Conceptual Remedial Action Plan

DuPont Brevard Site

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Executive Summary

This Remedial Action Plan (RAP) presents a plan for completing the final remedial actions at the E.I. du Pont de Nemours and Company (DuPont) Brevard site (site). At this site, DuPont produced high purity silicon from 1957 to 1962, and DuPont and subsequent property owners produced X-ray films from 1962 to 2002. DuPont and other property owners have been investigating and remediating the site since the 1980s under the Resource Conservation Recovery Act (RCRA) Corrective Action Program, with oversight by the North Carolina Department of Environmental Quality (NCDEQ). Approximately 1,100 remedial investigation samples have been collected at the site, and DuPont submitted the Remedial Investigation Report (RIR) to NCDEQ in 2015, which marked the completion of the site's investigation phase (Parsons 2015b). A number of remedial actions were completed during the investigation phase. Key completed remedial actions included demolition and removal activities of the former plant, removal and recycling/relocation of X-ray film waste, installation of cap/covers over former landfills/disposal areas and similar areas, and installation of a groundwater treatment system for the DuPont State Recreational Forest (DSRF) Visitor Center water supply well.

In order to accelerate the cleanup process in North Carolina, the General Assembly of North Carolina passed a law referred to as the Risk Bill, which allows risk-based remediation based on the submittal of an RIR and RAP to the NCDEQ. Specifically, the purpose of the Risk Bill is "to authorize the Department to approve the remediation of contaminated sites based on site-specific remediation standards in circumstances where site-specific remediation standards are adequate to protect public health, safety, and welfare and the environment and are consistent with protection of current and anticipated future use of groundwater and surface water affected or potentially affected by the contamination." This RAP was prepared in accordance with the Risk Bill. The purpose of this RAP is to identify site-specific remediation standards, propose and justify remedial actions that comply with the remediation standards, and describe the implementation of the remedial actions in accordance with the Risk Bill.

To put the property back into productive use, site-specific remediation standards (i.e., remediation levels and points of compliance) were developed based on the current and planned future land use for the site. Although current use of the site is minimal, future land use will change once DuPont transfers the entire site to the State of North Carolina (State) in the near future. The State's planned future land uses for the site include DSRF recreational and administrative uses, and North Carolina National Guard (NCNG) low impact military training and administrative uses. Based on the current and planned future land use, the remedial action objectives (RAOs) for the RAP are to protect public health, safety, and welfare and the environment by:

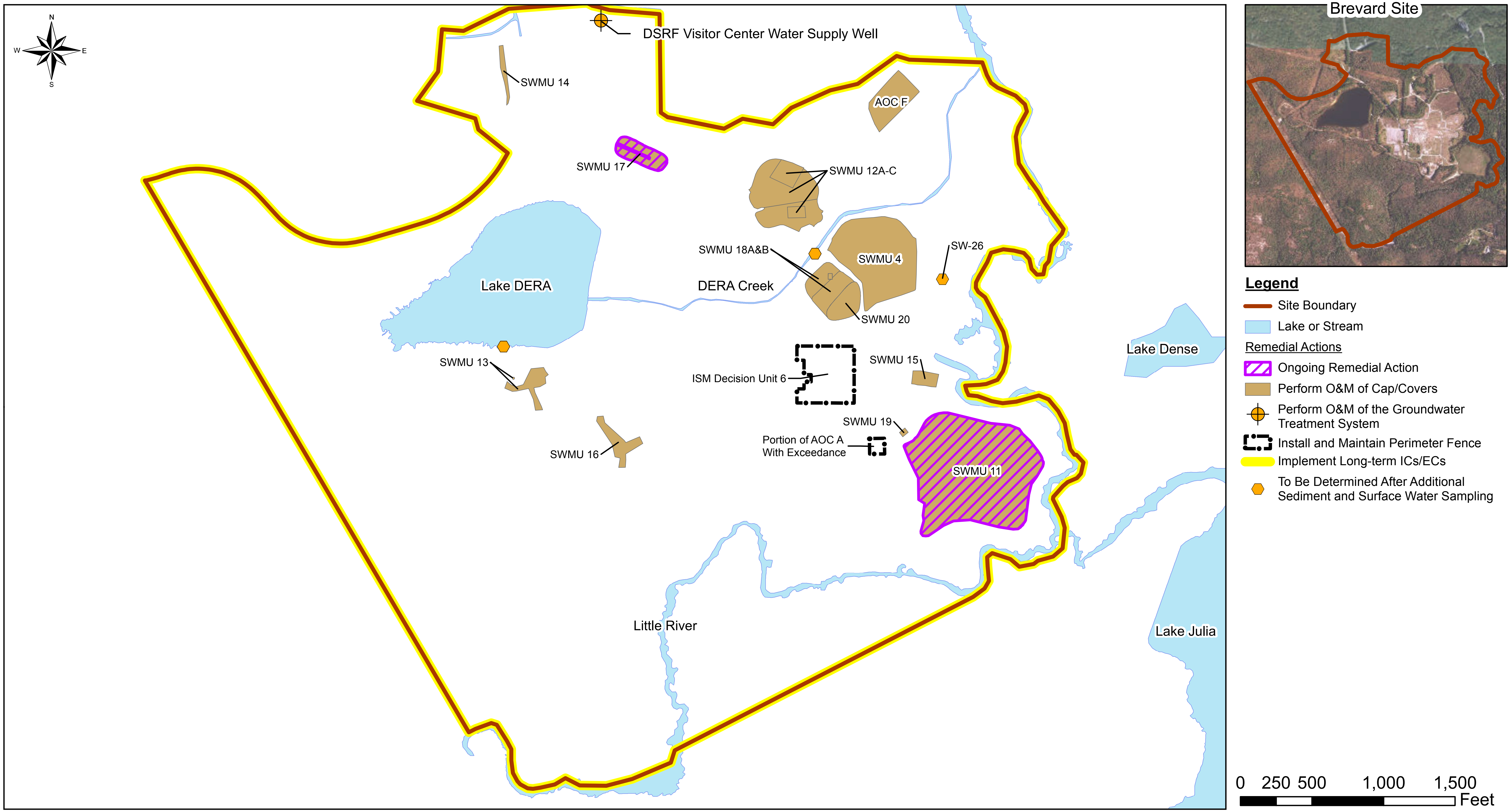
- Completing the existing DuPont remedial action commitments;
- Eliminating unacceptable exposures associated with site-specific remediation standard exceedances; and
- Implementing institutional controls/engineering controls (ICs/ECs) to further ensure potential exposures do not occur.

Few exceedances of the site-specific remediation standards remain at the site. Thus, minimal additional remedial actions (e.g., long-term operation and maintenance [O&M] activities and long-term ICs/ECs) are needed in order to protect public health, safety, and welfare and the environment. As a result, the following remedial actions are proposed to satisfy the RAOs (see Figure ES-1):

- Perform active remediation at Solid Waste Management Unit (SWMU) 11 and SWMU 17:
  - Design and install a vegetative cap for final closure of SWMU 11.
  - Design and perform in-situ solidification/stabilization for soil and waste within SWMU 17.
- Perform O&M activities for cap/covers at SWMUs 4, 11, 12A-C, 13, 16, 17, 18A&B, and 20 (e.g., annual inspections of the cap/covers and repair/replacement of the cap/covers as necessary).
- Perform O&M activities for the treatment system at the DSRF Visitor Center water supply well (e.g., periodic repair/replacement of the treatment system, sampling of groundwater).
- Install and maintain access-control fencing around two areas referred to as Incremental Sampling Methodology (ISM) Decision Unit 6 and Area of Concern (AOC) A.
- Implement long-term ICs/ECs for future excavation activities, future land use, future groundwater use, and future building construction.
- Collect additional sediment and surface water samples from Lake DERA, DERA Creek, and the SW-26 seep to evaluate whether or not further action is needed for polycyclic aromatic hydrocarbons.

The proposed remedial actions listed above are recommended as the final site remedy because they adequately address short- and long-term risks, they reduce the toxicity, mobility, and/or volume of constituents and waste material, they will be effective over the short- and long-term, and they are easy to implement.

This RAP includes details about how the proposed remedial actions will be implemented. A key long-term component of implementation will be placing a deed restriction on the site to ensure the required O&M activities and ICs/ECs are implemented and maintained over the long-term and the site remains protective of public health, safety, and welfare and the environment. The DuPont-owned property will be transferred to the State concurrent with RAP implementation. Thus, a Property Control Plan is being developed to establish specific procedures for the State's long-term implementation of the required O&M activities and ICs/ECs. The Property Control Plan is consistent with the State's planned use for the site and is being prepared in collaboration with the State.



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Summary of the Remedial Actions
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure ES-1

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List of Acronyms

Acronym	Explanation
§	Section
AFB	Alternate Fuel Boiler
AGFA	AGFA Corporation
AOC	Area of Concern
BGS	Below ground surface
CA	Corrective Action
CAMU	Corrective Action Management Unit
COC	Constituent of Concern
COPC	Constituent of Potential Concern
CRG	Corporate Remediation Group
CSEM	Conceptual Site Exposure Model
DERA	DuPont Employees Recreation Association
DERS	DuPont Environmental Remediation Services
DSRF	DuPont State Recreational Forest
DuPont	E.I. du Pont de Nemours and Company
EC	Engineering Control
EcoCommunities	Ecological Communities
°F	Degrees Fahrenheit
Ft	Feet
GAC	Granular Activated Carbon
GMP	Groundwater Monitoring Plan
HASP	Health and Safety Plan
HI	Hazard Index
HSWA	Hazardous and Solid Waste Amendments
IC	Institutional Control
IRM	Interim Remedial Measure
ISM	Incremental Sampling Methodology
MSL	Mean Sea Level
NC	North Carolina
NC2B	15A North Carolina Administrative Code 02B
NC2L	15A North Carolina Administrative Code 02L
NCAC	North Carolina Administrative Code
NCDA&CS	North Carolina Department of Agriculture and Consumer Services
NCDENR	North Carolina Department of Environment and Natural Resources

Acronym	Explanation
NCDEQ	North Carolina Department of Environmental Quality
NCNG	North Carolina National Guard
NCGS	North Carolina General Statutes
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PET	Polyethylene Terephthalate
POC	Point of Compliance
Property	DuPont-Owned Portion of the Property
RAO	Remedial Action Objective
RAP	Remedial Action Plan
RCRA	Resource Conservation Recovery Act
RFI	RCRA Facility Investigation
RIR	Remedial Investigation Report
Risk Bill	Risk-Based Environmental Remediation of Industrial Sites Law
RL	Remediation Level
RWM	Remediation Waste Material
Site	Brevard Site
SL	Screening Level
S/S	Solidification/Stabilization
State	State of North Carolina
Sterling	Sterling Diagnostic Imaging Inc.
SWMU	Solid Waste Management Unit
TCE	Trichloroethylene
TR	Trout Waters
VI	Vapor Intrusion
VOCs	Volatile Organic Compounds
WSW	Water Supply Well
WSW-VISIT	DuPont Visitor Center Water Supply Well
WWTP	Wastewater Treatment Plant

SECTION 1: INTRODUCTION

E.I. du Pont de Nemours and Company (DuPont) has been performing remediation activities at the Brevard Site (site) since the 1980s as part of the Resource Conservation Recovery Act (RCRA) Corrective Action (CA) Program in accordance with Hazardous Waste Management Permit No. NCD003152329-R2. The permit was issued by the North Carolina (NC) Department of Environment and Natural Resources (NCDENR), which officially became the NC Department of Environmental Quality (NCDEQ) on September 18, 2015.[1,2] Remediation activities are being performed at the site to satisfy RCRA CA requirements, as well as to facilitate the transfer of the property ownership from DuPont to the State of North Carolina (State).

In 2011, the General Assembly of NC passed a law entitled Risk-Based Environmental Remediation of Industrial Sites (referred to as the Risk Bill) which allows risk-based remediation at sites to accelerate the cleanup process (General Assembly NC 2011).[3] To put the property back into productive use, DuPont and the State (including the NCDEQ, NC Department of Agriculture and Consumer Services [NCDA&CS], the NC Forest Service [DSRF] and the NC National Guard [NCNG]) have agreed that it is appropriate to conduct future remediation activities in accordance with the Risk Bill. The purpose of the Risk Bill is "to authorize the Department to approve the remediation of contaminated sites based on site-specific remediation standards in circumstances where site-specific remediation standards are adequate to protect public health, safety, and welfare and the environment and are consistent with protection of current and anticipated future use of groundwater and surface water affected or potentially affected by the contamination." This Remedial Action Plan (RAP) was prepared to satisfy NCGS § 130A-310.69 of the Risk Bill, which states, "A person who proposes to conduct remediation pursuant to this Part shall develop and submit a proposed remedial action plan to the Department."

1.1 RAP Purpose

The purpose of this RAP is to identify site-specific remediation standards, propose and justify remedial actions to comply with the remediation standards, and describe the implementation of the remedial actions in accordance with the Risk Bill. The proposed remedial actions presented in this RAP were based on current and future land use to protect public health, safety, and welfare and the environment.

[1] http://portal.ncdenr.org/web/guest/denr-blog/-/blogs/denr-has-a-new-name-n-c-dept-of-environmental-quality?_33_redirect=%2Fweb%2Fguest%2Fdenr-blog

[2] NCDENR will henceforth be referred to as NCDEQ in this RAP.

[3] This law was enacted as Part 8 of Article 9 of Chapter 130A of the North Carolina General Statutes (NCGS § 130A) which has been revised over time (General Assembly NC 2015).

1.2 Site Location

The site is located in Cedar Mountain, in Transylvania County, North Carolina, approximately six miles southeast of the town of Brevard and three miles north of the South Carolina border (see Figure 1-1). The site is located off of Staton Road and is bordered by heavily-wooded mountains the DSRF to the north, south, east, and west and by the Little River to the south and east (see Figure 1-1). Other site water bodies include Lake DERA (a man-made lake) and DERA Creek (a channelized drainage way that flows from west to east [from Lake DERA to Little River] through the site).

1.3 DuPont Property Transfer Goals

DuPont owns approximately 475 of the 491-acre site (see Figure 1-1). The DuPont-owned portion of the site (property) will be transferred from DuPont to the State concurrent with the implementation of this RAP. The property transfer goals are to:

- Ensure the ongoing protection of people and the environment following the transfer of the property;
- Identify remedial actions for the site that are consistent with the State's desired future land use; and
- Meet regulatory obligations and public expectations.

1.4 RAP Organization

The RAP is organized as follows.

- Section 1: Introduction
- Section 2: Site Overview
- Section 3: Site-Specific Remediation Standards
- Section 4: Identification of Areas Needing Further Action
- Section 5: Conceptual Overview of the Remedial Actions
- Section 6: Evaluation of the Remedial Actions
- Section 7: Implementation of the Remedial Actions
- Section 8: References

SECTION 2: SITE OVERVIEW

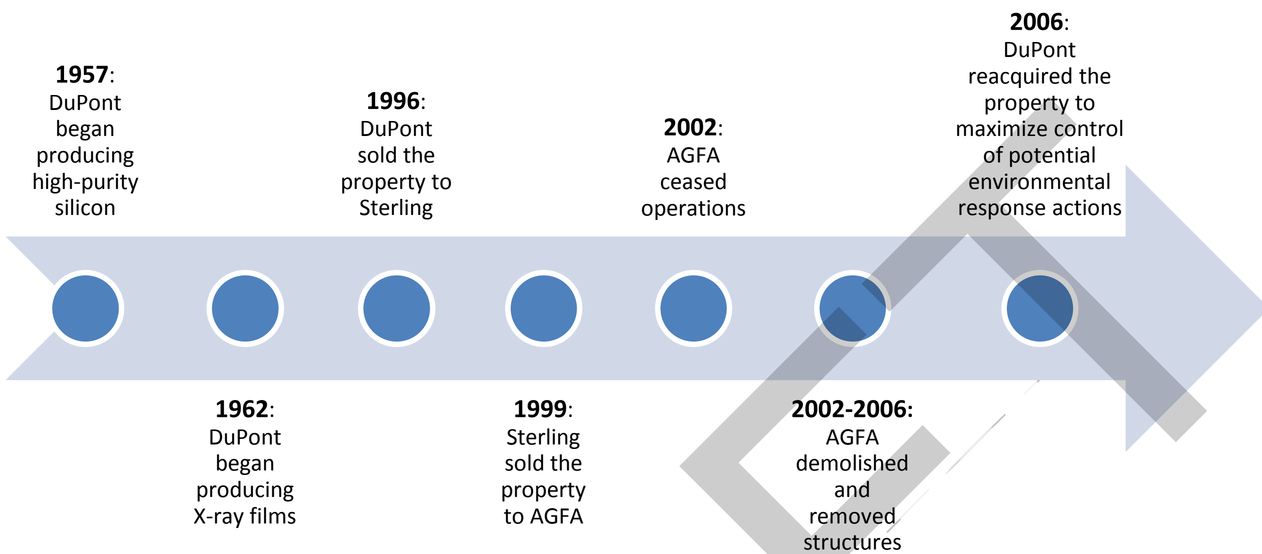
Details regarding the history and current conditions of the site were presented in the RIR (Parsons 2015b). For the purposes of the RAP, the following topics are summarized in this section.

- Operational History
- Regulatory Setting
- Site Setting
- RCRA Facility Investigation Summary
- Releases from Historical Operations
- Completed Remedial Actions
- Existing DuPont Remedial Action Commitments
- Current and Future Land Use
- RIR Screening Conceptual Site Exposure Model (CSEM)
- Screening Levels (SLs) and Constituents of Potential Concern (COPCs)
- RAP CSEM

2.1 Operational History

DuPont began manufacturing operations in Brevard in 1957 becoming the first commercial producer of silicon, the raw material used to make transistors and other solid state electronic devices. Brevard was chosen as the manufacturing location to guarantee isolation from other industries and agricultural areas, which were possible sources of impurities. DuPont's Chemicals and Pigments Department produced high purity silicon until approximately 1962 when the property was transferred to the Imaging Department to start production of medical imaging (X-ray) films. During this time, DuPont also operated a powerhouse, a wastewater treatment facility, a silver recovery unit (Save-All System), the Alternate Fuel Boiler (AFB), and solid waste landfills to support manufacturing activities (see Figure 2-1). Areas outside of the former manufacturing area were used for recreational purposes that were managed by the DuPont Employees Recreation Association (DERA).

DuPont produced medical imaging films until Sterling Diagnostic Imaging Inc. (Sterling) purchased the Facility in 1996 and sold it to AGFA Corporation (AGFA) in 1999. Both Sterling and AGFA conducted the same operations as DuPont. AGFA discontinued operations in December 2002. DuPont reacquired the divested property in 2006 to maximize control of future potential environmental response actions. As part of the reacquisition agreement between DuPont and AGFA, AGFA demolished and removed major structures. Demolition and removal activities were completed in May 2006 and DuPont reacquired the property in July 2006. The graphic on the following page presents an operational history time line for the property.



2.2 Regulatory Setting

Site investigation and remediation activities have been conducted at the site under RCRA since 1980. An initial RCRA Part A Permit Application was submitted for the former Brevard facility in November 1980. An amended Part A Application was submitted in November 1992 for the storage of hazardous wastes in containers. DuPont submitted a RCRA Part B Permit Application for a Hazardous Waste Container Storage Area to the NCDEQ in May 1983. The State issued a Part B Permit for the Brevard facility on January 25, 1984 (Permit No. NCD003152329). The expiration date of the permit was January 25, 1994. The RCRA Part B Permit was renewed and became effective on August 8, 1996 and named DuPont and Sterling as co-owners of the permit. This permit identified CA activities to be completed as part of the permit guidelines along with schedules for the activities. DuPont submitted a RCRA Part B permit re-application for a Hazardous and Solid Waste Amendments (HSWA)-only permit on July 20, 2007. This permit became effective on August 31, 2008, was reissued on April 21, 2011, and will remain in effect until August 31, 2018 (NCDENR 2008a, 2011). Detailed descriptions of the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) identified in the permit are presented in the RIR (Parsons 2015b). Thirty-seven SWMUs and/or AOCs were identified at the site: SWMUs 1 through 20 and AOCs A through K. Locations of SWMUs and AOCs are presented on Figure 2-2.

2.3 Site Setting

2.3.1 Climate

The site is located in Transylvania County. Transylvania County has a moderate climate with a relatively-high average annual precipitation (64 inches). The warmest and coolest months of the year are July and

December, respectively. The average high and low temperatures during these months are 83 degrees Fahrenheit (°F) in July and 24 °F in December. The highest average precipitation amounts per month (6.4 inches) are in January and December.

2.3.2 Topography

The site is located on top of a granitic plateau, which generally slopes downward from northwest to southeast. Land elevations are higher along the northwest portion of the site near Lake DERA (over 2,600 feet above mean sea level [MSL]) than in other portions of the site. Elevations decrease to less than 2,525 feet above MSL eastward along Little River. Land along the river is reasonably-flat outwash with slopes significantly increasing on the land outside of the site boundary, east and south of the river.

2.3.3 Geology

Four northeast-trending geologic zones are in Transylvania County, each containing rocks of differing lithologies. The site is located in the most southeastern zone, where Whiteside Granite is the predominant rock type. In general, near surface site geology is overburden, residuum (saprolite and partially-weather rock), and bedrock (see Figure 2-3; Parsons 2009).

The site soil interval is from the ground surface to the top of the residuum unit. Overall, material across the site consists of silty sands and sandy silts with colors ranging from black or hydric in appearance, to tan, grayish, yellow-orange, and brown with intermixing and noted gradations. Overburden material on the site ranges from 0.25 feet thick to approximately 20 feet thick. Thick overbank deposits were found proximate to Little River and thin overbank deposits were found along topographic high regions of the site (Parsons 2009).

Saprolite (considered part of the residuum at the site) is weathered bedrock that is in-situ and maintains the mineral fabric of its parent material. Partially-weather rock is the same as unconsolidated saprolite, but contains more competent material (e.g., rock fragments). The thickness of the saprolite ranges from 4.5 feet to 26 feet across the site, with the greatest thickness being below the former manufacturing area.

The bedrock beneath the site is made up of phaneritic and aphanitic gneiss in the northern and southern portions of the site, respectively. Bedrock material near the northeast site boundary has higher quartz content and is very hard and competent. The minerals near the northeast site boundary are larger than those along the eastern and southern site boundaries, and there are several pockets of large potassium feldspar.

2.3.4 Hydrogeology

Groundwater in the Western Piedmont and Blue Ridge provinces occurs predominately in fractured bedrock. The crystalline nature of the granite and gneiss result in very low primary porosity. Groundwater flow direction and rate are governed by the orientation and size of fractures, faults, and foliation planes within the bedrock. Fracture openings are generally less than one percent of the rock volume and water-bearing fractures are uncommon at depths greater than 300 feet below surface (Parsons 2009).

Two aquifers have been identified and characterized at the site: Surficial and Bedrock. Generally, the Surficial Aquifer consists of subsurface overburden materials (soil) and residuum materials (unconsolidated saprolite and partially weathered rock) that overlay crystalline bedrock composed of granite and gneiss. The thickness of the Surficial Aquifer (overburden combined with the residuum) can be correlated to the relief of the underlying bedrock outcrop (Parsons 2009).

The only aquifer used or expected to be used as a source for drinking water at the site is the Bedrock Aquifer. The only active Bedrock Aquifer water supply wells (WSWs) are the DSRF Visitor Center WSW (WSW-DSF3) and the DuPont Visitor Center WSW (WSW-VISIT). Four other existing Bedrock Aquifer WSWs are inactive. The Surficial Aquifer is not currently used for drinking water purposes, nor is it expected to be used for drinking water purposes in the future (Parsons 2015b).

The overall flow direction across the site within the Surficial Aquifer is east/southeast toward the Little River and also appears to be radial from the bedrock mound beneath the SWMU 17 area. The overall flow direction across the site within the Bedrock Aquifer is toward the east/southeast (see Figure 2-4). Groundwater gradients generally follow bedrock topography. Horizontal gradients are the steepest in the areas where bedrock topography is the greatest, and are the lowest in areas where the topography begins to level off near Little River (Parsons 2009).

2.3.5 Surface Water

Lake DERA (elevation approximately 2,566 feet above MSL) is an approximately 19-acre man-made lake located in the northwest portion of the site (see Figure 2-1). The lake is fed by small creeks along its northwest corner, surface water runoff, and possibly by shallow groundwater flowing in from the north. Overflow from Lake DERA is channeled through DERA Creek and drains into the Little River, approximately 3,500 feet to the east-northeast. Lake DERA and DERA Creek are not used for water supply purposes (Parsons 2015b).

The Little River originates south of the site and flows northward along the south and east site boundary (see Figure 1-1). The river receives overflow from Lake Julia located southeast of the site boundary and runoff from surrounding highlands from the south. The Little River continues its northern run for six miles where it drains into the French Broad River (Parsons 2009).[4] The Little River is classified by NCDEQ as Class C fresh surface water (aquatic propagation and survival, fishing, wildlife, secondary recreation, and agricultural use). In addition, the Little River has a supplemental classification of Class TR (Trout Waters [intended to protect freshwaters for natural trout propagation and survival of stocked trout]; Parsons 2015b). The Little River is not used for water supply purposes (Parsons 2015b).

[4] Based on visual observations of aerial images of the site using Google Earth in 2012, as referenced in the RIR.

2.3.6 Site Ecological Setting

An ecological assessment was performed for the site in 2006 to identify significant natural environmental features. The key features identified in the report included the Lake DERA marsh, the Little River/Cedar Mountains, and two wetland communities (URS 2006). A second ecological assessment was performed for the site in 2011 to identify, evaluate, and document the presence of unique features and/or significant ecological resources (URS 2011). The conclusions from the assessments were that, aside from the former manufacturing area, the overall site resources, when considered collectively, represent a significant natural area that encompasses approximately 316 acres and supports high quality environments and diverse species. As identified by the NC Natural Heritage Program, rare and unique resources at the site are valuable as linkages with similar communities in the adjacent DSRF (Acidic Forest Cove) or represent unique patches of regionally- and nationally-rare habitats (e.g., Low Elevation Granitic Domes). These resources provide common and unique habitats for resident and migrant wildlife, including documented threatened and endangered species. Notable species and significant ecological communities (EcoCommunities) are presented in Figure 2-5.

Lake DERA features a silty bottom with limited submerged aquatic vegetation along its shallowest reaches. An assessment of Lake DERA was conducted by the NC Wildlife Resources Commission on August 10, 2010. The assessment consisted of a snorkel survey and use of an YSI® Pro20 to develop a temperature and dissolved oxygen profile of the lake. The snorkel survey revealed that the northern portion of the lake is shallow and contains some emergent vegetation which serves as habitat for young-of-the-year and adult littoral fish species. Overall, fish density and diversity were low; three fish species were observed: largemouth bass (Micropterus salmoides), bluegill (Lepomis macrochirus), and redbreast sunfish (Lepomis auritus). YSI® measurements confirmed that the relatively-shallow lake is fully mixed by wind and has adequate dissolved oxygen levels throughout the water column. Consequently, the ecological quality of Lake DERA is considered moderate due to limited aquatic vegetation and a low diversity of aquatic life (URS 2011).

DERA Creek flows from west to east (from Lake DERA to Little River) through the site, and has year-round flow. During the 2011 ecological assessment of the site, bluegill and bass were observed in the outfall pool, just east of the Lake DERA dam; however, sediments in this area were notably marked by iron flocculant (URS 2011). Swamp Forest-Bog and Acidic Cove Forest were found along the creek, limiting access.

2.4 RCRA Facility Investigation Summary

DuPont conducted the RCRA Facility Investigation (RFI) for the site in phases (see the in-text table below).

Year	Phase	Purpose	References
2003	I	▪ Characterize constituent concentrations in groundwater and surface water; ▪ Gain a better understanding of the geologic and hydrogeologic conditions at the site, and ▪ Address other objectives that were identified in the Current Conditions Report	DuPont Corporate Remediation Group (CRG) 2002, 2003
2004	II	▪ Investigate regulated units and former manufacturing areas; and ▪ Address site-wide groundwater monitoring data gaps	DuPont CRG 2004
2008 -2009	III	▪ Gain a better understanding of physical and chemical conditions at the site; and ▪ Determine if potential impacts to human health and the environment required remedial actions	DuPont CRG 2008; Parsons 2009
2015	RIR[5]	▪ Resolve any remaining data gaps after the Phase III evaluation	Parsons 2015b

The RIR marked the completion of the investigation phase of CAs. Information from the three phases and the RIR provided adequate information to support the RAP (Parsons 2015b). Approximately 1,100 samples were evaluated in the RIR and the locations of the samples are presented on Figure 2-6. The NCDEQ reviewed the RIR and provided comments regarding minor data gaps, which will be addressed during RAP implementation.

Other site investigation reports of note included:

- RCRA Facility Assessment (DuPont Environmental Remediation Services [DERS] 1996)
- Confirmatory Sampling Work Plan (DERS 1998)
- DuPont State Forest Service Visitor Center Interim Measures (DuPont CRG 2009)
- Environmental Indicator for corrective action “current human exposures under control” (Parsons 2012c)
- Environmental Indicator for “migration of contaminated groundwater under control" (Parsons 2012a)
- DuPont Brevard Ecological Inventory Summary Report (URS 2011)
- DuPont Facility Property: Significant Natural Features (DuPont 2006)

2.5 Releases from Historical Operations

Areas where constituents were potentially released to the environment from SWMUs and AOCs were investigated during the RFI process. In general, the SWMUs and AOCs with confirmed or potential

[5] To be consistent with Risk Bill terms, Phase IV results were documented in the RIR (rather than a Phase IV Soil RFI Report).

releases included former landfills/disposal areas and other locations within the former manufacturing area.

2.6 Completed Remedial Actions

Several remedial actions have been completed at the site and are summarized in the following subsections.

2.6.1 Plant Demolition and Removal Activities

Remedial actions were performed within the former manufacturing area during the demolition and removal of buildings and other infrastructure from 2002 to 2006, reducing potential future releases from these areas. Approximately 32,370 tons (75,530 cubic yards) of debris and other materials were removed from the site. Erosion and sediment controls were established at the beginning of the demolition effort and areas that were disturbed during demolition and removal activities were stabilized by hydro-seeding and broadcast seeding. Parking lots, concrete slabs, grass areas, and all gravel areas were graded to achieve positive drainage of surface water. Any disturbed or borrow areas used during demolition and removal activities were stabilized before the end of the project. The demolition and removal activities were performed by AGFA and overseen by DuPont, and were documented in maps, analytical data, before and after photographs, videos, and field notes, all of which are available at the site (DuPont CRG 2006). The major demolition and removal activities are summarized in this section and the former manufacturing area is presented on Figure 2-7.

2.6.1.1 Waste Removal

Special waste and other materials (including asbestos, lead-based paint, mercury switches, light ballasts [polychlorinated biphenyl (PCB) and non-PCB]), residual material in vessels, hydraulic fluids, gearbox oils, halon materials used for fire suppression, and batteries were removed from the site. All debris was segregated by material type (e.g., concrete, aluminum, copper, carbon steel, and stainless steel). Sorted metal debris was removed from the site and transported to a reclamation center. Other demolition debris was disposed off-site at a permitted facility (DuPont CRG 2006).

2.6.1.2 Sub-Structure Cleaning

To address potential future hazards during demolition and removal activities at sub-structures left on site (e.g., slabs). The slabs that were left in place were pressure washed at 3,000 pounds per square inch and scraped using hand tools, followed by a clean water rinse. Wash and rinse waters were collected and containerized and samples were collected and analyzed for constituents based on the type of former operation in the area. If sample results were within site-specific National Pollutant Discharge Elimination System (NPDES) limits, the water was discharged to the wastewater treatment plant (WWTP). If the sample results were above the NPDES limits, the water was transported off-site for disposal. Wash water sample results were compared to applicable screening criteria (e.g., drinking water and surface water regulatory standards) to determine if the cleaning operations had removed residual constituents from the slab. Slabs where the cleaning had generated wash and rinse water concentrations that exceeded regulatory requirements were washed and rinsed a second time and sampled/analyzed again. This process was repeated until the regulatory criteria were met or until it was decided that the slab should be properly removed and disposed. Approximately 16 slabs, pads, or foundations were completely removed from the site during these activities (DuPont CRG 2006). The foundations that remain in place are shown in Figure 2-7.

2.6.1.3 Site Sewer Cleaning and Closure

All site sewers were cleaned and closed during demolition and removal activities (see Figure 2-7; Parsons 2015b). The cleaning effort involved either washing using a 3,000-pound per square inch pressure washer or gravity flushing using a large volume of water. The resulting water, which was discharged to the WWTP, was sampled and analyzed for constituents based on the type of former operation in the area and all results were within site-specific NPDES limitations. Remote inspection was performed where possible on 30% of the total length of sewer pipe using an electric remote-control robot equipped with a camera. In all, 3,500 linear feet of sewer pipe, 1,500 linear feet of process sewer, and 2,000 linear feet of storm sewer were inspected and videotaped. None of the inspection reviews indicated significant accumulation of debris or stained pipes, which led to the approval of closure activities. Sewer and manhole closure involved either removing or abandoning the sewer pipe, or filling the pipe and manholes with an inert material. All other underground piping (e.g., water, gas, fire protection) was capped at grade and abandoned.

2.6.2 Closure of SWMU 11 and SWMU 12A-C

DuPont operated two permitted industrial solid waste landfills on site (SWMU 11 and 12A-C), both operating under NC Solid Waste Permit No. 88-06. The permit allowed for the disposal of production scrap (e.g., polyester film base), scrap metal, shop grindings and shavings, solid resin, and office refuse in the area designated as the North Landfill (SWMU 12A-C). Demolition waste was disposed of in the East Landfill (SWMU 11). DuPont closed the SWMU 12A-C in 1993 and received official approval of closure from NCDEQ on August 22, 1996 (DuPont CRG 2002). DuPont completed closure activities at SWMU 11 in late 1996 and received official closure notification from the NCDEQ on May 18, 2001. A cap/cover was installed on both SWMU 11 and SWMU 12A-C.

2.6.3 SWMU 11 CAMU and SWMU 14 Interim Remedial Measures

DuPont established a Corrective Action Management Unit (CAMU) at SWMU 11 subsequent to closure of SWMU 11 in the 1990s to act as the consolidation location for X-ray film (i.e., polyethylene terephthalate [PET]) that could not be recycled from SWMU 14. Nonhazardous, off-specification and process startup-waste PET film was deposited into SWMU 11 (the former East Landfill) and SWMU 14 (the Former West Landfill; see Figure 2-2). The SWMU 14 area was reclaimed and used as a ball field during DuPont ownership. The ball field had not been used since DuPont reacquired the site in 2006. DuPont submitted the SWMU 11 CAMU Application on April 20, 2010, and a revised application on October 29, 2010. NCDEQ approved the establishment of the CAMU in a modification to the RCRA Part

B permit on April 21, 2011. The SWMU 11 CAMU (the Former East Landfill) is a 13.5-acre unlined unit located on the southeast portion of the site (Figure 2-2). The SWMU 11 CAMU is currently covered by an approximately 1-2 foot thick soil cover. To meet the CAMU requirement for groundwater monitoring, an Interim CAMU Groundwater Monitoring Plan (GMP) was developed by Parsons in August 2010 and submitted as Attachment 6 to the CAMU Application (DuPont CRG 2010); this GMP plan will remain in effect until final closure of the unit.

An interim remedial measures (IRM) removal/consolidation effort at SWMU 14 and the SWMU 11 CAMU was performed from June 2011 to July 2012 in accordance with the Interim Measures Work Plan, which was approved in April 2011 (WRScompass 2011). Plastic materials from SWMUs 11 and 14 were removed, and where possible, the waste PET material was recycled. The remaining acceptable remediation waste material (RWM) from SWMU 14 was placed into the SWMU 11 CAMU. During the effort, approximately 9,771 in-place cubic yards of PET material from SWMU 11 and 6,140 in-place cubic yards of PET material from SWMU 14 were shipped off the site for recycling. Approximately 80,665 in-place cubic yards of acceptable RWM was removed from SWMU 14 and placed into the SWMU 11 CAMU. RWM was periodically sampled to document that the material being moved from SWMU 14 to SWMU 11 was non-hazardous. After excavation and hauling at SWMU 14, the disturbed areas were graded to match the surrounding contours and promote positive drainage using the remaining overburden, cover soil, and topsoil. Grading incorporated the existing installed downstream drainage features, rock check dams, and sediment traps. The area was final graded, hydro-seeded and mulched (WRScompass 2011). A small portion of SWMU 14 waste material remains near Staton Road as shown on Figure 2-2.

Excavation performed during the plastics removal provided an understanding of the contents and extents (lateral and vertical) of SWMU 11. Materials remaining in SWMU 11 have the visual and chemical waste characteristics indicative of solid, non-hazardous waste. An interim landfill cap was constructed over the SWMU 11 CAMU by the end of July 2012 according to the specifications detailed in the CAMU plan (Parsons 2012c).

