taking place in conjunction with the GSACU activities. The GSACU is a contaminated soil removal project that combines the scope of four former SRS FFA projects into a single, cost-effective remedy that will accelerate remedial activities and reduce risk. The project consists of four subunits: HRB, WP (including the two CERCLA site evaluation units), HP-52, and the ORWBG (see Figure 1-2).

The overall scope of the GSACU is to excavate contaminated materials from HRB, WP, and HP-52, transport the materials to the ORWBG, unload the materials in designated areas of the ORWBG, and construct a low-permeability geosynthetic cap over the entire ORWBG. Along with the contaminated soil at WP, a portion of the HIPSL vitrified clay pipe will be removed. The removal will affect the length of the HIPSL that traverses the long dimension of the WP, approximately in the middle of the eastern half. The area where the PTSM and pipe have been removed will be backfilled with clean fill, then overlain with an engineered cover system to preclude any issues with contaminant migration or contact with PTSM. The removal action of the WP portion of the HIPSL as covered in the GSACU will be coordinated with the activities associated with the Closure Plan for the HIPSL. This will be performed to ensure that material to be removed is handled and transported as few times as possible. At the same time, any contaminant migration issues involved with the removal and exposure of the contaminated soil to rainfall and infiltration will be mitigated when the removal action occurs. A depiction of the area where the HIPSL is to be removed in conjunction with the GSACU is shown on SK-C-53180, Appendix A. Personal Protective Equipment (PPE), excavated soil, and other debris will be dispositioned with GSACU Project waste materials.

Table 4.1 Closure Plan Actions for the HIPSL

Section	Area	Location Descritption	Action(s)	Reference
S.1	HDPE	Parallel to HIPSL (vitrified clay)	Grout ends of pipe, manholes, and trebler 904-109G. Place GCL and vegetative layers around the trebler (except at concrete pad) and at the perimeter of the manholes to a distance of at least 10 feet from the component edges.	SK-C-53188, Appendix A
S.2	VCP	Parking Lot (Tritium Facility)	Grout pipe west of manhole P-44, manhole, maintain asphalt.	SK-C-53188, Appendix A
S.3	VCP	North of Entrance Road to Parking Lot	Grout pipe and manhole. Place GCL and vegetative layers over pipe and manhole.	SK-C-53188, Appendix A
S.4	VCP	North of H-Area Entrance Road	Grout pipe. Place fill and concrete pad over pipeline.	SK-C-53180, Appendix A
S.5	VCP	Under H Area Entrance Road, North of Railroad	Grout pipe. tie concrete pads into asphalt road on both sides. Maintain the existing asphalt road.	SK-C-53180, Appendix A
S.6	HIPSL VCP	South of H Area Entrance Road to Collapse Area	Grout pipe. Place fill and concrete pad over pipeline.	SK-C-53180, Appendix A
S.7	VCP	North of Steam Line in Collapse Area	Remove PTSM to the extent practicable, manhole and pipe. Place GCL and vegetative layer.	SK-C-53180, Appendix A
S.8	HIPSL VCP	Under Steam Line	Grout the pipes. Place fill and concrete pad over pipeline.	SK-C-53180, Appendix A
S.9	VCP	South of Steam Line to Railroad (Collapse Area)	Remove PTSM, manhole and pipe. Place GCL and vegetative layer.	SK-C-53180, Appendix A
S.10	HIPSL VCP	Under Railroad Tracks	Grout the pipe.	SK-C-53180, Appendix A
S.11	VCP	Within WP pipeline and diversion box including manhole D-41A and bypass line	Remove PTSM to the extent, practicable, piping, diversion box, and manhole P-41A. Place GCL, GDL, and vegetative layers.	SK-C-53180, Appendix A
S.11A	VCP	Bypass line south of Warner's Pond and under E Road.	Grout the pipe.	SK-C-53180, Appendix A
S.12	HIPSL VCP	West of WP to E Road	Grout pipe and manhole P-41. Place concrete pad at E Road for surface drainage. Place GCL and vegetative layers and tie-in to concrete pad.	SK-C-53188, Appendix A
S.13	VCP	Under E Road and Road 4	Grout pipe.Tie concrete pads to existing asphalt on both sides of roads. Maintain existing asphalt over E Road and Road 4.	SK-C-53188, Appendix A
S.14	VCP	Between E Road and Road 4	Grout pipe. Place concrete pad at E Road and Road 4 for surface drainage. Place GCL and vegetative layers, and tie-in to concrete pad..	SK-C-53188, Appendix A
S.15	HIPSL VCP	From Road 4 to Trebler (904-48G)	Grout pipe. Place concrete pad at Road 4 for surface drainage. Place GCL and vegetative layers, and tie-in to concrete pad.	SK-C-53188, Appendix A
S.16	VCP	From Trebler (904-48G) to Seepage Basin	Grout pipe and trebler. Place GCL and vegetative layers over the pipe, around the trebler, and to a distance of 10 feet from the perimeter of the trebler.	SK-C-53188, Appendix A
S.17	VCP	Abandoned section of VCP near manhole P-44.	Grout the pipe. Place continous section of GCL and vegetative layers over pipes S-17 and S-3.	SK-C-53189, Appendix A

5.0 POST-CLOSURE CARE

Routine maintenance will be performed on the vegetative cover overlying the GCL and GDL, the concrete pads, asphalt roadways, and asphalt parting areas that are included in the HIPSL cover system. In addition, the signs will be posted and routine inspections and maintenance will be performed on the signs to ensure that personnel on site are made aware of the situation. The HIPSL cover and the signs will be inspected on a monthly basis. This will be initiated after completion of this closure. Maintenance of the vegetative cover will be performed as necessitated by the seasonal variations in the growing season.