2.6.4 Closure of SWMU 4

The 25-acre WWTP (SWMU 4) was closed during demolition and removal activities, and over 2,563 tons of biosolids were removed from the WWTP emergency spill, aeration, and settling basins using a barge-mounted diesel dredge. In addition, 1,085 tons of biosolids were removed from the diversion basin. All removed solids were filtered and disposed of off-site in a permitted landfill. Testing of residual solids and underlying soil did not indicate any potential future environmental concerns (DuPont CRG 2006). Approximately 60,000 cubic yards of soil was used to grade and cap the area to create proper drainage. Based on pre-closure sampling analysis, AGFA and DuPont determined that the biosolids in the Polishing Pond could remain in place. The Polishing Pond was drained and the sludge was dewatered and solidified. A non-woven, needle-punched geotextile fabric was installed over the solidified sludge. Three feet of cover soil was placed and compacted over the geotextile fabric and the area was reseeded to create a vegetative cover. The final grade of the polishing pond was constructed at a 1.2% slope to minimize accumulation of surface water (DuPont CRG 2006).

2.6.5 Installation of DSRF Visitor Center Water Treatment System

DuPont sampled the DSRF Visitors Center WSW in January 2007 upon receiving a notification for intended future use of the WSW by DSRF personnel. Only one constituent (trichloroethylene [TCE]) was detected at a concentration that exceeded the 15A NC Administrative Code (NCAC) 02L (NC2L) value. This exceedance led to the initiation and completion of additional investigation and remediation activities.

DuPont voluntarily designed a granular activated carbon (GAC) treatment system for the DSRF Visitor Center WSW as an IRM to ensure a safe water supply to DSRF Visitor Center workers and users. The system was installed in January 2009 and treatment system confirmation water samples were collected on a monthly basis for four months after the restrooms were opened to the public. The sampling frequency was reevaluated and adjusted accordingly. The current sampling program consists of changing the GAC filter annually and sampling treatment system water semiannually. The IRM report was submitted to NCDEQ in June 2009 (DuPont CRG 2009). Results of the ongoing semiannual monitoring program indicate that the GAC system is effectively removing volatile organic compounds (VOCs) in the groundwater used as a water supply for the DSRF Visitor Center. No VOCs were detected in any of the samples collected from the post-filtration (treated water) sampling locations (Parsons 2015a). In addition, no VOCs were detected in soil gas around the building indicating that there was no potential for VOCs in indoor or ambient air (Parsons 2009).

2.6.6 Installation of Historical Cap/Covers

As part of historical operations, cap/covers were also installed over the following former landfills/disposal areas when the areas were no longer used:

- SWMU 13
- SWMU 16
- SWMU 17
- SWMU 18A&B
- SWMU 20

The locations of these former SWMUs and AOCs with existing cap/covers are shown in Figure 2-8.

2.6.7 SWMUs and AOCs with No Further Action Needed

No further action is needed at the following SWMUs and AOCs in accordance with the 2011 NCDEQ Hazardous Waste Management Permit No. NCD003152329-R2 and SWMU/AOC-specific documentation (see Figure 2-9):

- SWMU 1
- SWMU 2A
- SWMU 2B

- SWMU 2C
- SWMU 3A
- SWMU 3B
- SWMU 3C
- SWMU 3D
- SWMU 3E
- SWMU 5
- SWMU 6
- SWMU 7
- SWMU 8
- SWMU 9
- SWMU 10
- SWMU 14
- SWMU 15
- SWMU 19
- AOC C
- AOC F

In addition, no further action is needed for the following AOCs based on the results of the RIR (Parsons 2015b):

- AOC B
- AOC D
- AOC E
- AOC G
- AOC H
- AOC I
- AOC J
- AOC K

2.7 Existing DuPont Remedial Action Commitments

2.7.1 Final Closure of SWMU 11

DuPont is committed to designing and installing a vegetative cap for SWMU 11 to complete SWMU 11 closure activities. SWMU 11 received a cap/cover when it was initially closed in 1996 (see Section 2.6.2). SWMU 11 subsequently received an interim CAMU cap/cover in 2012 (see Section 2.6.3). DuPont and NCDEQ have had numerous discussions regarding the establishment, operation, and final closure requirements for SWMU 11. Based on the nature of the waste in SWMU 11, NCDEQ has agreed that a low permeability cap is not required. Therefore, SWMU 11 will be covered with an alternative vegetative cap to perform the closure requirements. In addition, soil cover and sideslope grading will be performed to address waste materials protruding from the edge of the landfill (and to provide for long-term maintenance and additional protection from flood scour).

The goals for the SWMU 11 vegetative cap are to:

- Cover visible waste materials protruding from the edge of the landfill;
- Minimize long-term maintenance needs and expenses; and
- Provide adequate stormwater management and 100-year flood protection.

Additionally, the soil cover and sideslope regrading will:

- Eliminate the potential for exposure to unit wastes;
- Incorporate the existing soil cover and make use of on-property borrow soil, minimizing soil import needs;
- Provide slope stability and mitigate soil erosion; and
- Decrease infiltration to the waste.

The SWMU 11 design and implementation activities are discussed further in Section 7.

2.7.2 SWMU 17 IRM

DuPont is in the process of designing an in-situ solidification/stabilization (S/S) treatment action for soil and waste within SWMU 17. SWMU 17 (also known as the Former Power Hill Disposal Area) consists of five disposal areas that reportedly received the neutralized waste hydrofluoric acid used in the Silicon® product manufacturing process, along with other miscellaneous wastes. Records indicate that the unit was in operation from 1958 to 1977 (DuPont CRG 2003). Although it remains protective of public health, safety, and welfare and the environment, SWMU 17 has been identified for additional remedial action because of uncertainties about the nature and extent of the waste materials in the SWMU and because the unit appears to be impacting an off-property drinking water source (the DSRF Visitor Center where a GAC water treatment system was installed and is being monitored). In addition, completion of IRM activities will support anticipated future land use. An in-situ S/S treatability study will be conducted to evaluate the effectiveness of this technology to meet the following IRM goals and objectives.

2.7.2.1 SWMU 17 IRM Goals

The SWMU 17 IRM goals are as follows:

1. Remove and/or treat toxic or mobile materials with in-situ S/S by:
    a. Removing and disposing of waste materials that can be visually identified (e.g., sludges) and/or that could hinder the effectiveness of in-situ S/S (e.g., waste containers, rugs, other solid debris);
    b. Stabilizing the remaining waste material to reduce mobility; and
    c. Solidifying the remaining waste material to (1) create a physical barrier intended to prevent human and ecological contact with the material and (2) lowering the permeability to limit infiltration and leaching.

2. Reduce SWMU-related constituent concentrations in downgradient groundwater and reduce the operational time frame for the GAC treatment system at the DSRF Visitor Center WSW.

To meet the SWMU 17 IRM goals, DuPont will conduct the IRM in two stages; the activities of the second stage will build upon the results of the first stage. The activities that will be performed in the two IRM stages are listed below.

2.7.2.2 SWMU 17 IRM Stage 1 Goals

The Stage 1 investigation activities, which will be described in the work plan for the SWMU 17 IRM) were developed to meet the following goals:

1. Gather additional information about the SWMU contents, locations, and characteristics via test trenching. Gathering additional information will minimize uncertainties about the nature and extent of the SWMU including the location and volume of former waste trenches and SWMU materials, the physical nature of the materials (e.g., unbroken containers, rolled up carpet), and the migration potential of constituents from the SWMU due to the complex hydrogeology of the area.
2. Remove waste materials accessed during test trenching efforts. During test trenching, waste materials that can be visually identified and/or that could hinder potential in-situ activities will be removed to prepare the area for additional remedial actions, if necessary.
3. Determine the best approach for additional treatment of the SWMU, if any. Samples will be collected from the test trenching areas for baseline analysis and treatability studies.

2.7.2.3 SWMU 17 IRM Stage 2 Goals

Stage 2 implementation activities will build upon the results of the Stage 1 investigations. Implementation activities will be summarized in a work plan that will be developed once the results from the Stage 1 activities have been evaluated. The following preliminary goals have been developed for the Stage 2 of the IRM:

1. Conduct additional remediation (e.g., removal, in-situ S/S), as necessary; and
2. Continue to treat impacted groundwater at the DSRF Visitor Center with the GAC Treatment System.

2.7.3 Cap/Covers, O&Ms, and ICs for Former Landfills/Disposal Areas

DuPont is committed to conducting the following long-term actions associated with former landfills/disposal areas:

- Perform O&M activities (e.g., annual inspections of the cap/covers and repair/replacement of the cap/covers as necessary) for the cap/covers at SWMUs 4, 11, 12A-C, 13, 16, 17, 18A&B, and 20;
- Implement ICs to prohibit excavation at SWMUs 4, 11, 12A-C, 13, 14, 16, 17, 18A&B, and 20, and AOC F; and[6]

[6] Even though no further action is necessary for SWMU 14 and AOC F, DuPont has decided to implement this IC since waste material remains in these areas.

- Implement ICs to require that soil is sampled prior to any excavation activities within the former manufacturing area (which includes SWMU 15 and SWMU 19).[7]

2.8 Current Status of SWMUs and AOCs

Based on the completed remedial actions (see Section 2.6) and the existing DuPont remedial action commitments (see Section 2.7), further action is needed at 13 SWMUs and AOCs as summarized in the table below and Figure 2-9.

No Further Action Needed	Active Remediation	Perform O&M of Existing Cap/Cover	Implement ICs to Prohibit Excavation	Implement ICs to Require That Soil is Sampled Prior to Any Excavation Activities[9]	Further Action Needed
SWMU 1	SWMU 11	SWMU 4	SWMU 4	SWMU 15	AOC A (i.e., address the soil exceedance discussed in Section 4.1.1)
SWMU 2A	SWMU 17	SWMU 11	SWMU 11	SWMU 19	
SWMU 2B		SWMU 12A-C	SWMU 12A-C		
SWMU 2C		SWMU 13	SWMU 13		
SWMU 3A		SWMU 16	SWMU 14		
SWMU 3B		SWMU 17	SWMU 16		
SWMU 3C		SWMU 18A&B	SWMU 17		
SWMU 3D		SWMU 20	SWMU 18A&B		
SWMU 3E			SWMU 20		
SWMU 5			AOC F		
SWMU 6					
SWMU 7					
SWMU 8					
SWMU 9					
SWMU 10					
SWMU 14					
SWMU 15					
SWMU 19					
AOC B					
AOC C					
AOC D					
AOC E					
AOC F					
AOC G					
AOC H					
AOC I					
AOC J					
AOC K					

2.9 Current and Future Land Uses

The site is no longer used for manufacturing operations and the manufacturing infrastructure was dismantled during demolition and removal activities. Current use of the site is minimal. The only current site users are DSRF Visitor Center workers and visitors, security guards, and military personnel who use the site periodically for military training (e.g., flight landing practice). According to information provided by the State, the planned future land uses for the property after it is transferred to the State

[7] Even though no further action is necessary for SWMU 15, SWMU 19, and the former manufacturing area, DuPont has decided to implement this IC across the entire former manufacturing area (which encompasses the estimated locations of SWMU 15 and SWMU 19) since former process features and/or wastes could be present in this area.

include recreational uses consistent with NCDA&CS, NCNG, and DSRF staff land use plans, and NCNG military training (Parsons 2015b). Specifically, potential future uses at the site include:

- Forest trail use by DSRF users (e.g., hikers)
- Water recreational activities in Little River, Lake DERA, and DERA Creek by DSRF users
- Administrative facilities for DSRF staff
- Low impact military training by the NCNG
- Administrative facilities for NCNG staff
- Multiple uses (e.g., a driving course, large training exercises, equipment staging, and helibase functions) for the large parking lot near the former manufacturing area (see Figure 2-7)
- A managed recreation center at Lake DERA for Wounded Warrior REHAB (including primitive camping, water recreation, and designated fishing areas)

Based on the current and planned future land use for the site, the following potential receptors were identified to be representative of reasonable maximum exposure scenarios in the RIR:

- Current and Future DSRF User[8]
- Current and Future DSRF Visitor Center Worker (Indoor Worker)
- Future DSRF Worker
- Future NCNG Worker (Military Exercises and Training)
- Future Utility/Excavation Worker
- Current and Future Ecological Receptors

2.10 RIR Screening Conceptual Site Exposure Model (CSEM)

A CSEM is a visual representation of how exposure to constituents at a site could occur. It is used to integrate all available site information and identify how receptors may be exposed to constituents under current and plausible future land uses. A CSEM is a tool used to communicate potential exposures to constituents at a site based on sources of contamination, release mechanisms, exposure pathways, and receptors.

The CSEM for the site was presented in the RIR (Parsons 2015b). The RIR Screening CSEM was used to identify potentially-complete and complete exposure pathways for the site based on current and potential future land uses (see Figure 2-10). Since the RIR Screening CSEM was used for screening purposes (i.e., to identify conservative SLs and COPCs as summarized in section 2.11), it included future residents and future industrial workers even though these hypothetical receptors are not realistic receptors given the planned future land use. All complete and potentially-complete exposure pathways presented in the RIR Screening CSEM were considered in the identification of SLs and COPCs (Parsons 2015b).

[8] DSRF user includes forest trail users and water recreational users at Little River, Lake DERA, and DERA Creek. The only current DSRF user is a Little River recreational user since there is no current recreational use within the property boundary.

2.11 Screening Levels and COPCs

Conservative, pathway- and medium-specific SLs based on the potentially-complete and complete pathways were identified in the RIR Screening CSEM using the approach outlined in the following in-text table (Parsons 2015b).

Pathway	Media	Receptors Used to Develop SLs (1)
Surface and subsurface soil direct contact (via incidental ingestion, dermal contact, and inhalation of particulates) (2)	Soil	Future resident and future industrial worker
Soil-to-groundwater	Soil	Future resident
Vapor intrusion (VI)	Groundwater	Future resident and future industrial worker
Surficial Aquifer used as drinking water	Groundwater	Future resident
Bedrock Aquifer used as drinking water	Groundwater	Future resident
Surface water exposures (via incidental ingestion, dermal contact, and fish consumption)	Surface water	Current and future DSRF user and current and future ecological receptors
Sediment exposures (via incidental ingestion, dermal contact, and fish consumption)	Sediment	Current and future ecological receptors

Notes:
(1) These receptors were used for screening purposes since the exposure assumptions for these receptors are more conservative than the exposure assumptions for other potential receptors (e.g., the exposure assumptions for a default industrial worker are more conservative than exposure assumptions for other site-specific workers).
(2) Surface soil direct contact and subsurface soil direct contact pathways were combined in the development of SLs.

The pathway- and medium-specific SLs were used to identify pathway- and medium-specific COPCs in the RIR (Parsons 2015b). A constituent with a maximum concentration greater than the applicable SL was identified as a COPC for that pathway and medium. Table 2-1 lists the COPCs identified in the RIR by pathway and medium.

Appendix A provides additional details about the basis used to identify pathway- and medium-specific SLs in the RIR. Appendix A also summarizes the magnitude of constituent concentrations compared to pathway- and medium-specific SLs for all applicable COPCs.

The SLs and COPCs were used in this RAP to define areas where ICs and/or engineering controls (ECs) are needed in order to prevent unacceptable exposures for potentially-complete pathways.

2.12 RAP CSEM

Complete exposure pathways for the site based on current and planned future land uses were identified in the RAP CSEM (see Figure 2-11). In accordance with the Risk Bill, site-specific remediation standards can be based on current and planned future use of the site (i.e., site-specific remediation standards do not have to be based on exposure scenarios that are not applicable to a site). Therefore, the following complete exposure pathways identified in the RAP CSEM were used to develop the site-specific remediation standards for the site in accordance with the Risk Bill:

- Surface soil direct contact (via incidental ingestion, dermal contact, and inhalation) by a current and future DSRF user, future DSRF worker, future NCNG worker, and future utility/excavation worker.
- Subsurface soil direct contact (via incidental ingestion, dermal contact, and inhalation) by a future utility/excavation worker.

- Bedrock Aquifer used as drinking water by a current and future DSRF Visitor Center worker.
- Surface water exposures (via incidental ingestion, dermal contact, and fish consumption) by a current and future DSRF user and current and future ecological receptors.
- Sediment exposures (via incidental ingestion, dermal contact, and fish consumption) by current and future ecological receptors.

In addition, the following potentially-complete exposure pathways identified in the RAP CSEM were used to identify additional IC/EC needs for the site in accordance with the Risk Bill:

- Surface and subsurface soil direct contact (via incidental ingestion, dermal contact, and inhalation) by a future resident and future industrial worker. This is not a complete exposure pathway because these hypothetical receptors are not realistic given the planned future land use
- VI exposures (via inhalation of indoor air) by a current and future DSRF Visitor Center worker, future DSRF worker, future NCNG worker, future resident, and future industrial worker. This is not a complete exposure pathway because no VOCs have been detected in soil gas around the building indicating that there was no potential for VOCs in indoor or ambient air and because ICs/ECs will be implemented to characterize and mitigate the potential VI pathway as necessary within the portion of the site where VOCs in the Surficial Aquifer could be present
- Surficial Aquifer used as drinking water by a current and future DSRF user, current and future DSRF Visitor Center worker, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker. This is not a complete exposure pathway because it is not currently used for drinking water purposes and because ICs will be implemented to preclude future use for drinking water purposes. .
- Bedrock Aquifer used as drinking water by a current and future DSRF user, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker. This is not a complete exposure pathway because ICs will be implemented to require that all new or existing Bedrock Aquifer WSWs are sampled prior to being put into service in order to address the potential exposures associated with Bedrock Aquifer used as drinking water.

SECTION 3: SITE-SPECIFIC REMEDIATION STANDARDS

The remedial action objectives and site-specific remediation standards for the RAP are presented in this section. These site-specific remediation standards are based on site-specific RLs that were presented in the RIR and points of compliance (POCs) that were developed based on the five complete exposure pathways identified in the RAP CSEM.

3.1 Remedial Action Objectives

Based on the complete and potentially-complete exposure pathways identified in the RAP CSEM, the remedial action objectives (RAOs) for the RAP are to protect public health, safety, and welfare, and the environment by:

- Completing the existing DuPont remedial action commitments outlined in Section 2.7.
- Eliminating unacceptable exposures associated with the following complete exposure pathways:
  - Surface soil direct contact by a current and future DSRF user, future DSRF worker, future NCNG worker, and future utility/excavation worker
  - Subsurface soil direct contact by a future utility/excavation worker
  - Bedrock Aquifer used as drinking water by a current and future DSRF Visitor Center worker
  - Surface water exposures by a current and future DSRF user and current and future ecological receptors
  - Sediment exposures by current and future ecological receptors
- Implementing ICs/ECs to ensure potential exposures associated with following potentially-complete pathways do not occur:
  - Surface and subsurface soil direct contact by a future resident and future industrial worker
  - VI exposures by a current and future DSRF Visitor Center worker, future DSRF worker, future NCNG worker, future resident, and future industrial worker
  - Surficial Aquifer used as drinking water by a current and future DSRF user, current and future DSRF Visitor Center worker, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker
  - Bedrock Aquifer used as drinking water by a current and future DSRF user, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker

3.2 Site-Specific RLs

Site-specific RLs were developed for the complete exposure pathways identified in the RAP CSEM (see Figure 2-11 and Section 2.12 of this RAP). The RLs were based on the NCDA&CS's, DSRF's, and NCNG's proposed future uses for the site and the document *Establishing Remediation Goals for the DuPont Brevard Facility* (URS 2014) and NCDEQ's *Guidelines for Establishing Remediation Goals at RCRA Hazardous Waste Sites* (NCDENR 2013).

The site-specific RLs were developed using the same methodology NCDEQ uses for risk assessment; however, the RLs were also based on the actual planned future uses for the site, as proposed by the DSRF and the NCNG (Parsons 2015b).[9] Site-specific RLs were identified for the following five complete exposure pathways:

- Surface soil direct contact by a current and future DSRF user, future DSRF worker, future NCNG worker, and future utility/excavation worker
- Subsurface soil direct contact by a future utility/excavation worker
- Bedrock aquifer used as drinking water by a current and future DSRF Visitor Center worker
- Surface water exposures by a current and future DSRF user and current and future ecological receptors
- Sediment exposures by current and future ecological receptors

Consistent with the NCGS § 130A-310.68 (a)(3), pathway- and medium-specific RLs were developed based on the complete exposure pathways using the approach outlined in the following table.

Pathway	Media	Receptors Used to Develop RLs	Basis for RL
Surface soil direct contact	Soil	Current and future DSRF user, future DSRF worker, future NCNG worker, and future utility/excavation worker[10]	Most stringent of RLs calculated for DSRF user, DSRF worker, NCNG worker, and utility/excavation worker. In addition, the cumulative cancer risk cannot exceed 1E-04 consistent with NCGS § 130A-310.68 (b)(9) and the cumulative noncancer hazard index (HI) for each endpoint cannot exceed 1 consistent with NCGS § 130A-310.68 (b)(10).
Subsurface soil direct contact	Soil	Future utility/excavation worker[10]	RLs were calculated for utility/excavation worker. In addition, the cumulative cancer risk cannot exceed 1E-04 consistent with NCGS § 130A-310.68 (b)(9) and the cumulative noncancer HI for each endpoint cannot exceed 1 consistent with NCGS § 130A-310.68 (b)(10).
Bedrock Aquifer used as drinking water	Groundwater	Current and future DSRF Visitor Center Worker	Most stringent of NC2L values and NC Interim Maximum Allowable Concentrations.
Surface water exposures	Surface water	Current and future DSRF user and current and future ecological receptors	Most stringent of 15A NCAC 02B (NC2B) values for freshwater organisms (chronic), trout waters (organism only), and human health (fish consumption). If NC2B values were not available for a COPC, the National Recommended Water Quality Criterion was used (USEPA 2014).
Sediment exposures	Sediment	Current and future ecological receptors	Most stringent of Inactive Hazardous Site Branch Preliminary Soil Remediation Goals for unrestricted land use and ecological screening values including ecological sediment benchmarks from the USEPA and other sources (Parsons 2015b).

[9] Risk assessment is a process that is used to characterize the nature and magnitude of health risks to humans and ecological receptors from constituents that may be present in the environment. NCDEQ has used risk assessment methodologies to identify acceptable constituent concentrations in soil and groundwater for either future residential or industrial land use exposure scenarios.

[10] Current soil concentrations are protective of groundwater. The soil-to-groundwater-to-surface water pathway was not included in the RL determination because it was eliminated from further consideration in the RIR based on site-specific soil-to-groundwater-to-surface water criteria as well as groundwater, pore water and surface water sampling results.

3.3 Points of Compliance

The POCs associated with the pathway- and medium-specific RLs are defined in the following table:

Pathway	Media	POC Location(s)
Surface soil direct contact	Soil	0 – 2 feet below ground surface (ft bgs)
Subsurface soil direct contact	Soil	2 – 15 ft bgs
Bedrock Aquifer used as drinking water	Groundwater	Existing and future Bedrock Aquifer WSWs
Surface water exposures	Surface water	Little River, Lake DERA, DERA Creek, and site surface waters that flow into Little River, Lake DERA, and DERA Creek
Sediment exposures	Sediment	Sediment in the biologically-active zone of Little River, Lake DERA, DERA Creek, and site surface waters that flow into Little River, Lake DERA, and DERA Creek

These POCs are based on the locations where potential receptors associated with complete pathway could be exposed based on current and planned future land use. Empirical surface water and sediment data will be used to evaluate whether or not remedial actions are necessary to address constituents in site soil and groundwater.

SECTION 4: IDENTIFICATION OF AREAS NEEDING FURTHER ACTION

The purpose of this section is to:

- Identify areas that may need remedial action based on site-specific remediation standard exceedances; and
- Identify ICs/ECs required by the Risk Bill for potentially-complete exposure pathways.

4.1 Summary of Site-Specific Remediation Standard Exceedances

To determine if any additional site areas need remedial actions, COPC concentrations were compared to the site-specific remediation standards (i.e., RLs and POCs) for the five complete exposure pathways for the site (see Section 3). The complete exposure pathways were presented in the RAP CSEM (see Figure 2-11) and the RIR (Parsons 2015b).

4.1.1 Surface Soil Direct Contact Pathway

Maximum detected surface soil[11] COPC concentrations were compared to the most stringent RLs for the surface soil direct contact pathway. COPC concentrations were above the RLs at only five sample locations (see Figure 4-1). The RL exceedances at these five locations were due to 3-methylcholanthrene and the following polycyclic aromatic hydrocarbon (PAHs): 7,12-dimethylbenz(a)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene (see Table 4-1). The two highest cumulative exceedances at the five sample locations were in the Incremental Sampling Methodology (ISM) sample at Decision Unit 6 (DU-6ISM) and AOC A (AOCA-SS-6).

If remedial actions are taken to address the exceedances in ISM Decision Unit 6 and AOC A, the potential risks associated with site surface soil will be significantly reduced. Since it is unlikely that potential receptors would spend all of their time at one location on the site, the average[12] surface soil concentrations for 3-methylcholanthrene and the PAHs were calculated after eliminating the DU-6ISM and AOCA-SS-6 samples to determine if the three other samples with RL exceedances posed an unacceptable risk at the site. This approach (averaging the concentrations at locations across the site) is appropriate since potential receptors will be exposed to soil across the entire site. The average site surface soil concentrations when samples DU-6ISM and AOCA-SS-6 were excluded from the data set were less than the RLs. Therefore, remedial action will be conducted to address RL exceedances in ISM Decision Unit 6 and AOC A only. The surface soil direct contact pathway may need to be re-evaluated if additional surface soil samples are collected in the future.

[11] For the purpose of this report, soil refers to soil and waste samples.

[12] See Appendix B.

4.1.2 Subsurface Soil Direct Contact Pathway

Maximum detected subsurface soil COPC concentrations were compared to the most stringent RLs for the subsurface soil direct contact pathway. COPC concentrations were below the RLs at all sample locations (see Figure 4-2). Therefore, no additional action is needed to address the subsurface soil direct contact pathway. The subsurface soil direct contact pathway may need to be re-evaluated if additional subsurface soil samples are collected in the future (e.g., samples collected during the SWMU 17 IRM).

4.1.3 Bedrock Aquifer Used as Drinking Water Pathway

Maximum detected groundwater COPC concentrations in existing Bedrock Aquifer WSWs were compared to the most stringent RLs for the Bedrock Aquifer used as drinking water pathway (see Figure 4-3). COPC concentrations at the majority of the POC sample locations (i.e., existing WSWs) were less than the RLs. DSRF Visitor Center WSW (WSW-DSF3) is the only WSW that had a site-related COPC concentration (TCE) greater than an RL (see Figure 4-3 and Table 4-1). Although iron and/or manganese exceeded RLs in WSW-CMPGND, WSW-GUARD, and WSW-WWT, and vanadium exceeded the RL in WSW-CMPGND, these constituents are not site related. Iron, manganese, and vanadium are naturally-occurring constituents that are not associated with any former manufacturing process. In addition, WSW-CMPGND (where the vanadium RL exceedance was detected) is located upgradient of the former manufacturing areas and former landfills/disposal areas (see Figure 2-4). As a result, remedial action to address a DuPont release is not necessary for the iron, manganese, and vanadium RL exceedances. However, the State will still need to comply with NC's implementation of Safe Drinking Water Act requirements as appropriate (e.g., comply with NC2L values).

Due to the TCE RL exceedance in the DSRF Visitor Center WSW, ongoing O&M of the DSRF Visitor Center WSW existing treatment system is needed to ensure ongoing protection of DSRF Visitor Center workers and users. Even though no other site-related RL exceedances were identified, DuPont will also implement ICs to require that all new or existing Bedrock Aquifer WSWs are sampled prior to being put into service.

4.1.4 Surface Water Exposures Pathway

Maximum detected surface water COPC concentrations at the surface water POCs were compared to the most stringent RLs for the surface water exposures pathway (see Figure 4-4). COPC concentrations at the majority of the POC sample locations were less than the RLs. The only POC location that had a site-related COPC concentration (vinyl chloride) greater than an RL was a seep (SW-26) that flows into the Little River (see Figure 4-4 and Table 4-1). However, the vinyl chloride RL was based on fish consumption and the vinyl chloride concentration in SW-26 was less than the most stringent ecological criterion. It is unlikely that this seep would ever be used for recreational fishing purposes because it does not have the habitat to support fish. Therefore, the assumptions upon which the RLs are based (i.e., DSRF users will routinely consume fish containing vinyl chloride) are not valid for this seep. Since the vinyl chloride RL exceedance in SW-26 will not cause an unacceptable exposure for ecological or human receptors (and the downstream Little River is not impacted by vinyl chloride), remedial action is not necessary at this location. However, per NCDEQ's request, DuPont will collect sediment and surface water samples from the SW-26 seep to further characterize vinyl chloride concentrations. The only other COPC concentrations that exceeded RLs were iron and/or manganese, which are not site-related COPCs (see Figure 4-4 and Table 4-1). Iron and manganese are naturally-occurring constituents that are not associated with any former manufacturing process. As a result, remedial action is not necessary for the iron and manganese RL exceedances.

4.1.5 Sediment Exposures Pathway

Maximum detected sediment COPC concentrations at the sediment POCs were compared to the most stringent RLs for the sediment exposures pathway (see Figure 4-5). COPC concentrations at the majority of the POC sample locations were less than the RLs. A Lake DERA sample (SED-28) and a DERA Creek sample (SED-09) were the only sample locations with potentially site-related COPC concentrations (PAHs) greater than RLs (see Figure 4-5). The RL exceedances at these two locations were due to 12 PAHs (see Table 4-1). In response to an NCDEQ comment on the RIR, DuPont has agreed to collect additional Lake DERA and DERA Creek sediment samples to further evaluate these PAH RL exceedances and determine whether or not remedial action is needed.[13]

Although iron and/or manganese concentrations exceeded RLs in sample locations SED-10 and SED-26, and lead and selenium concentrations exceeded RLs in sample location SED-33 (see Figure 4-5 and Table 4-1), these detections are not site related. Iron, manganese, lead, and selenium are naturally-occurring constituents that are not associated with any former manufacturing process. In addition, sample location SED-33 (where the lead and selenium RL exceedances were detected) is located upgradient of the former manufacturing areas and former landfills/disposal areas (see Figure 2-4). As a result, remedial action to address a DuPont release is not necessary for iron, manganese, lead, and selenium RL exceedances.

4.1.6 Constituents of Concern

The pathway- and medium-specific COPCs identified in the RIR were identified as constituents of concern (COCs) for a pathway/medium if all of the following criteria were met:

- The COPC was associated with a complete exposure pathway (i.e., surface soil direct contact, subsurface soil direct contact, Bedrock Aquifer used as drinking water, surface water exposures, and/or sediment exposures)
- The maximum COPC concentration at a POC location exceeded an RL
- The COPC was site-related (i.e., some metals are not site-related)

Based on these three criteria, the following COPCs were identified as COCs (see Table 4-2):

[13] DuPont will also collect co-located surface water samples as part of the sediment sampling. In addition, DuPont will collect sediment and surface water samples from the SW-26 seep per NCDEQ's request.

Pathway	Media	COCs
Surface soil direct contact	Soil	3-Methylcholanthrene 7,12-Dimethylbenz(a)anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Dibenz(a,h)anthracene
Subsurface soil direct contact	Soil	None
Bedrock Aquifer used as drinking water	Groundwater	TCE
Surface water exposures	Surface water	Vinyl chloride
Sediment exposures	Sediment	To be determined after additional sediment sampling [(1)]

Notes:

[(1)] Potential COCs based on existing data are anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

4.2 ICs/ECs Needed for Potentially-Complete Exposure Pathways

In accordance with the Risk Bill, ICs/ECs need to be implemented for potentially-complete exposure pathways to prevent unacceptable exposures that could occur if the site land use was to drastically change in the future (which is not expected for this site). The potentially-complete exposure pathways for the site include:

- Surface and subsurface soil direct contact by a future resident and future industrial worker
- VI exposures by a current and future DSRF Visitor Center worker, future DSRF worker, future NCNG worker, future resident, and future industrial worker
- Surficial Aquifer used as drinking water by a current and future DSRF user, current and future DSRF Visitor Center worker, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker
- Bedrock Aquifer used as drinking water by a current and future DSRF user, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker

Thus, the following ICs/ECs will need to be implemented to address the potentially-complete exposure pathways that were not already addressed by actions presented in Section 4.1:

- ICs to prohibit residential land use
- ICs to prohibit industrial land use
- ICs/ECs to characterize and mitigate the potential VI pathway as necessary
- ICs to prohibit extraction of Shallow Aquifer groundwater for use as drinking water[14]

[14] As discussed in Section 4.1.3, DuPont will implement ICs to require that all new or existing Bedrock Aquifer WSWs are sampled prior to being put into service in order to address potential exposures associated with Bedrock Aquifer used as drinking water by a current and future DSRF user, future DSRF worker, future NCNG worker, future utility/excavation worker, future resident, and future industrial worker.

SECTION 5: CONCEPTUAL OVERVIEW OF THE REMEDIAL ACTIONS

The purpose of this section is to provide a conceptual overview of the proposed remedial actions so that they can be evaluated against Risk Bill criteria in Section 6 to ensure the proposed remedial actions are appropriate. Details about how the proposed remedial actions will be implemented are presented in Section 7.

The following remedial actions are proposed to meet the existing DuPont remedial action commitments presented in Section 2.7, satisfy the RAOs presented in Section 3.1 and address the areas needing further action identified in Section 4:

- Complete active remediation at SWMU 11 and SWMU 17 (see Figure 5-1).
  - Design and install a vegetative cap for final closure of SWMU 11; and
  - Design and perform in-situ S/S for soil and waste within SWMU 17. An auger system or injection/mixing head on an excavator will likely be used to apply a S/S agent (e.g., Portland cement) to the soil/waste. A treatability study is being conducted to evaluate the effectiveness and implementability of in-situ S/S for SWMU 17.
- Perform O&M of existing cap/covers at SWMUs 4, 11, 12A-C, 13, 16, 17, 18A&B, and 20 (see Figure 5-2). O&M activities will include annual inspections of the cap/covers and repair/replacement of the cap/covers as necessary if the cap/covers are damaged or disturbed.
- Implement ICs to prohibit excavation at SWMUs 4, 11, 12A-C, 13, 14, 16, 17, 18A&B, and 20, and AOC F (see Figure 5-3). The purpose of the ICs is to ensure the cap/covers are not disturbed in the future.
- Implement ICs to require that soil is sampled prior to any excavation activities within the former manufacturing area (see Figure 5-3). The purpose of the ICs is to ensure that appropriate measures are taken to manage excavated material as necessary based on an evaluation of the pre-excavation sample results.
- Install and maintain access-control fencing around ISM Decision Unit 6 and the portion of AOC A with the exceedance. The purpose of fencing these areas is to prevent surface soil direct contact exposures associated with RL exceedances (see Figure 5-4).
- Perform O&M of the existing GAC treatment system on the DSRF Visitor Center WSW until TCE and any degradation byproducts are less than RLs (see Figure 5-5). O&M activities will include periodic replacement of the GAC, collection of samples from the WSW semiannually, and repair/replacement of the GAC treatment system as necessary.
- Implement ICs to require that any new or existing Bedrock Aquifer WSW is sampled prior to putting the WSW into service (see Figure 5-5). The purpose of the ICs is to ensure that the water quality in the WSW is acceptable for the intended use in accordance with NC's implementation of Safe Drinking Water Act requirements.
- Collect additional sediment and surface water samples in Lake DERA, DERA Creek, and the SW-26 seep to further evaluate whether or not remedial action is needed to address PAHs (see Figure 5-6).

- Implement ICs within the site boundary to prohibit (1) residential land use, (2) industrial land use, and (3) extraction of Shallow Aquifer groundwater to use as drinking water (see Figure 5-7). The purpose of the ICs is to prevent unacceptable exposures if land use or groundwater use were to drastically change in the future (which is not expected). These ICs will address the potentially-complete exposure pathways discussed in Section 2.12.
- Implement ICs/ECs to characterize and mitigate the potential VI pathway as necessary within the portion of the site where VOCs in the Surficial Aquifer could be present (see Figure 5-7). The purpose of the ICs/ECs is to ensure that there are no unacceptable VI exposures for routinely occupied buildings constructed in the future. These ICs will address the potentially-complete exposure pathways discussed in Section 2.12.

The proposed remedial actions can be implemented in a relatively short time frame (e.g., two to three years following RAP approval). ECs and health and safety measures will be utilized to minimize potential risks to workers, the surrounding community, and ecological receptors as appropriate during implementation of the remedial actions.

SECTION 6: EVALUATION OF THE REMEDIAL ACTIONS

In accordance with NCGS § 130A-310.69(c), the remedial actions identified in Section 5 were evaluated based on the following factors:

- Long-Term Risks and Effectiveness;
- Toxicity, Mobility, and Volume of Contaminants;
- Short-Term Risks and Effectiveness; and
- The Ease/Difficulty of Implementing the RAP.

6.1 Long-Term Risks and Effectiveness

The long-term risks and effectiveness associated with the proposed remedial actions were evaluated and summarized in the following table using the five sub-factors listed in NCGS § 130A-310.69(c)(1).