USDOE is responsible for updating, maintaining, and revising the Post-Closure Care Plan. The plan will be amended when there are changes in the facility design or when there are events that affect post-closure. When USDOE revises the Post-Closure Care Plan, the date of the revision will appear on the plan.

6.0 SCHEDULE FOR CLOSURE

Closure construction will be consistent with the GSACU closure, which is due to start in December 2003. The duration of the closure construction for the HIPSL is 56 months (worked in parallel with the GSACU schedule). Closure activities include excavation and removal of the PTSM, excavation and removal of the vitrified clay pipe at the WP area (as depicted sketches on Appendix A), placement of grout in the manhole and vitrified clay pipe system, placement of grout in the manholes to preclude human intrusion, placement of an engineered cover system where excavation has occurred and over the remainder of the vitrified clay pipe to perform infiltration control, and performance of post-closure care as prescribed. The fill material will also be compacted to near-natural conditions. While this closure will not impact the operating capacity of H-Area facilities, coordination of vehicular access and security considerations are needed. Interaction with the SRS infrastructure for the road closures, H-Area Stormwater Management System, and compliance with the Radiological Controlled Area requirements will also be necessary. A schedule of the activities to be performed is depicted on Table 6.1. Note that any intermediate dates are for planning purposes only and are subject to change without impacting the closure completion date.

Table 6.1 Schedule for Closure Activities for the HIPSL/GSACU (WP)

Activity Description	HIPSL Closure Plan	GSACU CMI/RAIP
Submit Document	July 2003	May 2003
Receive Comments	October 2003	August 2003
Submit Comment Responses	November 2003	September 2003
Receive Approval	December 2003	October 2003
Remedial Action Start	December 2003*	December 2003*
Post-Closure Certification	Within 60 days of closure completion	

***NOTE**: The activities associated with the HIPSL closure will be completed and coordinated within the GSACU project schedule. For example, some preliminary drainage control and surface water re-routing will be performed for the GSACU project prior to the removal of soil from the WP waste unit.

7.0 EQUIPMENT DECONTAMINATION

Because personnel may be working with radiologically contaminated soils from the HIPSL, construction equipment may be exposed to contaminated material during removal operations. The Radiological Control Group will monitor daily construction operations and will approve equipment decontamination techniques as necessary. Materials excessed by this closure, such as fences, light poles, etc., may be re-used. Any material that cannot be re-used will be disposed of on site according to SRS policies. Suspect materials will be dispositioned appropriately.

8.0 CERTIFICATION

Closure - Within 60 days of closure completion, USDOE will send SCDHEC, via registered mail, closure certification(s) verifying that the closure has been completed in accordance with this approved Closure Plan. Both USDOE and an independent professional engineer(s), registered in South Carolina, will certify that the HIPSL and WP closure has been completed in accordance with this approved Closure Plan. In addition, this will be documented in the WP Post-Closure Document as noted in the RAIP.

Post-Closure - Within 60 days of post-closure care completion, USDOE will send SCDHEC, via registered mail, a post-closure certification(s) verifying that the post-closure care has been completed in accordance with this approved post-closure plan. Both USDOE and an independent professional engineer(s), registered in South Carolina, will certify that the HIPSL post-closure care has been peformed in accordance with this approved Post-Closure Plan.

9.0 NOTICES REQUIRED FOR DISPOSAL FACILITY

No later than the submission of the closure certification, USDOE will submit a survey plat that contains the information required by SCHWMR R.61-79.264.116 to the Aiken County Registrar of Mesne Conveyance (local zoning authority) and to SCDHEC. The survey plat will be prepared and certified by a professional land surveyor licensed in south Carolina. This plat will contain a note, prominently displayed, stating the owner's obligation to restrict disturbance of the hazardous waste disposal unit is in accordance with SCHWMR R.61-79.264, Subpart G.

In addition, USDOE will certify that a record of the type, quantity, and location of non-hazardous wastes disposed of in this facility has been submitted to the Aiken County Registrar of Mesne Conveyance and attached to the previously submtted survey plat. Within 60 days of closure certification, USDOE will submit this waste information certification along with the waste information to SCDHEC.

10.0 CLOSURE COST ESTIMATE

[REF: SCHWMR R.61-79.264.142; 264.144]

In accordance with SCHWMR R.61-79.264.140(c), federal facilities are exempt from adhering to the requirements for preparing a closure cost estimate.

11.0 FINAL ASSURANCE MECHANISM FOR CLOSURE ATTACHMENTS

[REF: SCHWMR R.61-79.264.143]

In accordance with SCHWMR R.61-79.264.140(c), federal facilities are exempt from adhering to the requirements for preparing financial assurance mechanisms.

12.0 LIABILITY REQUIREMENTS

[REF: SCHWMR R.61-79.264.147]

In accordance with SCHWMR R.61-79.264.140(c), federal facilities are exempt from adhering to the requirements for having liability coverage.

13.0 FINANCIAL MECHANISMS

[REF: SCHWMR R.61-79.264.148; 264.149]

In accordance with SCHWMR R.61-79.264.140(c), federal facilities are exempt from adhering to the requirements for presenting financial mechanisms.

14.0 CONSTRUCTION QUALITY ASSURANCE

Closure activities will be performed in accordance with ANSI/ASQC E4, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" and SRS procedures.