Factor	**Evaluation**
The magnitude of risks remaining after completion of the remediation	The magnitude of potential risks remaining after implementation of the proposed remedial actions is minimal. As discussed in Section 4.1, there are few exceedances of site-specific remediation standards prior to implementation of the proposed remedial actions. The few exceedances that will remain will be controlled with long-term actions including cap/covers, O&M activities, and ICs/ECs.
The type, degree, frequency, and duration of any post-remediation activity that may be required, including, but not limited to, O&M, monitoring, inspection, reports, and other activities necessary to protect public health, safety, and welfare and the environment	Long-term activities such as O&M, inspections, potential repair/replacement, ICs/ECs, and reporting are anticipated. However, the degree of the long-term activities is not expected to be onerous. The few long-term activities are not complicated and can be easily implemented. Even if there was a temporary failure with one or more of the long-term activities, there would be minimal impact on the potential risk posed by the site or the effectiveness of the proposed remedial actions given the limited potential risk posed by the site.
The potential for exposure of human and environmental receptors to constituents remaining at the site	The potential for exposure of human and ecological receptors to COCs that will remain at the site is minimal. As discussed in Section 4.1, there are few exceedances of site-specific remediation standards prior to implementation of the proposed remedial actions. The few exceedances that will remain will be controlled with a variety of long-term actions including cap/covers, O&M activities, and ICs/ECs.
The long-term reliability of any engineering and voluntary institutional controls, including repair, maintenance, or replacement of components	Long-term activities such as O&M, inspections, potential repair/replacement, ICs/ECs, and reporting are anticipated to occur. These activities rely on relatively simple and easy to implement technologies that have been proven to be reliable at other sites.
The time required to achieve remediation standards	Site-specific remediation standards can be achieved in a relatively short time frame (e.g., two to three years following RAP approval).

6.2 Reduction in Toxicity, Mobility, and Volume of Contaminants

The reduction in toxicity, mobility, and volume of contaminants associated with the proposed remedial actions was evaluated and summarized in the following table using the three sub-factors listed in NCGS § 130A-310.69(c)(2).

Factor	Evaluation
The amount of contaminants that will be removed, contained, treated, or destroyed	A significant amount of contaminants and waste material have been and/or will be removed, contained, and treated. For instance, approximately 75,000 cubic yards of debris and other waste materials were removed and disposed of off-site during the plant demolition and removal activities. Approximately 15,000 cubic yards of PET was removed and recycled off-site during the 2011 to 2012 SWMU 14 IRM and Interim Closure of the SWMU 11 CAMU. Cap/covers have been installed over SWMUs 4, 11, 12A-C, 13, 16, 17, 18A&B, and 20. Treatment of VOCs (e.g., TCE) with the GAC system at the DSRF Visitor Center WSW is ongoing. SWMU 11 will receive additional containment (i.e., vegetative cap) and SWMU 17 will be treated with in-situ S/S during implementation of the proposed remedial actions.
The degree of the expected reduction in toxicity, mobility, and volume	The completed and/or proposed removal, containment, and treatment actions described above have significantly reduced and/or will significantly reduce the mobility and volume of COCs and waste material.
The type, quantity, toxicity, and mobility of contaminants that will remain after implementation of the RAP	COCs and waste material will remain after implementation of the proposed remedial actions. However, further reduction of the toxicity, mobility, and/or volume of COCs and waste material beyond the proposed remedial actions is not warranted given (1) the degree of completed and/or proposed removal, containment, and treatment actions described above, (2) the waste materials from former landfills/disposal areas that were generally inert and non-toxic, (3) the few remaining COCs at the site, and (4) the limited impacts associated with the remaining COCs.

6.3 Short-Term Risks and Effectiveness

The short-term risks and effectiveness associated with the proposed remedial actions were evaluated and summarized in the following table using the two sub-factors listed in NCGS § 130A-310.69(c)(3).

Factor	Evaluation
Short-term risks that may be posed to the community, workers, or the environment during implementation of the RAP	Short-term risks that may be posed to the community, workers, and the environment during implementation of the RAP are minimal. As discussed in Section 4.1, there were few exceedances of site-specific remediation standards prior to implementation of the proposed remedial actions. In other words, the potential risks associated with COCs and waste material remaining at the site is minimal. Nonetheless, ECs and health and safety measures will be utilized during the implementation of the proposed remedial actions to further reduce potential short-term risks.
The effectiveness and reliability of protective measures to address short-term risks	ECs and health and safety measures are relatively simple and easy-to-implement technologies have been proven to be reliable at other sites.

6.4 Ease or Difficulty of Implementation

The ease or difficulty of implementation associated with the proposed remedial actions was evaluated and summarized in the following table using the five sub-factors listed in NCGS § 130A-310.69(c)(4).

Factor	Evaluation
Commercially-available remedial measures	The proposed remedial actions rely upon relatively small amounts equipment, materials, and supplies. The equipment, materials, and supplies that will be needed are readily available.
The expected operational reliability	The expected operational reliability is high because the proposed remedial actions rely upon relatively simple and easy-to-implement technologies that have been proven to be reliable at other sites.
Available capacity and location of needed treatment, storage, and disposal services for wastes	Little to no waste will be generated by the proposed remedial actions. If waste is generated, DuPont-approved disposal facilities have availability to accept the waste.
The time to initiate remediation	All of the proposed remedial actions will likely be initiated within one year of RAP approval, if not sooner.
The approvals necessary to implement the remediation	Following RAP approval, permits (e.g., local grading permit, coverage under a general NPDES stormwater permit) will likely be required for some of the proposed remedial actions (e.g., work at SWMU 11 and SWMU 17). Obtaining these permits is expected to be relatively easy.

6.5 NCDEQ Approval Criteria

NCGS § 130A-310.71(a) identifies 10 approval criteria that must be met for NCDEQ to approve the RAP. The RIR and RAP address all 10 criteria as summarized in the following table.

NCDEQ Approval Criteria	Content in RIR and RAP
Determine whether site-specific remediation standards are appropriate for a particular contaminated site. In making this determination, the Department shall consider proximity of the contamination to water supply wells or other receptors; current and probable future reliance on the groundwater as a water supply; current and anticipated future land use; environmental impacts; and the feasibility of remediation to unrestricted use standards.	Future land uses for the site are clear and future property owners have been engaged in the RAP process. Site-specific remediation standards were developed based on input from the NCDA&CS, DSRF, and NCNG in collaboration with NCDEQ and site impacts are minimal (see Section 4.1). The only WSW with a COC RL exceedance has a GAC treatment system to remove the COC. Other on-site WSWs are not currently being used and COCs were not identified at these WSWs.
Determine whether the party conducting the remediation has adequately demonstrated through modeling or other scientific means acceptable to the Department that no contamination will migrate to adjacent property at levels above unrestricted use standards, except as may remain pursuant to a cleanup conducted pursuant to G.S. 130A-310.73A(a)(2).	Once the remaining DuPont-owned property is transferred to the State, the State will own a contiguous area of land that is significantly larger than the site boundary depicted in this RAP. Although there are groundwater impacts relatively near the site boundary depicted in this RAP (e.g., TCE impacts in the DSRF Visitor Center WSW), these impacts will not affect adjacent properties once the remaining DuPont-owned property becomes integrated with the surrounding State land.
Determine whether the proposed remedial action plan meets the requirements of G.S. 130A-310.69.	An RIR was submitted to NCDEQ pursuant to NCGS § 130A-310.69(a). This RAP includes all of the components listed in NCGS § 130A-310.69(b). Sections 6.1 through 6.4 of this plan provide an evaluation of the factors in NCGS § 130A-310.69(c).
Determine whether the proposed remedial action plan meets the requirements of any other applicable remediation program except those pertaining to remediation standards.	Implementation of the RAP will result in conditions at the site that are protective and will fulfill the RCRA CA requirements for the site.
Establish the acceptable level or range of levels of risk to public health, safety, and welfare and to the environment.	Site-specific RLs were established in this RAP consistent with NCGS § 130A-310.68(b).
Establish, for each contaminant, the maximum allowable quantity, concentration, range, or other measures of contamination that will remain at the contaminated Site at the conclusion of the contaminant-reduction phase of the remediation.	Table 4-2 of this RAP presents the typical COPC concentrations that exceed RLs and the concentrations expected to remain at the site following implementation of the proposed remedial actions. To the extent practicable, the RAP Completion Report will document residual COC concentrations remaining after the proposed remedial actions are implemented.
Consider the technical performance, effectiveness, and reliability of the proposed remedial action plan in attaining and maintaining compliance with applicable remediation standards.	A summary of the technical performance, effectiveness, and reliability evaluation for the proposed remedial actions is presented in Sections 6.1 through 6.4 of this RAP.
Consider the ability of the person who proposes to remediate the Site to implement the proposed remedial action plan within a reasonable time and without jeopardizing public health, safety, or welfare or the environment.	DuPont can implement the proposed remedial actions within a reasonable time frame (e.g., two to three years following RAP approval) while protecting public health, safety, and welfare and the environment.
Determine whether the proposed remedial action plan adequately provides for the imposition and maintenance of engineering and institutional controls and for sampling, monitoring, and reporting requirements necessary to protect public health, safety, and welfare and the environment. In making this determination, the Department may consider, in lieu of land-use restrictions authorized under G.S. 130A-310.69, reliance on other State or local land-use controls. Any land-use controls implemented shall adequately protect public health, safety, and welfare and the environment, and provide adequate notice to current and future property owners of any residual contamination and the land-use controls in place.	This RAP provides for the implementation and maintenance of ICs and ECs, sampling, and monitoring as summarized in Section 7. The ICs and ECS were designed to protect public health, safety, and welfare and the environment. Proposed land use controls are based on future land use. Current (DuPont) and future (State) property owners have been actively engaged in developing the ICs and ECs.
Approve the circumstances under which no further remediation is required.	A no further action determination is not anticipated for this site given the nature and duration of long-term activities (e.g., O&M and ICs/ECs).

6.6 Conclusions

As summarized in Sections 6.1 through 6.4, the proposed remedial actions are expected to:

- Adequately address long-term risks;
- Be effective over the long-term;
- Adequately reduce the toxicity, mobility, and/or volume of COCs and waste material;
- Adequately address short-term risks;
- Be effective over the short-term; and
- Be relatively easy to implement.

As summarized in Section 6.5, the RIR and RAP satisfy the 10 NCDEQ approval criteria. Therefore, it is recommended that the proposed remedial actions be implemented as the final site remedy.

SECTION 7: IMPLEMENTATION OF THE REMEDIAL ACTIONS

7.1 Public Participation Procedures

In accordance with NCGS § 130A-310.70, the public and other stakeholders will be involved in the RAP process by completing the following steps prior to submittal of this RAP to NCDEQ.

- A notice of intent to remediate will be sent to all local governments having tax or land-use jurisdiction over the site, and to all adjoining land owners; and
- An informal public meeting will be held to receive public comments.

Once public comments are received, this RAP will be modified, as appropriate, based on those comments, and this section will describe how this RAP was modified based on the public comments. In addition, based on a request from NCDEQ, the public participation procedures associated with a RCRA Class 3 permit modification will be implemented.[15]

In the final version of this RAP submitted to NCDEQ, this section will reference an appendix with copies of the notices of intent and a certification that the notices of intent were provided.

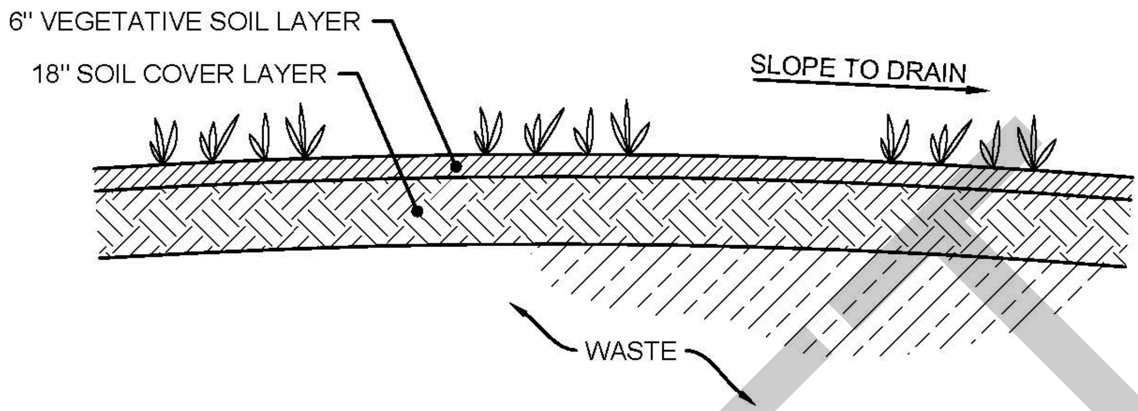
7.2 Remaining Remedial Design Activities

In accordance with NCGS § 130A-310.69(b)(13), the remaining remedial design activities, including treatability studies and additional sampling, needed to support the remedial actions are presented in this section.

7.2.1 SWMU 11 Vegetative Cap Design

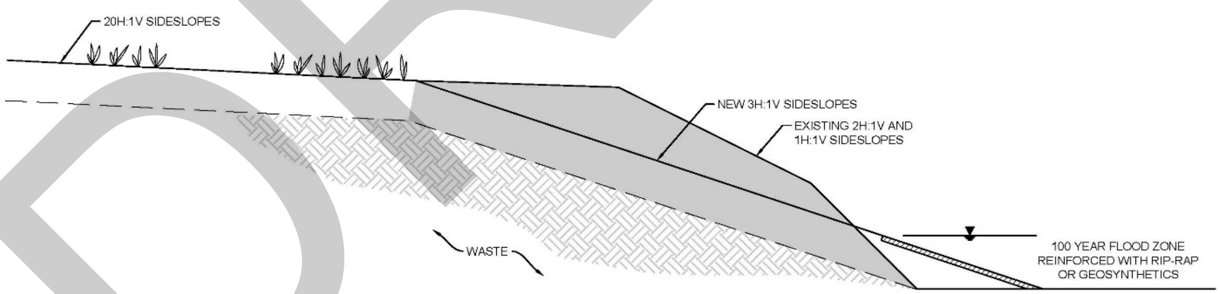
DuPont and NCDEQ have reached agreement on a conceptual closure approach for the SWMU 11 vegetative cap. The currently-proposed conceptual design includes installing a six- inch thick vegetative soil cover layer that overlays an 18-inch thick soil cover layer, as shown below. Remedial design activities will begin once the RAP is approved.

[15] See 15A NCAC 13A .0109 STANDARDS FOR OWNERS/OPERATORS OF HWTSD FACILITIES - PART 264: http://portal.ncdenr.org/web/wm/hw/rules/addrequirments#Part2



The soil cover layer will cover SWMU 11 waste and reduce infiltration into the waste. The vegetative soil layer will promote the establishment of vegetation and stabilization of the cover system to reduce erosion. The final surface of the soil cover will be seeded to establish trees and other native vegetation on the unit, consistent with the surrounding ground cover, habitat, and stakeholder input. The conceptual design assumes that the vegetative cover soil layer and the soil cover layer will be constructed using on-site or equivalent borrow soil.

Portions of the sideslopes that are currently steeper than three horizontal to one vertical (3H:1V) will be regraded to 3H:1V. Grading will improve stability and promote positive drainage from the SWMU 11 cover system. Additionally, riprap will be placed along the toe of the slopes within the 100-year flood plain in accordance with Army Corps of Engineers guidance for bank-slope protection. A conceptual view of the 3H:1V side-slope regrading and consolidation of waste is shown below.



3H:1V Graded Side Slopes

(Grey-shaded area represents waste to be relocated)

Implementation of the soil cover system at SWMU 11 is anticipated to be as follows:

- Clearing and grubbing the existing surface and sideslopes;
- Relocating waste on the sideslopes and re-grading the sideslopes to (3H:1V) while maintaining the existing toe of slope;
- Placing the soil cover layer;

- Placing and seeding the vegetative cover layer; and,
- Placing riprap along the sideslopes in the floodplain to the 100-year flood elevation.

During the design of the final cover, static and seismic slope stability analyses will be performed to verify that the closed unit will be stable. Additionally, during the design phase, the soil cover layer thickness may be adjusted where the existing soil cover is in good condition and will not be disturbed by grading and waste consolidation efforts (i.e. portions of the top deck). DuPont will work with local stakeholders to determine the best approach for developing a sustainable vegetative cover system that will likely include native grasses. The refined plan and design will be presented in an upcoming RAP Implementation Work Plan.

7.2.2 SWMU 17 In-Situ S/S Design

Remedial design work and remedial actions at SWMU 17 are ongoing as an IRM. Prior to full-scale implementation, an additional investigation will be performed, including a geophysical survey, test trenches, and a bench-scale treatability study. A SWMU 17 IRM work plan, which is being developed, will describe the investigation in detail and will include the following.

- An updated geophysical investigation will be conducted to locate potential buried waste material.
- Test trenches will be excavated to visually identify and remove waste materials (e.g., sludges) or other materials that could hinder potential in-situ S/S activities (e.g., waste containers, rugs, and other solid debris). The waste materials will be segregated and placed in lined, roll-off containers for characterization and off-site disposal. Segregating these materials will reduce the potential for impacts to public health, safety, and welfare and the environment and improve the ability to apply and mix the binding agent.
- Soil samples will be collected during test trenching activities to support bench-scale S/S studies and to characterize the material for disposal.
- Excavated soil from the test trenching activities will be used to backfill the trenches.
- A treatability study will be performed at SWMU 17 to verify the effectiveness of the proposed in-situ S/S as well as to develop design parameters for the treatment. An IRM work plan (which will include the plan for the treatability study) is being developed.
- Final remedial design of the in-situ S/S will be conducted following the treatability study.

7.2.3 Additional Sampling

The following additional sampling will be conducted to support the RAP:

- **Additional Characterization of PAHs in Sediment and Surface Water**: Additional Lake DERA, DERA Creek sediment and surface water samples will be collected and analyzed for PAHs in order to further evaluate whether or not remedial action is needed to address PAHs. Additional sediment and surface water samples will be collected from the SW-26 seep to further characterize vinyl chloride concentrations. A sampling plan will be provided to NCDEQ for review and approval.
- **Additional Characterization of Potential VOCs in Surficial Aquifer at the DSRF:** DuPont is working with NCDEQ to resolve the objective and the scope for additional characterization.

- **Additional Characterization of PCBs in Soil**: DuPont is working with USEPA and NCDEQ to resolve questions regarding PCBs in soil.

The results of these additional sampling activities will be documented in a report that will be submitted to NCDEQ for review.

7.3 Compliance with Other Regulations during Implementation

In accordance with NCGS § 130A-310.69(b)(7), measures will be implemented for applicable construction activities (e.g., SWMU 11 and SWMU 17 earthwork activities) in order to prevent discharge into surface waters that violate applicable surface water quality standards. These measures will likely include:

- Obtaining a local gradient permit:
- Obtaining coverage under the State's general stormwater NPDES permit;
- Implementing applicable provisions of the local grading permit and the State's general stormwater NPDES permit; and
- Preparing and implementing a temporary erosion and sediment control plan and stormwater pollution prevention plan.

In accordance with NCGS § 130A-310.69(b)(8), measures will be implemented for applicable construction activities (e.g., SWMU 11 and SWMU 17 earthwork activities) to prevent air emissions that could violate applicable air quality standards. These measures will likely include:

- Dust control best management practices to prevent fugitive dust emissions; and
- Dust monitoring to evaluate fugitive dust emissions and ensure worker safety.

In addition, DuPont will comply with other applicable regulations as appropriate (e.g., RCRA regulations for waste generation, storage, transportation, and disposal, and Occupational Safety and Health Act regulations for protection of workers). Prior to any construction or excavation activities, DuPont will also identify sensitive ecological areas, conduct ecological assessments as necessary, and implement mitigation measures as necessary.

7.4 Confirmatory Sampling

In accordance with NCGS § 130A-310.69(b)(9), (10), and (13), it is expected that the following confirmatory sampling activities will be conducted to evaluate the concentrations of COCs with respect to RLs after the remedial actions that include contaminant reduction are completed:

- Groundwater and surface water monitoring as necessary prior to the final closure of the SWMU 11 CAMU in accordance with the GMP (Parsons 2010);
- Soil sampling following in-situ S/S at SWMU 17 as necessary in accordance with a future plan prepared pursuant to the SWMU 17 IRM; and
- Groundwater monitoring at the DSRF Visitor Center as necessary per the GMP (URS 2009).

The existing site Sampling and Analysis Plan/Quality Assurance Project Plan will be updated as necessary for these activities (URS 2009; Parsons 2010, 2014).

7.5 Health and Safety for Workers and Other Potential Receptors

In accordance with NCGS § 130A-310.69(b)(14), health and safety measures will be implemented for all field construction activities in order to ensure that workers, visitors, and people in the vicinity of the site are not adversely affected by field construction activities. These measures will be implemented in accordance with the project Health and Safety Plan (HASP), which will be updated as needed for the field construction activities. The HASP will address provisions including, but not limited to:

- Conducting pre-construction process hazard analyses;
- Using trained and experienced workers;
- Implementing health and safety procedures;
- Implementing ECs;
- Performing air monitoring;
- Implementing dust controls;
- Implementing noise controls; and
- Controlling work-area access.

7.6 Deed Restriction and Property Control Plan

In accordance with NCGS § 130A-310.69(b)(11), a deed restriction will be used to ensure the required O&M activities and ICs/ECs are implemented over the long-term. The deed restriction will be recorded with the county.

A Property Control Plan will be developed to establish specific procedures for long-term implementation of the required O&M activities and ICs/ECs. The Property Control Plan will include:

- A Long-term O&M Plan;
- An Excavation and Land Use Management Plan;
- A Groundwater Use Management Plan; and
- A VI Characterization and Mitigation Plan.

The Property Control Plan will be referenced or attached to the deed restriction. Additional details about the four plans that will support the Property Control Plan are discussed below.

7.6.1 Long-Term O&M Plan

In accordance with NCGS § 130A-310.69(b)(9), a Long-term O&M Plan will be developed to provide specific details for the long-term implementation of required O&M activities.

O&M Activities	Area	Objective	Summary of O&M Components
Long-term O&M of existing cap/covers	SWMUs 4, 11, 12A-C, 13, 16, 17, 18A&B, and 20 (see Figure 5-2)	Ensure the existing cap/covers remain in place to prevent exposure to subsurface waste materials	• Inspect cap/covers annually • Report inspections annually • Repair/replace the cap/covers as necessary (e.g., maintain seeded vegetative cover layer, reinforce riprap on sideslopes) • Report repair/replace activities
Maintain access control fencing	ISM Decision Unit 6 and AOC A (see Figure 5-4)	Ensure the fencing is maintained to prevent exposure to surface soil RL exceedances	• Inspect fencing annually • Report inspections annually • Maintain and replace fencing as necessary
Long-term O&M of the existing GAC treatment system at the DSRF Visitor Center WSW	DSRF Visitor Center WSW (see Figure 5-5)	Ensure the existing GAC treatment system continues to operate as intended and adequately treats TCE and any degradation byproducts in the DSRF Visitor Center WSW	Replace the pre-GAC canisters semiannually Replace two of the four GAC units annually Sample the GAC effluent semiannually Report sampling activities to NCDEQ and DSRF semiannually

7.6.2 Excavation and Land Use Management Plan

An Excavation and Land Use Management Plan will be developed to provide specific details for the long-term implementation of required ICs/ECs related to excavation activities and land use.

IC/EC	Area	Objective	Summary of IC/EC Components
Prohibit excavation (i.e., “No Dig Areas”)	SWMUs 4, 11, 12A-C, 13, 16, 17, 18A&B, and 20 and AOC F (see Figure 5-3)	Ensure the existing cap/covers are not disturbed by excavation activities	• Inspect cap/covers annually • Report inspections annually
Require that soil is sampled prior to any excavation activities (i.e., “Test Before Dig”)	Former manufacturing area (see Figure 5-3)	Ensure that appropriate measures are performed to manage excavated material as necessary based on an evaluation of the pre-excavation sample results.	• Collect soil samples prior to excavation and analyze for applicable constituents • Evaluate sampling results to ensure excavated material is handled and managed appropriately • Report soil sampling results, evaluation results, and any recommended actions/controls associated with the excavation activity • Conduct action if a site-related constituent concentration exceeds an RL
Prohibit residential land use	Entire site (see Figure 5-7)	Ensure there is no residential land use	• Inspect land use and deed restrictions annually • Submit a certification to NCDEQ that land use continues to comply with land use restrictions and the deed restriction is still properly recorded as required by NCGS § 130A-310.69(b)(12)
Prohibit industrial land use	Entire site (see Figure 5-7)	Ensure there is no industrial land use	• Inspect land use and deed restrictions annually • Submit a certification to NCDEQ that land use continues to comply with land use restrictions and the deed restriction is still properly recorded as required by NCGS § 130A-310.69(b)(12)

7.6.3 Groundwater Use Management Plan

A Groundwater Use Management Plan will be developed to provide specific details for the long-term implementation of required ICs/ECs related to groundwater use.

IC/EC	Area	Objective	Summary of IC/EC Components
Require that any new or existing Bedrock Aquifer WSW is sampled prior to putting the WSW into service	Bedrock Aquifer across entire site (see Figure 5-5)	Ensure that the water quality in the WSW is acceptable for the intended use in accordance with NC's implementation of Safe Drinking Water Act requirements	• Collect and analyze groundwater samples from the WSW prior to use and during use in accordance with NC's implementation of Safe Drinking Water Act requirements • Evaluate and report sampling results in accordance with NC's implementation of Safe Drinking Water Act requirements • Conduct action as necessary if a site-related constituent concentration exceeds an RL
Prohibit the extraction of Shallow Aquifer groundwater for use as drinking water	Surficial Aquifer across entire site (see Figure 5-7)	Ensure that future potential receptors do not use the Surficial Aquifer for drinking water	• Submit a report to confirm that no on-site Surficial Aquifer WSWs are being used for drinking water purposes

7.6.4 VI Characterization and Mitigation Plan

A VI Characterization and Mitigation Plan will be developed to provide specific details for the long-term implementation of required ICs/ECs related to the potential VI pathway.

IC/EC	Area	Objective	Summary of IC/EC Components
VI Characterization	Portion of the site where VOCs may be present (see Figure 5-7)	Characterize the potential for VI in any new building that will be routinely occupied	• Collect groundwater, soil gas, and/or indoor samples as appropriate and analyze for VOCs • Evaluate sampling results to determine whether or not mitigation is needed • Report sampling results, evaluation results, and any recommendations based on the results
VI Mitigation (if necessary)	Portion of the site where VOCs may be present (see Figure 5-7)	Ensure that the potential VI pathway is mitigated for each occupied building as appropriate based on the design and location of the building	• Install of a mitigation system (e.g., vapor barrier, passive convertible ventilation system) • Test mitigation system installation • Perform post-construction baseline multimedia sampling (groundwater, soil gas, indoor air, ambient air) • Submit a report documenting the installation and testing of the mitigation system and post-construction baseline sampling results
VI O&M (if necessary)	Portion of the site where VOCs may be present (see Figure 5-7)	Ensure that the potential VI pathway is mitigated for each occupied building as appropriate based on the design and location of the building	• Develop building- or area-specific VI O&M Plan • Inspect VI mitigation system periodically • Perform multimedia sampling periodically to demonstrate mitigation is effective • Submit report

7.7 RAP Completion Report

In accordance with NCGA § 130A-310.73, a RAP Completion Report will be submitted to NCDEQ when the RAP has been fully implemented. The RAP Completion Report will document that the RAP has been fully implemented and remediation standards have been achieved. In addition, all local governments with taxing and land-use jurisdiction over the site will be notified when the RAP Completion Report is submitted to NCDEQ.

7.8 Implementation Schedule

RAP implementation schedule milestones include:

- A RAP Implementation Plan will be submitted 120 days after RAP approval.
- Design and implementation of the SWMU 11 vegetative cap will take approximately three years.
- Design and implementation of the SWMU 17 in-situ S/S project will take approximately two years.
- The RAP Completion Report (per Risk Bill Section 130A-310.73) will document that the RAP has been fully implemented and remediation standards have been achieved. The report will be completed within 120 days after all remedial actions are implemented.

7.9 Remedial Action Cost Estimate and Financial Assurances

7.9.1 Cost Estimate

The cost estimates for performing remedial actions will be determined.

7.9.2 Financial Assurances

The need and scope of financial assurance will be determined.

SECTION 8: REFERENCES

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Figures

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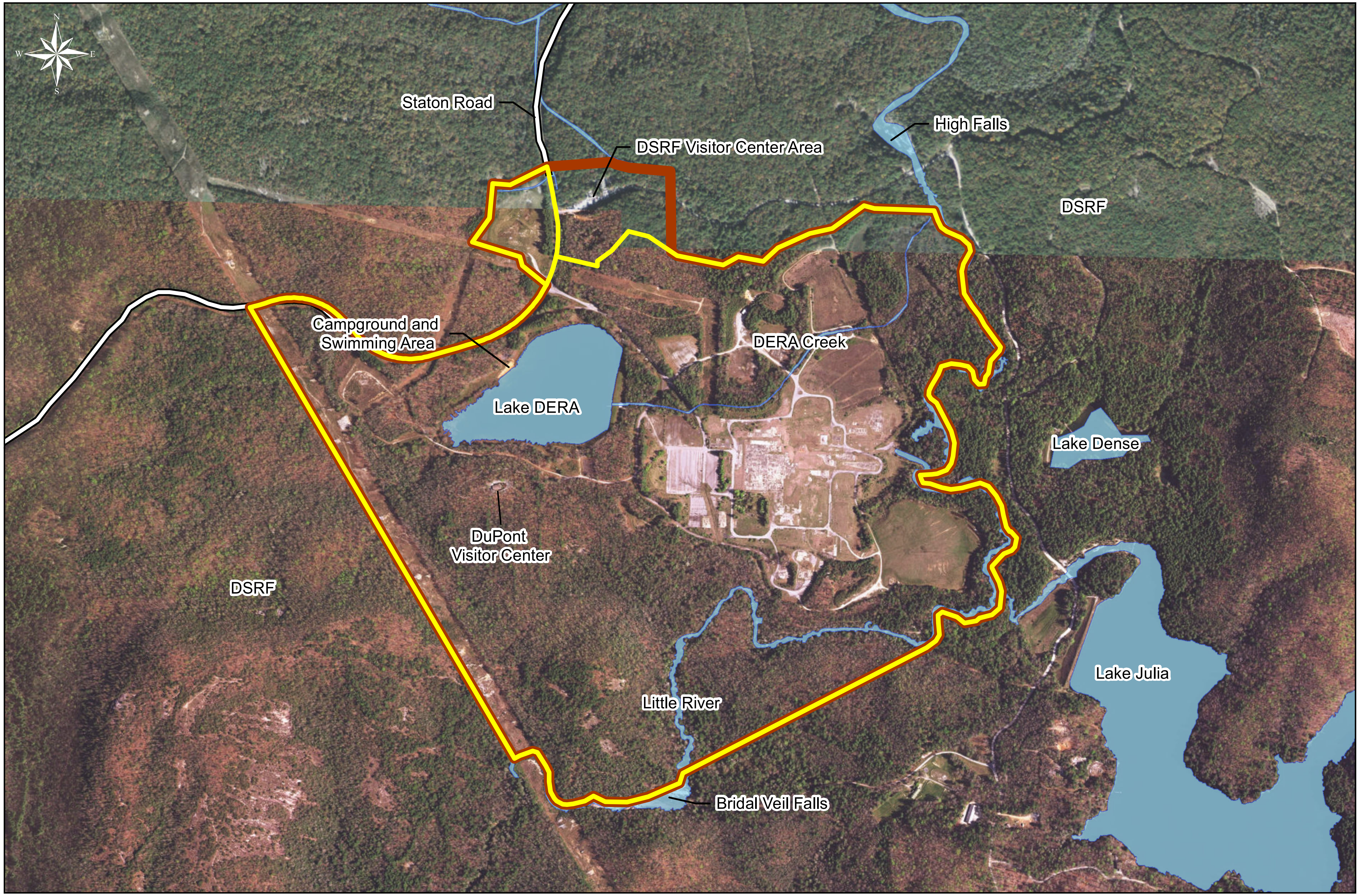

Legend

- Property Boundary
- Site Boundary
- Lake or Stream
- Staton Road

Notes:
Discoloration in base layer is due to GIS imagery.

0 725 1,450 2,175 Feet

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Site Location
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 1-1

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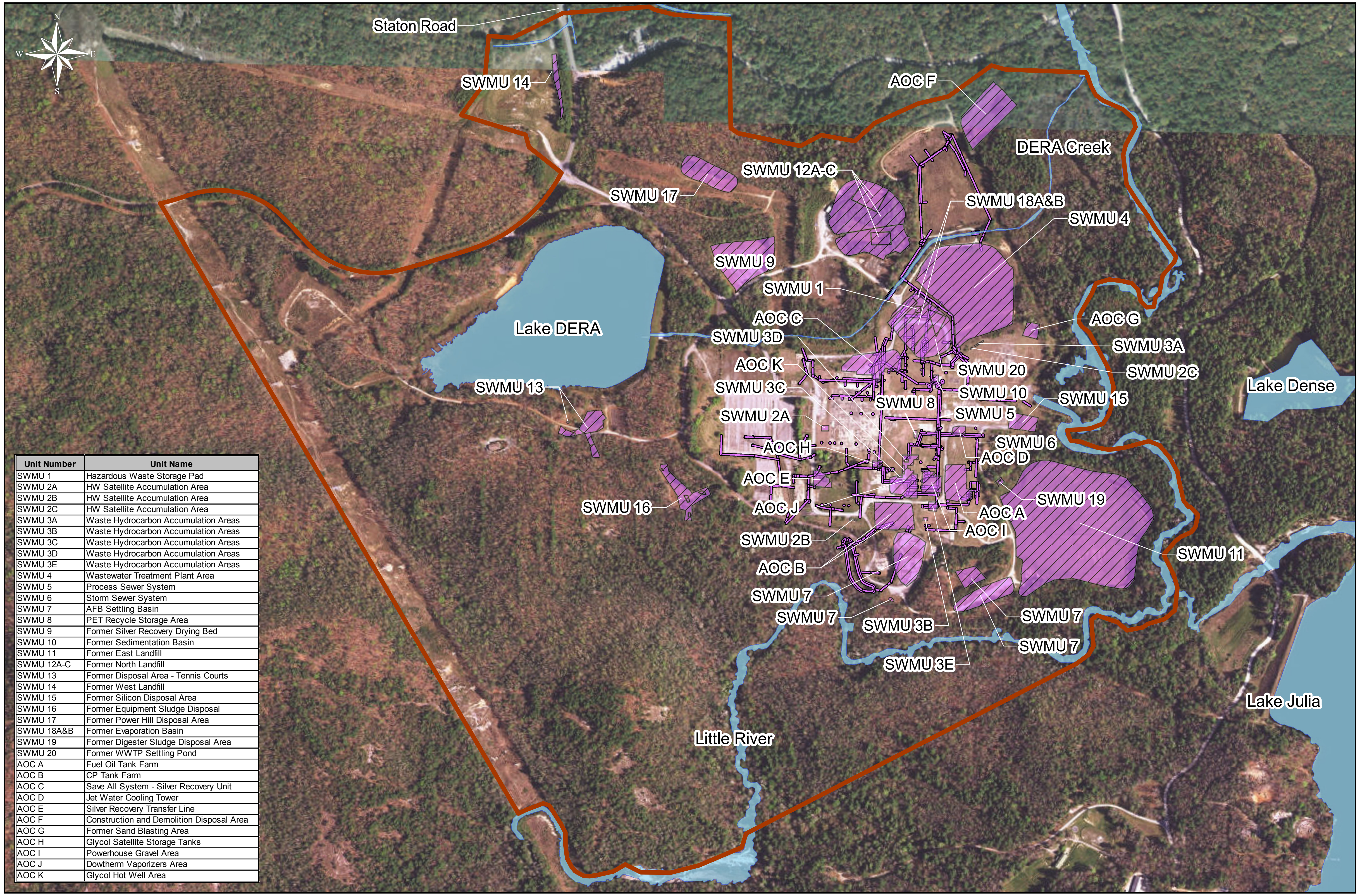
Historical Manufacturing-Related Features
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-1



Unit Number	Unit Name
SWMU 1	Hazardous Waste Storage Pad
SWMU 2A	HW Satellite Accumulation Area
SWMU 2B	HW Satellite Accumulation Area
SWMU 2C	HW Satellite Accumulation Area
SWMU 3A	Waste Hydrocarbon Accumulation Areas
SWMU 3B	Waste Hydrocarbon Accumulation Areas
SWMU 3C	Waste Hydrocarbon Accumulation Areas
SWMU 3D	Waste Hydrocarbon Accumulation Areas
SWMU 3E	Waste Hydrocarbon Accumulation Areas
SWMU 4	Wastewater Treatment Plant Area
SWMU 5	Process Sewer System
SWMU 6	Storm Sewer System
SWMU 7	AFB Settling Basin
SWMU 8	PET Recycle Storage Area
SWMU 9	Former Silver Recovery Drying Bed
SWMU 10	Former Sedimentation Basin
SWMU 11	Former East Landfill
SWMU 12A-C	Former North Landfill
SWMU 13	Former Disposal Area - Tennis Courts
SWMU 14	Former West Landfill
SWMU 15	Former Silicon Disposal Area
SWMU 16	Former Equipment Sludge Disposal
SWMU 17	Former Power Hill Disposal Area
SWMU 18A&B	Former Evaporation Basin
SWMU 19	Former Digester Sludge Disposal Area
SWMU 20	Former WWTP Settling Pond
AOC A	Fuel Oil Tank Farm
AOC B	CP Tank Farm
AOC C	Save All System - Silver Recovery Unit
AOC D	Jet Water Cooling Tower
AOC E	Silver Recovery Transfer Line
AOC F	Construction and Demolition Disposal Area
AOC G	Former Sand Blasting Area
AOC H	Glycol Satellite Storage Tanks
AOC I	Powerhouse Gravel Area
AOC J	Dowtherm Vaporizers Area
AOC K	Glycol Hot Well Area

Notes:
Discoloration in base layer is due to GIS imagery.

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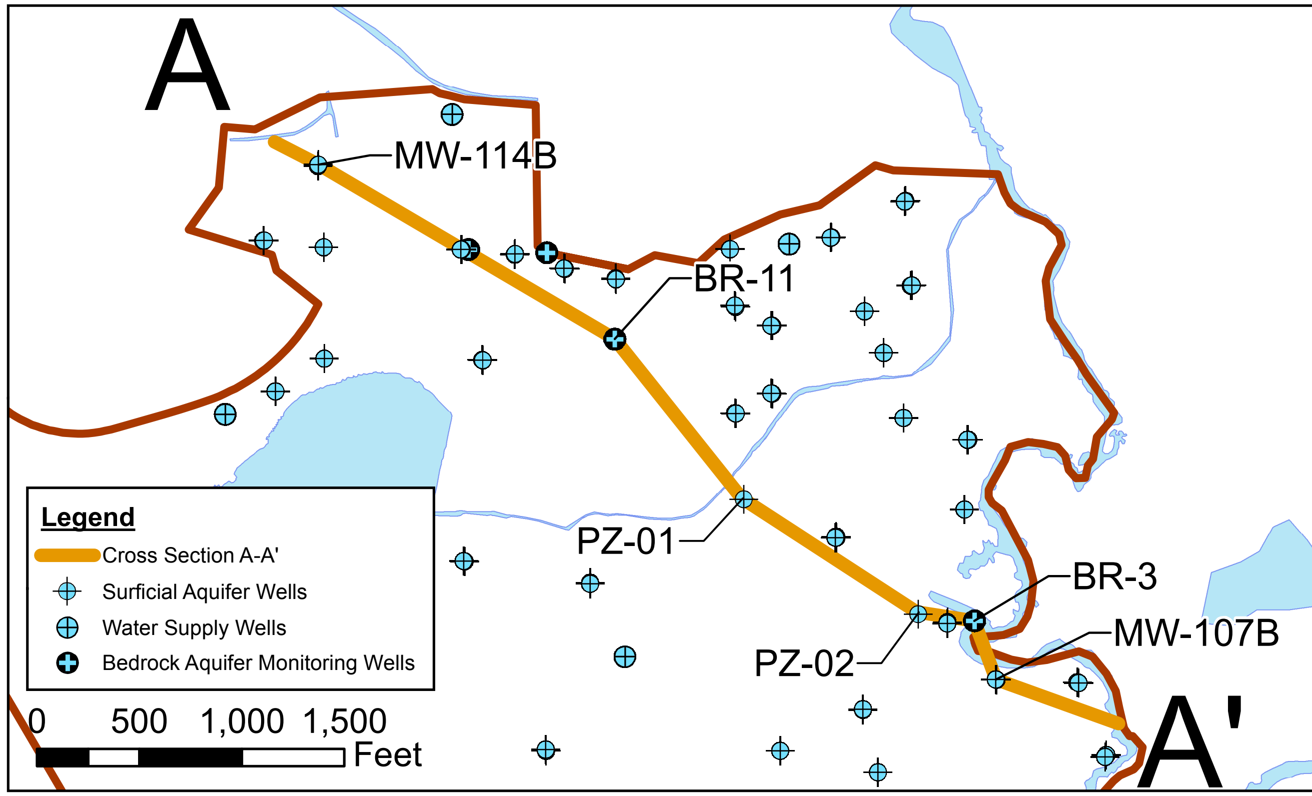
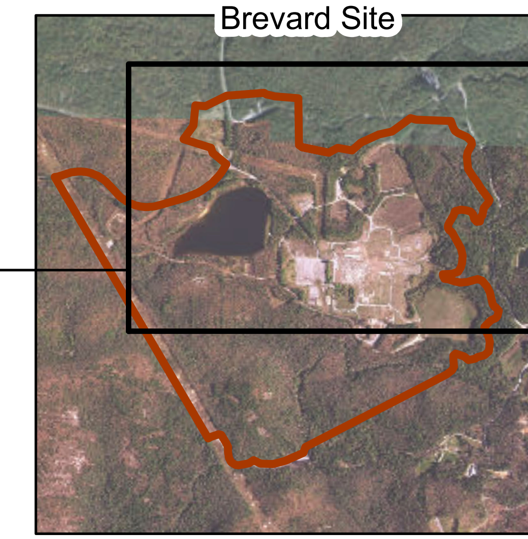
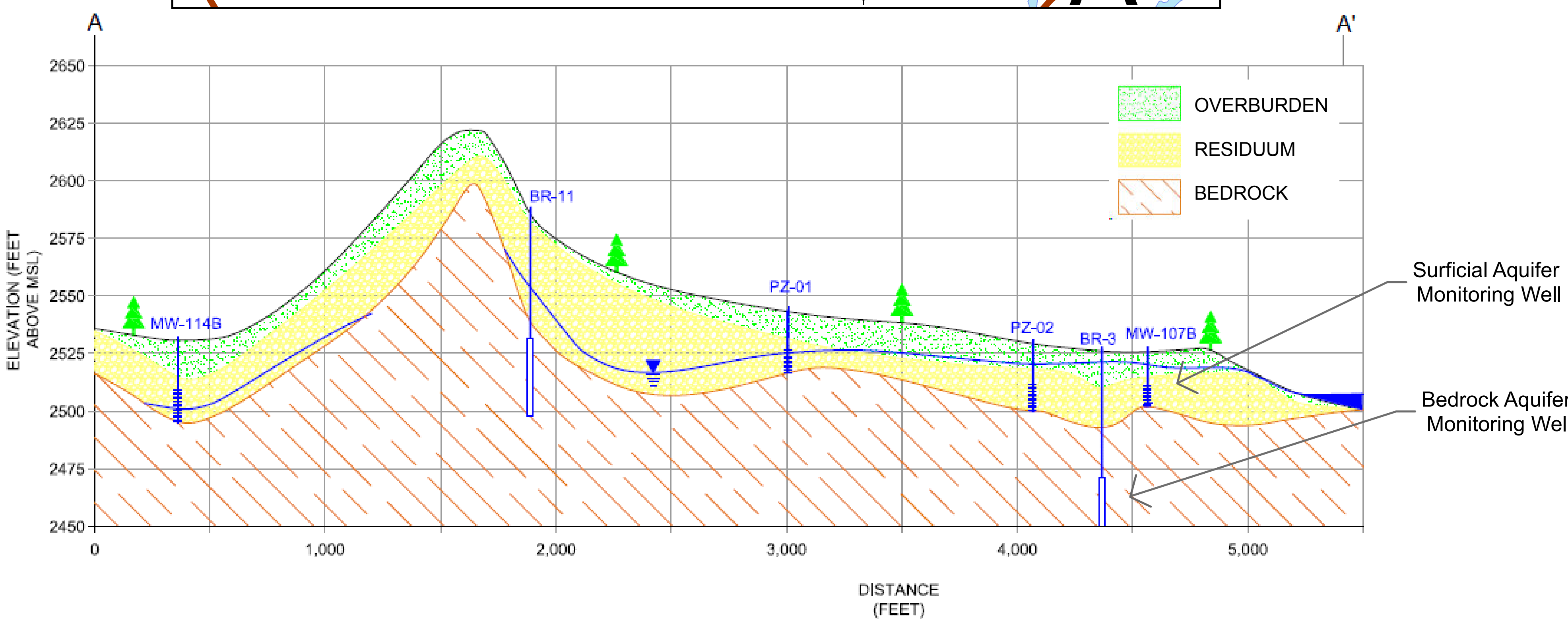
SWMUs and AOCs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-2







-Cross-Section Source: Parsons

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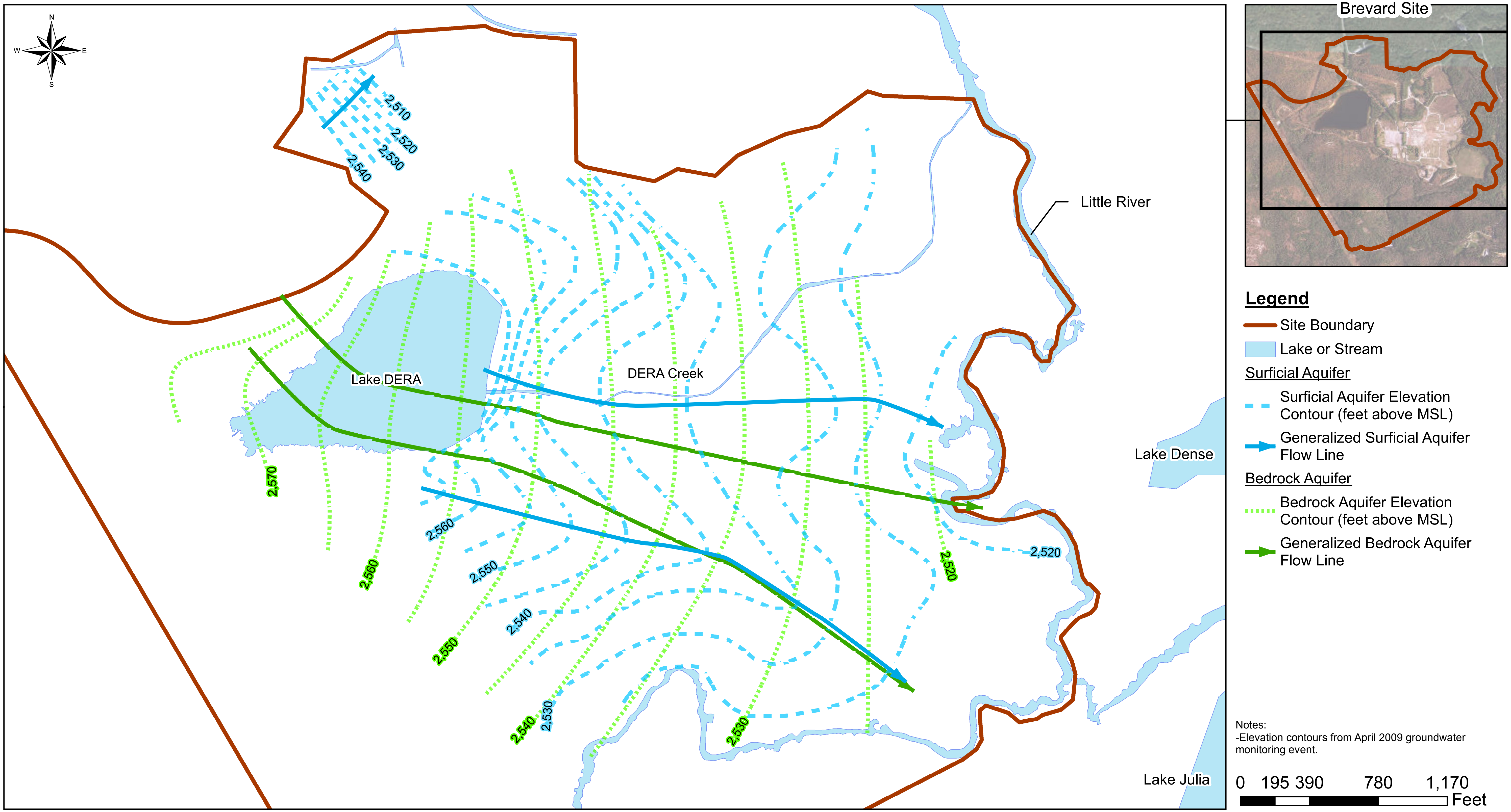
Geological Cross-Section
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-3



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Groundwater Elevation Contours
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-4

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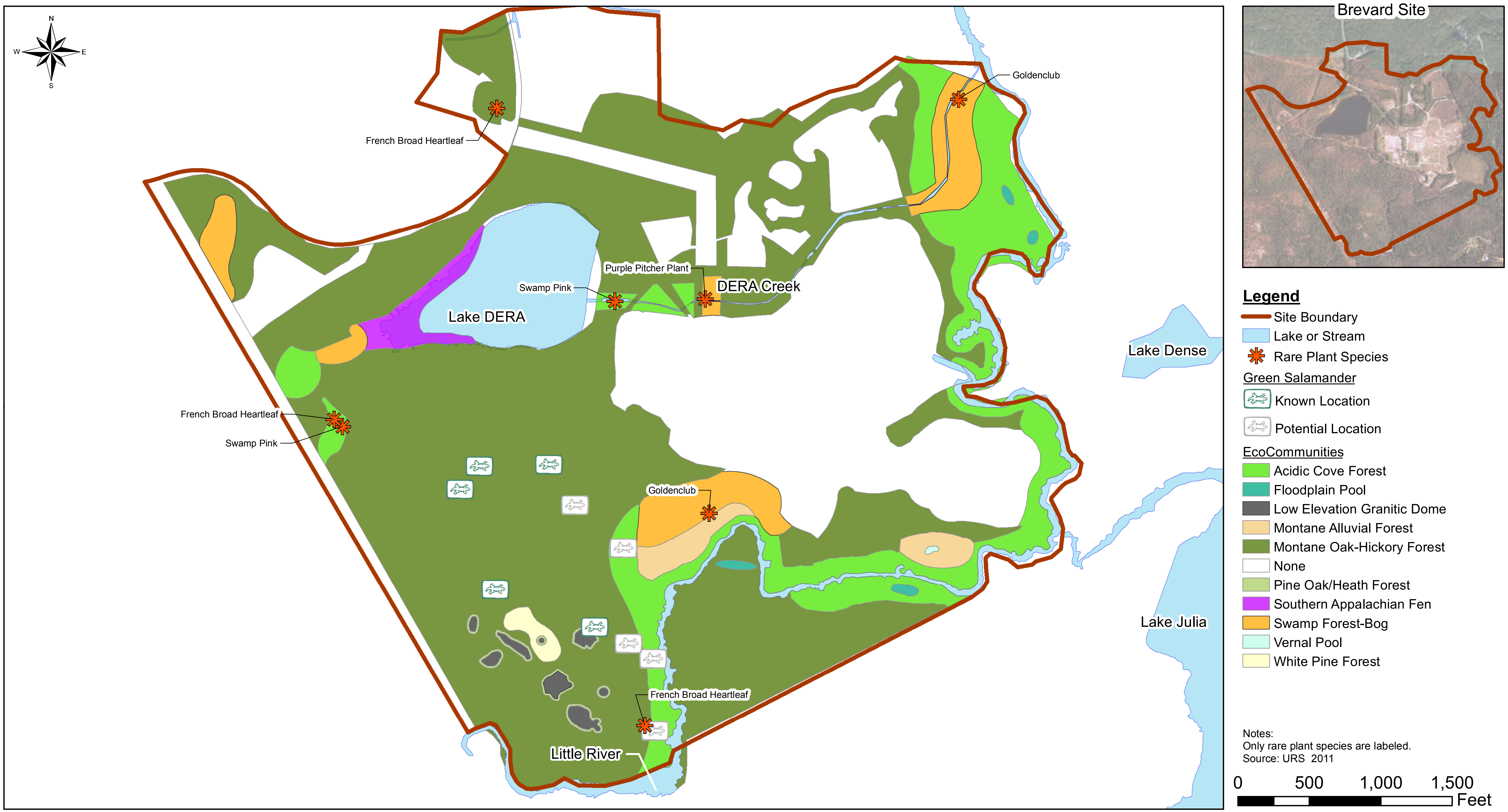

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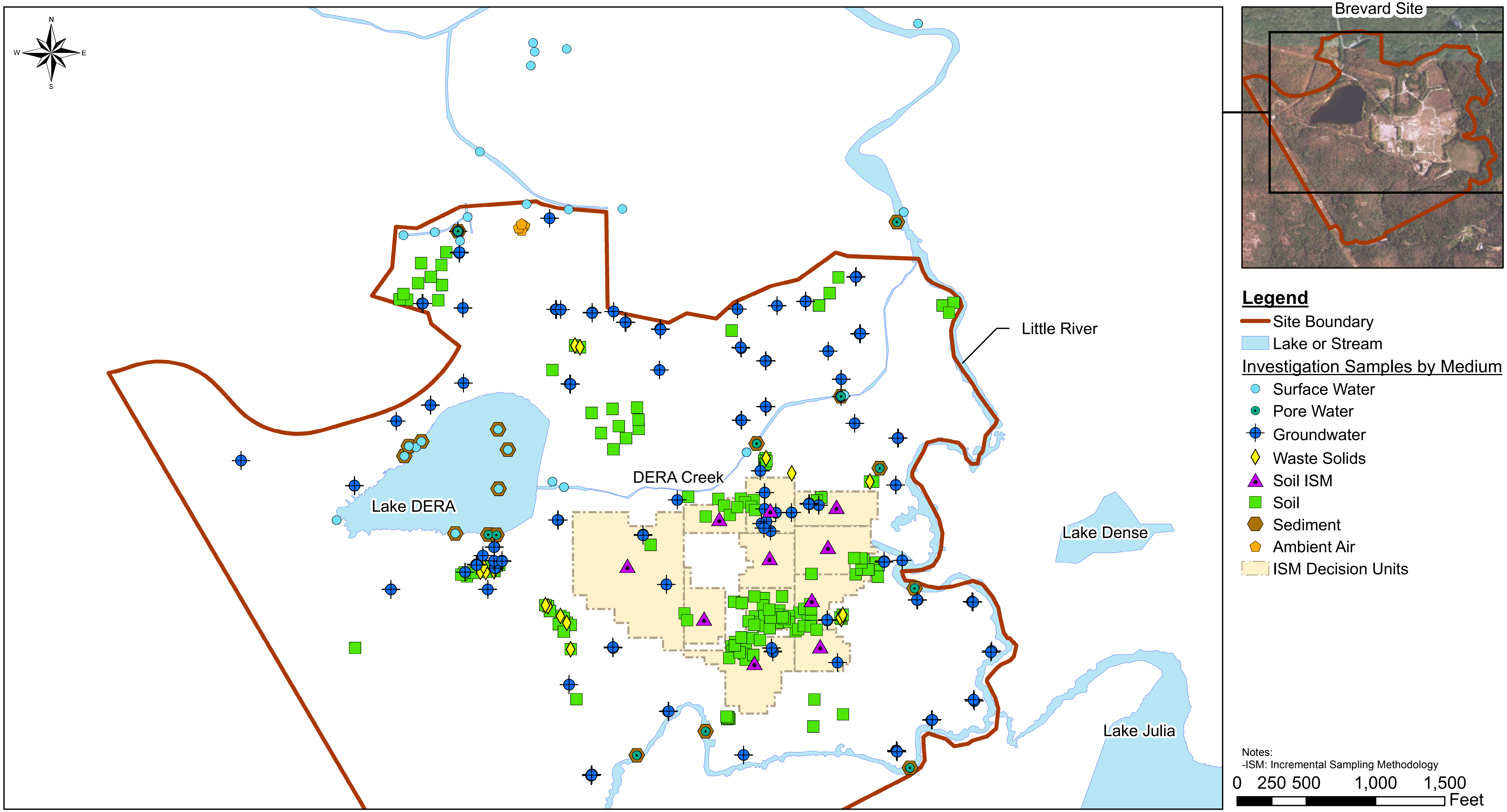
Significant Ecological Communities
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-5



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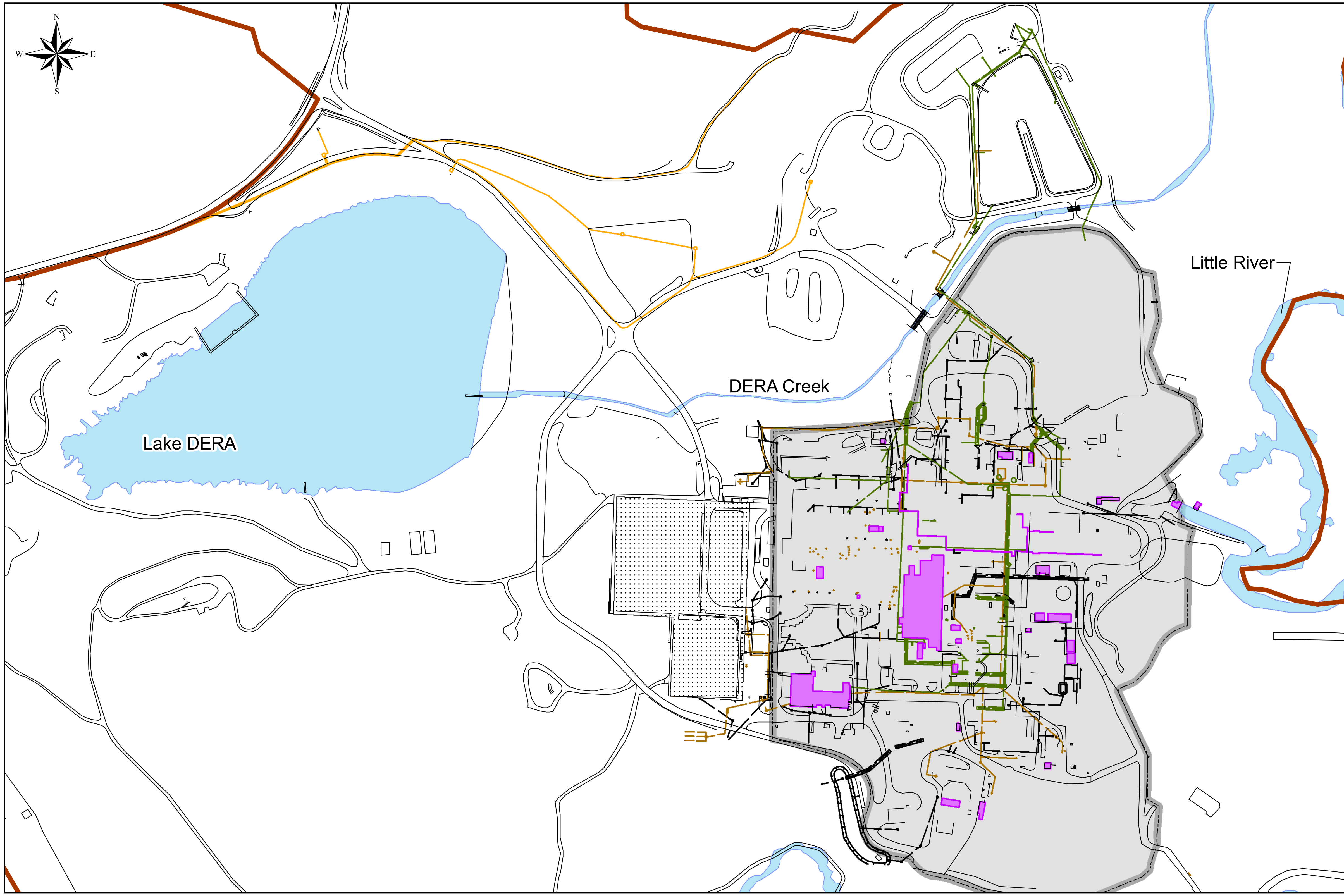
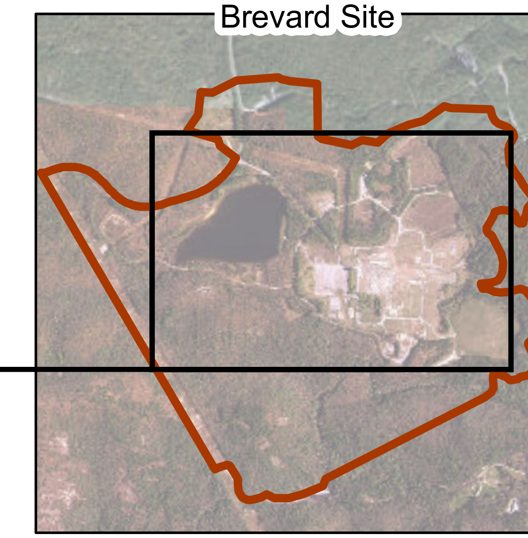
Remedial Investigation Sample Summary
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-6





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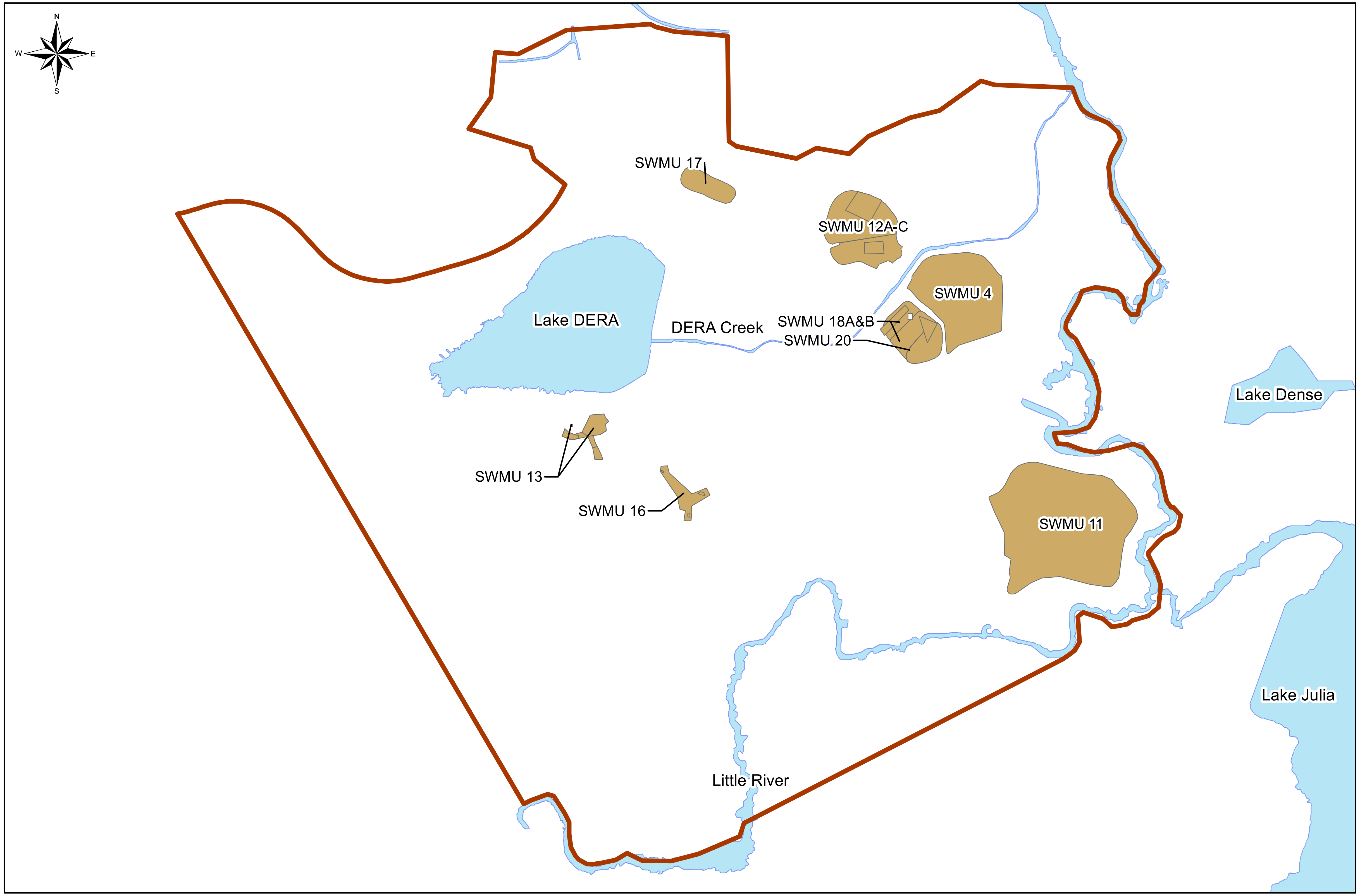
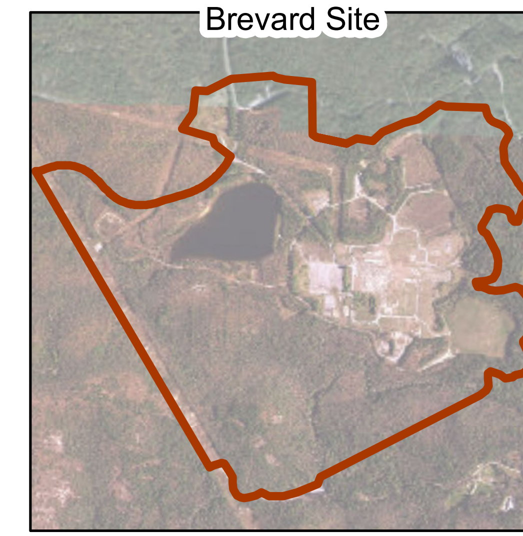
Plant Demolition and Removal Area and Remaining Infrastructure
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-7





Legend

- Site Boundary
- Lake or Stream
- Existing Cap/Covers

0 250 500 1,000 1,500 Feet

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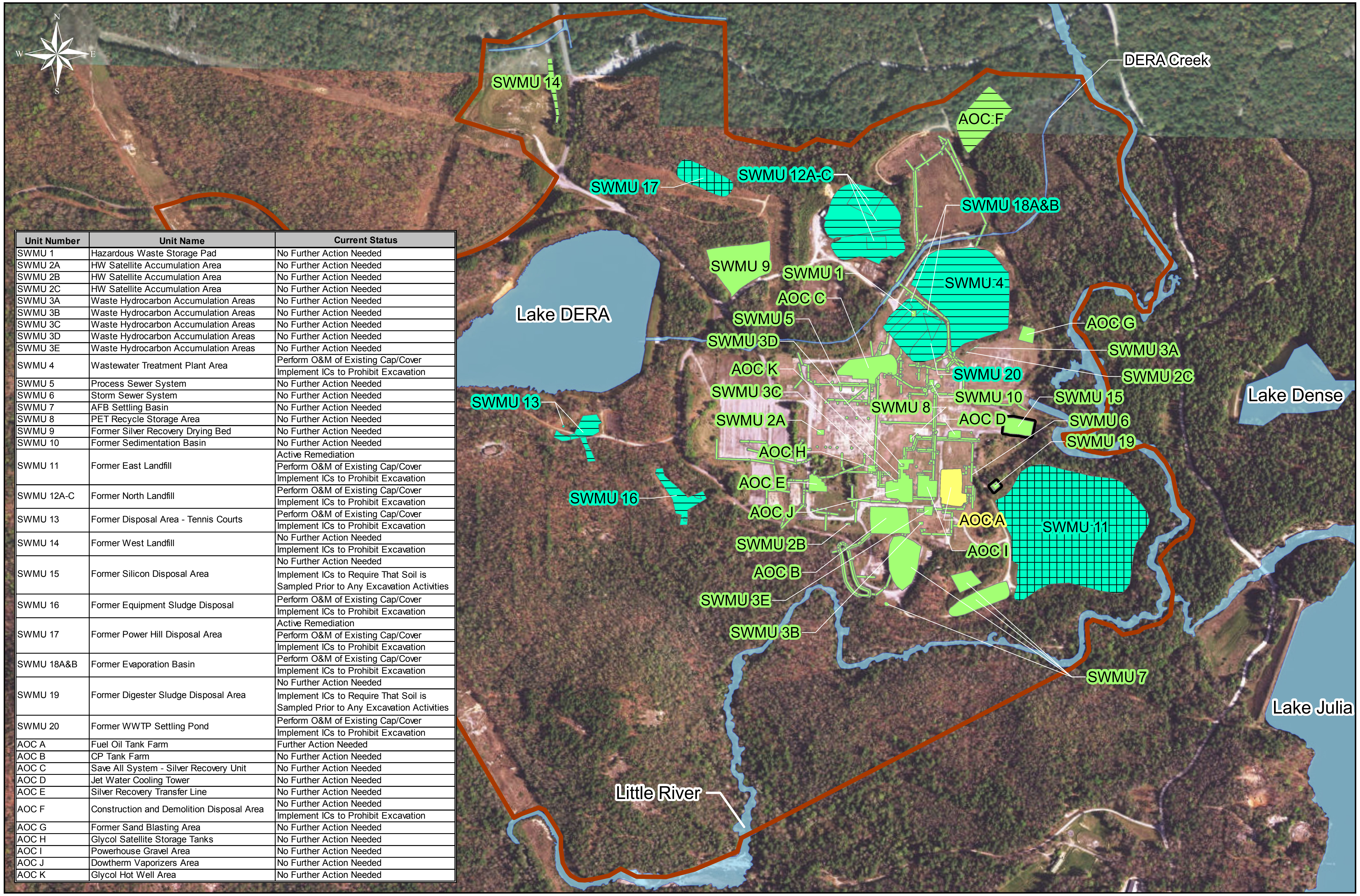
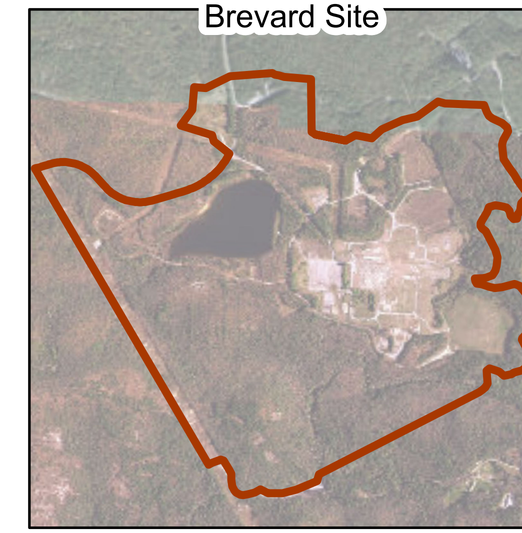
Existing Cap/Covers
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-8



Unit Number	Unit Name	Current Status
SWMU 1	Hazardous Waste Storage Pad	No Further Action Needed
SWMU 2A	HW Satellite Accumulation Area	No Further Action Needed
SWMU 2B	HW Satellite Accumulation Area	No Further Action Needed
SWMU 2C	HW Satellite Accumulation Area	No Further Action Needed
SWMU 3A	Waste Hydrocarbon Accumulation Areas	No Further Action Needed
SWMU 3B	Waste Hydrocarbon Accumulation Areas	No Further Action Needed
SWMU 3C	Waste Hydrocarbon Accumulation Areas	No Further Action Needed
SWMU 3D	Waste Hydrocarbon Accumulation Areas	No Further Action Needed
SWMU 3E	Waste Hydrocarbon Accumulation Areas	No Further Action Needed
SWMU 4	Wastewater Treatment Plant Area	Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 5	Process Sewer System	No Further Action Needed
SWMU 6	Storm Sewer System	No Further Action Needed
SWMU 7	AFB Settling Basin	No Further Action Needed
SWMU 8	PET Recycle Storage Area	No Further Action Needed
SWMU 9	Former Silver Recovery Drying Bed	No Further Action Needed
SWMU 10	Former Sedimentation Basin	No Further Action Needed
SWMU 11	Former East Landfill	Active Remediation Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 12A-C	Former North Landfill	Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 13	Former Disposal Area - Tennis Courts	Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 14	Former West Landfill	No Further Action Needed Implement ICs to Prohibit Excavation
SWMU 15	Former Silicon Disposal Area	No Further Action Needed Implement ICs to Require That Soil is Sampled Prior to Any Excavation Activities
SWMU 16	Former Equipment Sludge Disposal	Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 17	Former Power Hill Disposal Area	Active Remediation Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 18A&B	Former Evaporation Basin	Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
SWMU 19	Former Digester Sludge Disposal Area	No Further Action Needed Implement ICs to Require That Soil is Sampled Prior to Any Excavation Activities
SWMU 20	Former WWTP Settling Pond	Perform O&M of Existing Cap/Cover Implement ICs to Prohibit Excavation
AOC A	Fuel Oil Tank Farm	Further Action Needed
AOC B	CP Tank Farm	No Further Action Needed
AOC C	Save All System - Silver Recovery Unit	No Further Action Needed
AOC D	Jet Water Cooling Tower	No Further Action Needed
AOC E	Silver Recovery Transfer Line	No Further Action Needed
AOC F	Construction and Demolition Disposal Area	No Further Action Needed Implement ICs to Prohibit Excavation
AOC G	Former Sand Blasting Area	No Further Action Needed
AOC H	Glycol Satellite Storage Tanks	No Further Action Needed
AOC I	Powerhouse Gravel Area	No Further Action Needed
AOC J	Dowtherm Vaporizers Area	No Further Action Needed
AOC K	Glycol Hot Well Area	No Further Action Needed



Legend

- Site Boundary
- Lake or Stream

SWMU and AOC Status
- Perform O&M of Existing Cap/Cover
- Active Remediation
- Further Action Needed
- No Further Action Needed
- Implement ICs to Prohibit Excavation
- Implement ICs to Require That Soil is Sampled Prior to Any Excavation Activities