15.0 REFERENCES

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WSRC, 1998. *F- and H-Area Inactive Process Sewer Lines Phase III Groundwater Assessment (U)*, WSRC-RP-98-4156, Westinghouse Savannah River Company, Aiken, SC

WSRC, 2000. *Scoping Summary for the General Separations Area Eastern Groundwater Operable Unit (U)*, WSRC-RP-2000-4134, September 2004, Westinghouse Savannah River Company, Aiken, SC

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APPENDICES

Appendix	Description
A	Drawings/Sketches • SK-C-53180 — Warner's Pond Closure - Existing Conditions • SK-C-53181 — WP Closure - Existing Grading and Excavation Plan • SK-C-53182 — WP Closure - South Grading Plan • SK-C-53183 — WP Closure - North Grading Plan • SK-C-53184 — WP Closure - Sections and Details • SK-C-53188 — HIPSL Plan View Depicting Pipe Dispositon • SK-C-53189 — HIPSL Plan View and Details
B	Leachability Analysis
C	Geotechnical Data (used for Leachability Analysis)
D	Soils Characterization Data
Note:	Appendices B, C and D are contained on a CD attached to the end of this document.

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APPENDIX A

Drawings and Sketches

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	(BY OTHERS)
	EXISTING ELECTRICAL OVERHEAD WIRE AND POWER POLE
	EXIST CHAIN LINK FENCE
	CHAIN LINK FENCE GATE
	EXISTING CHAIN LINK FENCE WITH BARBED WIRE
	EXISTING PAVED ROADS
	EXISTING DIRT/GRAVEL ACCESS ROADS
	BOUNDARY MARKER
	BASIN CLOSURE SIGN
	ABANDONED PIPE SIGN
285	EXISTING INDEX CONTOUR
284	EXISTING MINOR CONTOUR
290	PROPOSED INDEX CONTOUR
289	PROPOSED MINOR CONTOUR
	PROPOSED TOP OF SLOPE
	SLOPE BREAK LINES
	PROPOSED SILT FENCE
P	EXISTING PROCESS SEWER LINE
FOC	EXISTING FIBER OPTIC CABLE
E	EXISTING BURIED ELECT CONDUIT/CABLE
ST	EXISTING STEAM LINE AND SUPPORTS
SS	EXISTING STORM SEWER LINE
S	EXISTING STORM SEWER LINE
DW	EXISTING DOMESTIC WATER
	DRAINAGE DITCH
	EXISTING MANHOLE
	EXISTING ORANGE MARKER
	EXISTING CONCRETE MARKER
	EXISTING RAILROAD
XXX.XX	LIMITS OF EXCAVATION TO THE SPECIFIED ELEVATION
	LIMITS OF EXCAVATION (1 FT MIN) BELOW EXISTING GRADE

ABBREVIATIONS:

RCP - REINFORCED CONCRETE PIPE

CMP - CORRAGATED METAL PIPE

T.O. - TOP OF

PVC - POLY VINYL CHLORIDE

GENERAL SEPARATIONS AREA CONSOLIDATION UNIT (GSACU) PROJECT

WARNER'S POND CLOSURE EXISTING CONDITIONS AND UNDERGROUND UTILITIES REMOVAL PLAN SK-C-53180, REV. 1

PSC= DRAWN BY (ORIG): ZWANZIGER LAST CADD REV. BY:
PLOT DATE TIME DATE: 04-25-03

GENERAL SEPARATIONS AREA
CONSOLIDATION UNIT (GSACU) PROJECT

WARNER'S POND CLOSURE
EXISTING GRADING AND EXCAVATION PLAN

SK-C-53181, REV. 1

PSC= DRAWN BY (ORIG): ZWANZIGER LAST CADD REV. BY: R.RAMIREZ
PLOT DATE 08-19-03 TIME DATE: 04-25-03

E 60400

GENERAL SEPARATIONS AREA
CONSOLIDATION UNIT (GSACU) PROJECT

WARNER'S POND CLOSURE - SOUTH
GRADING PLAN

SK-C-53182, REV. 0

PSC=
PLOT DATE
DRAWN BY (ORIG): ZWANZIGER LAST CADD REV. BY:
TIME
DATE: 04-25-03

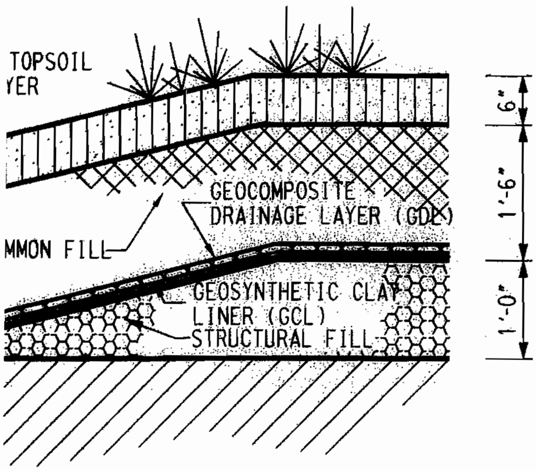
GENERAL SEPARATIONS AREA
CONSOLIDATION UNIT (GSACU) PROJECT

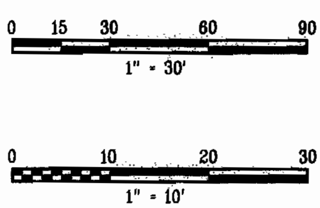
WARNERS POND CLOSURE - NORTH
GRADING PLAN