0 250 500 1,000 1,500 Feet

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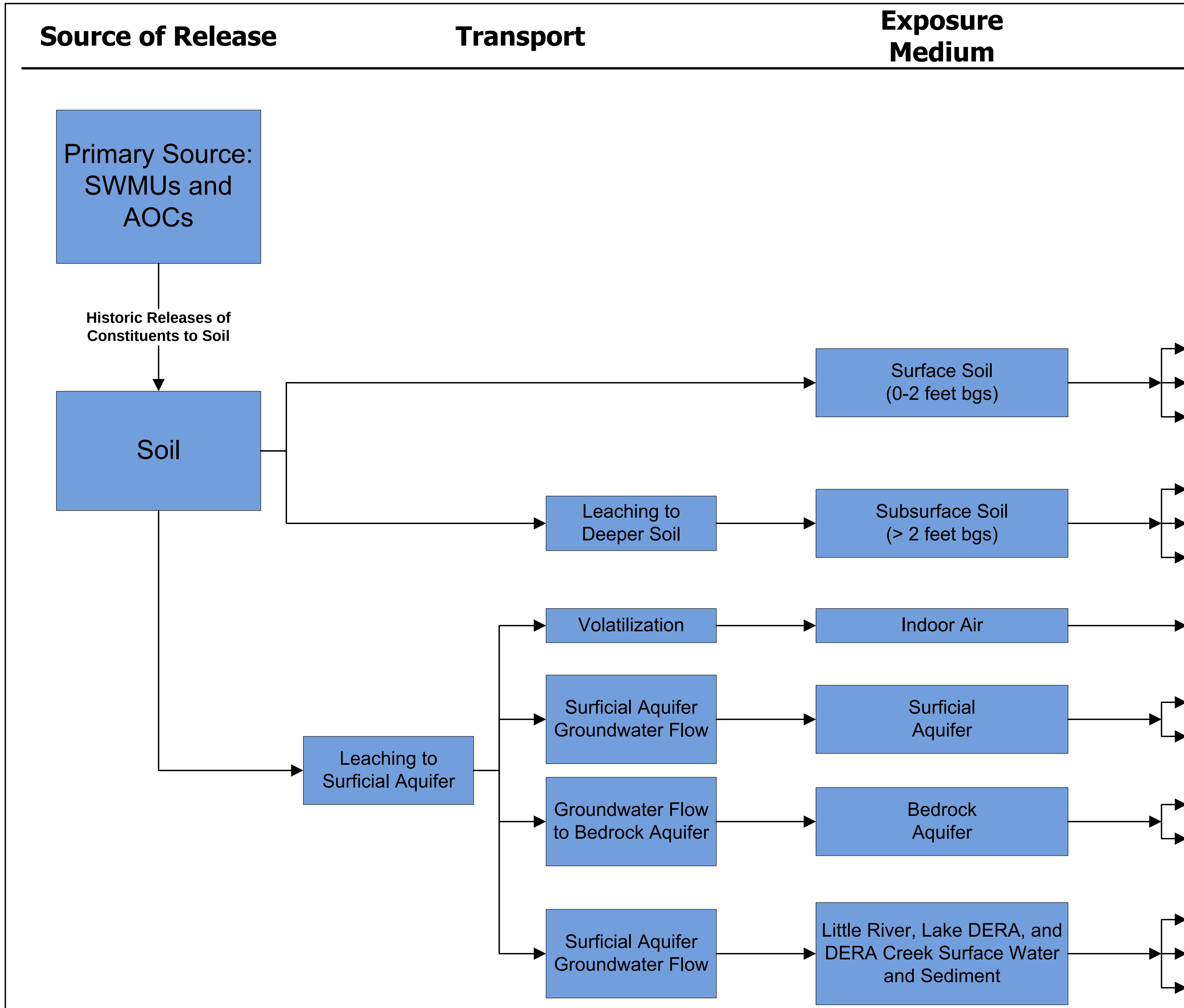
Current Status of SWMUs and AOCs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-9



Potential Receptors

Exposure Medium	Exposure Route	Current and Future DSRF User [1]	Current and Future DSRF Visitor Center Worker (Indoor Worker)	Future DSRF Worker	Future NCNG Worker (Military Exercises and Training)	Future Utility/ Excavation Worker	Future Resident [2]	Future Industrial Worker [2]	Current and Future Ecological Receptors
Surface Soil (0-2 feet bgs)	Incidental Ingestion	●	○	●	●	●	◇	◇	○
	Dermal Contact	●	○	●	●	●	◇	◇	○
	Inhalation	●	○	●	●	●	◇	◇	○
Subsurface Soil (> 2 feet bgs)	Incidental Ingestion	○	○	○	○	●	◇	◇	○
	Dermal Contact	○	○	○	○	●	◇	◇	○
	Inhalation	○	○	○	○	●	◇	◇	○
Indoor Air	Inhalation	○	◇	◇	◇	○	◇	◇	○
Surficial Aquifer	Ingestion	◇	◇	◇	◇	◇	◇	◇	○
	Dermal Contact	◇	◇	◇	◇	◇	◇	◇	○
Bedrock Aquifer	Ingestion	◇	●	◇	◇	◇	◇	◇	○
	Dermal Contact	◇	●	◇	◇	◇	◇	◇	○
Little River, Lake DERA, and DERA Creek Surface Water and Sediment	Incidental Ingestion	●	○	○	○	○	○	○	●
	Dermal Contact	●	○	○	○	○	○	○	●
	Fish Consumption	●	○	○	○	○	○	○	●

Key

- ○ Incomplete Pathway
- ◇ Potentially Complete Pathway
- ● Complete Pathway

Notes:
- The site conceptual model presented in the RIR was divided into two CSEMs (an RIR Screening CSEM and a RAP CSEM) to clarify how SLs and site-specific remediation standards were determined. The RIR Screening CSEM was used to identify SLs. In accordance with the Risk Bill, the RAP CSEM was used to develop site-specific RLs and points of compliance.

[1] Future DSRF users are forest trail users and recreational users of Little River, Lake DERA, and DERA Creek. A Little River recreational user is the only current DSRF user since there is no current recreational use within the DuPont-owned portion of the site.

[2] Future residents and commercial/industrial workers are not realistic potential receptors given the anticipated future land use. However, future residents and commercial/industrial workers were included in the CSEM for the purposes of developing SLs based on hypothetical unrestricted or industrial land use.

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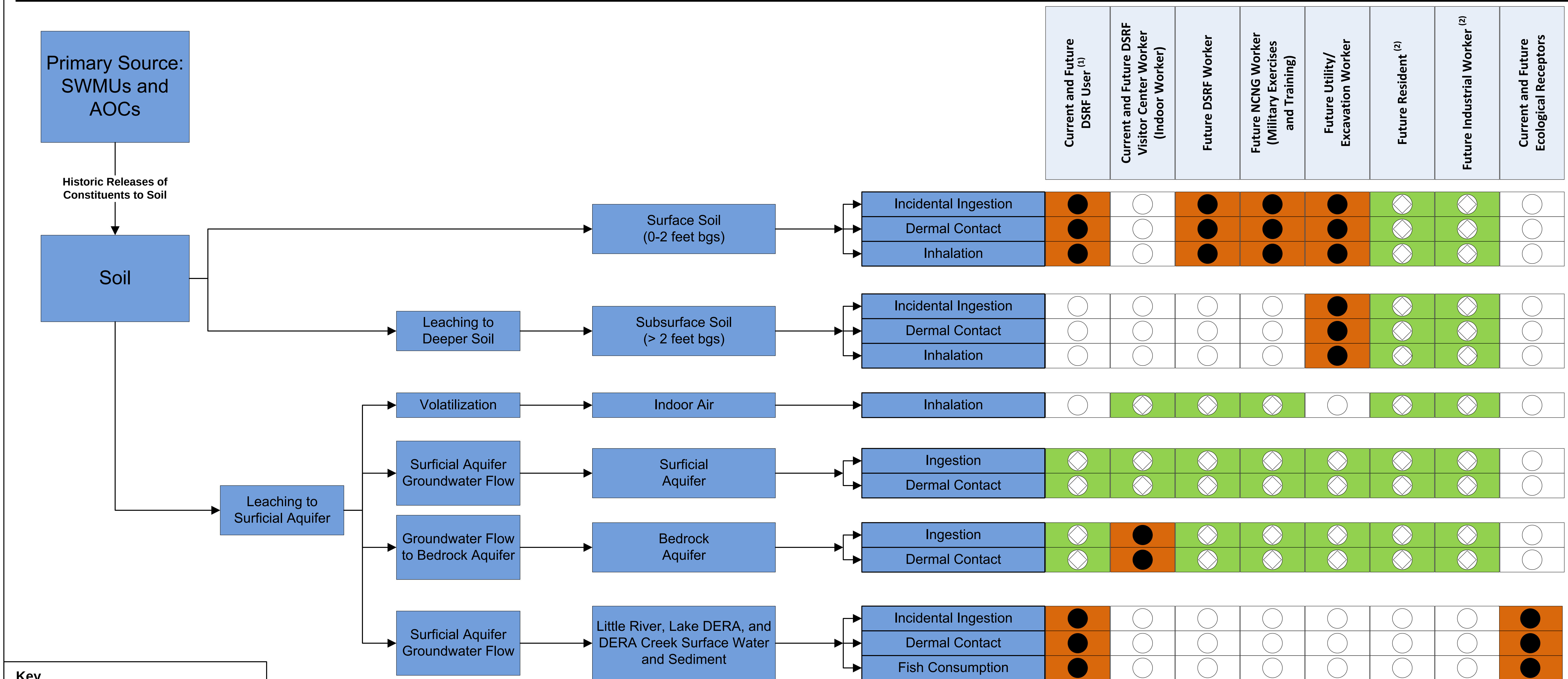
RIR Screening CSEM
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-10



Exposure Medium	Exposure Route	Current and Future DSRF User [1]	Current and Future DSRF Visitor Center Worker (Indoor Worker)	Future DSRF Worker	Future NCNG Worker (Military Exercises and Training)	Future Utility/ Excavation Worker	Future Resident [2]	Future Industrial Worker [2]	Current and Future Ecological Receptors
Surface Soil (0-2 feet bgs)	Incidental Ingestion	Complete	Incomplete	Complete	Complete	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
	Dermal Contact	Complete	Incomplete	Complete	Complete	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
	Inhalation	Complete	Incomplete	Complete	Complete	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
Subsurface Soil (> 2 feet bgs)	Incidental Ingestion	Incomplete	Incomplete	Incomplete	Incomplete	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
	Dermal Contact	Incomplete	Incomplete	Incomplete	Incomplete	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
	Inhalation	Incomplete	Incomplete	Incomplete	Incomplete	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
Indoor Air	Inhalation	Incomplete	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
Surficial Aquifer	Ingestion	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
	Dermal Contact	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
Bedrock Aquifer	Ingestion	Potentially Complete (controllable)	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
	Dermal Contact	Potentially Complete (controllable)	Complete	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Potentially Complete (controllable)	Incomplete
Little River, Lake DERA, and DERA Creek Surface Water and Sediment	Incidental Ingestion	Complete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Complete
	Dermal Contact	Complete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Complete
	Fish Consumption	Complete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete	Complete

Key

- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway
- Potentially Complete Pathway: In which exposure can be controlled with institutional or engineering controls.

Notes:

- The site conceptual model presented in the RIR was divided into two CSEMs (an RIR Screening CSEM and a RAP CSEM) to clarify how SLs and site-specific remediation standards were determined. The RIR Screening CSEM was used to identify SLs. In accordance with the Risk Bill, the RAP CSEM was used to develop site-specific RLs and points of compliance.

[1] Future DSRF users are forest trail users and recreational users of Little River, Lake DERA, and DERA Creek. A Little River recreational user is the only current DSRF user since there is no current recreational use within the DuPont-owned portion of the site.

[2] Future residents and commercial/industrial workers are not realistic potential receptors given the anticipated future land use. However, future residents and commercial/industrial workers were included in the CSEM for the purposes of developing SLs based on hypothetical unrestricted or industrial land use.

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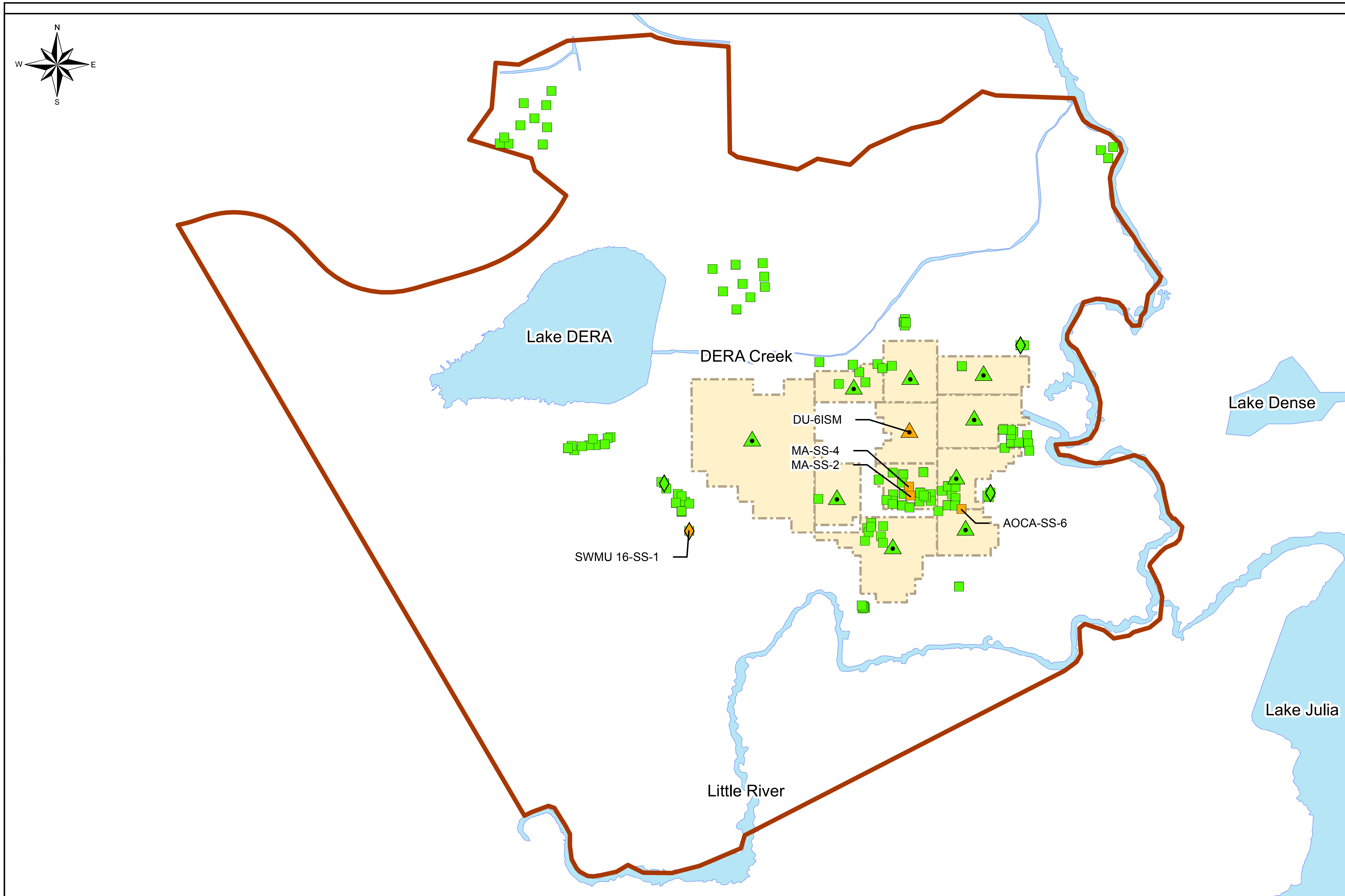
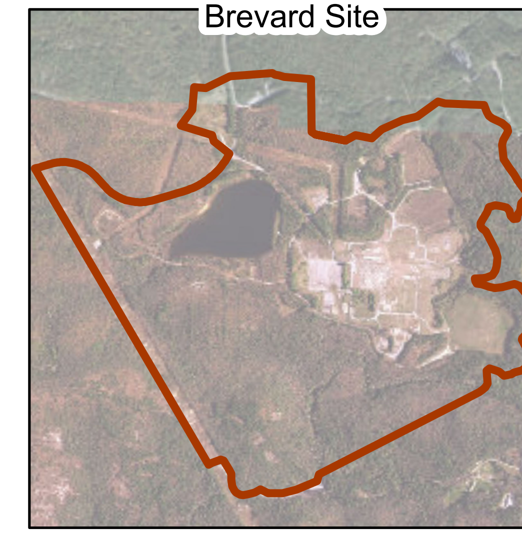
RAP CSEM
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 2-11





Legend

Site Boundary

Lake or Stream

Sample Category

Soil Sample 0-2 ft bgs

ISM Decision Units

ISM Sample

Waste Sample 0-2 ft bgs

Maximum COPC Concentrations

COPC Concentrations ≤ RL, Cumulative Risk ≤ 1E-04, and Cumulative HI ≤ 1

A COPC Concentration > RL, Cumulative Risk > 1E-04, or Cumulative HI > 1

Notes:
-ISM: Incremental Sampling Methodology

0 250 500 1,000 1,500 Feet

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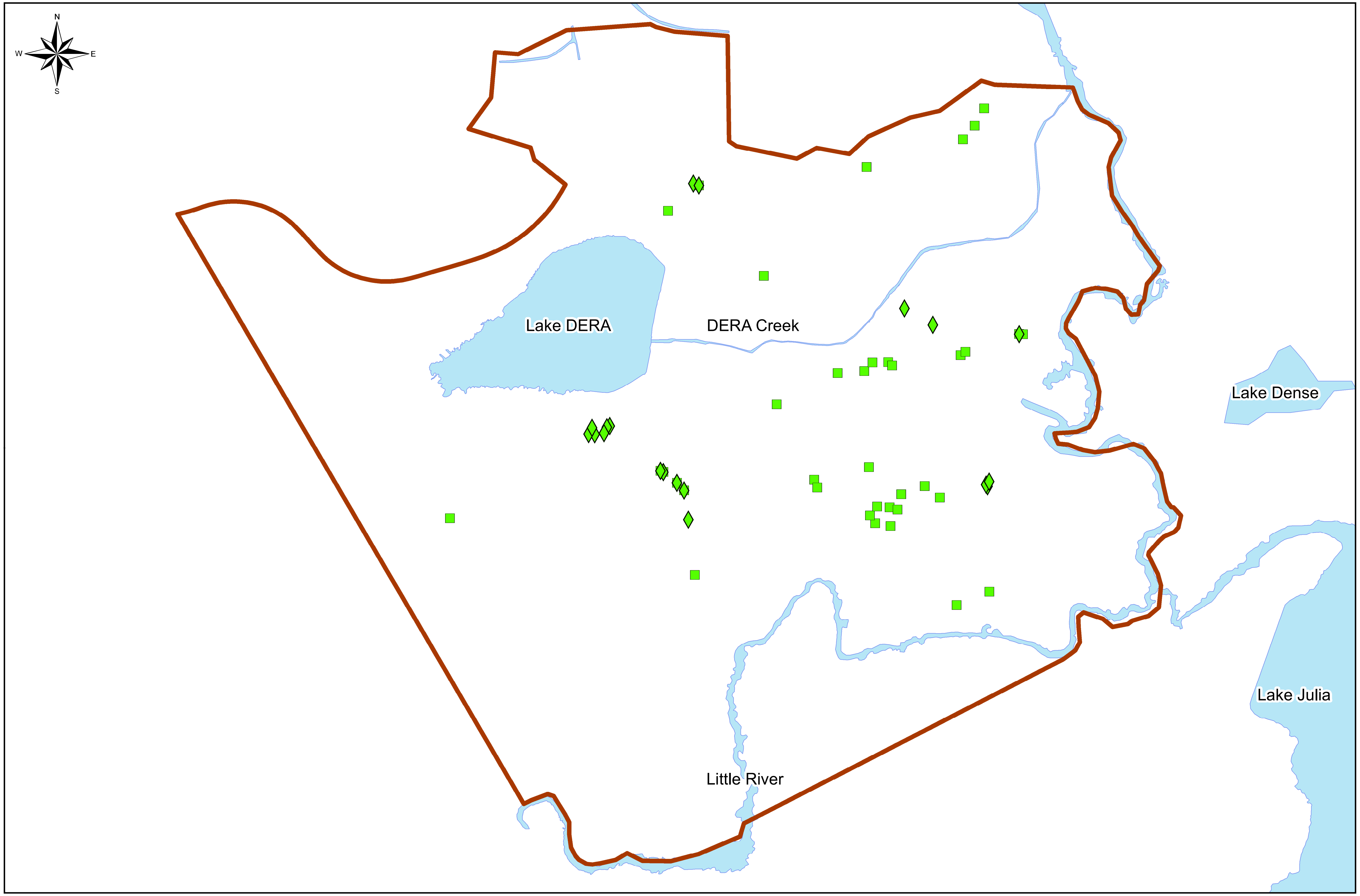
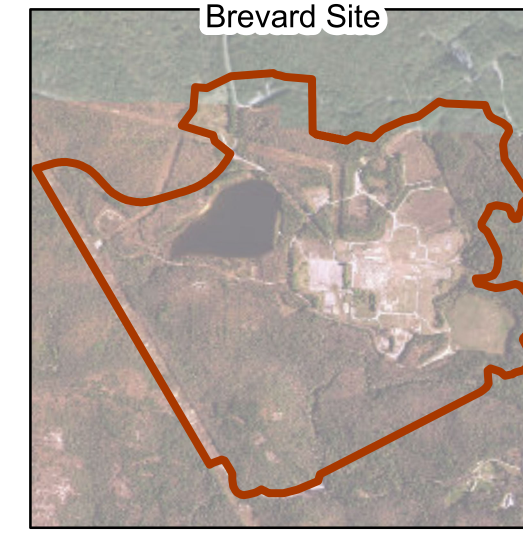
RL Exceedances at POC for Surface Soil Direct Contact Pathway
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 4-1

Document Path: G:\Projects\Brevard\Maps\2016\RAP\Fig_4-1_SurfaceSoil-DirectContact.mxd; Author: DB; Date Saved: 2/5/2016





Legend

Site Boundary

Lake or Stream

Sample Category

Soil Sample 2-15 ft bgs

Waste Sample 2-15 ft bgs

Maximum COPC Concentrations

COPC Concentrations ≤ RL, Cumulative Risk ≤ 1E-04, and Cumulative HI ≤ 1

A COPC Concentration > RL, Cumulative Risk > 1E-04, or Cumulative HI >1

0 250 500 1,000 1,500 Feet

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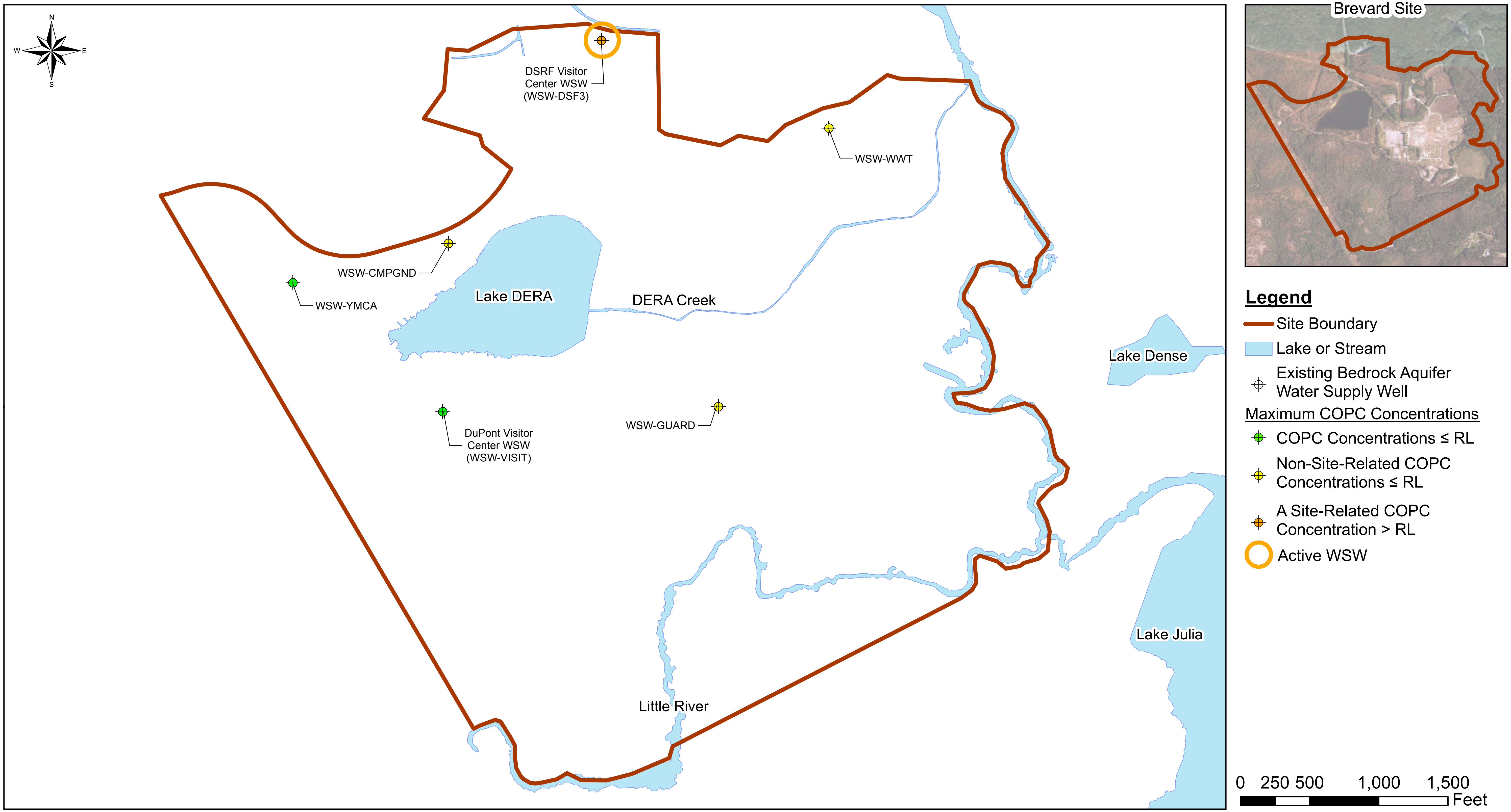
RL Exceedances at POC for Subsurface Soil Direct Contact Pathway
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 4-2



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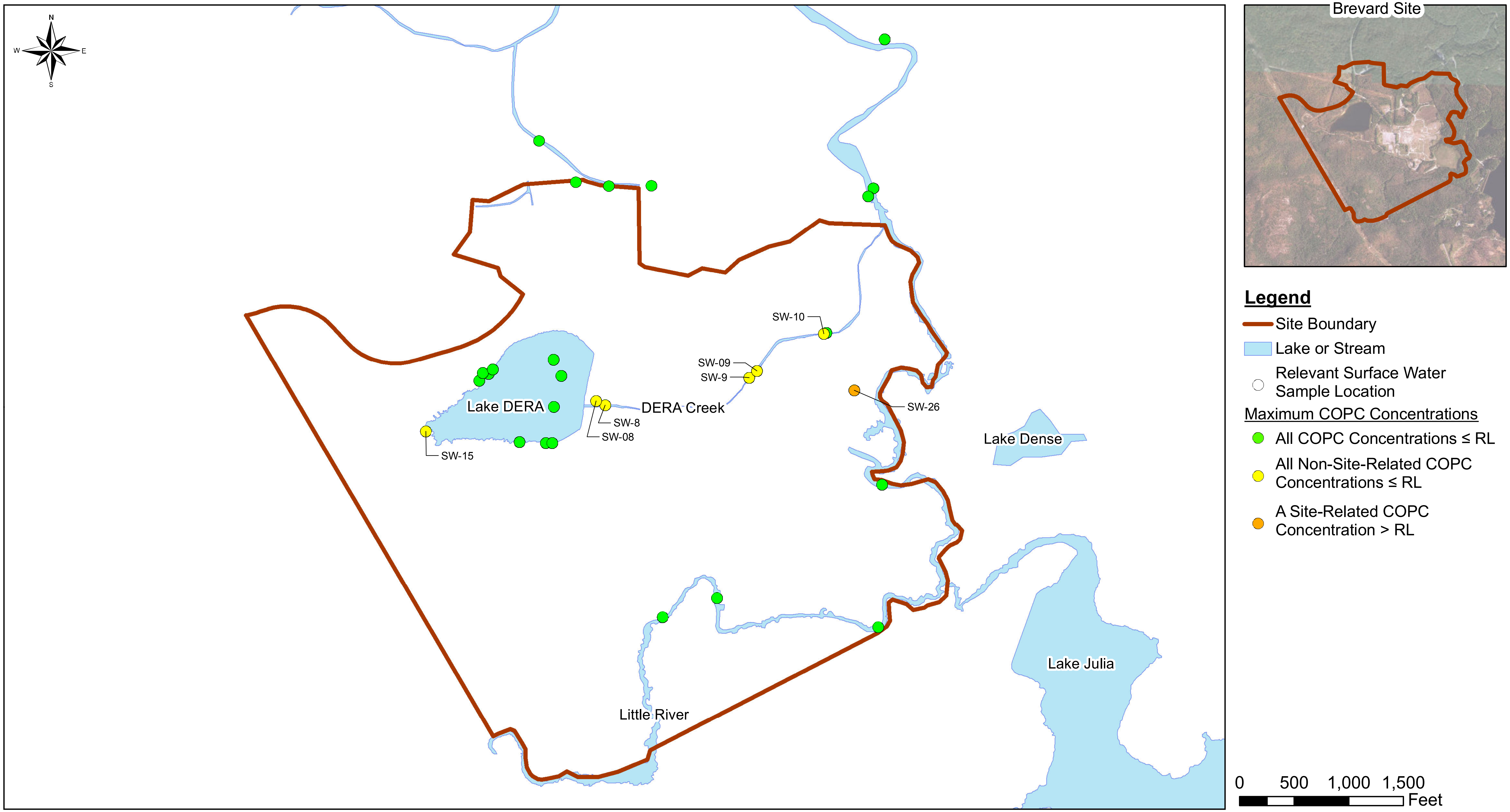
RL Exceedances at POC for Bedrock Aquifer Used as Drinking Water Pathway
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 4-3



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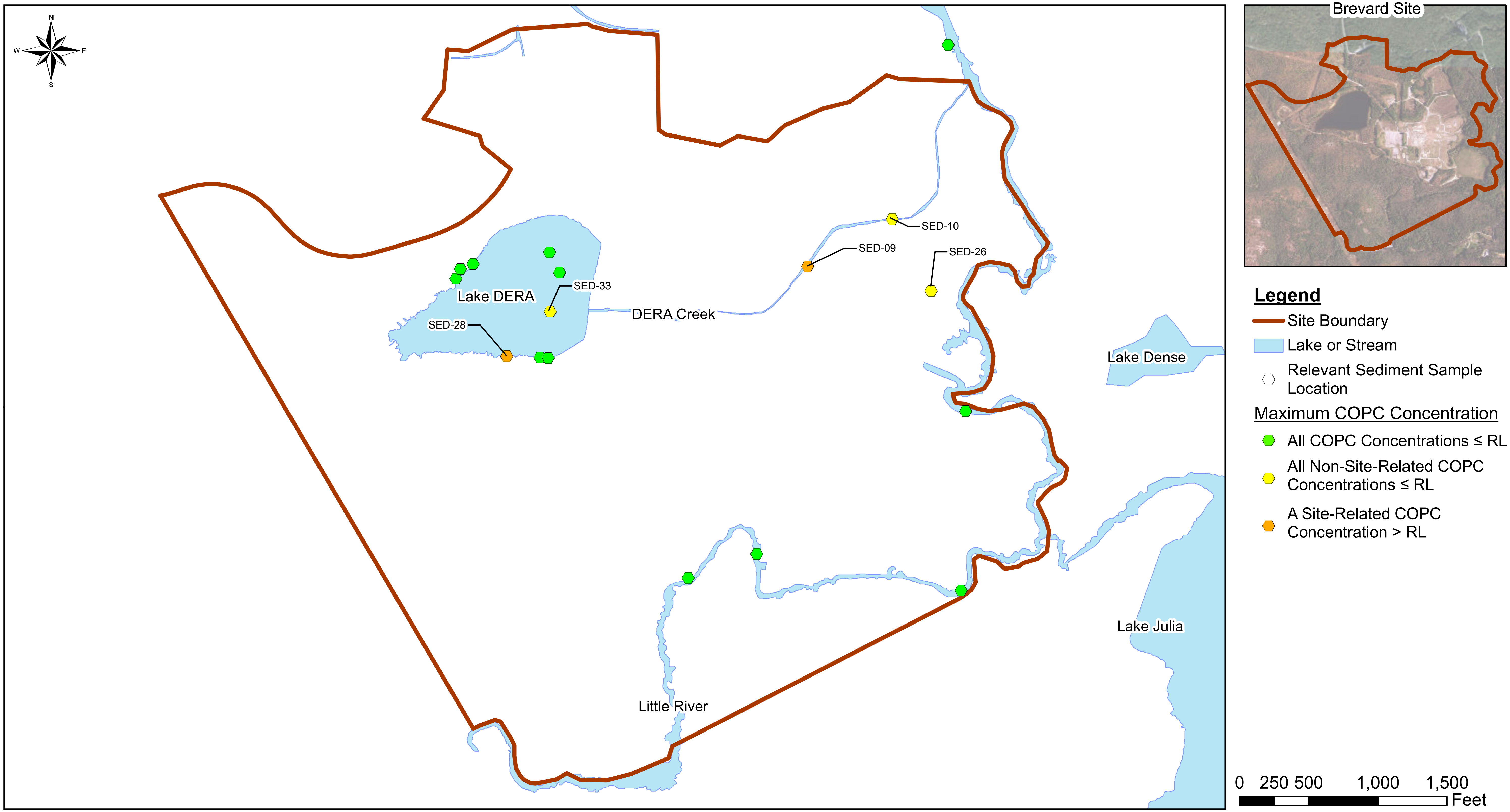
RL Exceedances at POC for Surface Water Exposures Pathway
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 4-4



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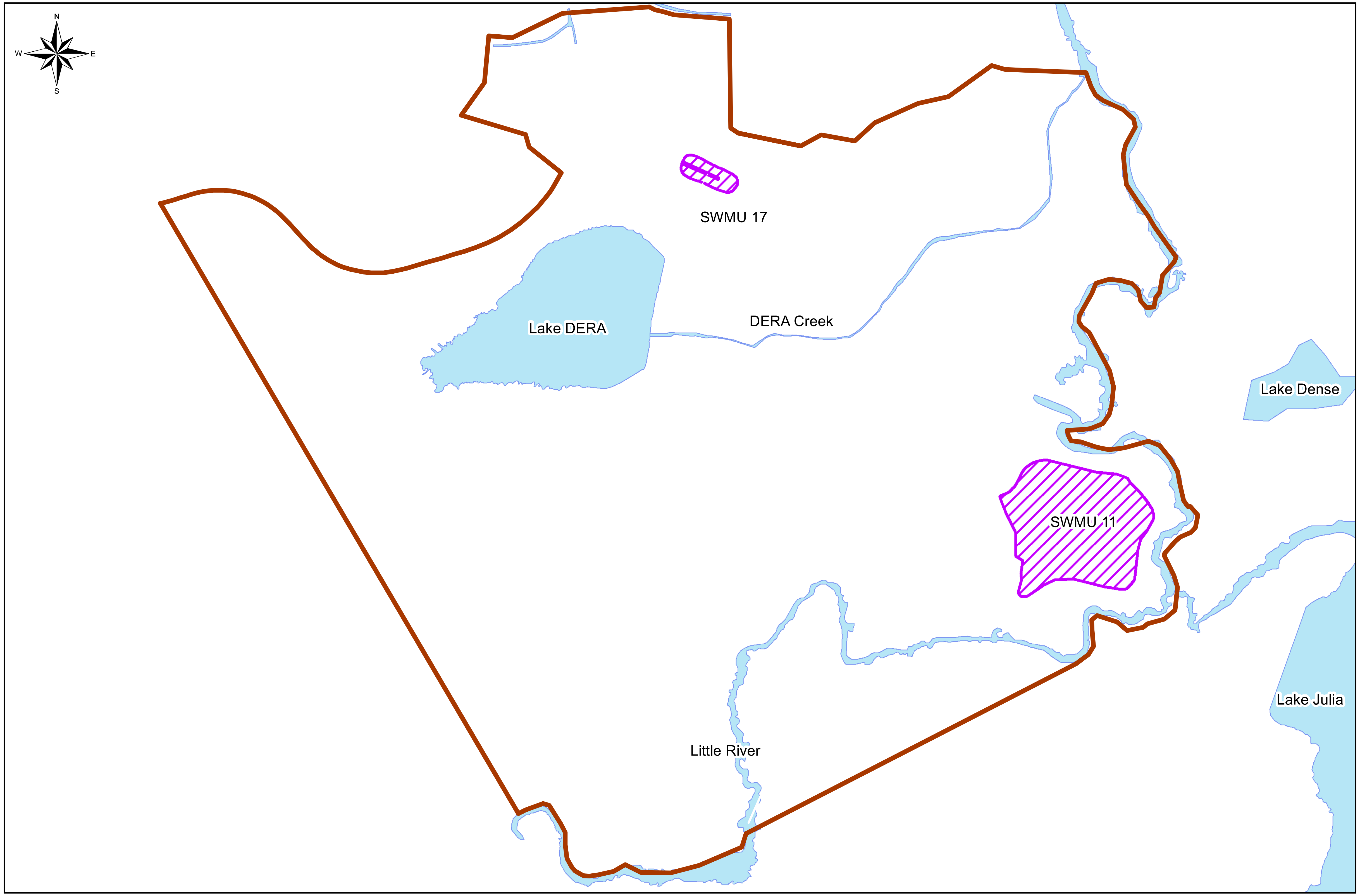
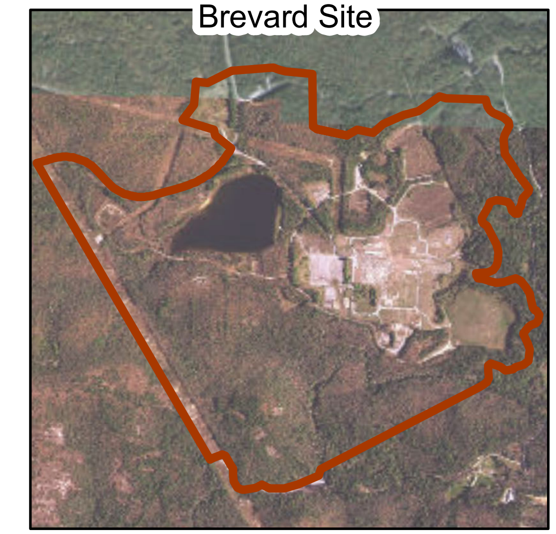
RL Exceedances at POC for Sediment Exposures Pathway
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 4-5