SK-C-53183, REV. 0

PSC=
PLOT DATE

DRAWN BY (ORIG): ZWANZIGER LAST CADD REV. BY:
TIME DATE: 04-25-03





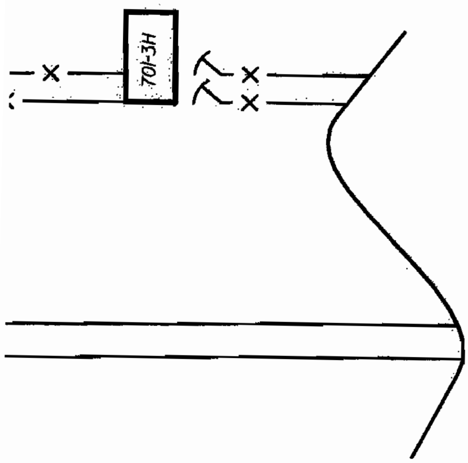
E: THIS DRAWING IS PLOTTED AT A REDUCED SCALE

GENERAL SEPARATIONS AREA
CONSOLIDATION UNIT (GSACU) PROJECT

WARNER'S POND CLOSURE
SECTIONS AND DETAILS

SK-C-53184, REV. 1

PSC= DRAWN BY (ORIG): ZWANZIGER LAST CADD REV. BY: R.RAMIREZ
PLOT DATE 08-19-03 TIME DATE: 04-25-03



VCP — VITRIFIED CLAY PIPE (VCP) REQUIRES COVER SYSTEM AND GROUT (UNO)

VCP — (VCP REMEDIATE BY GSACU PROJECT)

HDPE — ACTIVE PROCESS SEWER DOES NOT REQUIRE ANY ACTION AT THIS TIME

EXISTING CHAIN LINK FENCE WITH BARBED WIRE

CHAIN LINK FENCE GATE

EXISTING PROCESS MANHOLE

△1

ABANDONED PIPELINE WARNING SIGN

CONCRETE MONUMENT

ETF — EFFLUENT TREATMENT FACILITY

H-AREA INACTIVE PROCESS SEWER LINE (HIPSL)
PLAN VIEW DEPICTING THE HIPSL
(VITRIFIED CLAY AND POLYETHYLENE)
PIPE DISPOSITION

SK-C-53188, REV. 1

PSC=
PLOT DATE
DRAWN BY (ORIG): A.RINGUS
TIME
LAST CADD REV. BY:
DATE:

B= 7′-6″

A= 1′-6″ *MINIMUM NOT TO BE DISTURBED*

INACTIVE PROCESS SEWER LINE
VITRIFIED CLAY PIPE (VCP)
REQUIRES COVER SYSTEM

(VCP REMEDIATE BY GSACU PROJECT)

ACTIVE PROCESS SEWER DOES NOT
REQUIRE ANY ACTION AT THIS TIME

EXISTING CHAIN LINK FENCE
WITH BARBED WIRE

EXISTING PROCESS MANHOLE

H-AREA INACTIVE PROCESS SEWER LINE (HIPSL)
PLAN VIEW & DETAILS

SK-C-53189, REV. 1

PSC=
PLOT DATE

DRAWN BY (ORIG): A.RINGUS
TIME

LAST CADD REV. BY:
DATE:

APPENDIX B

Leachability Analysis

(Appendix B is contained on a CD attached to the end of this document)*

* This CD was submitted to SCDHEC with the 1992 RCRA Part B Permit Application, Volume V, Revision 20

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APPENDIX C

Geotechnical Data (used for Leachability Analysis)

(Appendix C is contained on a CD attached to the end of this document.) *

* This CD was submitted to SCDHEC with the 1992 RCRA Part B Permit Application, Volume V, Revision 20

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APPENDIX D

Soils Characterization Data		
(D-1)	1988-1989 HIPSL Characterization	(29 pages)
(D-2)	1992-1993 HIPSL Characterization	(26 pages)
(D-3)	1998 WP Pipeline Characterization	(18 pages)
(D-4)	1998 WP Pipeline Additional Sampling	(67 pages)
(D-5)	1992 HDPE Characterization	(23 pages)
(D-6)	TCLP Results	(2 pages)
Groundwater Characterization Data		
(D-7)	1998 Characterization	(51 pages)
(D-8)	HSL 2002-2003	(52 pages)

(Appendix D is contained on a CD attached to the end of this document.) *

* **This CD was submitted to SCDHEC with the 1992 RCRA Part B Permit Application, Volume V, Revision 20**

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ATTACHMENT 1

HIPSL Closure Certification

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SAVANNAH RIVER SITE
Aiken, SC 29808 • www.srs.gov

OCT 23 2007

M&O-SGW-2007-00401

Mr. Richard A. Haynes, P. E., Director
Division of Waste Management
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Dear Mr. Haynes:

H-AREA INACTIVE PROCESS SEWER LINE CLOSURE CERTIFICATION AND SURVEY PLAT (U)

Enclosed are the certifications by the operator and co-operator of the Savannah River Site and the independent registered Professional Engineer as required by the South Carolina Hazardous Waste Management Regulation (SCHWMR), R.61-79-264.115 and 119(b).

Also enclosed is a copy of the survey plat and a list of the type, location and quantity of hazardous waste conveyed in the H-Area Inactive Process Sewer Line that was submitted to the authority with jurisdiction over local land use, the Registrar of Mesne Conveyance of Aiken County, as required by the SCHWMR R.61-79.264.116 and 119(b). This document is considered an instrument that would normally be examined during a title search.

If you have any questions, please call Leslie Wells at (803) 952-7769.

Sincerely,

Mary A. Flora

Mary A. Flora, Manager
Program and Regulatory Integration
Soil and Groundwater Closure Projects

MAF/LHW:tb

Enclosure
c: W. C. Whitaker, DOE-ACP, 730-B (concur)
A. B. Gould, DOE-EQMD, 730-B (concur)
J. Johnson, EPA-Atlanta
R. T. Caldwell, II, SCDHEC-Aiken
R. W. Wingard, SCDHEC-Columbia
K. B. Frasier, SCDHEC-Columbia

WASHINGTON SAVANNAH RIVER COMPANY

The WSRC Team: Washington Savannah River Company LLC • Bechtel Savannah River, Inc. • BNG America Savannah River Corporation • BWXT Savannah River Company • CH2 Savannah River Company

Mr. Richard Haynes
M&O-SGW-2007-00401
Page 2

OCT 23 2007

bc: A. G. Hammett, 730-B
M. P. Prater, 730-B
W. J. Maloney, 735-B
D. G. Wells, 772-7B
E. M. McNamee, 730-4B
S. J. Bell, 730-4B
G. C. Blount, 730-4B
J. J. Thibault, 730-4B
L. H. Wells, 730-4B
P. A. Burns, 730-4B
D. V. Osteen, 735-B
SGCP DCC, 730-4B
Records Processing, 773-52A

File Inf.:
F&H HWMFs
10052
DOE 1-9-e
Permanent

CLOSURE CERTIFICATION STATEMENT
H-AREA INACTIVE PROCESS SEWER LINE

As required by R.61-79.264, Subpart G of the South Carolina Hazardous Management Regulation, the U. S. Department of Energy as owner and co-operator of the Savannah River Site and Washington Savannah River Company, as co-operator, hereby certify that the closure of the H-Area Inactive Process Sewer Line portion of the H-Area Hazardous Waste Management Facility has been completed in accordance with the approved Closure Plan (1992 RCRA Permit Application, Volume V, Revision 22, dated October 2004).

In accordance with R.61-79.264.119(b), records and survey plats have been issued to the Aiken County Registrar of Mesne Conveyance.

Bruce G Schappell 10/16/07

WSRC as Co-Operator — Date
Bruce G. Schappell
Area Project Manager
Closure and Remediation Projects

Jeffrey M. Allison 10/18/07

DOE as Owner and Co-Operator — Date
Jeffrey M. Allison
Manager

CERTIFICATION OF CLOSURE STATEMENT
FOR
INSIDE WARNER'S POND SECTION
OF
H-AREA INACTIVE PROCESS SEWER LINE
SAVANNAH RIVER SITE, AIKEN, SC

I, Jimmy Hock-Chin Wong, a Professional Engineer registered in the state of South Carolina, under certificate number 25202, hereby certify that I have reviewed the Closure Plan for H-area Inactive Process Sewer Line (HIPSL), Volume V (Revision 22, October 2004) and that I personally have made visual inspections during closure activities inside the Warner's Pond section of HIPSL and that the closure of said site has been performed in accordance with the referenced Closure Plan.

This certification pertains only to areas inside the Warner's Pond section of HIPSL and supplements the HIPSL Certification of Closure Statement dated June 13, 2006 signed by Kimberley S. Veal, P.E.

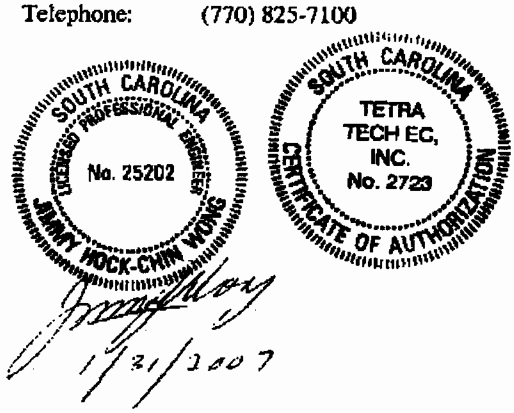
Jimmy Hock-Chin Wong, P.E.

Professional Engineer License No.: 25202

Company: Tetra Tech EC, Inc.

Address: 302 Research Drive, Suite 200
Norcross, GA 30092

Telephone: (770) 825-7100



CERTIFICATION OF CLOSURE STATEMENT
FOR
H-AREA INACTIVE PROCESS SEWER LINE
SAVANNAH RIVER SITE, AIKEN, SC

I, Kimberly S. Veal, a Professional Engineer registered in the state of South Carolina, under certificate number 18398, hereby certify that I have reviewed the Closure Plan for H-area Inactive Process Sewer Line (HIPSL), Volume V (Revision 22, October 2004) and that I personally have made visual inspections of the HIPSL site during closure activities and that the closure of said site has been performed in accordance with the referenced Closure Plan, approved by the South Carolina Department of Health and Environmental Control, as outlined in the "Final Report for H-Area Inactive Process Sewer Line Closure, Revision 1, June 13, 2006" prepared and submitted by Tetra Tech EC, Inc.