Document Path: G:\Projects\Brevard\Maps\2016\RAP\Fig_4-5_Sediment Concentrations compared to Site Specific Trail User.mxd; Author: DB; Date Saved: 2/2/2016





Legend
- Site Boundary
- Lake or Stream
- Active Remediation

0 500 1,000 1,500 Feet

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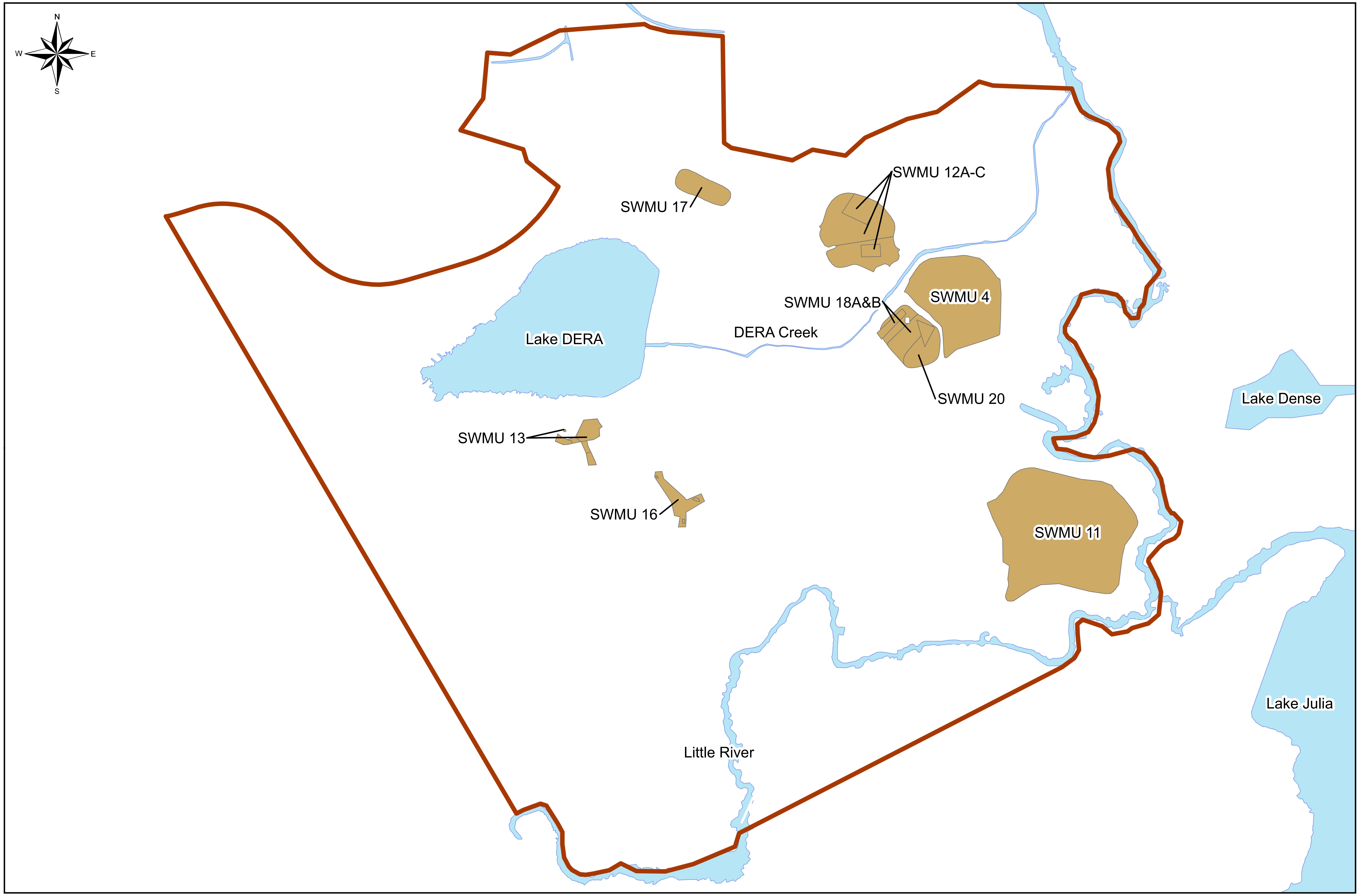
Active Remediation Locations (SWMU 11 and SWMU 17)
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-1



Legend

- Site Boundary
- Lake or Stream
- Perform O&M of Existing Cap/Covers and Implement ICs to Prohibit Excavation

0 520 1,040 1,560 Feet

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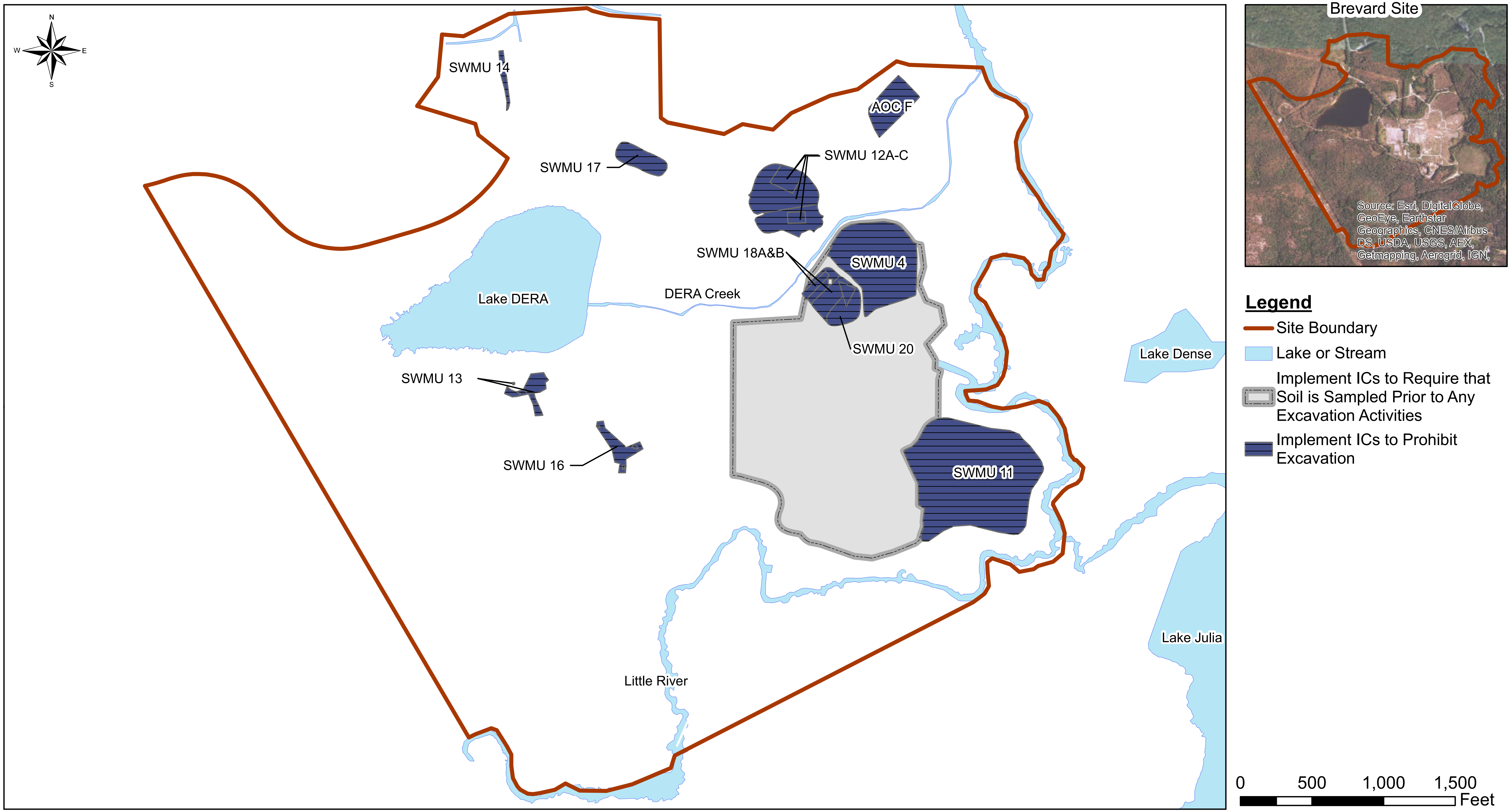
Perform O&M of Existing Cap/Covers
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-2

Document Path: G:\Projects\Brevard\Maps\2016\RAP\Fig_5-2_O&M and ICs for CAPs.mxd; Author: DB; Date Saved: 2/5/2016



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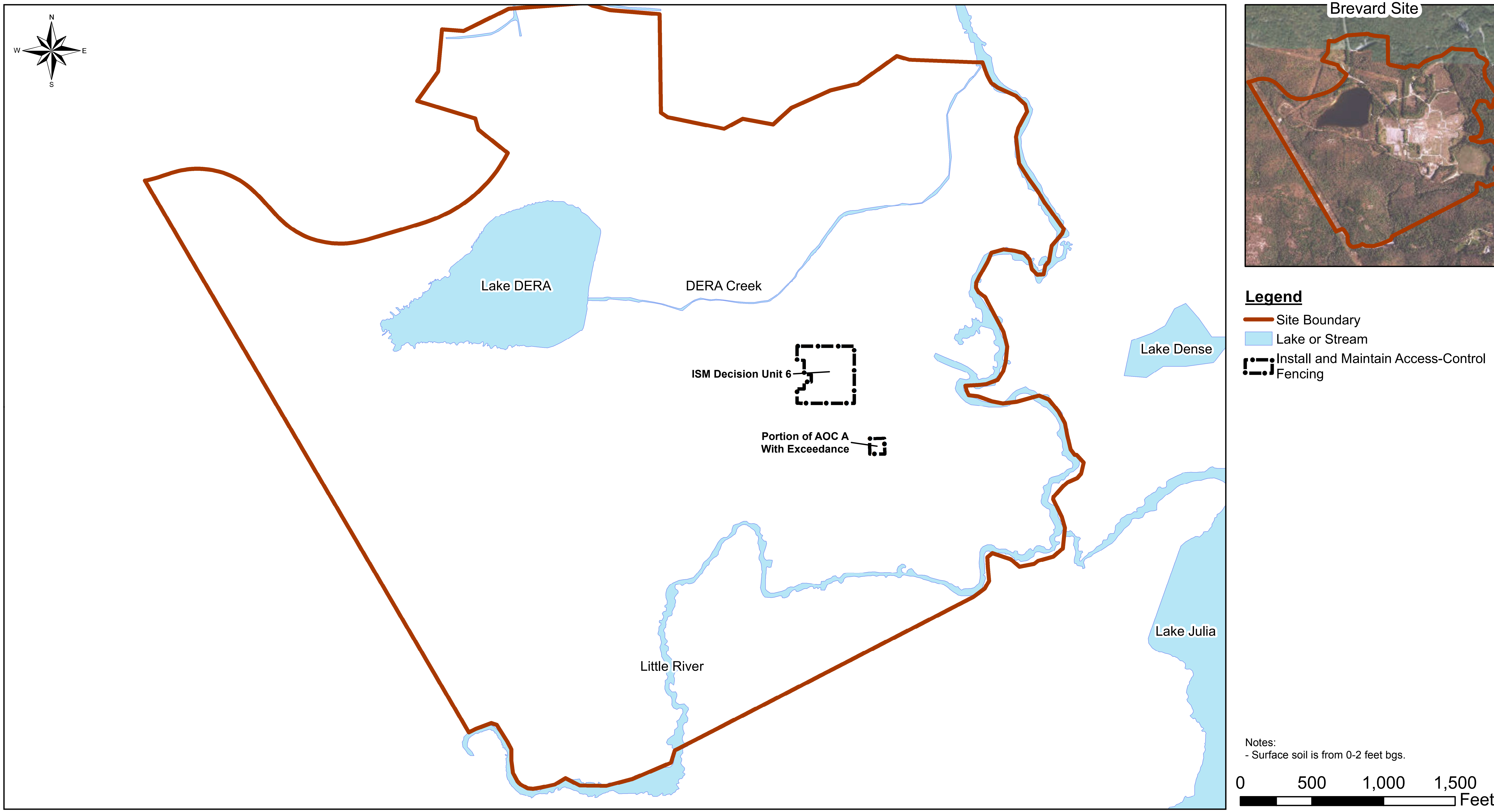
Implement Excavation-Related ICs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-3



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Actions to Address Surface Soil Direct Contact Pathway Exceedances
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-4

Legend

- Site Boundary
- Lake or Stream
- Perform O&M of Existing Treatment System
- Implement ICs to Require that Any New or Existing Bedrock Aquifer WSW is Sampled Prior to Putting the WSW into Service

0 250 500 1,000 1,500 Feet

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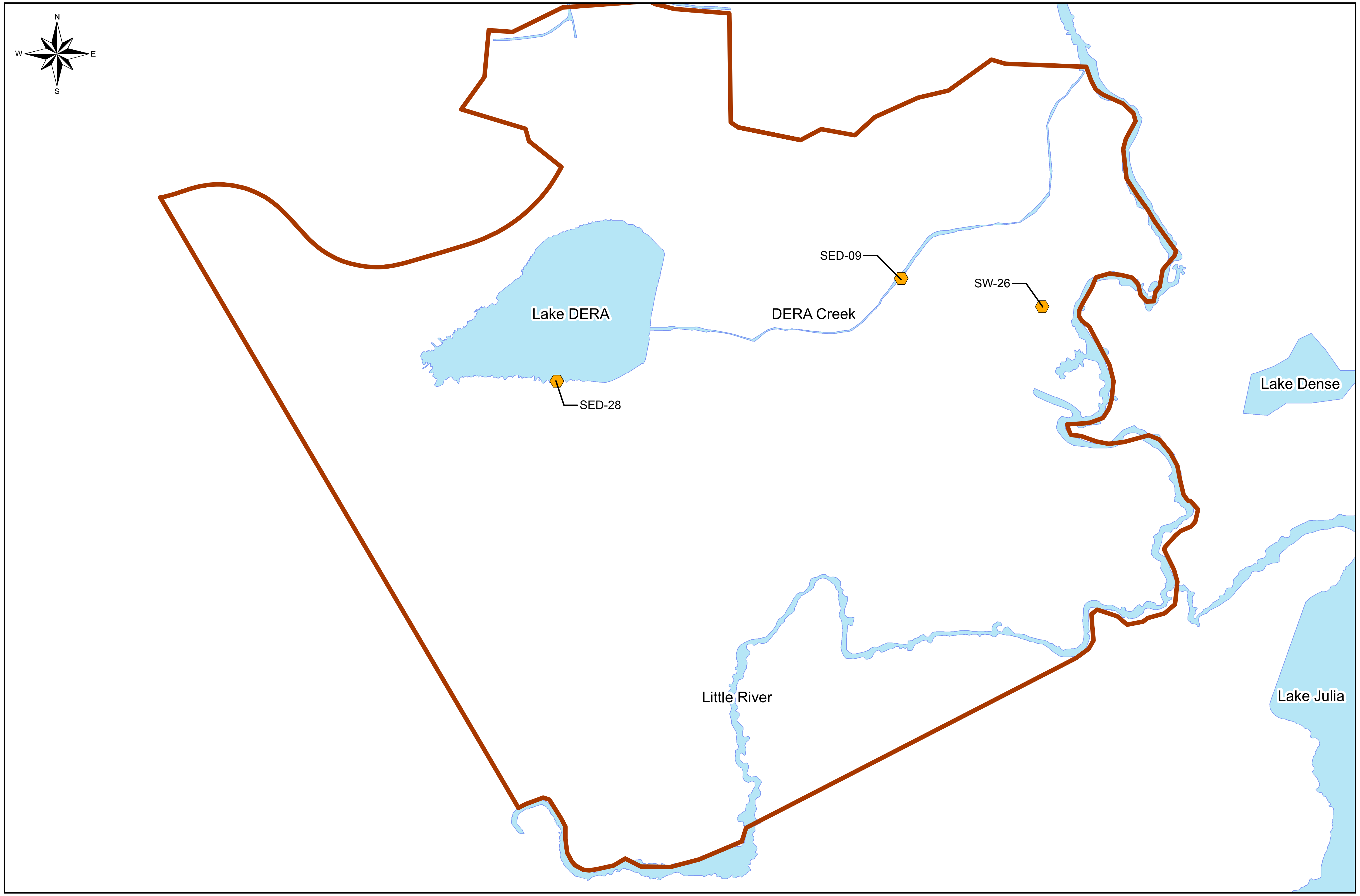
Actions to Address Bedrock Aquifer Used as Drinking Water Pathway Exceedances
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-5



Legend

- Site Boundary
- Lake or Stream
- To Be Determined After Additional Sediment and Surface Water Sampling

0 250 500 1,000 1,500 Feet

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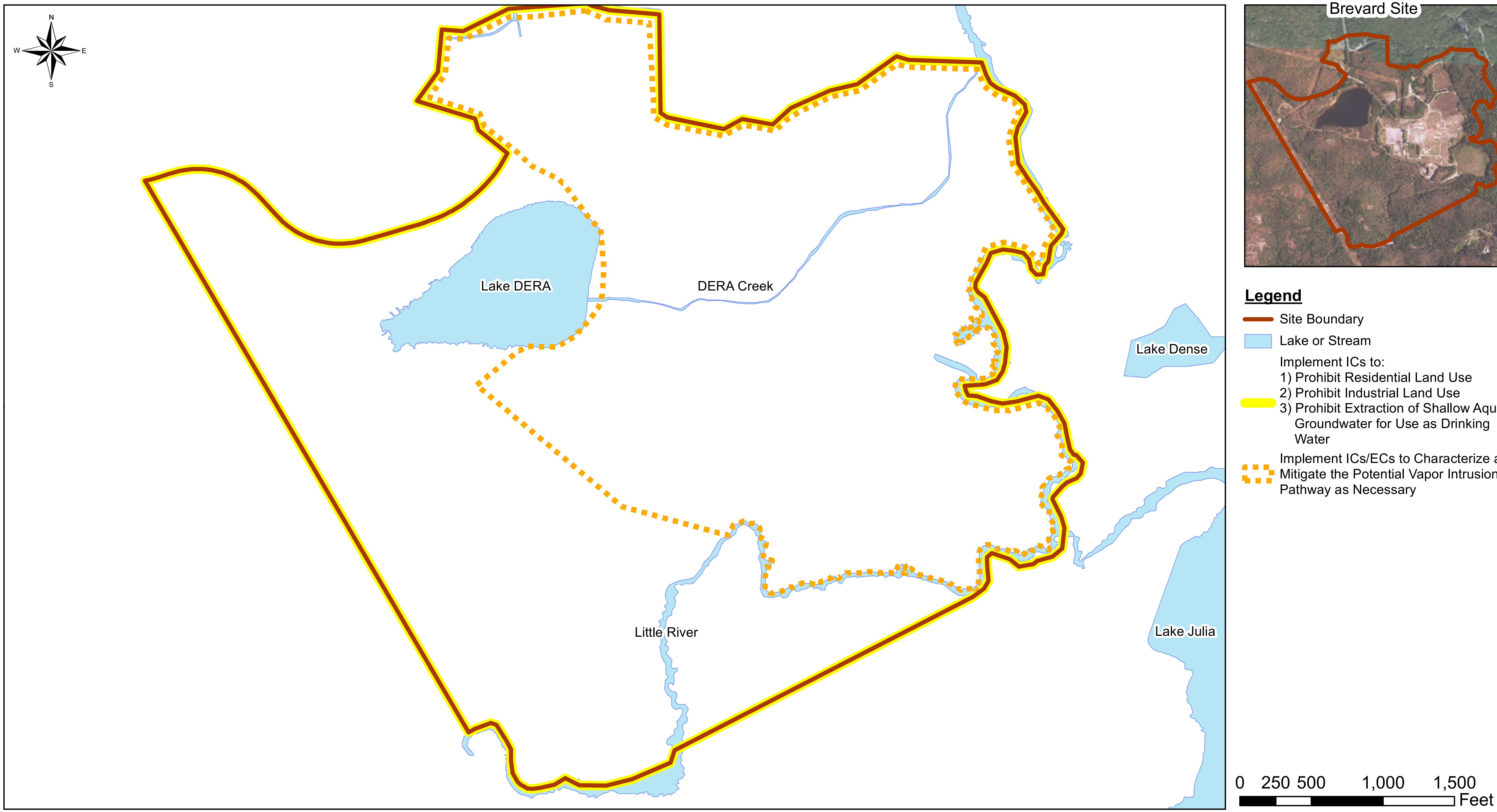
Additional Sediment and Surface Water Sampling
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-6



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ICs/ECs to Address Potentially Complete Pathways
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure 5-7

Tables

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Table 2-1: COPCs Identified in the RIR

COPCs	Complete and Potentially-Complete Exposure Pathways / Media						
	Surface and Subsurface Soil Direct Contact [1]	Soil-to-Groundwater	Vapor Intrusion	Surficial Aquifer Used as Drinking Water	Bedrock Aquifer Used as Drinking Water	Surface Water Exposure[2]	Sediment Exposure[3]
	Soil (0-15 feet bgs)	Soil (0-15 ft bgs)	Surficial Aquifer Groundwater	Surficial Aquifer Groundwater	Bedrock Aquifer Groundwater	Little River, Lake DERA, DERA Creek Surface Water	Little River, Lake DERA, DERA Creek Sediment
Inorganics							
Ammonia				X			
Antimony	X	X		X			
Arsenic	X	X		X			
Beryllium and compounds				X			
Cadmium		X		X			
Chromium, Total				X	X		
Cobalt	X	X		X			
Iron				X	X	X	X
Lead and Compounds	X			X			X
Manganese				X	X	X	
Mercury (elemental)	X	X					
Nickel Soluble Salts	X	X					
Selenium							X
Silver	X	X					X
Thallium (Soluble Salts)	X	X		X			
Vanadium	X	X		X	X		
Zinc and Compounds	X	X					
SVOCs							
1-Methylnaphthalene	X	X					
2-Methylnaphthalene	X	X					
7,12-Dimethylbenz(a)anthracene	X						
Acenaphthene		X					
Anthracene							X
Aroclor 1242	X	X					
Aroclor 1248	X	X					

Table 2-1: COPCs Identified in the RIR

COPCs	Complete and Potentially-Complete Exposure Pathways / Media						
	Surface and Subsurface Soil Direct Contact [1]	Soil-to-Groundwater	Vapor Intrusion	Surficial Aquifer Used as Drinking Water	Bedrock Aquifer Used as Drinking Water	Surface Water Exposure[2]	Sediment Exposure[3]
	Soil (0-15 feet bgs)	Soil (0-15 ft bgs)	Surficial Aquifer Groundwater	Surficial Aquifer Groundwater	Bedrock Aquifer Groundwater	Little River, Lake DERA, DERA Creek Surface Water	Little River, Lake DERA, DERA Creek Sediment
Aroclor 1254	X	X					
Aroclor 1260		X					
Benz[a]anthracene	X	X					X
Benzo(g,h,i)perylene							X
Benzo[a]pyrene	X	X		X			X
Benzo[b]fluoranthene	X	X					
Benzo[k]fluoranthene	X	X					X
Chrysene	X	X					X
Dibenz[a,h]anthracene	X	X		X	X		X
Fluoranthene							X
Fluorene							X
Indeno[1,2,3-cd]pyrene	X	X					X
Naphthalene	X	X					
Phenanthrene		X					X
Pyrene							X
DOWTHERM							
1,1'-Biphenyl	X	X	X	X			
Diphenyl Ether		X		X	X		
VOCs							
1,1,2,2-Tetrachloroethane	X	X	X	X			
1,1,2-Trichloroethane	X	X	X	X			
1,1-Dichloroethylene		X		X			
1,2-cis-Dichloroethylene	X	X		X			
1,2-Dichloroethane	X	X		X			
1,2-Diphenylhydrazine	X						
1,2-trans-Dichloroethylene		X					

Table 2-1: COPCs Identified in the RIR

COPCs	Surface and Subsurface Soil Direct Contact [1] – Soil (0-15 feet bgs)	Soil-to-Groundwater – Soil (0-15 ft bgs)	Vapor Intrusion – Surficial Aquifer Groundwater	Surficial Aquifer Used as Drinking Water – Surficial Aquifer Groundwater	Bedrock Aquifer Used as Drinking Water – Bedrock Aquifer Groundwater	Surface Water Exposure[2] – Little River, Lake DERA, DERA Creek Surface Water	Sediment Exposure[3] – Little River, Lake DERA, DERA Creek Sediment
	Complete and Potentially-Complete Exposure Pathways / Media						
1,4-Dioxane				X	X		
3-Methylcholanthrene	X						
Benzaldehyde		X					
Benzene	X	X		X			
Bis(2-ethylhexyl)phthalate				X			
Carbazole		X					
Carbon Tetrachloride			X	X			
Chloroform			X				
Dibenzofuran	X	X					
Ethylbenzene	X						
Ethylene Glycol		X					
Methylene Chloride		X					
N-Nitrosodimethylamine	X	X					
p-Cresol		X					
Phenol		X					
Tetrachloroethylene	X	X	X	X	X		
Trichloroethylene	X	X	X	X	X		
Trichlorofluoromethane			X				
Vinyl Chloride		X	X	X	X	X	
Xylenes		X					

Notes:

[1] Direct contact via incidental ingestion, dermal contact, and inhalation

[2] Surface water exposures via incidental ingestion, dermal contact, and fish consumption

[3] Sediment exposures via incidental ingestion, dermal contact, and fish consumption

Table 4-1: Summary of Remediation Level Exceedances

Pathway		Sample ID	COPC	Result	Qualifier	RL	EF
Surface Soil Direct Contact [(1),(2)] (mg/kg)	Soil (0-2 feet bgs)	BRE-S-AOCA-SS-6(0-2)_8/2/2004	7,12-Dimethylbenz(a)anthracene	5.7		0.60	9.5
			Benzo[a]pyrene	4.4		20	0.22
		BRE-V-SWMU16-SS-1(1-5)_7/12/2004	3-Methylcholanthrene	1.3	J	7.0	0.19
			Benz[a]anthracene	48		198	0.24
			Benzo[a]pyrene	41		20	2.1
			Benzo[b]fluoranthene	51		198	0.26
			Dibenz[a,h]anthracene	4.2		20	0.21
		SSP14-ISM-DU-6ISM_12/11/2014	Benz[a]anthracene	26		198	0.13
			Benzo[a]pyrene	21		20	1.1
			Benzo[b]fluoranthene	29		198	0.15
			Dibenz[a,h]anthracene	3.2		20	0.16
		SSP14-MA-SS-2_12/2/2014	Benz[a]anthracene	22		198	0.11
			Benzo[a]pyrene	17		20	0.86
			Benzo[b]fluoranthene	22		198	0.11
			Dibenz[a,h]anthracene	3.1	J	20	0.16
		SSP14-MA-SS-2-D_12/2/2014	Benz[a]anthracene	32		198	0.16
			Benzo[a]pyrene	18		20	0.91
			Benzo[b]fluoranthene	32		198	0.16
			Dibenz[a,h]anthracene	3.5		20	0.18
		SSP14-MA-SS-4_12/2/2014	Benzo[a]pyrene	14		20	0.71
			Benzo[b]fluoranthene	20		198	0.10
			Dibenz[a,h]anthracene	3.0		20	0.15
Subsurface Soil Direct Contact (mg/kg)	Soil (2-15 feet bgs)	None	None	N/A	N/A	N/A	N/A
Bedrock Aquifer as Drinking Water (ug/L)	Groundwater	SSP14-GW-WSW-CMPGND_12/19/2014	Iron	24,400		300	81
			Vanadium	2.1	J	0.30	7.0
		SSP14-GW-WSW-DSF3_12/16/2014	Trichloroethylene	13		3.0	4.3
		SSP14-GW-WSW-GUARD_12/19/2014	Iron	6,770		300	23
			Manganese	76		50	1.5
		SSP14-GW-WSW-WWT_12/18/2014	Iron	86,500		300	288
			Manganese	438		50	8.8

Table 4-1: Summary of Remediation Level Exceedances

Pathway		Sample ID	COPC	Result	Qualifier	RL	EF
Surface Water Exposures (ug/L)	Little River, Lake DERA, DERA Creek Surface Water	BRE-W-SW-10_2/4/2009	Manganese	332		120	2.8
		BRE-W-SW-10-DUP_2/4/2009	Manganese	347		120	2.9
		BRE-W-SW-15_2/4/2009	Iron	1,190		1,000	1.2
		BRE-W-SW-8_2/4/2009	Manganese	178		120	1.5
		BRE-W-SW-9_2/4/2009	Manganese	274		120	2.3
		PPS14-SW-10_10/21/2014	Manganese	510		120	4.3
		PPS14-SW-10-Z_10/21/2014	Manganese	498		120	4.2
		SSP14-SW-08_10/28/2014	Iron	1,520		1,000	1.5
			Manganese	371		120	3.1
		SSP14-SW-08-Z_10/28/2014	Iron	1,460		1,000	1.5
			Manganese	374		120	3.1
		SSP14-SW-09_10/28/2014	Manganese	416		120	3.5
		SSP14-SW-09-Z_10/28/2014	Manganese	402		120	3.4
		SSP14-SW-26_10/22/2014	Vinyl Chloride	5.0		2.4	2.1
Sediment Exposure (mg/kg)	Little River, Lake DERA, DERA Creek Sediment	SSP14-SED-09_10/21/2014	Anthracene	1.6		0.33	4.8
			Benz[a]anthracene	3.7		0.33	11
			Benzo(g,h,i)perylene	1.7		0.17	10.0
			Benzo[a]pyrene	2.8		0.33	8.5
			Benzo[k]fluoranthene	1.6		0.24	6.7
			Chrysene	3.6		0.33	11
			Dibenz[a,h]anthracene	0.39		0.033	12
			Fluoranthene	7.1		0.33	22
			Fluorene	0.49		0.33	1.5
			Indeno[1,2,3-cd]pyrene	1.6		0.20	8.0
			Manganese	5,760	J	460	13
			Phenanthrene	5.2		0.33	16
			Pyrene	5.0		0.20	26
		SSP14-SED-10_10/21/2014	Manganese	1,270	J	460	2.8
		SSP14-SED-26_10/22/2014	Iron	72,700	J	20,000	3.6
			Manganese	1,350	J	460	2.9
		SSP14-SED-28_10/23/2014	Anthracene	0.75		0.33	2.3
			Benz[a]anthracene	2.2		0.33	6.7
			Benzo(g,h,i)perylene	1.3		0.17	7.6
			Benzo[a]pyrene	1.9		0.33	5.8
			Benzo[k]fluoranthene	1.0		0.24	4.2
			Chrysene	2.0		0.33	6.1
			Dibenz[a,h]anthracene	0.37		0.033	11
			Fluoranthene	4.5		0.33	14
			Indeno[1,2,3-cd]pyrene	1.2		0.20	6.0
			Phenanthrene	2.9		0.33	8.8
			Pyrene	3.5		0.20	18

Table 4-1: Summary of Remediation Level Exceedances

Pathway		Sample ID	COPC	Result	Qualifier	RL	EF
		SSP14-SED-33_10/22/2014	Lead and Compounds	50	J	36	1.4
			Selenium	2.3	J	2.0	1.1

Notes:

J: Estimated value

U: Non-detected value

(1) For surface soil, some COPCs that have an exceedance factor (EF) < 1 are included on this table because the COPC contributes to a cumulative risk > 1E-04.

Table 4-2: Identification of COCs

COPCs	Complete Exposure Pathways					COC?	Rationale
	Surface Soil Direct Contact	Subsurface Soil Direct Contact	Bedrock Aquifer Used as Drinking Water	Surface Water Exposures	Sediment Exposures		
Inorganics							
Ammonia						No	Not applicable to complete exposure pathways
Antimony	X	X				No	No RL exceedance
Arsenic	X	X				No	No RL exceedance
Beryllium and compounds						No	Not applicable to complete exposure pathways
Cadmium						No	Not applicable to complete exposure pathways
Chromium, Total			X			No	No RL exceedance
Cobalt	X	X				No	No RL exceedance
Iron			X	X	X	No	Not a site-related constituent
Lead and Compounds	X	X			X	No	No RL exceedances for surface and subsurface soil; not site-related for sediment
Manganese			X	X		No	Not a site-related constituent
Mercury (elemental)	X	X				No	No RL exceedance
Nickel Soluble Salts	X	X				No	No RL exceedance
Selenium					X	No	Not a site-related constituent
Silver	X	X			X	No	No RL exceedance
Thallium (Soluble Salts)	X	X				No	No RL exceedance
Vanadium	X	X	X			No	No RL exceedance for surface and subsurface soil; not a site-related constituent for Bedrock Aquifer groundwater
Zinc and Compounds	X	X				No	No RL exceedance
SVOCs							
1-Methylnaphthalene	X	X				No	No RL exceedance
2-Methylnaphthalene	X	X				No	No RL exceedance
7,12-Dimethylbenz(a)anthracene	X	X				Yes	Exceeds RL in surface soil; no RL exceedance in subsurface soil
Acenaphthene						No	Not applicable to complete exposure pathways
Anthracene					X	TBD	To be determined based on additional sediment sampling
Aroclor 1242	X	X				No	No RL exceedance

Table 4-2: Identification of COCs

COPCs	Complete Exposure Pathways: Surface Soil Direct Contact	Subsurface Soil Direct Contact	Bedrock Aquifer Used as Drinking Water	Surface Water Exposures	Sediment Exposures	COC?	Rationale
Aroclor 1248	X	X				No	No RL exceedance
Aroclor 1254	X	X				No	No RL exceedance
Aroclor 1260						No	Not applicable to complete exposure pathways
Benz[a]anthracene	X	X			X	Yes	Exceeds RL in surface soil; no RL exceedance for subsurface soil; to be determined based on additional sediment sampling
Benzo(g,h,i)perylene					X	TBD	To be determined based on additional sediment sampling
Benzo[a]pyrene	X	X			X	Yes	Exceeds RL in surface soil; no RL exceedance in subsurface soil; to be determined based on additional sediment sampling
Benzo[b]fluoranthene	X	X				Yes	Exceeds RL in surface soil; no RL exceedance in subsurface soil
Benzo[k]fluoranthene	X	X			X	TBD	No RL exceedances in surface and subsurface soil; to be determined based on additional sediment sampling
Chrysene	X	X			X	TBD	No RL exceedances in surface and subsurface soil; to be determined based on additional sediment sampling
Dibenz[a,h]anthracene	X	X	X		X	Yes	Exceeds RL in surface soil; no RL exceedance in subsurface soil and Bedrock Aquifer groundwater; to be determined based on additional sediment sampling
Fluoranthene					X	TBD	To be determined based on additional sediment sampling
Fluorene					X	No	No RL exceedance
Indeno[1,2,3-cd]pyrene	X	X			X	TBD	No RL exceedances in surface and subsurface soil; to be determined based on additional sediment sampling
Naphthalene	X	X				No	No RL exceedance
Phenanthrene					X	TBD	To be determined based on additional sediment sampling
Pyrene					X	TBD	To be determined based on additional sediment sampling

Table 4-2: Identification of COCs

COPCs	Complete Exposure Pathways: Surface Soil Direct Contact	Subsurface Soil Direct Contact	Bedrock Aquifer Used as Drinking Water	Surface Water Exposures	Sediment Exposures	COC?	Rationale
DOWTHERM							
1,1'-Biphenyl	X	X				No	No RL exceedance
Diphenyl Ether			X			No	No RL exceedance
VOCs							
1,1,2,2-Tetrachloroethane	X	X				No	No RL exceedance
1,1,2-Trichloroethane	X	X				No	No RL exceedance
1,1-Dichloroethylene						No	Not applicable to complete exposure pathways
1,2-cis-Dichloroethylene	X	X				No	No RL exceedance
1,2-Dichloroethane	X	X				No	No RL exceedance
1,2-Diphenylhydrazine	X	X				No	No RL exceedance
1,2-trans-Dichloroethylene						No	Not applicable to complete exposure pathways
1,4-Dioxane			X			No	No RL exceedance
3-Methylcholanthrene	X	X				Yes	Exceeds RL in surface soil; no RL exceedance in subsurface soil
Benzaldehyde						No	Not applicable to complete exposure pathways
Benzene	X	X				No	No RL exceedance
Bis(2-ethylhexyl)phthalate						No	Not applicable to complete exposure pathways
Carbazole						No	Not applicable to complete exposure pathways
Carbon Tetrachloride						No	Not applicable to complete exposure pathways
Chloroform						No	Not applicable to complete exposure pathways
Dibenzofuran	X	X				No	No RL exceedance
Ethylbenzene	X	X				No	No RL exceedance
Ethylene Glycol						No	Not applicable to complete exposure pathways
Methylene Chloride						No	Not applicable to complete exposure pathways
N-Nitrosodimethylamine	X	X				No	No RL exceedance
p-Cresol						No	Not applicable to complete exposure pathways
Phenol						No	Not applicable to complete exposure pathways
Tetrachloroethylene	X	X	X			No	No RL exceedance
Trichloroethylene	X	X	X			Yes	No RL exceedances in surface and subsurface soil; exceeds RL in Bedrock Aquifer groundwater

Table 4-2: Identification of COCs

COPCs	Complete Exposure Pathways					COC?	Rationale
	Surface Soil Direct Contact	Subsurface Soil Direct Contact	Bedrock Aquifer Used as Drinking Water	Surface Water Exposures	Sediment Exposures		
Trichlorofluoromethane						No	Not applicable to complete exposure pathways
Vinyl Chloride			X	X		Yes	Exceeds RL in surface water; no RL exceedances in Bedrock Aquifer groundwater
Xylenes						No	Not applicable to complete exposure pathways

Appendix A

Screening Level Exceedance Locations

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Figures

List of Acronyms

Acronym	Explanation
CCEFs	Cumulative Cancer Exceedance Factors
CEFs	Cancer Exceedance Factors
DEQ	Department of Environment Quality
DERA	DuPont Employee Recreational Area
ECs	Engineering Controls
EF	Exceedance Factor
DuPont	E.I. DuPont de Nemours and Company
HI	Hazard index (noncancer)
ICs	Institutional Controls
IHSB	Inactive Hazardous Site Branch
IMAC	Interim Maximum Allowable Concentrations
NC	North Carolina
NC2L	North Carolina 2L drinking water criteria
NC2B	North Carolina 2B surface water criteria
NCDEQ	North Carolina Department of Environmental Quality
NCDWM	North Carolina Division of Waste Management
NCEFs	Noncancer Exceedance Factors
PSRG	Preliminary Soil Remediation Goals
RAP	Remedial Action Plan
RIR	Remedial Investigation Report
Site	Brevard Site
USEPA	United States Environmental Protection Agency
VI	Vapor Intrusion
SL	Screening Levels

SECTION 1: SCREENING LEVEL EXCEEDANCES

The generic screening levels (SLs) presented in the Remedial Investigation Report (RIR) for the E.I. du Pont de Nemours and Company (DuPont) Brevard Site (site) were used in the Remedial Action Plan (RAP) to identify areas where institutional controls (ICs) and engineering controls (ECs) may be needed after site-specific remedial actions are complete. To identify areas at the site where constituent concentrations in soil, groundwater, surface water, and sediment exceeded SLs, maximum constituent concentrations were compared to SLs based on the potentially-complete exposure pathways identified in the RIR (Parsons 2015). The purpose of this appendix is to present the sample locations where maximum constituent concentrations exceeded SLs for each potentially-complete and complete exposure pathway identified in the RIR and define the magnitude of the SL exceedances using exceedance factors (EFs).