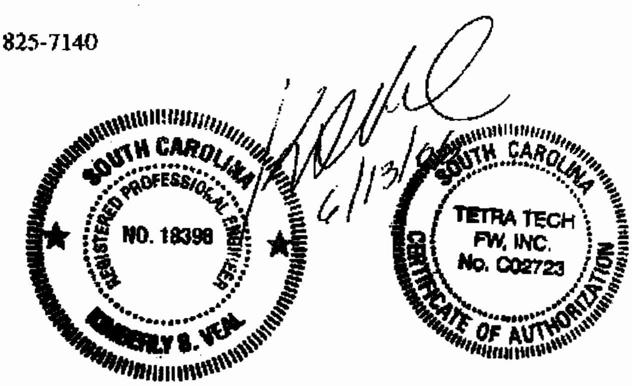
Kimberley S. Veal, P.E.

Professional Engineer License No.: 18398

Company:Tetra Tech EC, Inc.

Address: 302 Research Drive, Suite 200
Norcross, GA 30092

Telephone: (770) 825-7140



RECEIPT

The Aiken County Registrar of Mesne Conveyance has received two copies of a survey plats of the H-Area Inactive Process Sewer Line portion of the H-Area Hazardous Waste Management Facility at the Savannah River Site. These survey plats have been submitted in accordance with the South Carolina Hazardous Waste Management Regulations R.61-79.264.

The Aiken County Registrar of Mesne Conveyance has received a record of the type, quantity, and location of hazardous waste conveyed in the H-Area Inactive Process Sewer Line portion of the H-Area Hazardous Waste Management Facility at the Savannah River Site. This record was submitted on the survey plat in accordance with the South Carolina Hazardous Waste Management Regulations R.61-79.264.119.

Judith V. Warren RMC
Jerge H. Engle
Name

Dept RMC
Title

9-17-07
Date

U S DEPARTMENT OF ENERGY
SAVANNAH RIVER SITE

Please refer to 4 plats recorded this date. PB 53 Pgs 103-106

SCHWMR R.61-79.264.119 CERTIFICATION DESCRIPTION OF HAZARDOUS WASTE CONVEYED IN THE H-AREA INACTIVE PROCESS SEWER LINE

Type and Quantity of Hazardous Waste Conveyed:

The H-Area Seepage Basins received wastewater containing low-level radioactivity and chemicals from the H-Area Separations facilities, consisting mainly of evaporator overheads from process wastewater. The wastewater was conveyed in the H-Area Process Sewer Line, consisting of 3120 feet of underground vitrified clay and high density polyethylene pipes. The estimated cumulative quantities of major constituents placed in the H-Area Seepage Basins via the H-Area Process Sewer Line from 1955 to 1984 are presented below:

CONSTITUENTS	ESTIMATED CUMULATIVE QUANTITY (KG)
Sodium	140,000
Nitrate (as N)	1,000,000
Mercury	1,800
Lead	1,475
Chromium	500
Cadmium	1
Silver	2.5

Location of Hazardous Waste Conveyance:

Boundaries of the H-Area Inactive Process Sewer Line are defined by the following SRS coordinates:

NORTH H-AREA INACTIVE PROCESS SEWER LINE

N72175	E58820
N72176	E59414
N72191	E59673
N72231	E59671
N72219	E59453
N72231	E59453
N72231	E59375
N72216	E59375
N72216	E59062
N72239	E59062
N72239	E59033
N72216	E59033
N72215	E58820

SOUTH H-AREA INACTIVE PROCESS SEWER LINE

N72641	E60470
N72606	E60492
N72606	E60530
N72638	E60530
N72659	E60975
N72695	E60988
N72696	E60546
N72667	E60512

NORTH WARNER'S POND

N72594.05	E60366.87
N72554.96	E60412.81
N72422.52	E60198.05
N72457.28	E60154.04

SOUTH WARNER'S POND

N72509.07	E59918.91
N72294.64	E60169.89
N72004.12	E59995.82
N72006.54	E59674.67
N72078.32	E59559.82
N72135.85	E59653.83
N72230.04	E59662.91
N72263.17	E59787.04

2007030832
NOTICE
RECORDING FEES $10.00
PRESENTED & RECORDED:
09-17-2007 11:40 AM
JUDITH WARNER
REGISTER OF MESNE CONVEYANCE
AIKEN COUNTY, SC
By: JOYCE H ERGLE DEPUTY RMC
BK:RB 4161
PG:2398-2398

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North HIPSL

LAND USE CONTROL IMPLEMENTATION SURVEY PLAT

OF

(NORTH HIPSL) H-AREA INACTIVE PROCESS SEWER LINE OPERABLE UNIT

PROPERTY LOCATED AT SAVANNAH RIVER SITE

PREPARED FOR

U. S. DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA 29802

COUNTY OF: AIKEN STATE OF: S. CAROLINA

SCALE: 1" = 50' DWN. BY: JMB DATE: 05 FEB. 2007

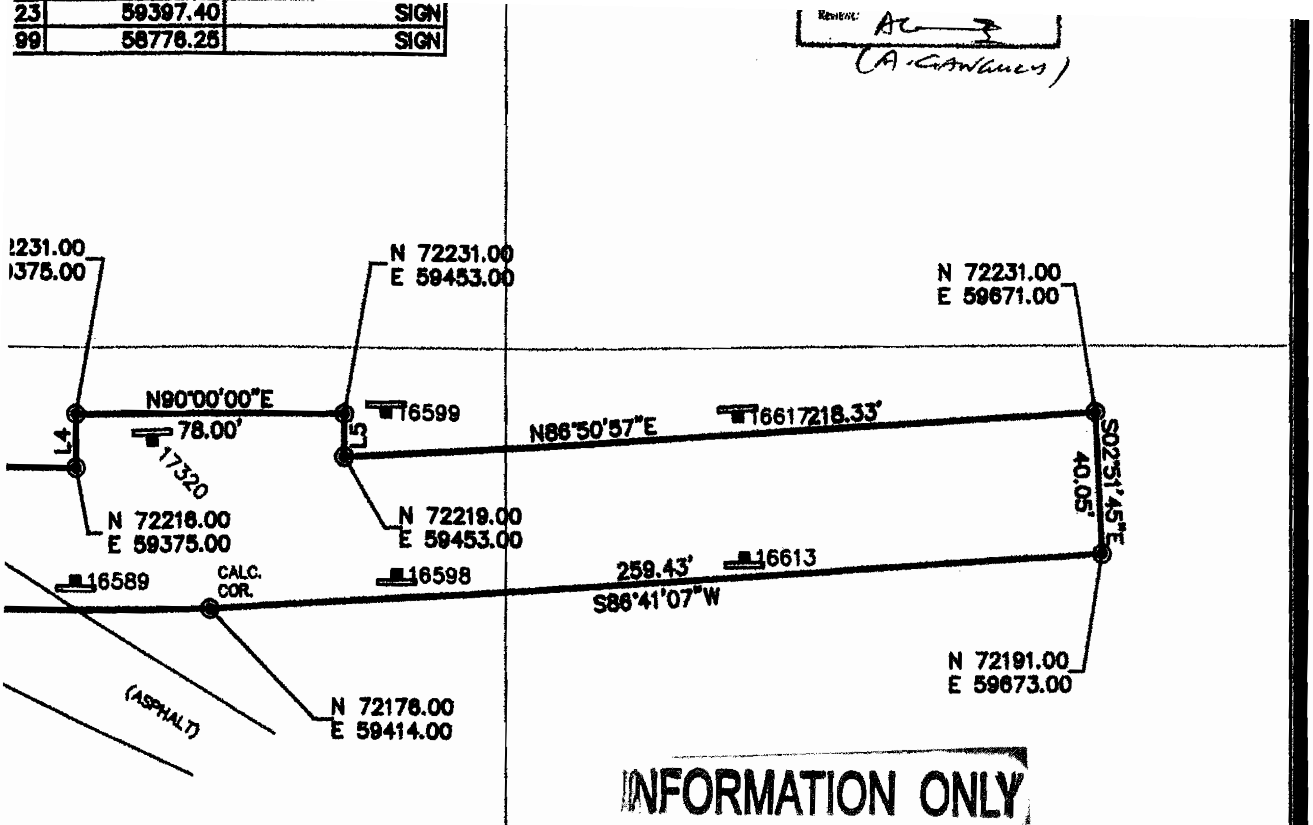
PREPARED BY

John M. Bailey & Associates, P.C.

PROFESSIONAL LAND SURVEYORS
101 LeCOMPTE AVENUE, NORTH AUGUSTA, S.C. 29841
(803)278-0721

SOUTH CAROLINA
JOHN M. BAILEY & ASSOCIATES, P.C.
NO. C00078
CERTIFICATE OF AUTHORIZATION

200'