1.1 Screening Levels

The following default North Carolina (NC) Department of Environment Quality (NCDEQ), NC Division of Waste Management (NCDWM), or United States Environmental Protection Agency (USEPA) criteria were used as the SLs in the RIR (Parsons 2015).

Soil	•Inactive Hazardous Site Branch (IHSB) Residential Preliminary Soil Remediation Goals (PSRGs) •IHSB Industrial PSRGs •IHSB Protection of Groundwater PSRGs
Groundwater	•15A NCAC4 2L.0200 (NC2L) drinking water criteria •NC Interim Maximum Allowable Concentrations (IMAC) •NCDW Residential Vapor Intrusion (VI) SLs •NCDWM Industrial VI SLs
Sediment (Little River, Lake DERA, and DERA Creek)	•Ecological Sediment Quality Benchmarks
Surface Water (Little River, Lake DERA, and DERA Creek Surface Water)	•15A NCAC 2B (NC2B) surface water critera (protection of freshwater organisms (chronic), trout waters (organism only), and human health (fish consumption) •National Recommended Water Quality Criteria (if NC2B standards were not available)

1.2 Calculation of Exceedance Factors

Exceedance factors (EFs) were calculated for all detected constituents by dividing the maximum constituent concentrations in soil, groundwater, surface water, and sediment by the most conservative potentially-complete exposure pathway SLs to determine where (and by how much) constituent concentrations exceeded the SLs. Noncancer exceedance factors (NCEFs) and cancer exceedance factors (CEFs) were calculated for each sample location by dividing the maximum constituent concentration at a sample location by the noncancer or cancer SL for each potentially-complete exposure pathway.

Potentially-Complete Exposure Pathway	Media	Receptor
Surface and subsurface soil direct contact (via incidental ingestion, dermal contact, and inhalation of particulates)	Soil	Future resident and future industrial worker
Soil-to-groundwater	Soil	Future resident
Vapor intrusion	Groundwater	Future resident and future industrial worker
Surficial Aquifer used as drinking water	Groundwater	Future resident
Bedrock Aquifer used as drinking water	Groundwater	Future resident
Surface water exposures (via incidental ingestion, dermal contact, and consumption of seafood)	Surface Water	Current and future DSRF user and current and future ecological receptors
Sediment exposures (via incidental ingestion, dermal contact, and consumption of seafood)	Sediment	Current and future ecological receptors

NCEFs were based on noncancer endpoints with a hazard index of 0.2 or a combination of cancer and noncancer endpoints. An NCEF greater than 1 indicates that at least one constituent concentration at a sample location was greater than the SL. An NCEF of 10 indicates that at least one constituent concentration at a sample location is greater than 10 times the SL. The highest NCEF for each sample location is presented on the applicable figures.

Cancer risks are presented as cumulative risks (i.e., cumulative CEFs [CCEFs]). To determine the CCEFs for each sample location, the CEFs for all constituents detected at a sample location were summed. A CCEF of 1 indicates that the cumulative cancer risk at a sample location is 1E-06. A CCEF of 10 indicates that the cumulative cancer risk at a sample location is 1E-05. The highest CCEF for each sample location is presented on the applicable figures.

1.3 Exceedance Locations

Figures A-1 through A-15 present the locations where constituent concentrations exceeded SLs. The following table identifies the pathway and SL used in each EF figure.

Figure	Pathway	Calculation	Criteria	EF Type
A-1	Surface soil direct contact	The maximum surface soil concentration was divided by the residential noncancer SLs	North Carolina residential noncancer PSRG (Hazard Index [HI] = 0.2)	NCEF
A-2	Surface soil direct contact	The maximum surface soil concentration was divided by the residential cancer SL	North Carolina residential cancer PSRG (cancer risk [CR] = 1E-06)	CCEF
A-3	Surface soil direct	The maximum surface soil	North Carolina industrial	NCEF

Figure	Pathway	Calculation	Criteria	EF Type
	contact	concentration was divided by the industrial noncancer SL	noncancer PSRG (HI = 0.2)	
A-4	Surface soil direct contact	The maximum surface soil concentration was divided by the industrial cancer SL	North Carolina industrial cancer PSRG (CR = 1E-06)	CCEF
A-5	Subsurface soil direct contact	The maximum subsurface soil concentration was divided by the residential noncancer SL	North Carolina residential noncancer PSRG (HI = 0.2)	NCEF
A-6	Subsurface soil direct contact	The maximum subsurface soil direct contact concentration was divided by residential cancer SL	North Carolina Residential cancer PSRG (CR = 1E-06)	CCEF
A-7	Subsurface soil direct contact	The maximum subsurface soil concentration was divided by industrial noncancer SL	North Carolina Industrial noncancer PSRG (HI = 0.2)	NCEF
A-8	Subsurface soil direct contact	The maximum subsurface soil concentration was divided by industrial cancer SLs	North Carolina industrial cancer PSRG (CR = 1E-06)	CCEF
A-9	Soil-to-groundwater	The maximum soil concentration was divided by the protection of groundwater SLs	North Carolina protection of groundwater PSRG	EFs are based on either noncancer or cancer criteria.
A-10	Vapor intrusion	The maximum Surficial Aquifer concentration was divided by the residential VI SL	North Carolina Division of Waste Management Residential VI SLs	EFs are based on either noncancer or cancer criteria.
A-11	Vapor intrusion	The maximum Surficial Aquifer concentration was divided by industrial VI SLs	North Carolina Division of Waste Management Industrial vapor intrusion (VI) SLs	EFs are based on either noncancer or cancer criteria.
A-12	Surficial Aquifer used as drinking water	The maximum Surficial Aquifer constituent concentration was divided by drinking water SLs	NC2L	EFs are based on either noncancer or cancer criteria.
A-13	Bedrock Aquifer used as drinking water	The maximum Bedrock Aquifer constituent concentration was divided by drinking water SLs	NC2L	EFs are based on either noncancer or cancer criteria.
A-14	Surface water exposures	The maximum surface water constituent concentration was divided ecological and human health SLs	NC2B	EFs are based on either noncancer or cancer criteria.
A-15	Sediment exposures	The maximum sediment constituent concentration was divided by ecological SLs	Ecological SLs	EFs are based on either noncancer or cancer criteria.

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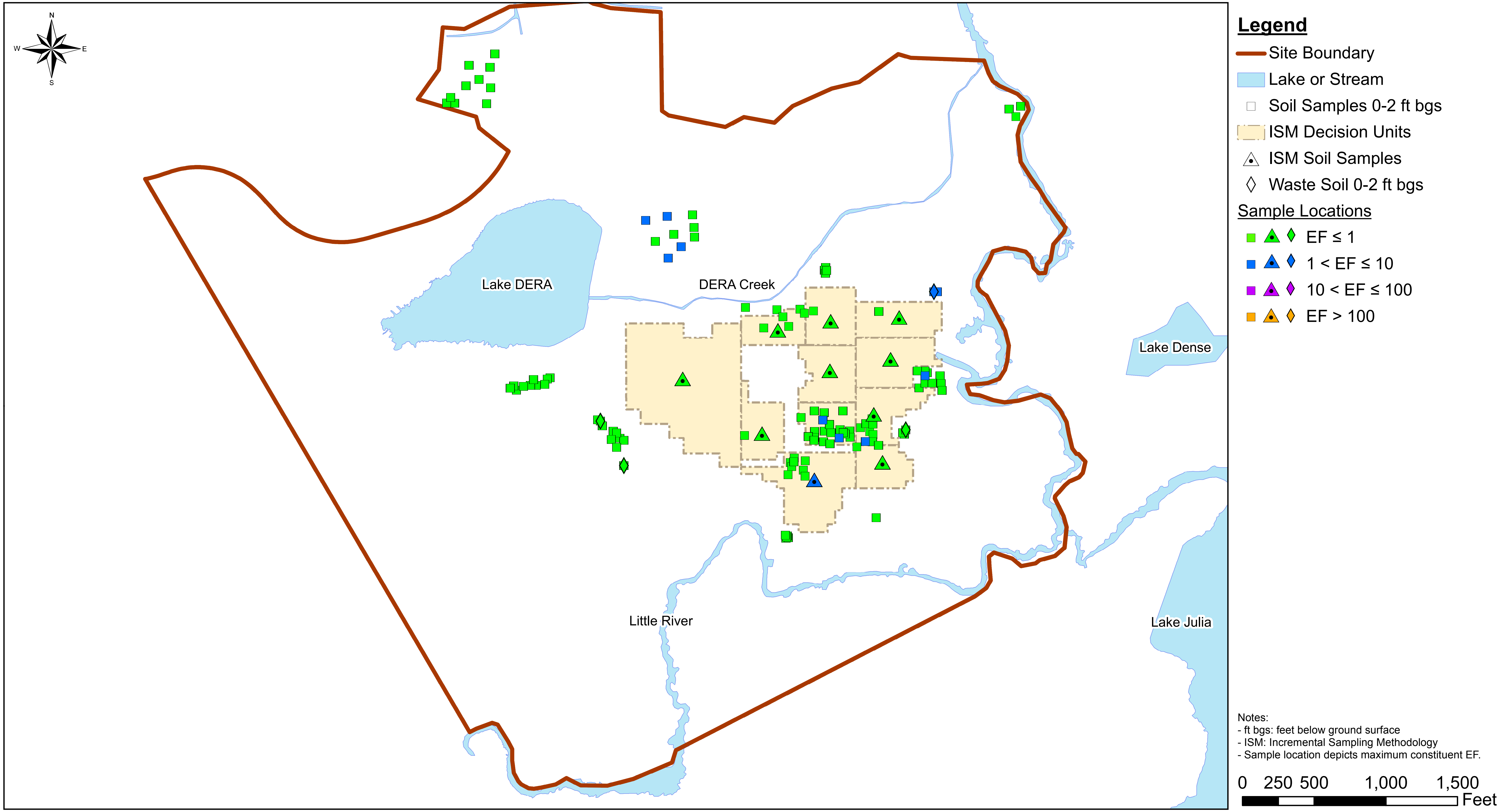

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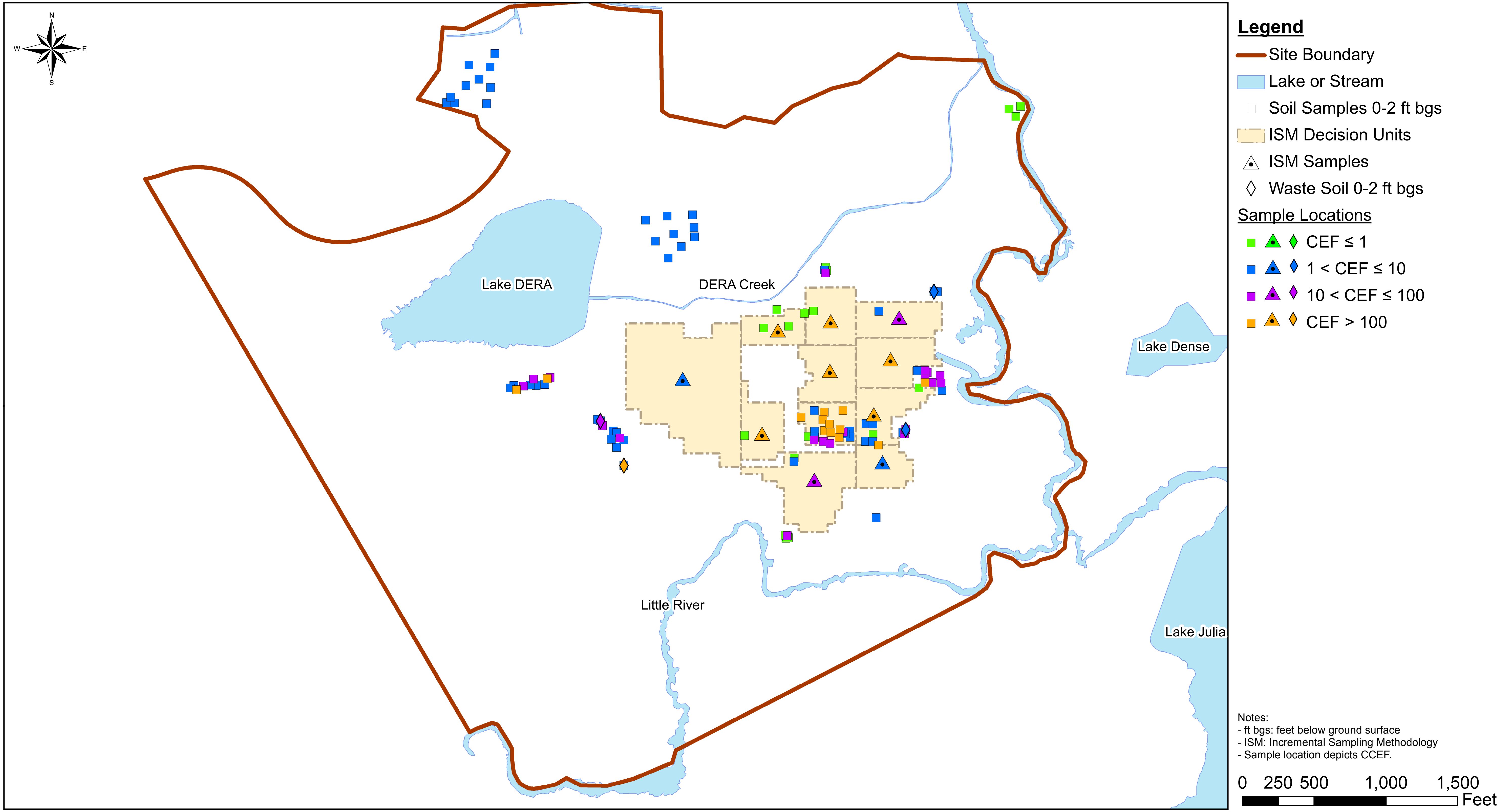
Surface Soil Concentrations Compared to Residential Noncancer SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-1



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Surface Soil Concentrations Compared to Residential Cancer SLs
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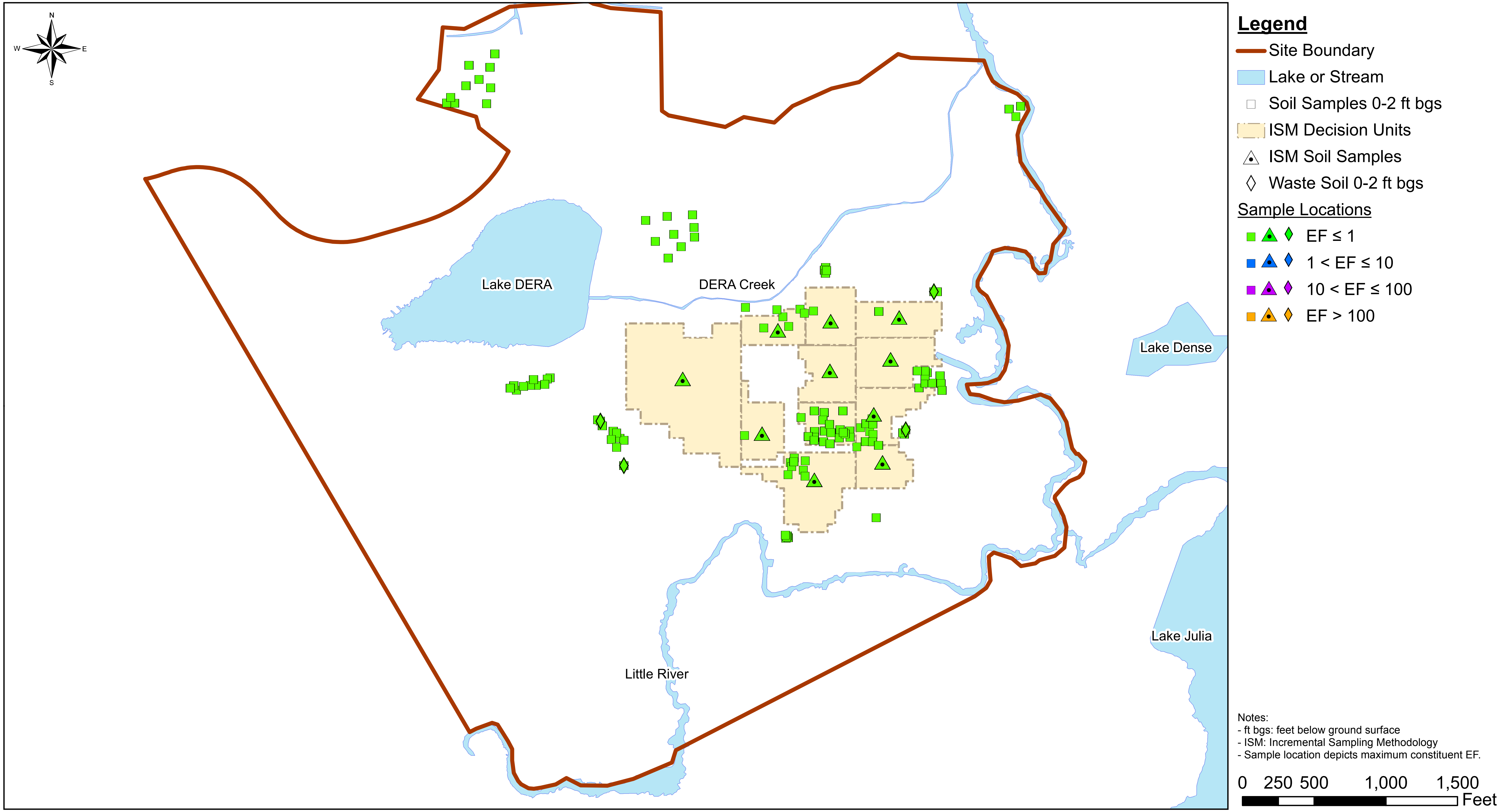
Brevard Site
Cedar Mountain, North Carolina

Figure A-2



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Surface Soil Concentrations Compared to Industrial Noncancer SLs
Remedial Action Plan
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Figure A-3

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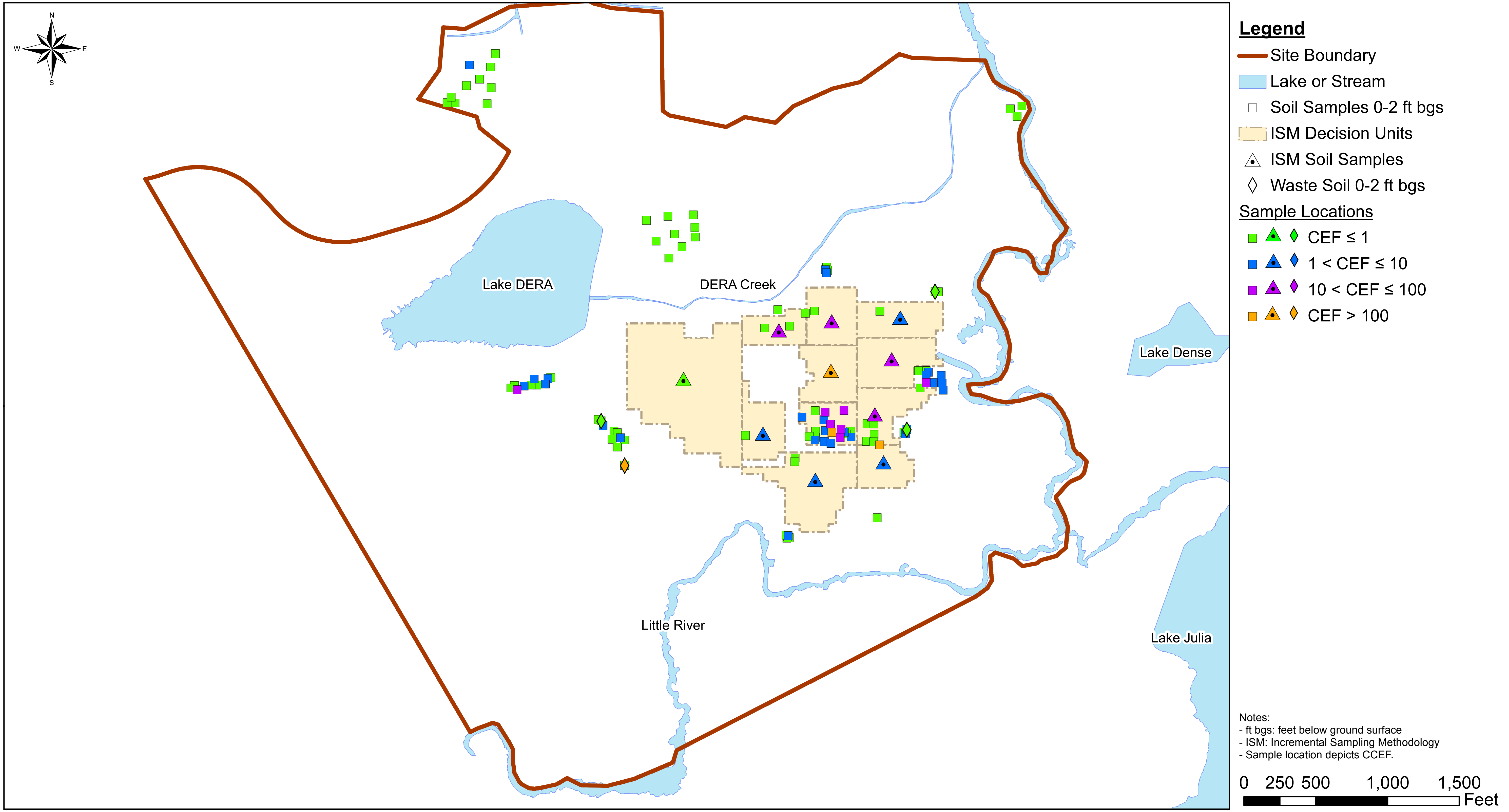

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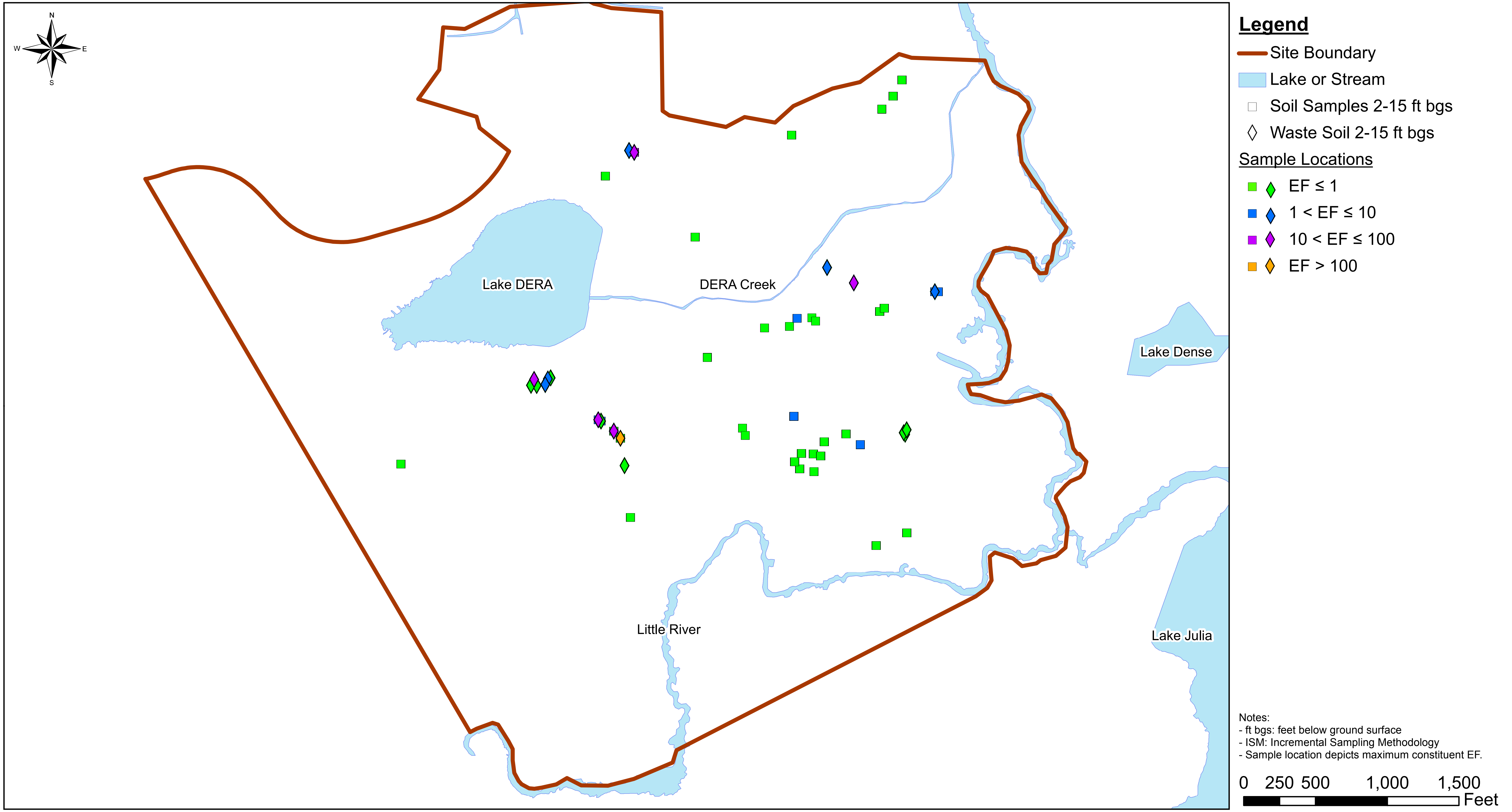
Surface Soil Concentrations Compared to Industrial Cancer SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-4



Notes:
- ft bgs: feet below ground surface
- ISM: Incremental Sampling Methodology
- Sample location depicts maximum constituent EF.

0 250 500 1,000 1,500 Feet

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Subsurface Soil Concentrations Compared to Residential Noncancer SLs
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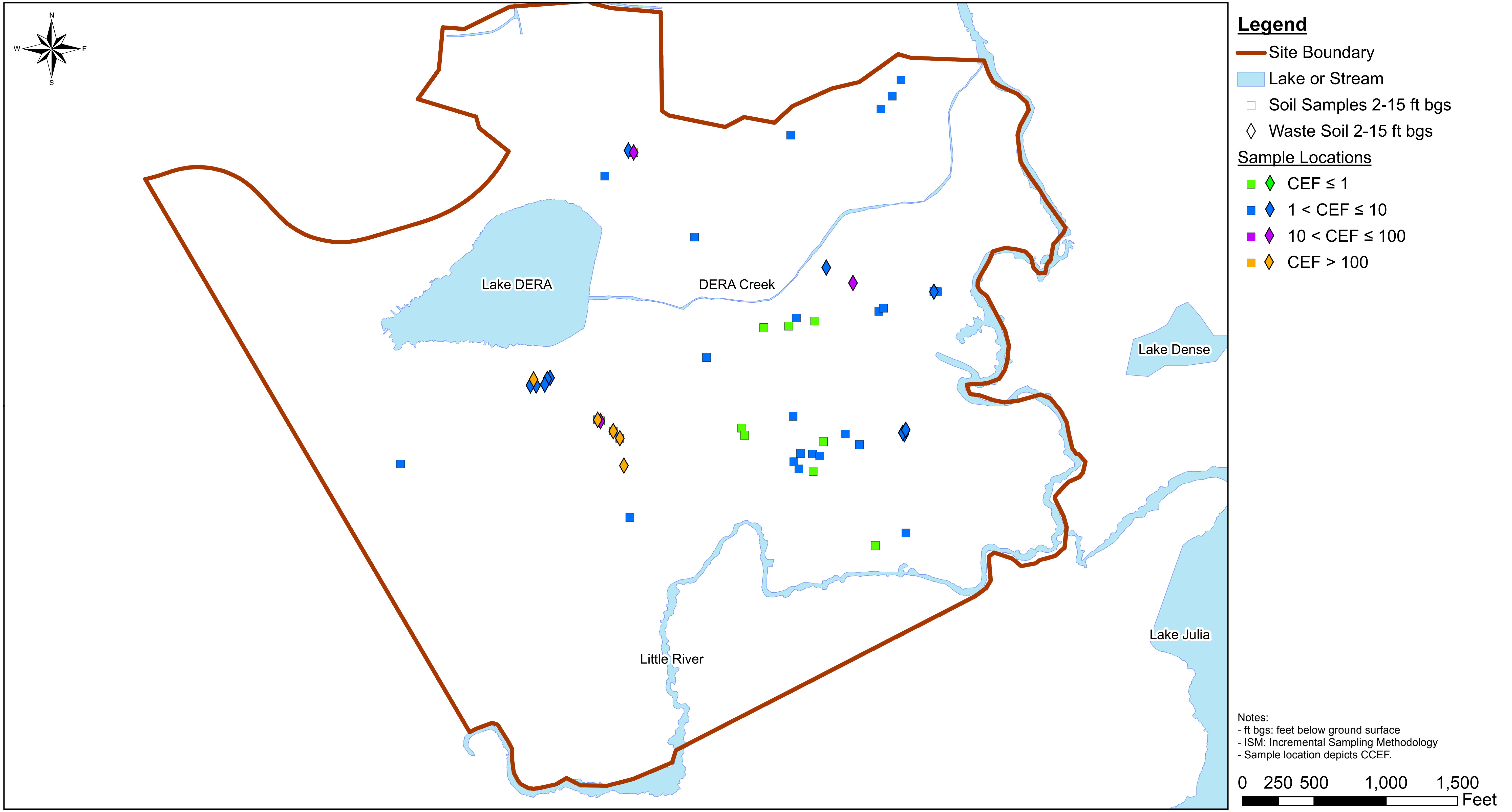
Brevard Site
Cedar Mountain, North Carolina

Figure A-5



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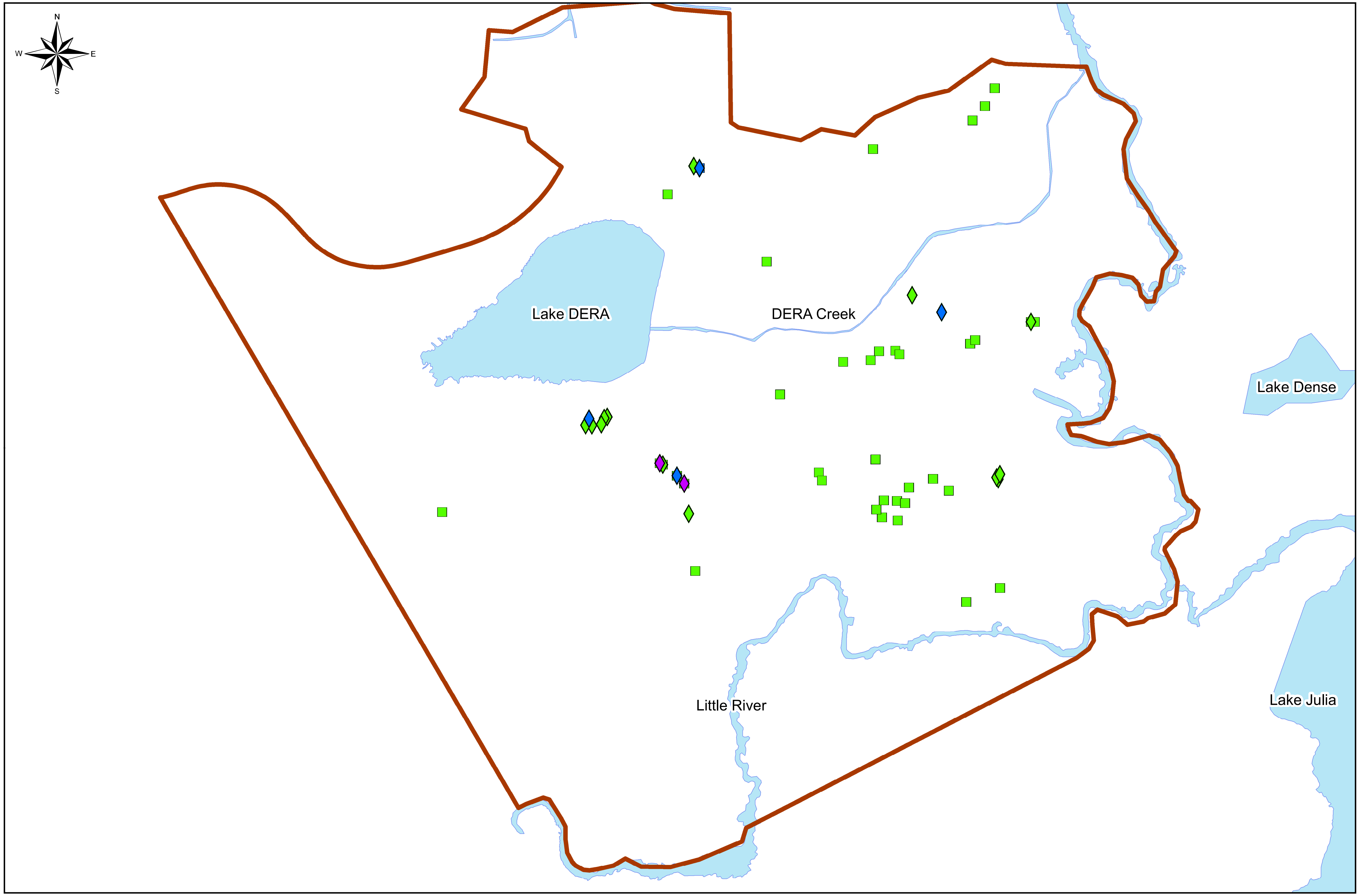
Subsurface Soil Concentrations Compared to Residential Cancer SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-6



Legend

- Site Boundary
- Lake or Stream
- Soil Samples 2-15 ft bgs
- Waste Soil 2-15 ft bgs

Samples Locations

- EF ≤ 1
- 1 < EF ≤ 10
- 10 < EF ≤ 100
- EF > 100

Notes:
- ft bgs: feet below ground surface
- ISM: Incremental Sampling Methodology
- Sample location depicts maximum constituent EF.

0 250 500 1,000 1,500 Feet

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Subsurface Soil Concentrations Compared to Industrial Noncancer SLs
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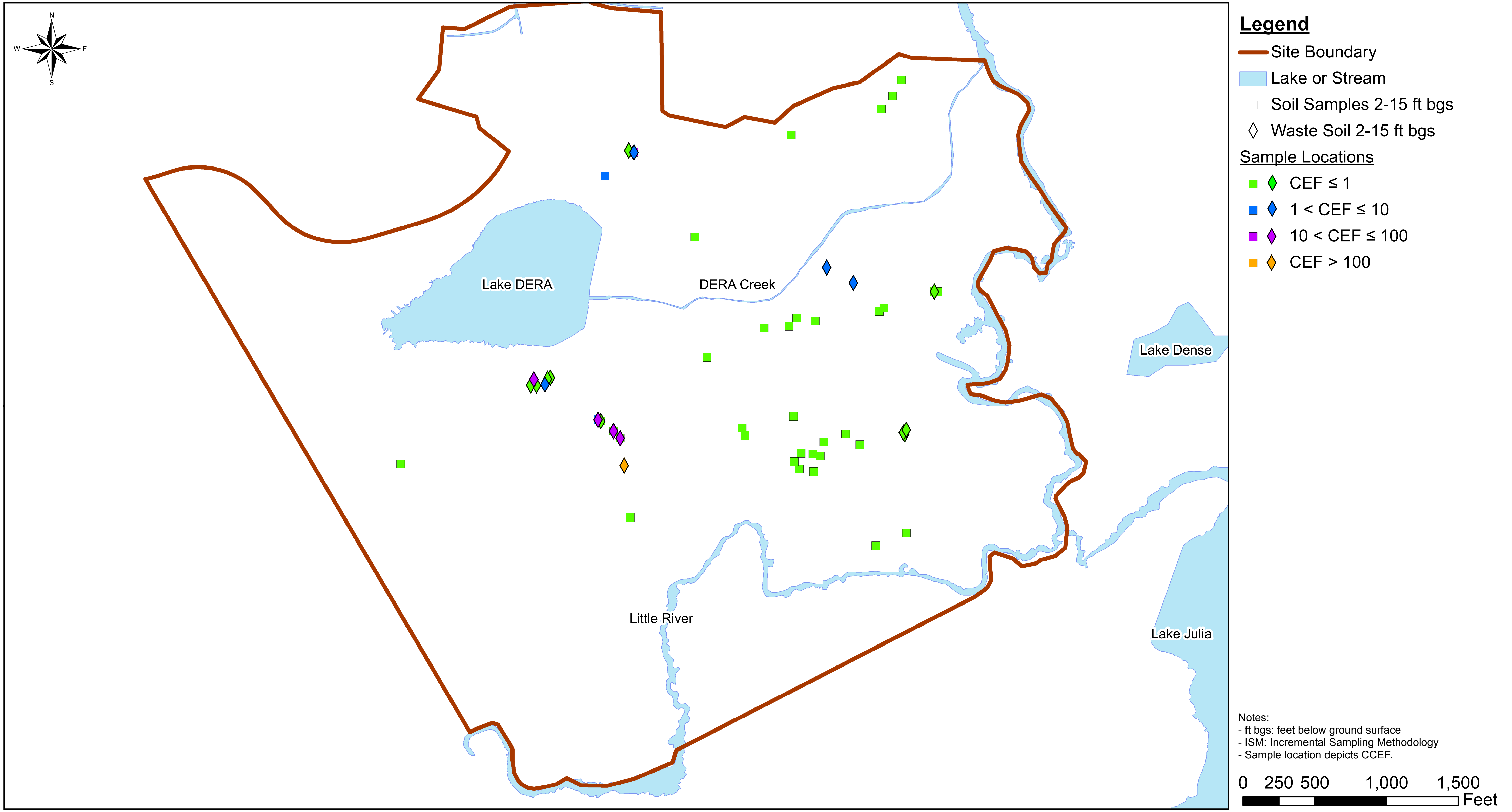
Figure A-7



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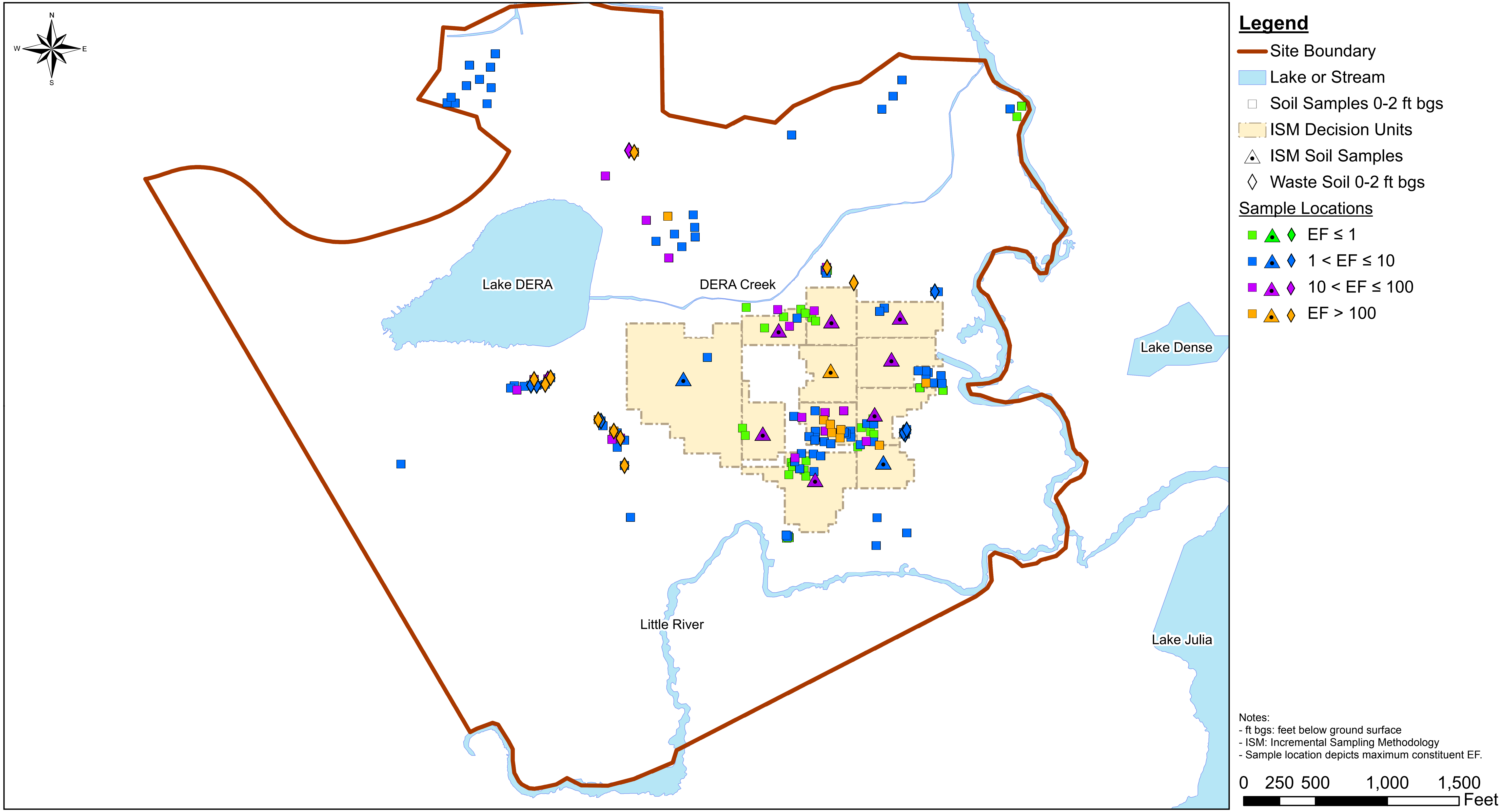
Subsurface Soil Concentrations Compared to Industrial Cancer SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-8



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Soil Concentrations Compared to Protection of Groundwater SLs
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Brevard Site
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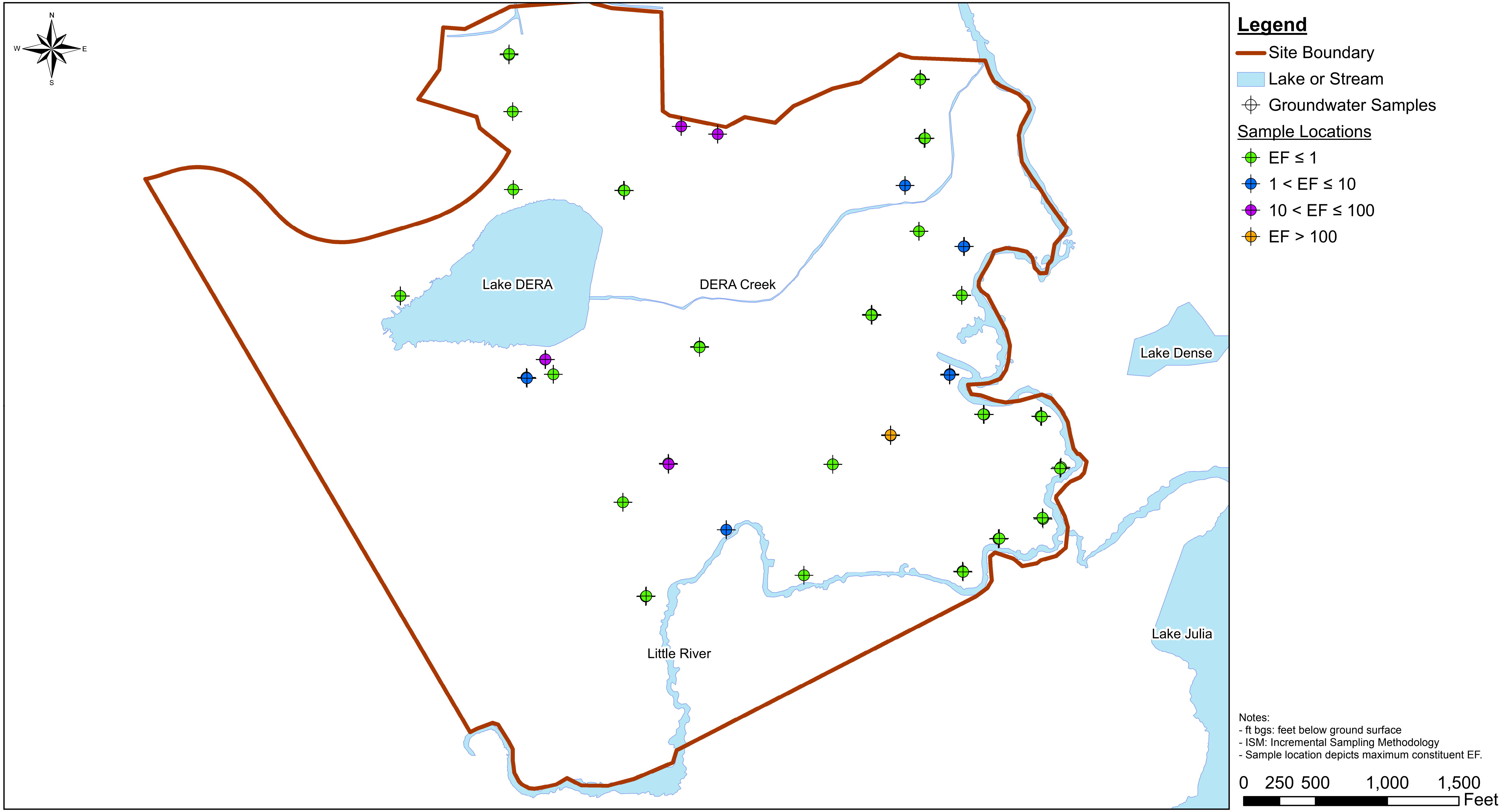
Figure A-9



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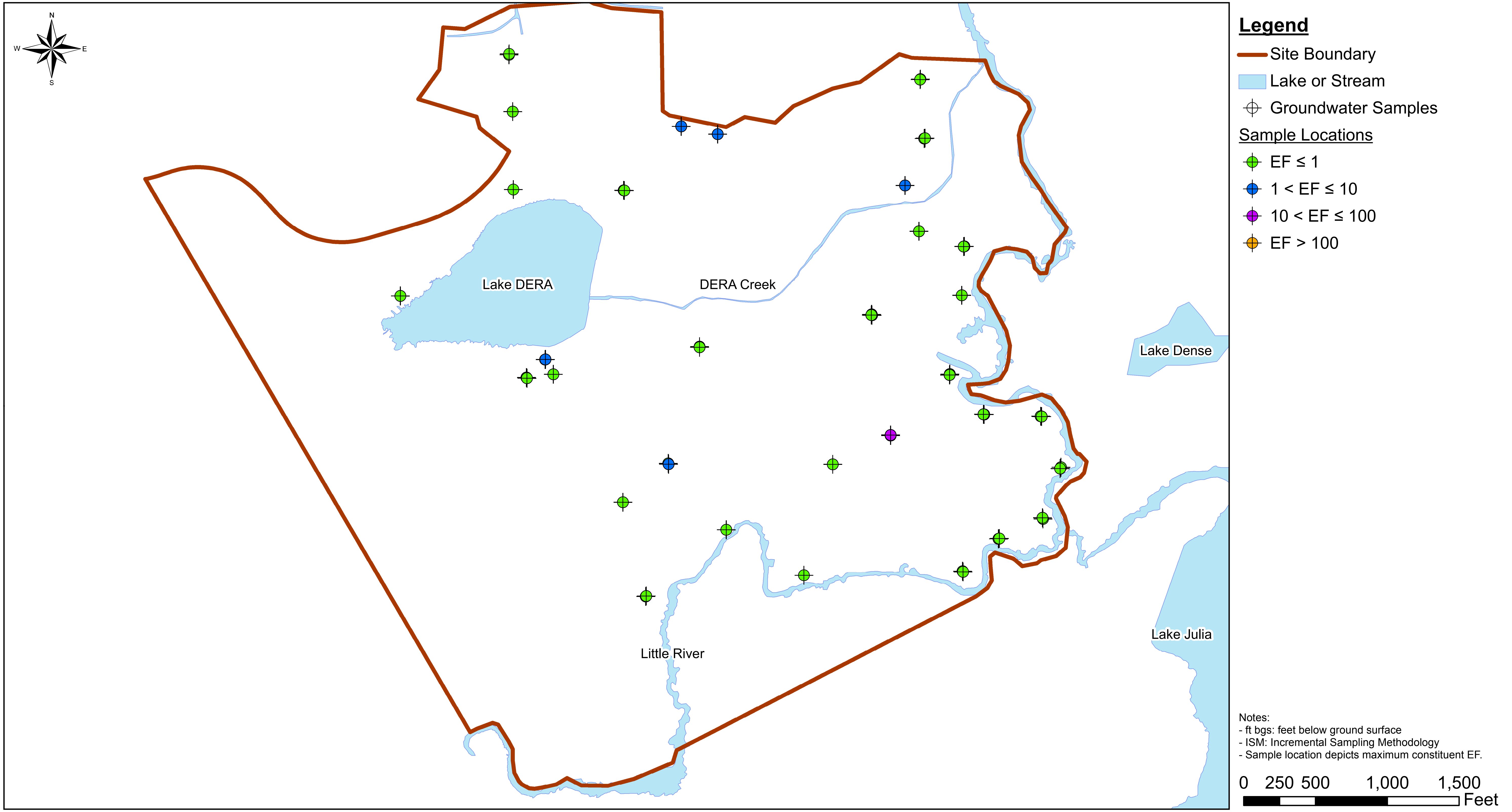
Surficial Aquifer Concentrations Compared to Residential Vapor Intrusion SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-10



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Surficial Aquifer Concentrations Compared to Industrial Vapor Intrusion SLs
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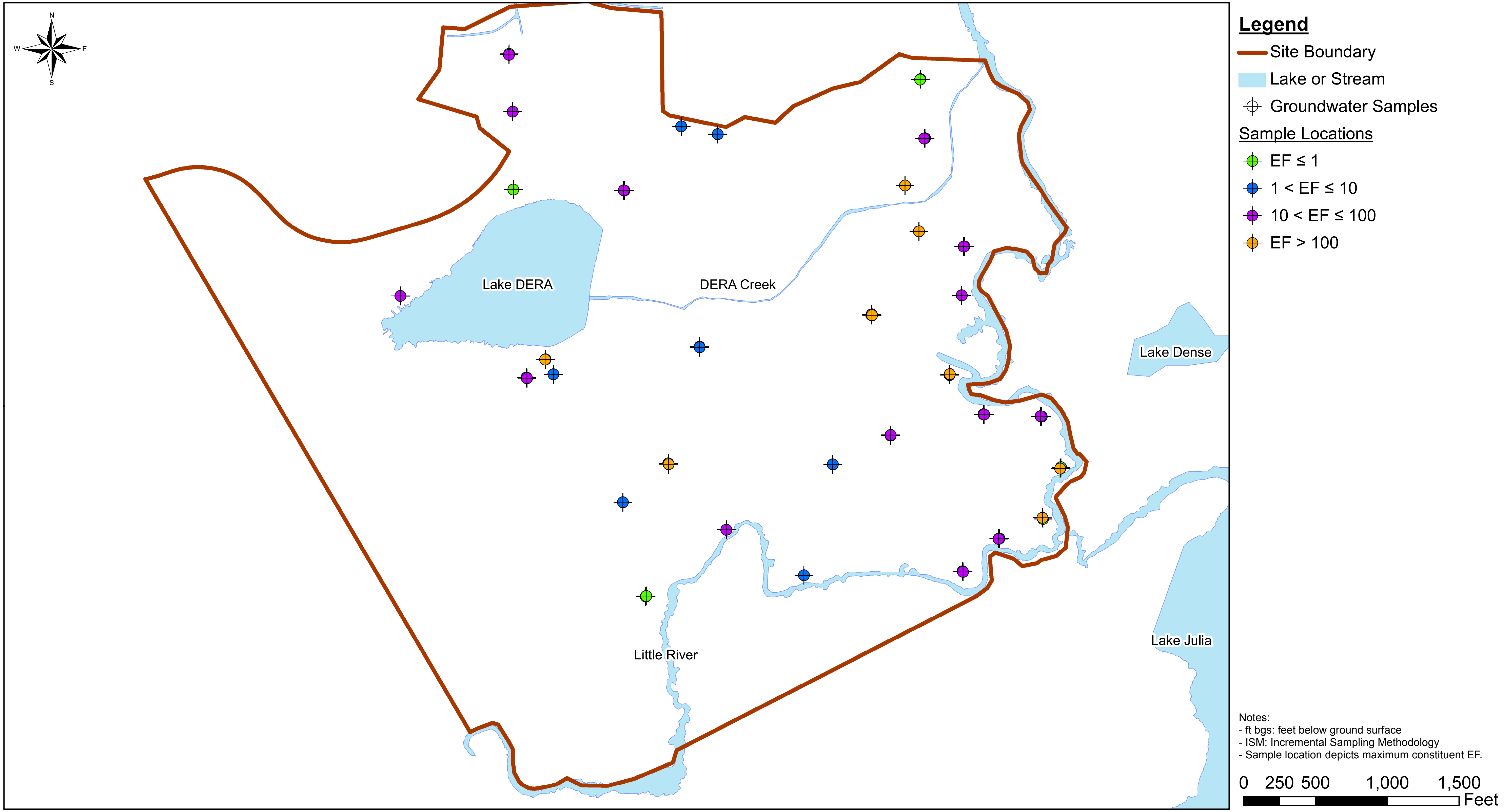
Brevard Site
Cedar Mountain, North Carolina

Figure A-11



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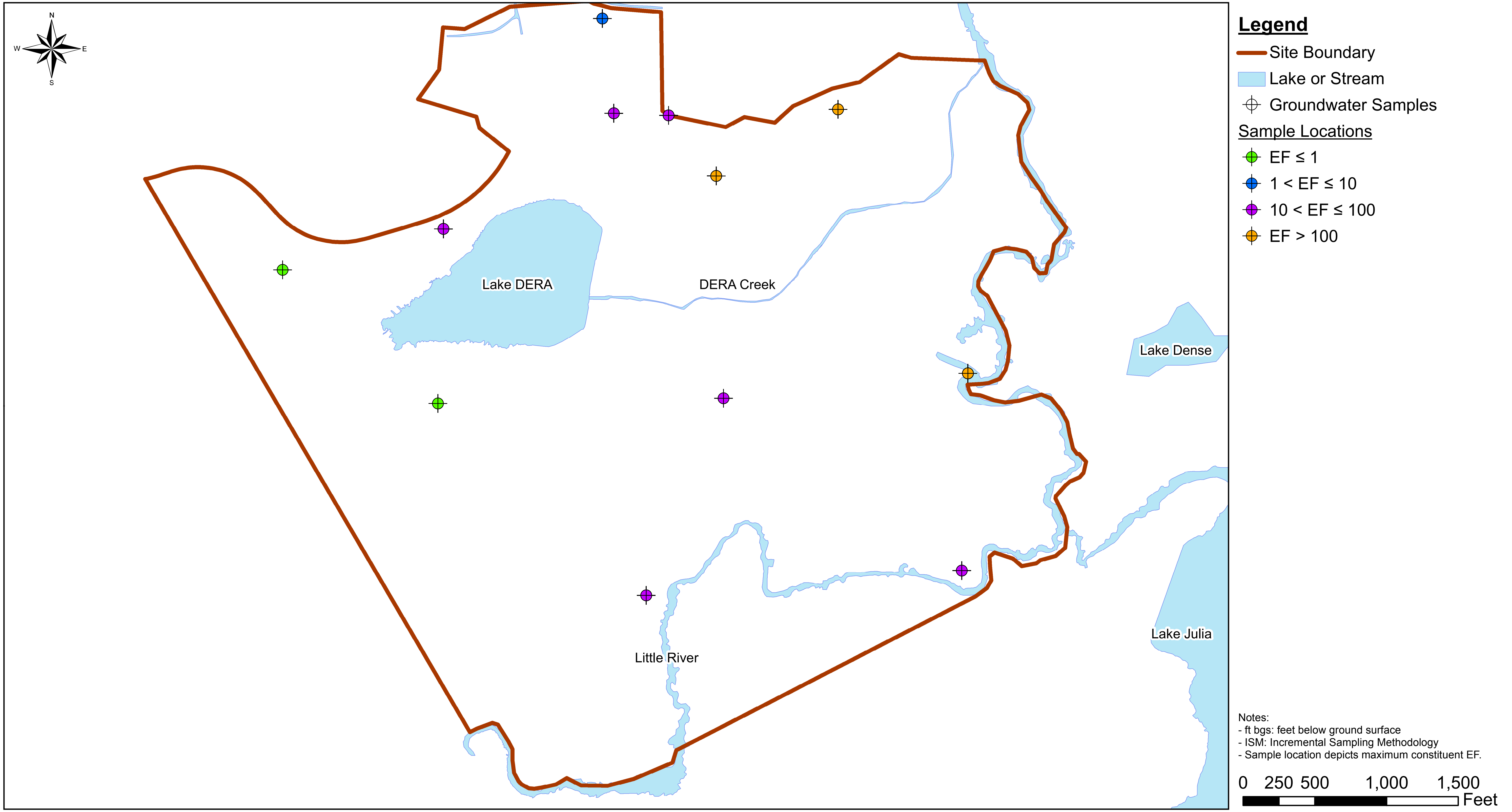
Surficial Aquifer Concentrations Compared to Drinking Water SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-12



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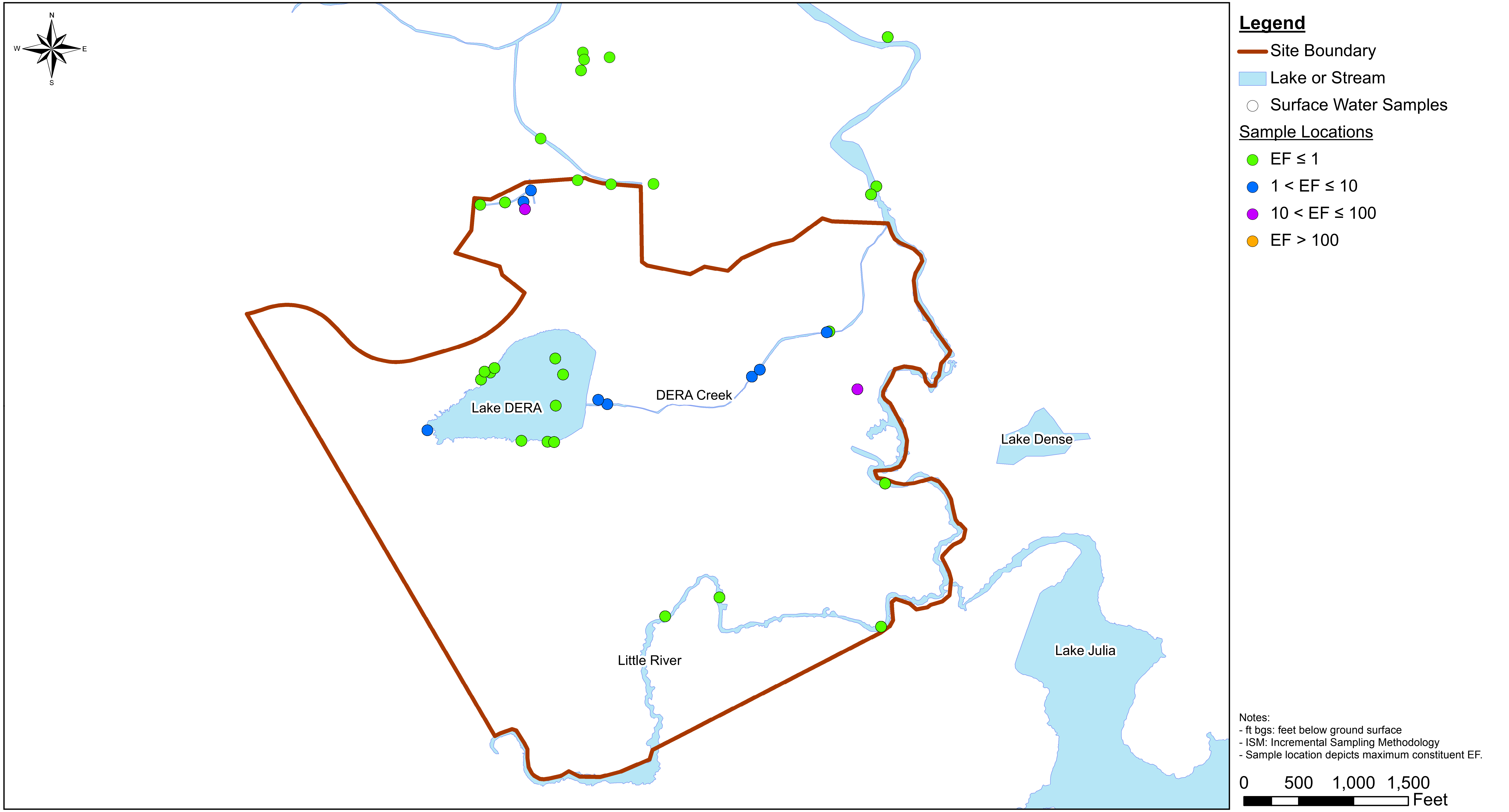
Bedrock Aquifer Concentrations Compared to Drinking Water SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-13



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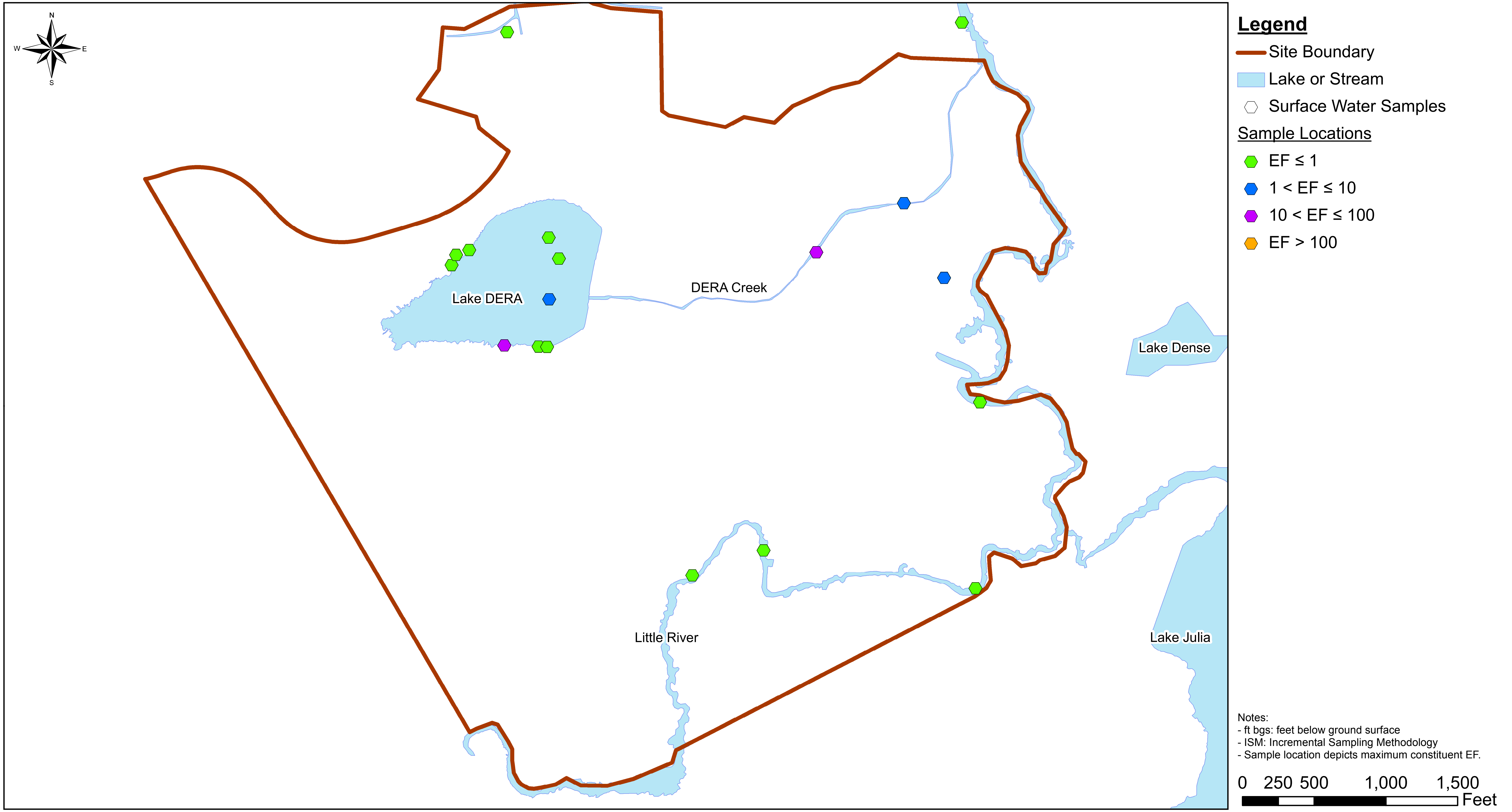
Surface Water Concentrations Compared to Ecological and Human Health SLs
Remedial Action Plan
Brevard Site
Cedar Mountain, North Carolina

Figure A-14



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Sediment Concentrations Compared to Ecological SLs
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Figure A-15

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Appendix B

Approach for Averaging Surface Soil Exceedances

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February 2016

Surface Soil Exceedance Averaging

If remedial actions are taken to address the exceedances in ISM Decision Unit 6 and AOC A, the potential risks associated with site surface soil will be significantly reduced. Since it is unlikely that potential receptors will spend all of their time at one location on the site, the average site surface soil concentrations for 3-methylcholanthrene and the PAHs were calculated after eliminating the DU-6ISM and AOCA-SS-6 samples to determine if the three other samples with RL exceedances posed an unacceptable risk at the site.

All site surface soil data, excluding the ISM samples, were combined to determine a representative reasonable maximum exposure (RME) point concentration. The RME represents a conservative (i.e., health protective) concentration that typically consists of the upper confidence limit (UCL) on the mean or the logarithmic mean. The RME was determined using the following decision rules:

1. The 95% UCL was used if the distribution type was normal;
2. The 95% log UCL was used if the distribution type was lognormal, normal/lognormal, or unknown;
3. The maximum detected concentration was used if it was less than the 95% UCL or the 95% log UCL were collected in the area; and
4. The maximum detected concentration was used if less than 10 samples were present.

The RME and the associated cancer exceedance factors (EFs) were calculated first for all of the surface soil data except the ISM samples. As shown in the Table B-1, the cumulative cancer EFs for a DSRF user and worker are greater than 100 indicating that the cumulative cancer risks for these receptors are greater than 1E-04. The same calculation was performed for all surface soil data except the ISM samples (specifically DU-6ISM) and the AOCA-SS-6(0-2) sample. The cumulative cancer EFs for a DSRF user and worker when the ISM samples and AOCA-SS-6(0-2) are excluded are less than 100, indicating that the cumulative cancer risks for these receptors are below the RL criteria.

This approach (determining an average concentration across the site) is appropriate since potential receptors will be exposed to soil across the entire site (not just at one location). The average site surface soil concentrations when samples DU-6ISM and AOCA-SS-6 were excluded from the data set were less than the RLs.

Tables

Table B-1: Average Surface Soil Concentrations

COC	Units	Number of Samples	Maximum Detection	95% UCL	95% Log UCL	Distribution Type	RME	DSRF User Cancer EF	DSRF Worker Cancer EF	NCNG Worker Cancer EF	Utility/ Excavation Worker Cancer EF
All Surface Soil Data (0-2') Excluding ISM Samples											
3-Methylcholanthrene	mg/kg	7	0.32	0.27	0.98	Normal/Lognormal	0.32	4.6	1.1	0.26	0.37
7,12-Dimethylbenz(a)anthracene	mg/kg	2	5.7	21	1.3E+153	Unknown	5.7	950	242	62	81
Benzo[a]anthracene	mg/kg	58	32	3.3	14	Lognormal	14	7.0	1.7	0.44	0.57
Benzo[a]pyrene	mg/kg	62	18	2.3	7.5	Lognormal	7.5	38	9.3	2.4	3.1
Benzo[b]fluoranthene	mg/kg	62	32	3.3	10	Lognormal	10	5.2	1.3	0.33	0.43
Dibenz[a,h]anthracene	mg/kg	46	3.5	0.59	1.6	Unknown	1.6	8.1	2.0	0.51	0.66
							Cumulative Cancer EF	**1,013**	**257**	**66**	**86**
All Surface Soil Data (0-2') Excluding ISM Samples and AOCA-SS-6(0-2)											
3-Methylcholanthrene	mg/kg	7	0.32	0.27	0.98	Normal/Lognormal	0.32	4.6	1.1	0.26	0.37
7,12-Dimethylbenz(a)anthracene	mg/kg	1	0.039	NA	NA	Unknown	0.039	6.5	1.7	0.42	0.55
Benzo[a]anthracene	mg/kg	57	32	3.3	13	Lognormal	13	6.4	1.6	0.41	0.53
Benzo[a]pyrene	mg/kg	61	18	2.3	6.6	Lognormal	6.6	33	8.2	2.1	2.7
Benzo[b]fluoranthene	mg/kg	61	32	3.3	9.7	Lognormal	9.7	4.9	1.2	0.31	0.40
Dibenz[a,h]anthracene	mg/kg	45	3.5	0.58	1.4	Unknown	1.4	7.2	1.8	0.45	0.59
							Cumulative Cancer EF	**63**	**15**	**3.9**	**5.2**

Notes:

RME: Reasonable maximum exposure

EF: Exceedance Factor

95% UCL: 95 percent upper confidence limit on the mean.

Reasonable Maximum Exposure concentration was determined using the following decision rules:

(1) The 95% UCL was used if the distribution type was normal;

(2) The 95% log UCL was used if the distribution type was lognormal, normal/lognormal, or unknown;

(3) The maximum detected concentration was used if it was less than the 95% UCL or the 95% log UCL .were collected in the area; and

(4) The maximum detected concentration was used if less than 10 samples were present.

Exceedance factors were calculated for all detected constituents by dividing the constituent concentrations in soil by the most conservative potentially-complete exposure pathway RLs to determine by how much constituent concentrations exceeded the RLs. Cancer RLs were lower than noncancer RLs in all cases.

Cancer risks are presented as cumulative risks (i.e., cumulative CEFs [CCEFs]). To determine the CCEFs for each sample location, the CEFs for all constituents detected at a sample location were summed. A CCEF of 1 indicates that the cumulative cancer risk at a sample location is 1E-06. A CCEF of 10 indicates that the cumulative cancer risk at a sample location is 1E-05.