LAND USE CONTROL IMPLEMENTATION SURVEY PLAT

OF

(SOUTH HIPSL) H-AREA INACTIVE PROCESS SEWER LINE OPERABLE UNIT

PROPERTY LOCATED AT SAVANNAH RIVER SITE

PREPARED FOR

U. S. DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA 29802

L-SRS

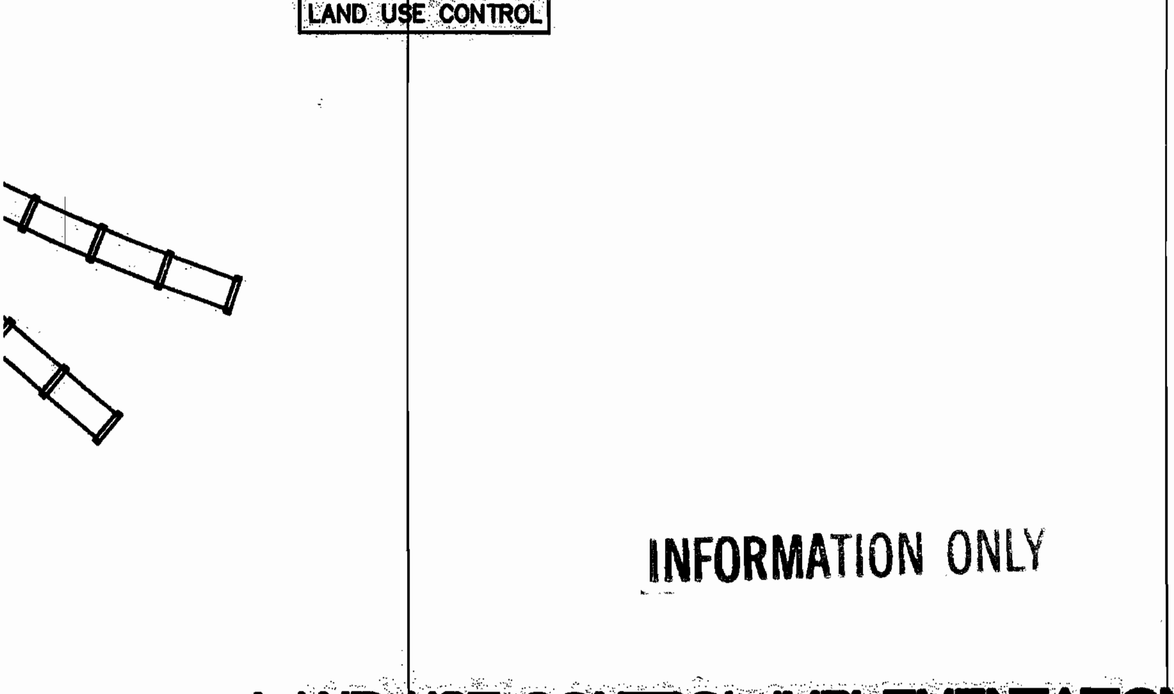
COUNTY OF: AIKEN STATE OF: S. CAROLINA

SCALE: 1" = 50' DWN. BY: JMB DATE: 05 FEB. 2007

PREPARED BY

John M. Bailey & Associates, P.C.

PROFESSIONAL LAND SURVEYORS
101 LeCOMPTE AVENUE, NORTH AUGUSTA, S.C. 29841
(803)278-0721



INFORMATION ONLY

LAND USE CONTROL IMPLEMENTATION SURVEY PLAT

OF

(NORTH) WARNER'S POND (685-23G) REMEDIATION OPERABLE UNIT

PROPERTY LOCATED AT SAVANNAH RIVER SITE

PREPARED FOR

U. S. DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA 29802

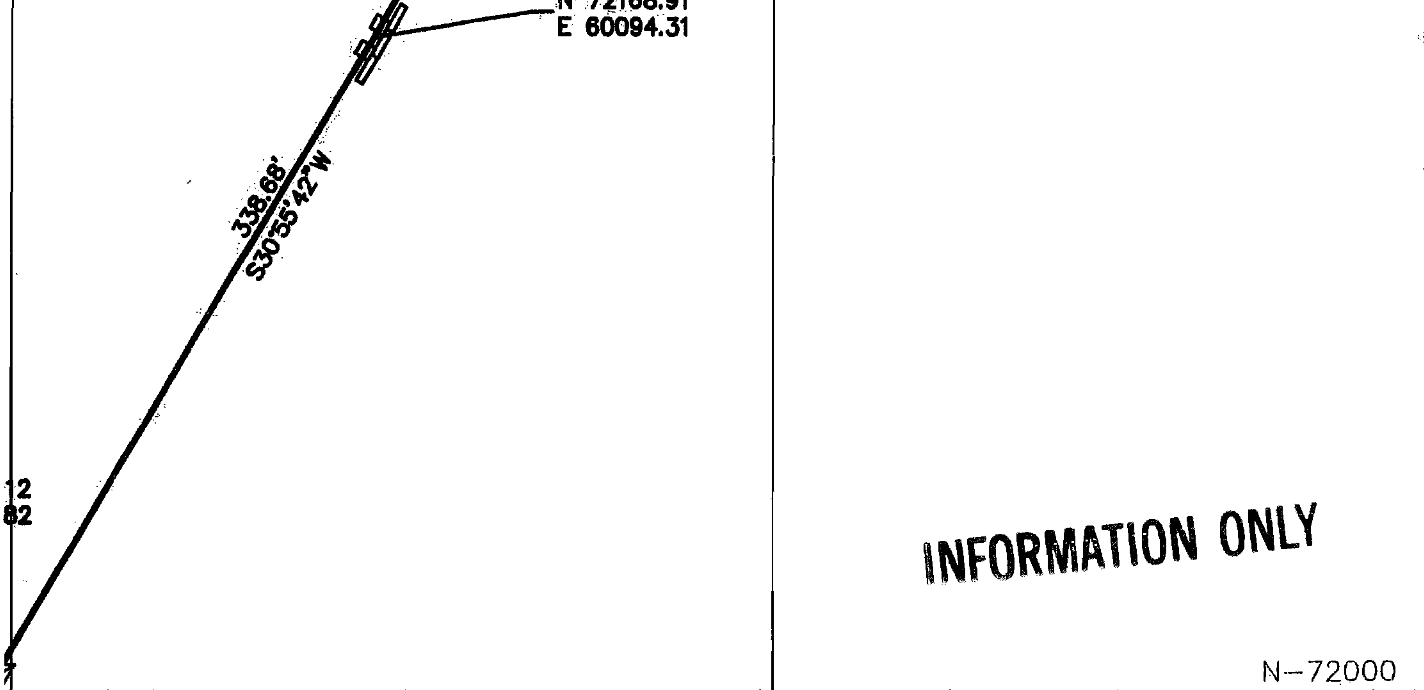
COUNTY OF: AIKEN STATE OF: S. CAROLINA

SCALE: 1" = 50' DWN. BY: JMB DATE: 08 FEB. 2007

PREPARED BY

John M. Bailey & Associates, P.C.

PROFESSIONAL LAND SURVEYORS
101 LeCOMPTE AVENUE, NORTH AUGUSTA, S.C. 29841
(803)278-0721



LAND USE CONTROL IMPLEMENTATION
SURVEY PLAT

OF

(SOUTH)
WARNER'S POND (685-23G) REMEDIATION
OPERABLE UNIT

PROPERTY LOCATED AT SAVANNAH RIVER SITE

PREPARED FOR

U. S. DEPARTMENT OF ENERGY
SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA 29802

COUNTY OF: AIKEN STATE OF: S. CAROLINA

SCALE: 1" = 50' DWN. BY: JMB DATE: 08 FEB. 2007

PREPARED BY

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